



Environmental Management Plan

Construction of Temporary Overhead
Distribution Line and Associated Duct
Banks

PREPARED FOR
Rowan Frederick II

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1. INTRODUCTION

At the request of Rowan Frederick II LLC (Rowan), Environmental Resources Management, Inc. (ERM) has prepared this Environmental Management Plan (EMP) for the construction of specific listed elements of an approximately 1.2-mile overhead temporary electrical distribution line and associated duct banks (the Project) to support the development of the Rowan Frederick II Data Center (Data Center or Bauxite II). Rowan is working alongside Potomac Energy, the local utility, to site and permit a temporary electrical distribution line, which is pertinent to the redevelopment of the Former Alcoa Eastalco Works property and will provide power to the Bauxite II data center development. This EMP has been prepared only for the specific development items associated with the Bauxite II data center development that intersect with the Environmental Covenant (EC) area associated with the former Eastalco Aluminum works, as described in further detail below.

The overall Eastalco property ("the overall property") comprises 2,200 acres. The central portion of the overall property formerly contained the Eastalco Aluminum Works. The remaining portions of the overall property were primarily used for agricultural purposes. An Environmental Covenant (EC) approved by the Maryland Department of the Environment (MDE) was recorded for portions of the overall property in 2017. The EC provides restrictions to the land use, including restrictions to residential use and groundwater use, and the associated Site Management Plan (SMP) describes requirements associated with construction disturbance of soil and groundwater within the EC. Within the EC is a Soil Management Area (SMA), which includes the central former plant area, two closed/permitted industrial landfills, former waste disposal sites (WDS), and other areas containing constituents of potential concern (COPCs), as shown on Figure 1. The SMP provides additional requirements for the handling of soil within the SMA, including soil generated during construction activities. This EMP incorporates the requirements of the EC, SMP, and SMA with respect to management of soil and groundwater encountered during construction of the temporary electrical distribution line.

Future development of the overall former Eastalco property (by Rowan and others) will include the construction of multiple data center buildings and associated infrastructure, including the temporary distribution line. The overall property is being redeveloped in separate areas or projects by multiple entities. Therefore, discrete projects subject to the requirements of the EC, SMP, or SMA will be advanced for review by MDE under either individual project EMPs or Remedial Action Plans. This EMP applies only to specific identified work elements of the temporary electrical distribution line and associated duct banks located within the EC and/or the SMA.

The overall property and limits of disturbance (LOD) for the Project are shown on Figure 1. The specific work elements covered by this EMP are for those that take place within the EC only or the EC and SMA (EMP LOD), as shown in Figure 2. The Project includes both an overhead (OH) portion and an underground (duct bank) portion. The northwestern end of the OH temporary distribution line route (approximately 3,000 linear feet) lies within the EC and SMA area and a smaller portion (less than approximately 200 feet) lies within the EC only. The duct bank portion of the Project lies entirely within the EC area, a portion is within the EC only area and a portion crosses into the EC and SMA area. Current aspects of the Project covered by this EMP include installation of utility poles, construction of an access road and drilling pad, and soil excavations to install duct banks and other related underground electrical components to transition power from underground

utilities to the OH temporary electrical distribution line. Details regarding the proposed Project are provided in Section 2.3.

It should also be noted that portions of the Bauxite II OH temporary distribution line and duct bank work described herein also fall within the boundaries of the Bauxite III data center development parcel, which is being advanced by Rowan Frederick III LLC. As part of site diligence for the Bauxite III data center development, a Phase II Environmental Site Assessment (ESA) (ERM, 2024) was performed at the Bauxite III site. A portion of the soil and groundwater quality data that was collected as part of this Phase II ESA is included in this EMP to provide information regarding COPC concentrations within the Bauxite II OH temporary distribution line Project area (subject of this EMP) and to inform soil and groundwater management planning described in this EMP. Although the current Project is partially located within the Bauxite III project parcel, the current Project purpose and need is to provide temporary power to a separate project, Bauxite II. As such, this temporary Distribution Line Project itself is separate from the Bauxite III project and is being advanced by a separate legal entity, Rowan Frederick II LLC, on a separate construction schedule.

2. BACKGROUND

2.1 ENVIRONMENTAL SITE HISTORY

The central portion of the overall Eastalco property was formerly an aluminum smelting plant (Alcoa Eastalco Works) that operated from 1969 to 2005 and underwent formal closure in 2010. Demolition of the plant took place between 2011 and 2016. The former plant area has undergone environmental evaluation and in 2017 became subject to an EC which included the SMP approved by the MDE. The EC details activity and land use restrictions on the property. Additionally, the associated SMP details specific development requirements within the EC and the site's SMA. The SMA is entirely included within the EC and includes the central former plant area, two closed and permitted industrial landfills, former waste disposal sites (WDS), and other site areas that contain elevated levels of COPCs. The requirements for development within the EC and SMA boundary are summarized in the following sections.

Historical plant operations resulted in impacts to groundwater, surface water, surface soils, and subsurface soils in the former plant area (now included within the entire EC area and a portion of the SMA). COPCs in the SMA primarily include fluoride in groundwater, cyanide in surface water, and polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs) in soils. Total chromium in surface and subsurface soil has also exceeded total chromium standards, (which are actually based on hexavalent chromium toxicity), but speciation for hexavalent chromium has generally not exceeded standards (see Section 3.2.1). Prior sampling efforts have indicated that areas surrounding the former plant area but still within the EC boundary exhibit low concentrations in soil of arsenic and several PAH compounds.

Requirements for redevelopment work within the EC boundary include:

- Land use is limited to restricted commercial (Tier 2b) or restricted industrial (Tier 3b) purposes.

- Use of groundwater is prohibited.
- Any activity within the overall property must abide by the requirements of the SMP.
- A health and safety plan (HASP) must be prepared in accordance with the SMP and maintained on-site during site work. A HASP must address areas where groundwater is proposed to be encountered.
- Excavations within the EC that encounter groundwater must be conducted in accordance with a HASP. Water encountered in or removed from excavations in the EC area must be containerized and analyzed before disposal or reuse as dust control.

Additionally, the SMP describes several other development-related requirements for areas within the SMA. The following are the land use restrictions and maintenance requirements prescribed within the SMA:

- A 6-foot chain link fence shall be maintained around the entire SMA. The EC and SMA are currently fenced off from the general public, and entry can only occur through a secure entrance with a security guard.
- Incorporation of a presumptive soil remedy, which the SMP specifies as consisting of an engineering control, generally defined as placement of a marker barrier over the contaminated area being developed, followed by the placement of either hardscape features (buildings, parking areas, and roadways) or by 2 feet of clean cover soils in landscaped or green space areas. The SMP also acknowledges that technologies or practices developed after its finalization can be substituted for presumptive remedies if submitted for MDE approval. Alternatively, the developer may choose to conduct a Pre-Development Assessment (PDA) to confirm soils have not been impacted by COPCs.
- Engineering controls (i.e. placement of a marker barrier and coverage by hardscape/landscape) in the SMA must be maintained, and notification/maintenance requirements exist for repairs to the engineering controls and for penetrations to the marker barrier.
- Landfill areas must be maintained in accordance with the 2015 Closure and Post Closure Plan.
- Long term groundwater monitoring and well maintenance is required.
- A 30-day notification to the MDE is required for planned soil disturbances within the SMA.

2.2 OH TEMPORARY DISTRIBUTION LINE ROUTE AND DUCT BANK PROJECT DESCRIPTION AND SETTING

The overall former Eastalco property is approximately 2,200 located in Frederick County and is bounded to the northwest by Ballenger Creek Pike, on the north and eastern edges by Manor Woods Road, on the east by New Design Road, and to the south by Adamstown Road. However, the EMP Limit of Disturbance (LOD) is a subset of approximately 12.3 acres as shown on Figure 2.

The purpose of the OH temporary distribution line and associated duct banks are to provide temporary power to the planned Bauxite II data center campus. As noted above, the temporary

distribution line will include underground duct banks from the Utility Substation, temporary utility poles for overhead power lines, and an associated construction access road. The northern portion of the duct bank is within the EC only area. The southern portion of the duct bank and northwestern portion of the OH temporary distribution line route are inside of the EC and SMA area east of the South Landfill. The OH temporary distribution line continues to the southeast for approximately 420 feet, turns slightly and continues running southeast approximately another 420 feet, turns again and runs generally east for approximately 1,875 feet before turning to the south and exiting the SMA and, less than 200 feet beyond that, exiting the EC. The OH temporary distribution line continues southeast approximately another 3,000 feet outside of the EC; however, the work located outside the EC is not part of the EMP LOD and is not further addressed by this EMP. The proposed layout of the temporary distribution line as it relates to the EC and SMA boundaries is shown on Figure 1. Note that while the OH temporary electrical distribution line route is adjacent to WDS-4, final design will avoid locating utility poles within the footprint of WDS-4.

2.3 PROPOSED PROJECT AND FUTURE LAND USE

2.3.1 CONSTRUCTION OF OH TEMPORARY DISTRIBUTION LINE

The purpose of the OH temporary electrical distribution line is to provide power to the proposed Bauxite II datacenter development site. A small portion (less than 200 feet) of this work will take place inside of the EC only area and another portion (approximately 3,000 feet) will take place inside the EC and SMA area as shown in Figure 1. As shown in Figure 2, the constructed features within the EMP LOD consist of distribution poles set in the ground that hold up the electrical distribution lines. In order to provide for the necessary equipment to access the area and prepare the ground surface for pole installation, an access road consisting of placement and compaction of imported clean quarry stone set on ground surface at grade will also be constructed as part of this work. Approximately 3,700 cubic yards of stone will be required to complete the access road. The access road will be generally constructed in accordance with the geotechnical report, which indicates clearing, compaction of existing soil, placement of geotextile, as required in the SMA area, and placement of clean stone. The access route will be constructed between the pole pairs of the temporary distribution line, as described in drawings included in Appendix A. Prior to the beginning of construction, the clean stone certification will be provided to MDE.

As currently proposed, the Project will include 22 pairs of wooden poles (44 total) within the EMP LOD to support the double circuit temporary distribution line. Each pair of poles will be installed with approximately 35 feet between the poles. Two pairs of poles (4 total) are proposed to be installed in the EC only area and an additional 20 pairs of poles (40 total) are proposed to be installed within the EC and SMA area. The linear spacing between pairs of poles is expected to be approximately 175 feet along approximately 3,200 feet of distribution line within the EMP LOD. The majority of poles will range from 45 to 50 feet in height, but for up to 6 pairs of poles proposed where the temporary distribution line crosses the Tuscarora Creek, heights will be increased to 60 to 65 feet to clear existing infrastructure. The poles will be installed in boreholes that are a depth of 10% of pole height plus 2 feet (approximately 7 feet for 45-foot poles and 9 feet for 65-foot poles). Generally, boreholes for the setting of distribution poles includes drilling a

16-inch borehole with an auger on a derrick truck to a maximum of 9 feet below ground surface (bgs). Based on the anticipated depth and diameter of the boreholes, borehole drilling is expected to generate a total of approximately 10 cubic feet of soil for each 7-foot boring and approximately 13 cubic feet of soil at each 9-foot boring. This will total approximately 52 cubic feet of soil for installation of 4 poles within the EC only area and 424 cubic feet of soil for installation of 40 poles within the EC and SMA area. All excess soil will be managed in accordance with the EC and SMP requirements and will be disposed of off-site. Soil management is further discussed in Section 5.4.

During a Phase II investigation conducted at the Bauxite III site in April and May 2024, depth to water in the vicinity of the OH temporary distribution line ranged from 11 to 17 feet below ground surface (Table 1). At current time, due to the depth of the boreholes (7-9 feet bgs), groundwater is unlikely to be encountered during the drilling of the boreholes. However, in the event that groundwater is encountered and needs to be evacuated from the boring to install the pole, it will be pumped out via mechanical pump, containerized in designated storage tanks, and tested to determine appropriate disposal. Water management is discussed further in Section 5.7.

Once poles are set in place, the borehole annulus will be backfilled with clean fill. During installation of the distribution poles, approximately 3 cubic feet of backfill may be needed for each pole installed in 7-foot borings and approximately 4 cubic feet of backfill for each pole installed in 9-foot borings. Approximately 144 cubic feet of clean backfill material is expected to be used for this purpose: approximately 16 cubic feet will be used within the EC only area and 128 cubic feet will be used within the EC and SMA area. Plans and drawings for pole installation and completion of the temporary distribution line are provided in Appendix A. Clean fill certifications will be provided to MDE before work begins.

The following is an outline of the general sequencing for construction of the temporary distribution line. Several of the tasks can proceed concurrently.

CONSTRUCTION SEQUENCE FOR PROJECT AREA INSIDE EMP LOD

1. Establish erosion and sedimentation controls at the LOD.
2. Install temporary construction fencing, signage, or other appropriate demarcation to identify the boundary of the EC only and EC and SMA areas within the OH temporary distribution line LOD.
3. Construct Access Road
 - a. Remove vegetation.
 - b. Compact existing soils.
 - c. Inside EC only area, geotextile will be placed on top of the ground surface to provide stability for the road and clean quarry stone will be placed on top of the geotextile. Inside EC and SMA area, geotextile will be placed as demarcation barrier above site soil and, place quarry stone on geotextile.
4. Install Distribution Line Poles
 - a. Using hollow-stem auger, or similar equipment, advance borehole to approximately 7 or 9 feet bgs, depending on the pole height.
 - b. Set distribution line poles.

- c. Place a geotextile demarcation barrier above site soil at bottom of boring. Backfill with clean fill to ground surface.
5. Transfer any excess soil from the boreholes to appropriate containers or designated stockpile for storage and characterization prior to off-site disposal.
6. Remove temporary construction fencing, signage, and erosion/sedimentation controls at LOD.

2.3.2 CONSTRUCTION OF DUCT BANKS

The purpose of the underground duct banks is to transition power from underground utilities to the overhead temporary electrical distribution line. A portion of this work will take place inside of the EC only area and another portion will take place inside the EC and SMA area as shown on Figure 1. Figure 2 shows the LOD associated with the duct banks. More detailed drawings of the individual anticipated excavations are provided in Appendix A.

The depth of individual excavations for duct banks will range from 7 to 12 feet bgs (Appendix A). Based upon the dimensions of the duct bank areas to be excavated, approximately 7,600 cubic yards of soil will be excavated.

All excavated soils will be managed in accordance with the EC and attached SMP. Excess excavated soils generated within the EC and SMA area will be managed separately from those produced in the EC only area. All excess soil will be collected, stockpiled, and tested. All soil excavated from the utility duct bank area will be characterized as required by the receiving facility prior to being transported for off-site disposal. Soil management is further discussed in Section 5.4.

Following construction of the utilities within the duct banks, clean backfill material will be placed over and around the excavations. Excavated soil from the duct bank excavations is not anticipated to be used as backfill material. Duct bank excavations will be backfilled with clean material following installation of subgrade infrastructure. For the portion of the excavation located within the SMA, site soils must be delineated by a marker barrier. Therefore, a geotextile barrier will be placed at the bottom of the excavation prior to backfilling with clean materials. It is estimated that approximately 7,600 cubic yards of material will be excavated for the construction of the utility duct banks. Approximately 2,100 cubic yards of clean fill material will be used to backfill the utility duct bank following construction of the utilities. Clean fill certifications will be provided to MDE prior to beginning backfilling.

Based on recent environmental investigations (discussed in greater detail in Section 3.1), groundwater in the duct bank area was encountered at approximately 10 feet (Table 1). With a maximum excavation depth of 12 feet, groundwater may be encountered in some portions of the duct bank excavations. Dewatering estimates, provided in Appendix B indicate that the rate of water to be removed during duct bank construction may be as high as 52,058 gallons per day (Appendix B). Groundwater encountered during duct bank excavation will be pumped out via mechanical pump, containerized in designated storage tanks, and tested to determine appropriate disposal. Should high infiltration rates occur in excavated areas, wellpoints or dedicated sump pumps may be utilized. Water management is discussed further in Section 5.6.

The following is an outline of the general sequencing for construction of the temporary distribution line. Several of the tasks can proceed concurrently.

CONSTRUCTION SEQUENCE FOR DUCT BANK CONSTRUCTION

1. Establish erosion and sedimentation controls at the LOD.
2. Install temporary fencing, signage, or other appropriate demarcation to identify the boundary of the EC only and EC and SMA areas within the OH temporary distribution line LOD.
3. Excavate work area as shown in Appendix A to a maximum depth of 12 feet bgs. Stockpile excavated soil for on-site storage and testing, pending reuse or off-site disposal. Soil excavated from the EC only area will be stockpiled separately from soil excavated from the EC and SMA area.
 - a. Construct concrete duct bank features.
 - b. Install necessary utilities within duct banks.
 - c. Backfill excavation with clean fill. In accordance with the EC, for excavations within the SMA, a geotextile marker barrier will be placed at the bottom of the excavation prior to backfilling.
4. Transfer any excess soil from the excavation to designated stockpiles for storage and characterization prior to disposal.
5. Remove temporary construction fencing, signage, and erosion/sedimentation controls at LOD.

2.3.3 PLANS AND PERMITS

Several permit applications need to be submitted to various issuing authorities for aspects of the work subject to this EMP.

The table below provides a summary of permits required for the project.

1PERMITS

Permit	20-CP Permit Number	State Number	Status
SCD Approval	TBD	TBD	Application to be submitted Q2 2025
20 CP Permit	TBD	TBD	Application to be submitted Q2 2025
Construction Dewatering Permit (or Exemption)	TBD	TBD	Application to be submitted Q2 2025
JPA (Work in Floodplain)	TBD	TBD	Application to be submitted Q2 2025

Note:

TBD = To Be Determined

All of the required permits will be obtained by or provided to Potomac Energy prior to beginning the work.

3. RECENT SITE ACTIVITIES

3.1 IMPACTED MEDIA EVALUATION

In April and May 2024, ERM performed a Phase II environmental site assessment (ESA) for the Bauxite III data center project. Analytical results from this investigation provide information on the soil and groundwater conditions along the proposed OH temporary distribution line route and at the locations of proposed duct banks. This data, as well as data collected under the Bauxite II Temporary Distribution Line Sampling Plan (REV2 09 December 2024, Sampling Plan), submitted to MDE on 10 December 2024, will be used to determine the proper management of materials that will be excavated during the construction of these features. The Phase II ESA was completed in accordance with the Work Plan that was submitted to MDE and approved on 24 April 2024. The additional sampling proposed in the Sampling Plan was approved by MDE on 09 December 2024 and initiated on 16 December 2024 and will be used in soil and groundwater management decision-making during implementation of this EMP. Section 3.2 further describes the COPCs in soil and groundwater in the area subject to this EMP.

Sample locations are shown on Figure 3. Analytical results for samples that are located close to the proposed temporary distribution line and duct bank areas are discussed in Section 3.2.

Additional soil analytical data was obtained from the following sources to supplement the data collected as part of the Phase II ESA:

- Site Management Plan Eastalco Aluminum Company (GTA, 2017)
- Phase II Environmental Site Assessment, Initial Infrastructure Phase (GTA, 2022a), and Phase II ESA Initial Infrastructure Phase II Addendum (GTA, 2022b)

Sample data from these reports are referenced in Section 3.2 where they provide additional information about environmental conditions in the vicinity of the proposed temporary distribution line and duct banks.

3.2 CONTAMINANTS OF POTENTIAL CONCERN

3.2.1 SOIL

The SMP (EC document for the overall property) identifies the following as COPCs at the site:

- Polyaromatic hydrocarbons (PAHs) – specifically benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene
- Polychlorinated biphenyls (PCBs) – specifically Aroclor 1016, Aroclor 1642, and Aroclor 1248

These parameters were detected at concentrations exceeding the MDE Non-Residential Cleanup Standard for soil in portions of the SMA.

Prior investigations have also identified arsenic in soil in the SMA at levels exceeding the Non-Residential Cleanup Standard. However, these levels have been determined to be consistent with naturally occurring levels and are not considered to pose a risk at the site. In addition, ERM's

Phase II ESA identified the following constituents at levels exceeding the Non-Residential Cleanup Standard: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and Aroclor 1248, and total petroleum hydrocarbons (TPH) diesel range organics (DRO).

3.2.1.1 AREAS COVERED BY THIS EMP

The EMP LOD includes portions that are within the EC only and portions within the EC and SMA areas. The majority of the LOD associated with the temporary Distribution Line Route lies within the EC and SMA area, with only a small portion (less than 250 feet) located within the EC only area (Figure 1). The southern portion of the LOD associated with the Proposed Duct Banks (approximately two thirds of the entire duct bank area) is located within the EC and SMA area, but the northern one third of this area is within the EC only area.

The following soil sample locations are located in or near the EMP LOD:

- ERM soil samples:
 - EC only Area: B-4 and B-8
 - EC and SMA area: B-6, B-7, B-11, B-14, B-15, B-16, RB-1-20N, RB-1-0, RB-1-20S, RB-2-20N, RB-2-0, RB-2-20S, RB-3-20N, RB-3-0, and RB-3-20S
- GTA soil samples reported in 2017 SMP:
 - EC only area: PL-GTA-08, PL-GTA-12, PL-GTA-18
 - EC and SMA area: SW-GTA-01, SW-GTA-03, SP-GTA-02, SP-GTA-03, SP-GTA-04, SP-GTA-05, SP-GTA-06
- GTA soil samples reported in 2022 Phase II Initial Infrastructure ESA and Addendum:
 - EC only area: SA1-F, SA4-E, SA4-M,
 - EC and SMA area: SA1-H, SA7-J, SA7-K, SA10-A

Figure 4 shows soil samples that were collected near the EMP LOD. Analytical data for these samples are presented in Tables 2 through 6.

PAHs were detected in all of the soil samples near the EMP LOD; however, the only exceedances of MDE Non-Residential Soil Standards were at sample locations RB-0, RB3-0, and SP-GTA-03. PAH compounds that exceeded the standard were benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene. All of these soil samples were collected from within the SMA.

Metals were detected in all of the soil samples collected near the EMP LOD. The only parameters detected above MDE Non-Residential Cleanup Standards were arsenic and chromium (compared to the standard for hexavalent chromium). Only one sample analytical result for arsenic equaled or exceeded the Anticipated Typical Background concentration of 11 mg/kg (SA7K-1-11 exhibited arsenic at 11 mg/kg). Eight samples that were analyzed for total chromium were also analyzed for hexavalent chromium, none of which were detected above its MDE Non-Residential Cleanup Standard.

3.2.2 GROUNDWATER

Prior evaluations described in the EC and SMP identified fluoride in groundwater at levels exceeding its United States Environmental Protection Agency (USEPA) maximum contaminant level (MCL) in portions of the EC area.

As part of the 2024 Limited Phase II ESA performed at the Bauxite III site, ERM installed 8 monitoring wells across the Bauxite III site. Four of these monitoring wells are located within or very near the EMP LOD: Well MW-3 is located within the EC and Wells MW-2, MW-4, and MW-5 are all located within the SMA (Figure 3). Based on the groundwater contour map prepared as part of the Bauxite III Phase II ESA, these wells represent the quality of groundwater moving toward and through the EMP LOD (Figure 5).

In addition to fluoride, the monitoring wells were sampled for Target Compound List volatile organic compounds, polyaromatic hydrocarbons, polychlorinated biphenyls, Target Analyte List metals, and cyanide. The analytical results for the ground water samples are presented in Tables 7 through 10. Fluoride exceeded its MCL of 4 mg/L at wells MW-2, MW-4, and MW-5 at levels ranging from 4.7 mg/L to 68 mg/L. The only other parameter to exceed a screening value in groundwater was naphthalene, which exceeded its MDE Type I and II Aquifer standard of 0.17 ug/L at all four wells near the EMP LOD at concentrations ranging from 0.17 J ug/L to 1 ug/L.

3.2.3 SURFACE WATER (IF APPLICABLE)

No surface water data is included in this review. While the temporary distribution line will cross a surface water body at one point, the line will be constructed to span the water body, and the access road will not cross the surface water body. Thus, there is not expected to be any construction within the water body, and construction workers are not expected to come into contact with surface water.

3.2.4 EXPOSURE PATHWAYS

Based on the site investigation data available in ERM, 2024; and GTA 2022a and GTA2022b; and information in the SMP, potential environmental exposure risks to future occupants and construction workers may exist within the EMP LOD. However, with institutional controls and the EC itself serving as deed notice and prohibiting use of groundwater, there is not a complete exposure pathway after construction activities. Capping of areas of soil disturbance within the SMA (as required by the SMP and proposed in this EMP) further reduces post-construction risk.

Specific to this EMP and the construction elements covered, potential soil exposure is described in Section 3.2.5 and exposure to groundwater is described in Section 3.2.6.

The identified exposure pathways, potentially exposed populations, and COPCs are summarized in Table 11. The list of groundwater COPCs is amended to include parameters which exceeded an applicable standard during the Limited Phase II ESA of the Bauxite III site (ERM, 2024).

3.2.5 DIRECT CONTACT WITH SOIL CONTAMINATION

There is potential for site construction workers to come into contact with the COPCs during installation of poles for the OH temporary Distribution Line, excavation of the duct banks,

installation of the utilities within the duct banks, and management of soil stockpiles including loading for off-site disposal. Soil COPCs were detected above MDE Non-Residential Cleanup Standards in samples collected within and near the EMP LOD (Section 3.2.1). For planning and safety purposes, these parameters, along with other COPCs identified historically within the EC and SMA will be addressed in the construction contractor's site-specific Health and Safety Plan (HASP) (HASP guidance is included in Appendix C). A soil management plan is provided as Table 12.

The presumptive remedies for the soil contamination (HASP and capping) are protective of human health because they are designed to prevent exposure to contamination. Capping of disturbed soil with at least 2 feet of imported clean fill within the SMA, as described above, will eliminate the direct contact to future adult, youth, and child populations in those areas disturbed by the construction described in this EMP.

3.2.6 EXPOSURE TO GROUNDWATER CONTAMINATION

Groundwater at the overall site has generally been identified at 5 to 25 feet bgs with some perched water conditions also observed in some areas. Groundwater at the overall site and within the EMP LOD is not currently used for any purpose. The EC prevents its use within the area to which the EC applies. Groundwater use at the site will be prohibited for any purpose by restrictions that are recorded in the property deed for areas within the EC only and EC and SMA areas; however, there is potential for construction workers to come into contact with groundwater within the EC only and EC and SMA areas during the construction activities covered by this EMP.

Water level data collected during the ERM Limited Phase II investigation of the Bauxite III site are presented in Table 1. A groundwater contour map is provided as Figure 5. At the monitoring wells located within or near the EMP LOD, depth to water ranged from approximately 10 to 17 feet bgs.

Table 13 presents groundwater management plans including dewatering needs and estimated volumes. Figure 6 provides a map outlining the areas where groundwater is expected to be encountered during construction.

Construction worker contact with groundwater will be limited by implementing the site-specific HASP as well as groundwater management activities including containerizing the groundwater for testing and proper disposal. Methods for the management, containerization, testing and disposal of groundwater encountered during construction are detailed in Section 5.7.

3.2.7 INHALATION OF FUGITIVE DUST

During construction activities, it is possible for soil impacted by COPCs to become airborne. There is a potential for site construction workers to breathe this fugitive dust. The inhalation of fugitive dust will be limited by implementation of the site-specific HASP (guidance provided in Appendix C) and construction practices that prevent dust generation (e.g., dust control methods) as well as air monitoring for dust concentrations to ensure that hazardous exposures do not occur for workers. Details of this monitoring are provided in Section 5.2. Dust control measures will also comply with the requirements of the 20-CP permit and MD ESC Manual Section H5.

4. CLEANUP CRITERIA

The cleanup criteria for the Site are summarized in the table below. The cleanup criteria for the Site soil COPCs generally reflect the MDE NRCS values, which are the generic risk-based guidance values in MDE's Cleanup Standards for Soil and Groundwater; October 2018; Initial Final Guidance (Update No. 3). MDE cleanup standards are derived from USEAP Region III Regional Screening Levels (RSLs), which assume a 1E-6 cancer risk; generally speaking, MDE modifies these values to reflect a 1E-5 cancer risk in the NRCS values. The cleanup criteria for fluoride and cyanide are derived from the USEAP National Primary Drinking Water Regulations (NPWDR); May 2009.

CLEANUP CRITERIA

Media	COPC	Cleanup Criteria	Basis
Soil	Benzo(a)anthracene	21 mg/kg	NRCS
	Benzo(a)pyrene	2.1 mg/kg	NRCS
	Benzo(b)fluoranthene	21 mg/kg	NRCS
	Benzo(k)fluoranthene	210 mg/kg	NRCS
	Dibenz(a,h)anthracene	2.1 mg/kg	NRCS
	Indeno(1,2,3-c,d)pyrene	21 mg/kg	NRCS
	Aroclor 1016	5.1 mg/kg	NRCS
	Aroclor 1242	0.95 mg/kg	NRCS
	Aroclor 1248	0.95 mg/kg	NRCS
	Arsenic ^a	26.8 mg/kg	RCV
Groundwater	Fluoride	4.0 mg/L	NPWDR
	Naphthalene	0.17 ug/L	
Surface Water	Cyanide	0.2 mg/L	NPWDR

Note:

NRCS = MDE Non-Residential Cleanup Standard

RCV = MDE Risk-Based Comparison Value

NPWDR = USEPA National Primary Drinking Water Regulations.

^a Arsenic is proposed to be compared to the MDE risk-based comparison value (RCV) of 26.8 mg/kg for commercial properties.

If other COPCs are identified, the cleanup criteria will be re-evaluated. Generally, the cleanup criteria that will be applied to any additional COPCs will be the published MDE NRCS values, or site-specific values calculated using the appropriate frequency exposure parameters, as the need arises. Any stockpiled soil or groundwater generated from dewatering activities will be sampled to determine concentrations of COPCs and in accordance with the requirements of the receiving facility for off-site disposal.

5. REMEDIES AND INSTITUTIONAL CONTROLS

This EMP details protections against exposure to potentially contaminated soil and groundwater during construction and development activities discussed in the EMP. Potentially complete exposure pathways have been identified between contaminated soil and groundwater and construction worker and future on-site worker and visitor populations at the Site. These potential exposure pathways will be eliminated through preparation and implementation of a site-specific HASP by each contractor/subcontractor, construction observation for health and safety measures, proper management of impacted materials encountered during construction activities, and engineering and land use controls, deed restrictions on use of groundwater in the EC and capping of exposed soils in the SMA. Appendix C provides guidance for the HASP.

During the work under this EMP, there will be an environmental professional familiar with the authorized scope of work on-site during working hours. For this distribution line, there will be one environmental professional onsite, under contract to Rowan. This inspector is responsible to be familiar with approved environmental plans and scopes of work (including this EMP) and have the authority to stop work, if necessary, or otherwise direct concerns to appropriate contractor personnel.

The environmental professional will be notified by the contractor each morning of the activities for the next day, including specific information as to whether work is in the EC only or EC and SMA area, whether any movement of soil or water is planned (including location/estimated quantity) etc. The environmental professional reviews the submittal to verify compliance with plans, add conditions if needed, and prepare for the next day. These communications will be retained throughout the duration of the work described in this EMP. Using this information, specific elements which will be observed and documented by the environmental professional or delegates include:

- Daily beginning of each work element to ensure proper understanding of the work area in relation to the EC and SMA boundaries and to verify proper equipment, including the first full process of drilling boreholes, installing the distribution poles, constructing the access road, excavating the duct bank area, installing duct banks, etc.;
- Start and completion daily of any water movement (log source, destination, label the tank, and once moved the amount);
- Beginning, intermittent checking during work, and completion of daily soil movement daily for work area prep, excavation, backfill (noting the source, destination, and quantity). If clean fill is imported on-site, document the quarry fill certification or reference to MDE approval;
- Any other work item as needed to verify continued EMP compliance or to document daily soil, water, and backfill (soil, grout, etc.) volumes for items which continue more than one day; and
- Any environmental samples collected (water sampled for disposal, soil sampled for disposal or reuse).

In addition, the EMP will be distributed to and signed by representatives of Potomac Energy, list lead contractor and any other significant entities, and their subcontractors (see Section 7.2).

5.1 SITE SECURITY

The entire EC area is currently secured with fencing to prevent trespassing during non-working hours. Excavations in the SMA resulting from redevelopment work must be secured with perimeter fencing if they are to be left open for more than one workday. The existing fence is proposed to remain in place. Breeches to the fence required by construction activities must be re-secured at the close of each workday.

The points where the distribution line LOD and duct bank LOD cross the EC and SMA boundary will be clearly marked in the field using segments of temporary/construction fence and temporary signs to ensure that workers/equipment performing construction work not subject to this EMP do not cross into the EMP area prior to approval of this EMP, and so that after approval of this EMP, it remains clear to workers when they enter the EMP area.

5.2 HEALTH AND SAFETY MEASURES

As required by the SMP, the portion of the scopes of work under this EMP within the SMA area are currently and will remain secured with fencing. Any breaches to this fence as required by construction activities must be promptly re-secured and the developer must provide adequate security to prevent trespassing during non-working hours at the end of each workday.

Guidance for the site-specific HASP is provided as Appendix C. Avoidance of direct contact with potentially impacted soil and groundwater during work activities is expected to be the primary action to mitigate potential exposures to construction workers, along with the use of applicable personal protective equipment (PPE).

Additionally, all contractors and subcontractors will each prepare a site-specific HASP, that fully meets or exceeds all EC/SMA requirements, which will include appropriate controls and PPE to ensure that workers are protected. Contractors will independently assess available information and implement appropriate measures to protect the health and safety of their employees and subcontractors. Additionally, HASPs shall be submitted by each contractor and subcontractor at the time of signing the EMP Certification.

5.2.1 DUST CONTROL

As previously stated, risk of worker exposure to contaminants at the site, while minimal, mainly arises from direct contact, ingestion, or inhalation of nuisance dust. To reduce the likelihood of exposure for construction workers, the primary strategy will involve preventing direct contact with potentially contaminated soil and ensuring the proper utilization of standard personal protective equipment (such as work gloves and safety glasses) throughout work operations. In addition, dust control measures will be implemented in accordance with the requirements of the 20-CP permit and MD ESC Manual Section H5.

The highest concentrations of COPCs identified in the soil indicate that the OSHA Permissible Exposure Limits (PELs) for individual COPCs would only be surpassed if the nuisance dust PEL is

exceeded by a significant margin. Consequently, mitigation of potential exposure to contaminants will be achieved through airborne dust monitoring. By ensuring that nuisance dust levels remain below the established worker protection limits, the safety of construction workers from COPCs is effectively maintained.

According to OSHA, the nuisance dust PEL of 15 mg/m³ should be used as a safe guideline for air monitoring. This level of nuisance dust can be seen without needing active dust monitoring equipment. If airborne dust is noted during work with either known or possibly contaminated soils, dust suppression methods (such as wetting or misting from a water truck) will be enacted. If these methods do not reduce visible dust sufficiently, active dust monitoring will begin to ensure that dust levels stay below the PEL. If nuisance dust levels reach the PEL, earthwork will stop until the dust is no longer visible and levels drop below this limit.

Visible airborne dust observations shall be documented and measures for dust suppression will be enacted during earthwork activities within the EMP. Alongside the routine visual assessments conducted by contractor personnel and on-site environmental experts, the environmental professional will establish a protocol for portable dust monitoring. This will involve scheduled visits to the work site throughout the day to record weather conditions, the direction of prevailing winds, and the levels of airborne dust both at the work area and in upwind and downwind locations. The specific sites for monitoring will change depending on the activities taking place on a particular day. The same monitoring approach will be applied in instances where dust is visually observed, with action levels defined as previously mentioned.

5.2.2 VOLATILE ORGANIC VAPORS

The scopes of work within this EMP fall within the EC-only and EC and SMA area, which were historically known for high industrial activity and VOC contamination. ERM's recent Phase II included VOC analysis of both soil and groundwater samples and while there were detections, there were no exceedances of MDE Non-Residential Cleanup Standards. If areas with potential VOC impacts are identified anywhere within the LOD, the environmental professional will conduct regular PID readings during soil and groundwork interactions and results will be documented. If organic odors are detected or field VOC readings exceed established screening levels in contractor HASPs, Potomac Energy will halt operations, notify the MDE, and investigate the impacts. This EMP will be updated to address associated risks and necessary protective measures.

5.3 ADDITIONAL PROPOSED SOIL SAMPLING

Sampling of excess soil produced during construction will, at a minimum, comply with the standards set by a potential disposal facility. Should the observed quality of the soil (absence of visible contamination, waste, or debris) and/or the results from disposal samples indicate that the material could be suitable for reuse, Potomac Energy may choose to conduct further sampling of the material in accordance with the MDE Fill Material and Soil Management in Maryland fact sheet and associated regulations. However, at this time, no reuse of excavated soil is anticipated as part of the work proposed in this EMP.

5.4 CONSTRUCTION-RELATED SOIL MANAGEMENT

Soils excavated within the EC area are subject to the requirements spelled out in the recorded EC and the SMP. A small portion of the OH temporary distribution line (less than 200 feet) is located within the EC only area, the remainder of the OH temporary OH distribution line that is within the EMP LOD is within the EC and SMA area (approximately 3000 feet). Approximately one third of the duct bank excavation area (approximately 172,066 square feet) is located within the EC only area, while the remaining two thirds (approximately 333,397 square feet) are located within the EC and SMA area.

Soil excavated from the duct bank areas is planned to be managed via off-site disposal. Soil generated during construction will be tracked and managed based on the source ("inside the EC and SMA" or "inside the EC only") and the results of laboratory testing. For example, soil generated within the EC and SMA will be stockpiled in the SMA, soil generated within the EC, but outside the SMA will be stockpiled in an area inside the EC, but outside the SMA. Soil which exhibits evidence of contamination or waste, such as visible waste materials, staining, or odors and soils in specific locations such as track crossings may be segregated into smaller piles for testing and management. An example stockpile tracking log is provided as Table 14. Proposed stockpile locations are shown in Figure 2.

Per the EC/SMP, soils from the EC and SMA area must be capped after permanent placement. This requirement will be applied to any SMA soil that is exposed due to excavation but remains in place, including both the utility duct bank area and overhead distribution line utility poles. In these locations within the SMA area, a geotextile marker barrier will be placed prior to backfilling with clean material.

For materials that will be disposed off-site, soil sampling will, at a minimum, meet the requirements of the selected disposal facility. If field observations, field screening, unusual odors, odd coloration, or other factors indicate environmental impacts in significant quantities, the suspect impacted soils will be segregated from non-impacted soils so that additional characterization can be performed. MDE will be notified per the requirements of the SMP. This soil will be placed on and covered with plastic sheeting. Soil samples will be collected from the suspect impacted materials to evaluate whether it should be classified as regulated. MDE will be notified, and this will be recorded in the EMP Completion Report.

Impacted soil/waste (as determined by sampling results) will be disposed at an appropriate disposal facility. The potential disposal facilities will be contacted to establish the necessary sampling and analysis requirements. Disposal facility information will be provided to MDE prior to the initiation of work conducted under this EMP.

Clean fill materials such as open-graded aggregate, or fill material intended for use in construction applications, including for access road or backfilling excavations, will be verified as clean prior to use on-site. This will be achieved either through certification from the supplier for quarry stone or through sampling and approval by the MDE prior to application. Potomac Energy will obtain verification of clean fill material and provide to MDE prior to beginning construction.

5.5 CAPPING

Any areas of soil disturbance within the SMA must be placed under a cap, as specified in the EC and approved SMP for the site. During construction of the portions of the OH temporary distribution line, access road, and underground utility duct banks located within the SMA, a presumptive remedy as described in the SMP section 5.1, will apply. Under this EMP, prior to any backfilling earthwork, existing soils will be covered/marked by the placement of a marker/exposure barrier, which may consist of a geotextile fabric meeting MDOT SHA specification 921.09, Maryland application class SD Type I, woven, monofilament. Following the marker barrier, a minimum of 2 feet of MDE-approved clean fill will be placed. See sections 2.2 and 2.3 for additional detail.

5.6 GROUNDWATER MANAGEMENT

During the drilling associated with construction of the OH temporary distribution line utility poles, groundwater is not expected to be encountered. However, during the excavation associated with the construction of the duct banks, groundwater may be encountered in portions that are installed to the maximum depth of 12 feet.

Figure 6 illustrates the locations where the base elevation of excavation areas is likely to encounter groundwater. In Table 13, specific segments/construction elements are listed, along with the anticipated construction duration and estimated groundwater seepage/removal rate.

Groundwater and any stormwater extracted from drilling and excavations within the EC-only area and the EC and SMA area will be containerized and sampled before off-site disposal. Additional details regarding groundwater management can be found in Table 13. Additionally, Tables 15, 16, and 17 provide examples of the Tank Tracking Summary, Tank Volume Log, and Tank Testing Log.

The following sections detail the EC's water management requirements, anticipated locations and amounts of groundwater produced, construction details, and disposition of groundwater.

5.6.1 EC REQUIREMENTS FOR ENCOUNTERED GROUNDWATER

With respect to water management, page 3 of the EC states:

Excavation Encountering Groundwater: When conducting any excavation activities on the Property extending to the ground water table, the Property Owner shall implement the requirements of a site-specific health and safety plan in accordance with the Site Management Plan to ensure that worker protection measures are met. The encountered ground water shall be containerized during all dewatering activities at the property and shall be analyzed before disposal. The analytical results shall be the basis for appropriate disposition of the ground water in accordance with applicable local, State and federal laws and regulations.

Since the scopes of work discussed in this EMP take place within the EC boundary, the contractors performing the scopes of work are required to develop and adhere to a HASP that provides adequate protection to workers.

In accordance with the EC, groundwater in excavations will be containerized, sampled, and disposed of off-site.

5.6.2 SOURCE, QUANTITY, AND GENERAL DESCRIPTION

The following describes locations and quantities of water expected to be encountered.

- Although unlikely at borehole depths of 7 to 9 feet, water may be displaced from boreholes during installation of poles for the OH temporary distribution line. This quantity of water is expected to be minimal.
- Water associated with deep sections of the duct bank excavation (those that will be installed at the maximum depth of 12 feet bgs). Figure 6 shows the areas where groundwater is expected to be encountered. Appendix B presents the estimated dewatering rates and volumes for these excavations.

Figure 2 includes locations of soil and water management such as stockpiles and frac tanks, and Table 13 lists areas where groundwater is anticipated to be encountered and includes calculations for seepage and removal rates as well as the expected duration of time spent excavating.

5.6.3 DISPOSITION OF GROUNDWATER

The water extracted during construction activities covered by this EMP will be containerized and tested for COPCs to assure proper handling and disposal. Frac tanks will be staged in areas designated in Figure 2.

All tanks will be labelled with the following information as follows:

- Unique number
- Contents
- Status

When the first tank is 60% full, the water will be sampled for the full list of COPCs identified in Section 3.2 plus any additional requirements of the disposal facility. The potential disposal facilities will be contacted to establish the necessary sampling and analysis requirements.

When results are received from the laboratory, they will be provided to the disposal facility for waste acceptance approval and will be sent to MDE for information.

5.7 LAND USE CONTROLS

Land use controls currently exist in the form of an EC and SMA. Closure documentation issued by the MDE for the successful completion of the EMP activities will also list land use controls. The existing land use controls for the area within the EC include, but are not limited to, the soil excavation controls and restrictions, as well as restrictions on the use of groundwater beneath the property. These land use controls are recorded in the local land records. No additional land use controls beyond the existing EC and SMA requirements are proposed in this EMP.

6. CONTINGENCIES

If site conditions observed during construction and/or remediation differ substantially from those described herein, modifications to this EMP may be necessary. Such differing conditions may warrant an adjustment of sampling procedures, analytical methods, remedial activities, etc. and such modifications will be addressed in an addendum or revision to this EMP. MDE will be notified of any newly discovered contamination, proposed changes to this EMP, or citations from other regulatory agencies.

Specifically, if newly discovered contamination is identified during site development, the following contingency measures will be taken:

- Notify MDE within 24 hours (verbally and written/email);
- Postpone implementation of the EMP;
- Evaluate new site conditions identified; and
- Amend EMP to address new site conditions identified.

Any amendments to the EMP must be approved by MDE prior to implementation. Notified departments will include:

MDE Land Restoration Program
Land and Materials Administration
1800 Washington Boulevard
Baltimore, Maryland 21230
(410) 537-3466
Attention: Anuradha Mohanty

In addition to the above, if there is evidence of an oil discharge at the Site in violation of applicable regulations, it must be reported within two hours as specified in COMAR 26.10.08.01, to the OCP (410-537-3442) or, if after normal business hours, to the 24-hour Spill Reporting Hotline (1-866-633-4646). The MDE will be verbally notified within 48 hours (72 hours in writing /email) of changes (planned or emergency) to the EMP implementation schedule, previously undiscovered contamination, and citations from regulatory entities related to health and safety practices. Notifications shall be made to the MDE project manager at 410- 537-3466.

Any violations of State or Local permit requirements during implementation of the EMP in the EMP area must be reported to the CHS project manager by email within 24 hours of receipt of the violation notification.

7. ADMINISTRATIVE

7.1 SCHEDULE

The preliminary schedule to implement the EMP is presented below. Note that this preliminary schedule is subject to change based on unforeseen conditions that are beyond the development team's control. Deviations from this proposed schedule will be communicated to MDE.

ESTIMATED CONSTRUCTION SCHEDULE

Milestone	Estimated Schedule
EMP Review/Approval	1/3/2025-1/15/2025
Engineering, Design, Procurement	1/1/25 – 05/01/25
Submission of Weekly EMP Progress Reports	05/1/25 – 8/31/26
Construction Activities	6/15/25 – 8/31/26
EMP Completion Report Submittal	9/10/26
MDE Review Complete (Estimated)	10/10/26

Per the EC, any soil-disturbing activity within the EC and SMP area requires 30-day prior notification to MDE. This allows MDE to review the work elements and ask questions as needed prior to the beginning of field work. MDE is provided notice of these activities via submittal of the initial EMP in September 2024, as well as prior submittals. The MDE project manager will be additionally notified in writing within five calendar days prior to the beginning of EMP field implementation activities via the EMP Progress Report process. Schedule updates will be provided when needed, during preparation of the progress reports discussed in Section 7.2.

If site conditions or other factors lead to a change in the scope of work or procedures, MDE will be notified and an EMP modification or EMP Addendum will be provided to MDE. Some soil and groundwater management decisions will be based on data collected during the work, in consultation with MDE.

7.2 DOCUMENTATION

After approval of the EMP and prior to the start of work under this EMP, Potomac Energy and all site contractors working under this EMP (including the on-site environmental professional) will review the EMP and sign the certification (Section 8 of this EMP) stating that they have received and read the EMP. No work within the scope of this EMP will be conducted until the EMP is approved and referenced permits are obtained.

During implementation of this EMP, Potomac Energy will prepare weekly progress reports summarizing the remedial activities occurring during that week. These weekly progress reports will be submitted to the Client and to MDE by the Tuesday of the following week, to demonstrate implementation of this EMP. At the conclusion of EMP implementation, Potomac Energy will prepare an EMP Completion Report.

7.3 MAINTENANCE

Capped areas within the SMA require periodic maintenance activities. The maintenance plan that will be implemented by future owners or occupants of the site is presented below.

Physical maintenance requirements will include maintenance of the capped areas to prevent degradation of the cap and unacceptable exposure to the underlying soil. Yearly inspections of the cap will be conducted. The property owner will be responsible to direct an Environmental

Consultant to perform an annual inspection of the onsite cap, performing maintenance to the cap, and maintaining all cap inspection records. Maintenance records will include, at a minimum, the date of the inspection, name of the inspector, any noted issues, and subsequent resolution of the issues. A Cap Inspection Form is attached in Appendix D.

If construction or excavation is planned that will breach the cap within the SMA, the Site owner shall submit written notification to the MDE LRP at least 30 calendar days prior to any planned future excavation or intrusive activities on the Site. Such activities include any activity that breaches cap, including, but not limited to, borings for the purposes of geotechnical, soil, or groundwater sampling; landscaping activities; and utility installation or maintenance activities. Written notice of planned excavation activities will include the proposed date(s) for the excavation, location of the excavation(s), health and safety protocols (as required), MDE certified clean fill source and documentation (as required), and proposed characterization and disposal requirements (as required).

In the event of an unplanned emergency excavation on the Site, the Site owner shall follow all procedures set forth in this EMP and verbally or electronically notify the MDE within 24 hours following initiation of the emergency excavation activities. Within 10 calendar days following completion of an unplanned emergency excavation, the Site owner shall submit a detailed written report to the MDE.

8. EMP CERTIFICATION

By signing below, I certify that I have read and understand the terms and conditions of the EMP for the above designated project and agree to follow the practices described in the EMP.

Name	Company	Signature

9. REFERENCES

ERM, 2024. *Limited Phase II Environmental Site Assessment: Former Eastalco Works Lots 102, 105, 112C, and 112D*. Prepared for Rowan Digital Infrastructure. Prepared by Environmental Resources Management, Inc. 20 June 2024.

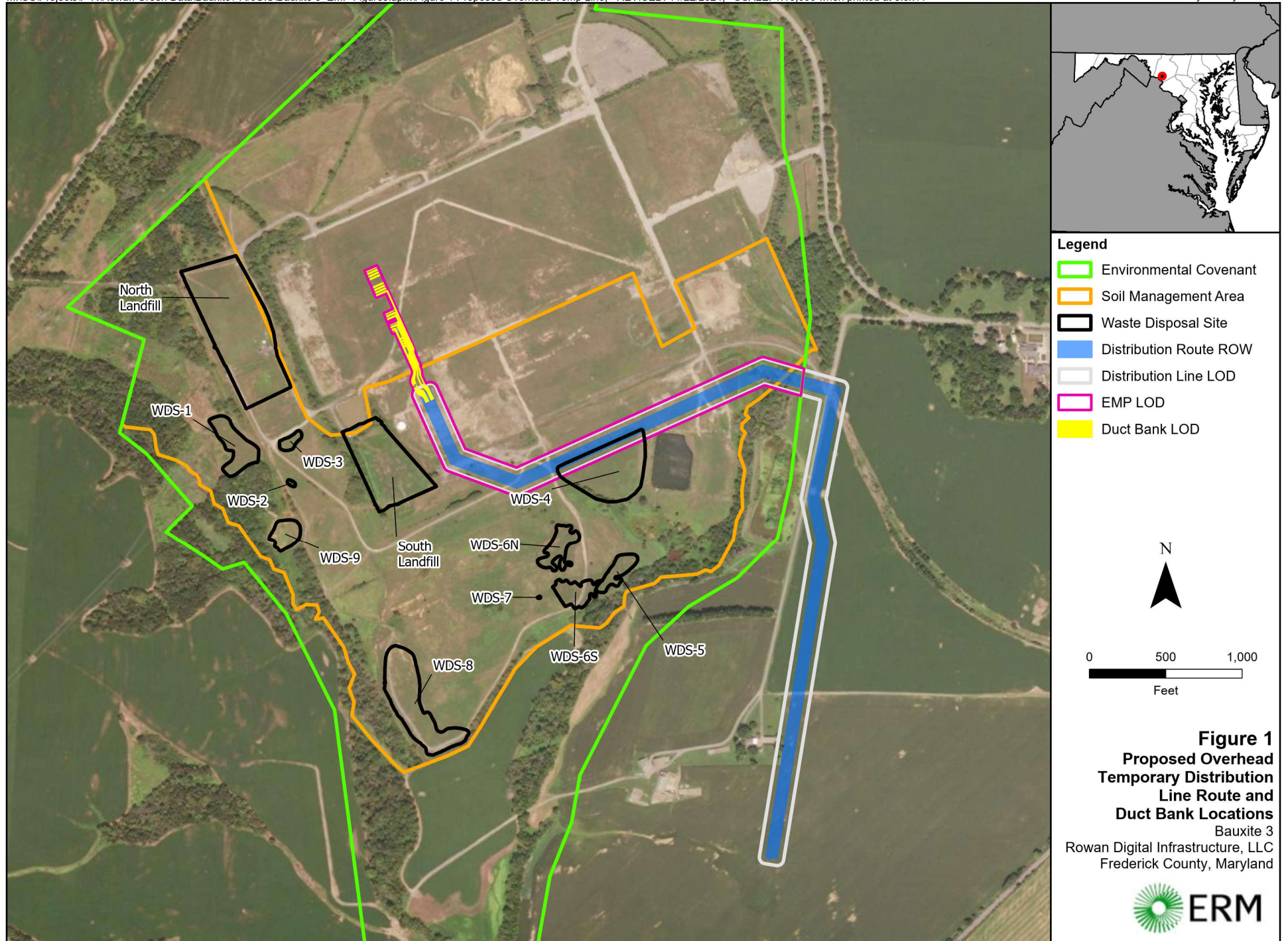
GTA. 2017. *Site Management Plan: Eastalco Aluminum Company*. Prepared for Eastalco Aluminum Company. Prepared by Geo-Technology Associates, Inc., October 30, 2017.

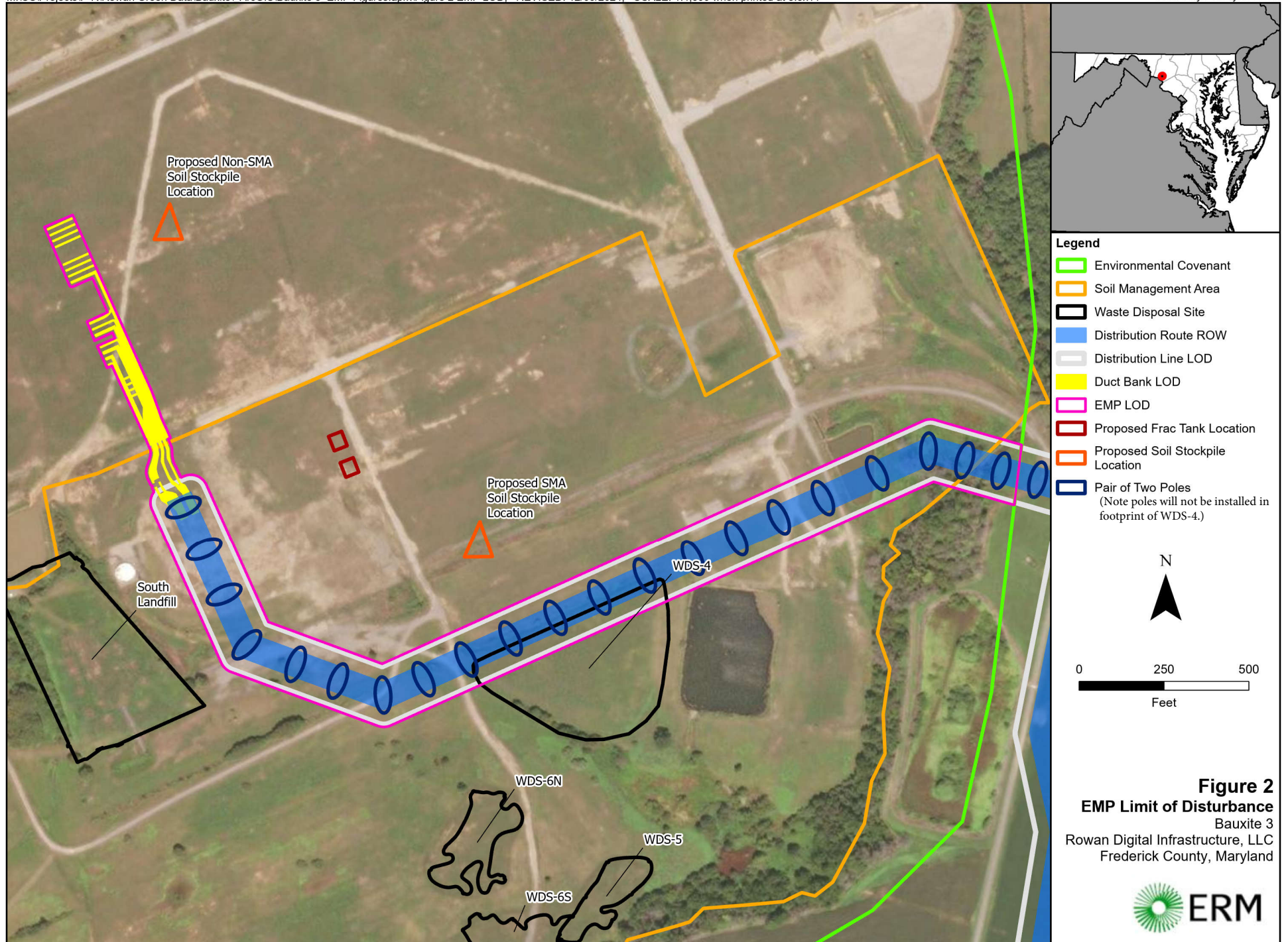


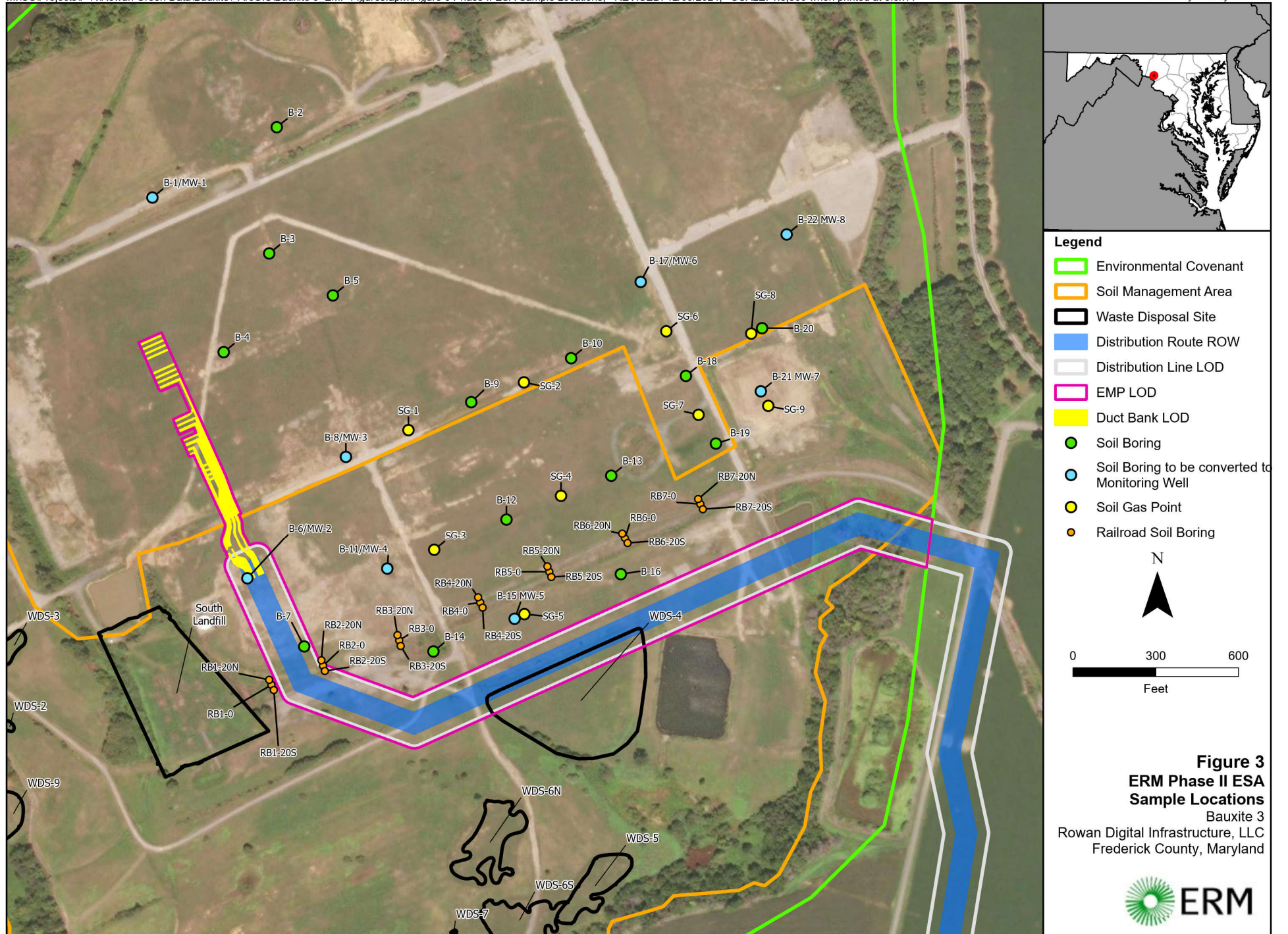
- GTA, 2022a. *Phase II Environmental Site Assessment, Initial Infrastructure Phase*. Prepared for Quantum Maryland, LLC. Prepared by Geo-Technology Associates, Inc., October 11, 2022.
- GTA, 2022b. *Phase II ESA Initial Infrastructure Addendum*. Prepared for Quantum Maryland, LLC. Prepared by Geo-Technology Associates, Inc., November 2, 2022.

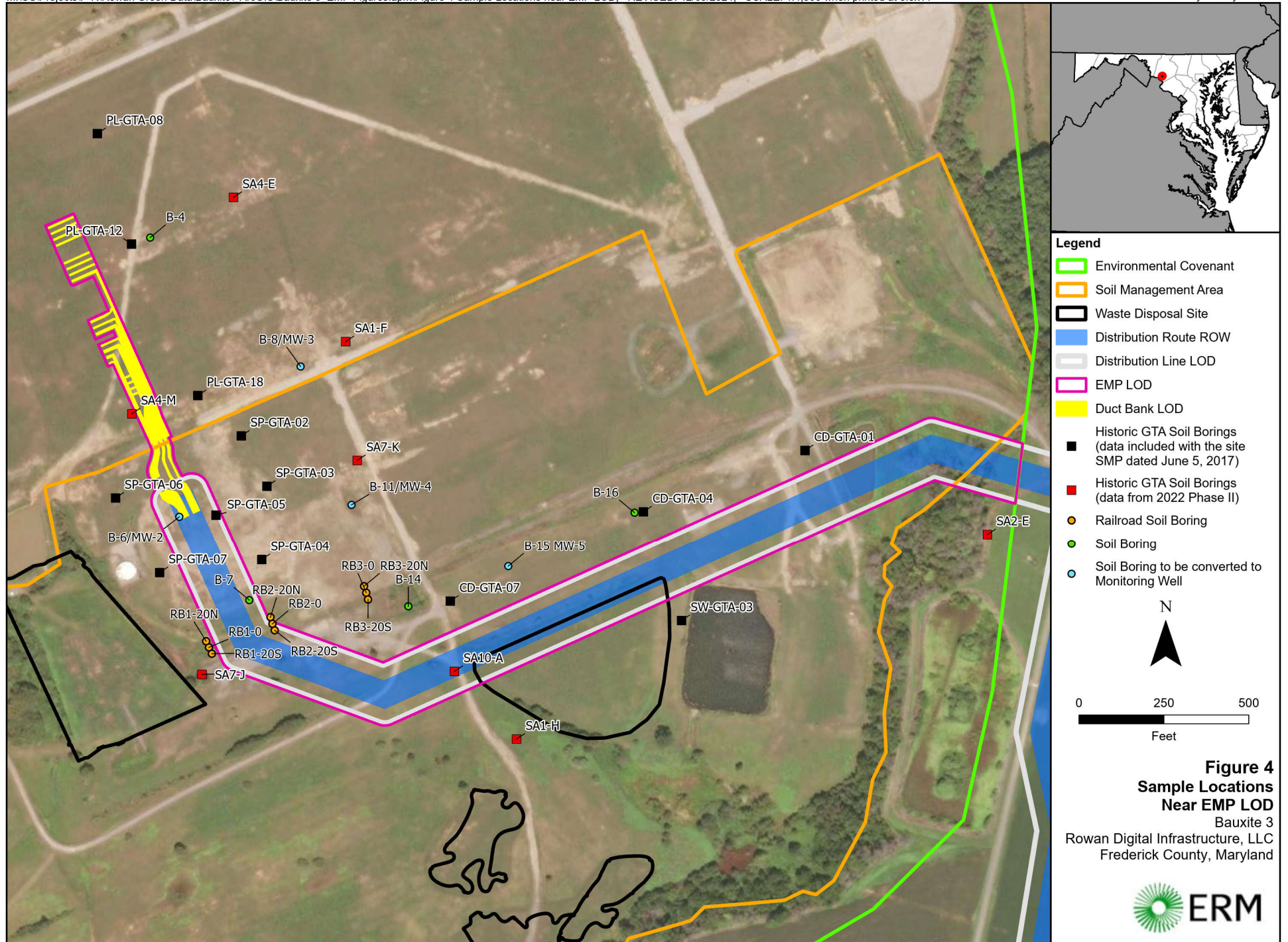


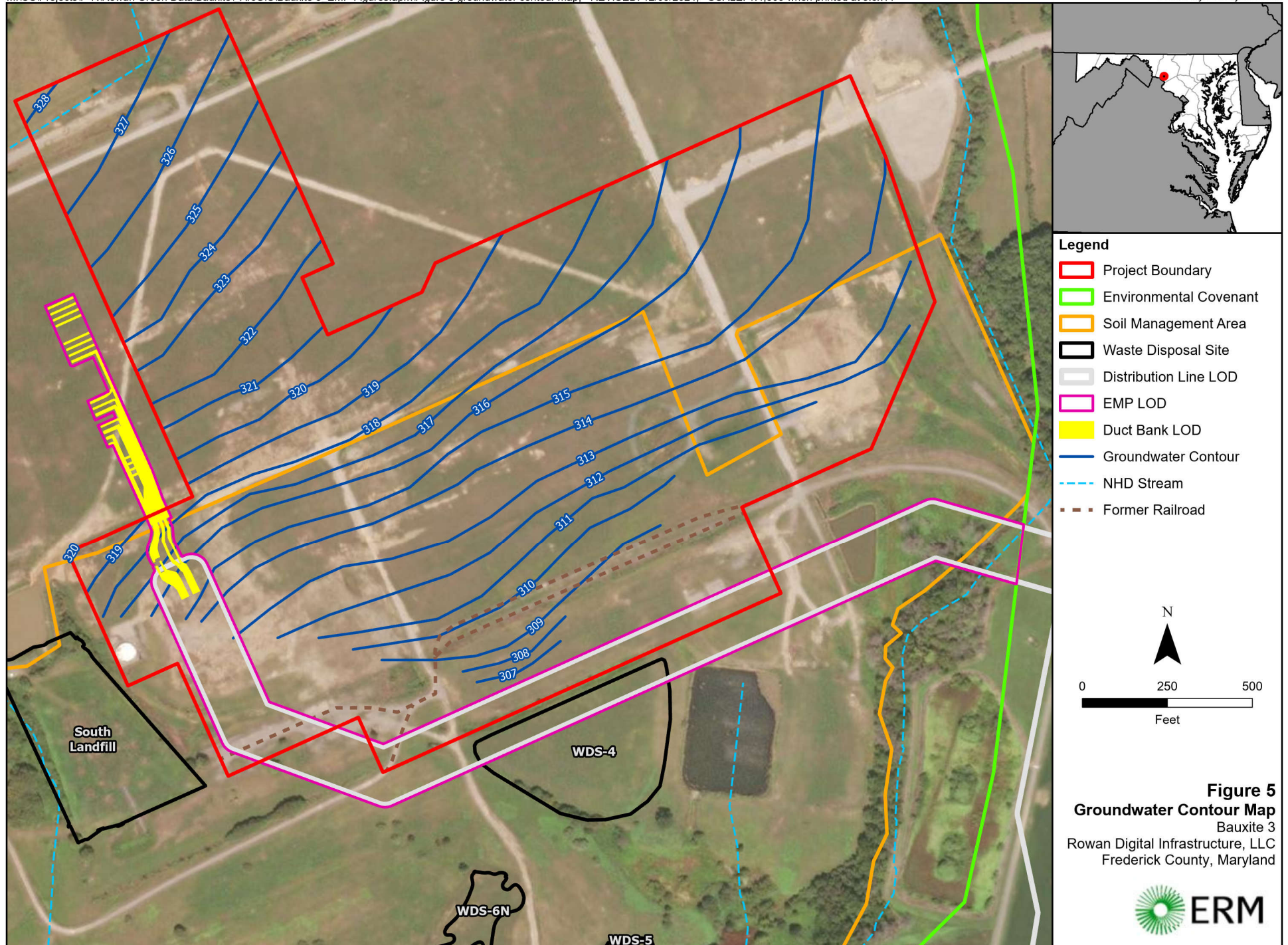
FIGURES











Legend

- ▬ Project Boundary
- ▬ Environmental Covenant
- ▬ Soil Management Area
- ▬ Waste Disposal Site
- ▬ Distribution Line LOD
- ▬ EMP LOD
- ▬ Duct Bank LOD
- ▬ Groundwater Contour
- - - NHD Stream
- - - Former Railroad

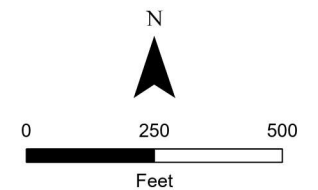
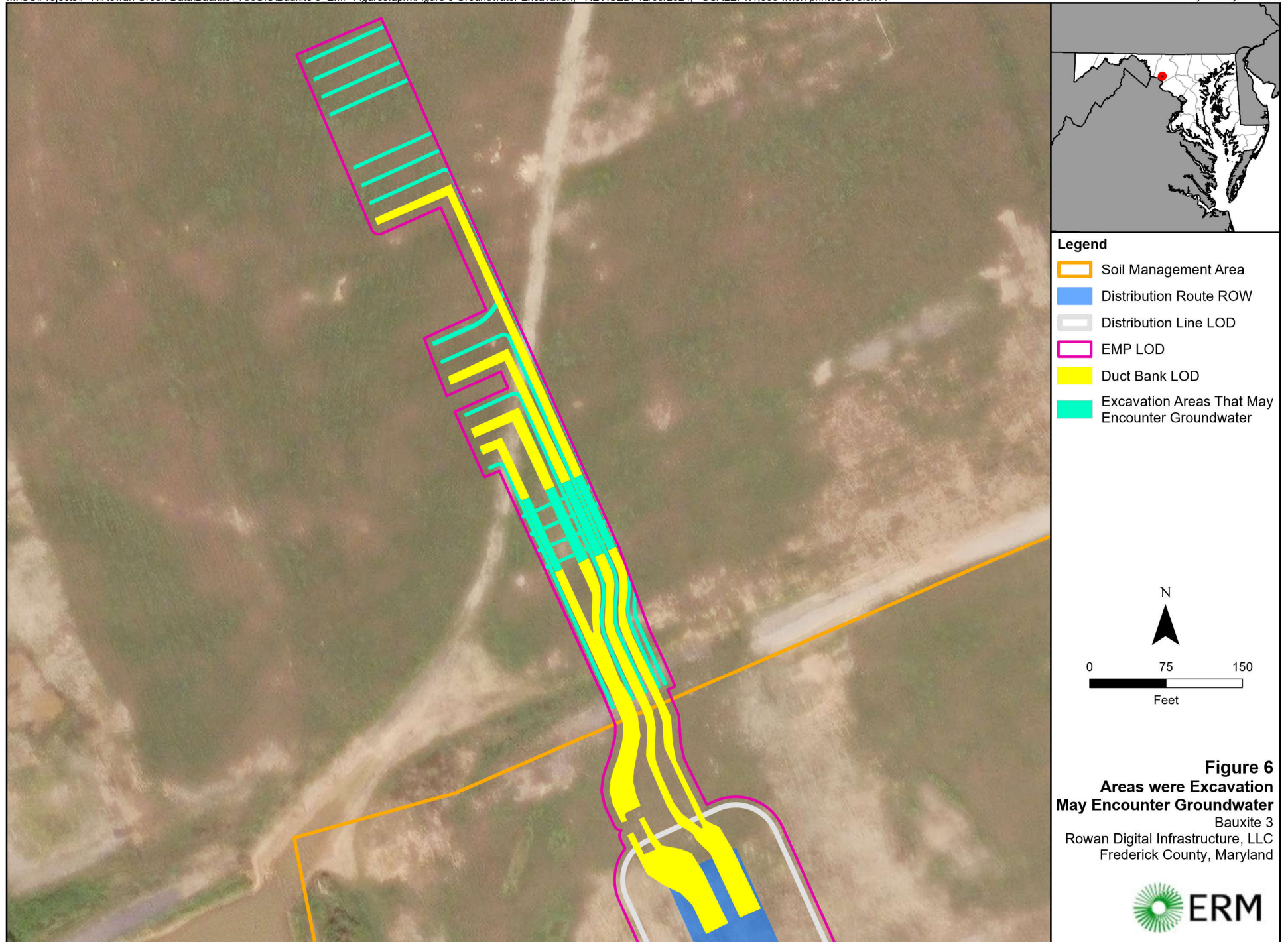


Figure 5
Groundwater Contour Map
 Bauxite 3
 Rowan Digital Infrastructure, LLC
 Frederick County, Maryland







TABLES

Table 1
Groundwater Elevation Data
Interim Distribution Line and Duct Bank Construction
Frederick, MD

Monitoring Well ID	Reference Elevation (TIC feet amsl)	Ground Surface Elevation (feet amsl)	Date	Depth to Water (feet bre)	Depth to water (feet bgs)	Groundwater Elevation (ft amsl)
MW-1	339.513	336.563	5/8/2024	11.66	8.71	327.853
MW-2	330.239	327.489	5/7/2024	14.44	11.69	315.799
MW-3	331.641	328.766	5/2/2024	13.05	10.175	318.591
MW-4	326.032	323.442	5/7/2024	13.53	10.94	312.502
MW-5	329.445	326.215	5/6/2024	20.41	17.18	309.035
MW-6	324.895	322.065	5/1/2024	8.10	5.27	316.795
MW-7	326.712	323.912	5/1/2024	13.10	10.3	313.612
MW-8	327.892	324.872	5/2/2024	11.55	8.53	316.342

Notes:

Bold = Monitoring wells within or near EMP LOD

amsl = Above Median Sea Level

bgs = Below Ground Surface

TIC= Top of Inner Casing

Table 2
Soil Data - TCL VOCs
Bauxite Interim Route Distribution Line
Frederick, MD

		Source	ERM Phase II ESA (Bauxite 3) 2024											
		Location ID	B-4	B-4	B-6	B-6	B-7/ MW-2	B-7/ MW-2	B-8	B-8	B-14	Dup 4	B-11	B-11
		Depth (ft)	4-5	13-14	4-5	14-15	4-5	12.5-13.5	4-5	14-15	4-5	4-5	4-5	14-15
		Sample ID	B-4-4-5-G	B-4-13-14-G	B-6-4-5-G	B-6-14-15-G	B-7-4-5-G	B-7-12.5-13.5-G	B-8-4-5-G	B-8-14-15-G	B-14-4-5-G	Dup 4	B-11-4-5-G	B-11-14-15-G
		Sample Date	5/10/2024	5/10/2024	5/7/2024	5/7/2024	5/6/2024	5/6/2024	5/2/2024	5/2/2024	5/10/2024	5/10/2024	5/7/2024	5/7/2024
Parameter	MDE Non-Residential Cleanup Standard	Units												
Acetone	67,000,000	ug/kg	< 1400 cn	10 J	< 1000 cn	< 1100 cn	8.6 J	4.5 J	13 J	< 250 cn	11 J	8.4 J	< 940	< 16 F2
Benzene	510	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
Bromodichloromethane (THM)	1,300	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
Bromoform (THM)	86,00	ug/kg	< 680 cn	< 9.6	< 520 cn	< 570 cn	< 9.9	< 6.6	< 6.9	< 500 cn	< 8.3	< 6.9	< 470	< 8.2 F2
Bromomethane	3,000	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
2-Butanone (Methyl Ethyl Ketone)	19,000,000	ug/kg	< 680 cn	< 9.6	< 520 cn	< 570 cn	< 9.9	< 6.6	< 6.9	< 500 cn	< 8.3	< 3.5	< 470	< 8.2 F2
Carbon Disulfide	350,000	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	1.2 J	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
Carbon Tetrachloride	2,900,000	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
Chlorobenzene	130,000.00	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
Chloroethane	5700000	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
Chloroform	1,400	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
Chloromethane	46,000	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
Cumene (Isopropylbenzene)	990,000	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
Cyclohexane	NVL	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
1,2-Dibromo-3-chloropropane	64	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
Dibromochloromethane	39,000	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
1,2-Dibromoethane	160	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
1,2-Dichlorobenzene	930,000	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
1,3-Dichlorobenzene	NVL	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
1,4-Dichlorobenzene	11,000	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
1,1-Dichloroethane	16000	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
1,2-Dichloroethane	2000	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
1,1-Dichloroethene	100,000	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
cis-1,2-Dichloroethene	230000	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
trans-1,2-Dichloroethene	2,300,000	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
1,2-Dichloropropane	6,600	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
cis-1,3-Dichloropropene	NVL	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
trans-1,3-Dichloropropene	NVL	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
Dichlorodifluoromethane	NVL	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
Ethylbenzene	25	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
Freon 113	NVL	ug/kg	< 680 cn	< 9.6	< 520 cn	< 570 cn	< 9.9	< 6.6	6.9	< 500 cn	< 8.3	< 6.9	< 470	< 8.2 F2
2-Hexanone	NVL	ug/kg	< 680 cn	< 9.6	< 520 cn	< 570 cn	< 9.9	< 6.6	< 6.9	< 1000 cn	< 8.3	< 6.9	< 470	< 8.2 F2
4-Methyl-2-pentanone (Methyl Isobutyl Ketone)	14,000,000	ug/kg	< 680 cn	< 9.6	< 520 cn	< 570 cn	< 9.9	< 6.6	< 3.4	< 250 cn	< 8.3	< 6.9	< 470	< 8.2 F2 F1
Methyl Acetate	NVL	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
Methylcyclohexane	NVL	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
Methylene Chloride (Dichloromethane)	320,000	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
Methyl tert-butyl ether (MTBE)	210,000	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
Styrene	3,500,000	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
Tetrachloroethene	39,000	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
1,2,4-Trichlorobenzene	NVL	ug/kg	< 680 cn	< 9.6	< 520 cn	< 570 cn	< 9.9	< 6.6	< 6.9	< 500 cn	< 8.3	< 6.9	< 470	< 8.2 F2
1,1,2,2-Tetrachloroethane	2,700	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
Toluene	4,700,000	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
1,1,1-Trichloroethane	3,600,000	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
1,1,2-Trichloroethane	630	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
Trichloroethene	190	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
Trichlorofluoromethane	NVL	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
Vinyl Chloride	200	ug/kg	< 340 cn	< 4.8	< 260 cn	< 290 cn	< 4.9	< 3.3	< 3.4	< 250 cn	< 4.1	< 3.5	< 240	< 4.1 F2
Xylenes	250,000	ug/kg	< 340 cn	< 9.6	< 260 cn	< 290 cn	< 9.9	< 6.6	< 6.9	< 250 cn	< 8.3	< 6.9	< 240	< 8.2 F2

Table 2
Soil Data - TCL VOCs
Bauxite Interim Route Distribution Line
Frederick, MD

		Source					
		Location ID	B-14	B-15/MW-5	B-15/ MW-5	B-16	B-16
		Depth (ft)	11-12	4-5	14-15	4-5	14-15
		Sample ID	B-14-14-15-G	B-15-4-5-G	B-15-14-15-G	B-16-4-5-G	B-16-14-15-G
		Sample Date	5/10/2024	5/6/2024	5/6/2024	5/9/2024	5/9/2024
Parameter	MDE Non-Residential Cleanup Standard	Units					
Acetone	67,000,000	ug/kg	< 16	36	6.8 J	< 1000 cn	< 1700 cn
Benzene	510	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
Bromodichloromethane (THM)	1,300	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
Bromoform (THM)	86,00	ug/kg	< 7.8	< 11	< 7.5	< 520 cn	< 850 F1 cn
Bromomethane	3,000	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F2 cn
2-Butanone (Methyl Ethyl Ketone)	19,000,000	ug/kg	< 7.8	4.1 J	< 7.5	< 520 cn	< 850 cn
Carbon Disulfide	350,000	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 cn
Carbon Tetrachloride	2,900,000	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
Chlorobenzene	130,000.00	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
Chloroethane	5700000	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F2 cn
Chloroform	1,400	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
Chloromethane	46,000	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
Cumene (Isopropylbenzene)	990,000	ug/kg	< 3.9 F1	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
Cyclohexane	NVL	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 cn
1,2-Dibromo-3-chloropropane	64	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
Dibromochloromethane	39,000	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
1,2-Dibromoethane	160	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
1,2-Dichlorobenzene	930,000	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
1,3-Dichlorobenzene	NVL	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
1,4-Dichlorobenzene	11,000	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
1,1-Dichloroethane	16000	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
1,2-Dichloroethane	2000	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
1,1-Dichloroethene	100,000	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
cis-1,2-Dichloroethene	230000	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
trans-1,2-Dichloroethene	2,300,000	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
1,2-Dichloropropane	6,600	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
cis-1,3-Dichloropropene	NVL	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
trans-1,3-Dichloropropene	NVL	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
Dichlorodifluoromethane	NVL	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
Ethylbenzene	25	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
Freon 113	NVL	ug/kg	< 7.8	< 8.3	< 7.5	< 520 cn	< 850 cn
2-Hexanone	NVL	ug/kg	< 7.8	< 8.3	< 7.5	< 520 cn	< 850 cn
4-Methyl-2-pentanone (Methyl Isobutyl Ketone)	14,000,000	ug/kg	< 7.8	< 8.3	< 7.5	< 520 cn	< 850 cn
Methyl Acetate	NVL	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 cn
Methylcyclohexane	NVL	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 cn
Methylene Chloride (Dichloromethane)	320,000	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
Methyl tert-butyl ether (MTBE)	210,000	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 cn
Styrene	3,500,000	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
Tetrachloroethene	39,000	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
1,2,4-Trichlorobenzene	NVL	ug/kg	< 7.8	< 4.2	< 7.5	< 520 cn	< 850 F1 cn
1,1,2,2-Tetrachloroethane	2,700	ug/kg	< 3.9	< 8.3	< 3.7	< 260 cn	< 430 F1 cn
Toluene	4,700,000	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
1,1,1-Trichloroethane	3,600,000	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
1,1,2-Trichloroethane	630	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
Trichloroethene	190	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
Trichlorofluoromethane	NVL	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
Vinyl Chloride	200	ug/kg	< 3.9	< 4.2	< 3.7	< 260 cn	< 430 F1 cn
Xylenes	250,000	ug/kg	< 7.8	< 8.3	< 7.5	< 260 cn	< 430 F1 cn

Table 2
Soil Data - TCL VOCs
Bauxite Interim Route Distribution Line
Frederick, MD

NOTES: Exceeds MDE Non-Residential Soil Cleanup Standard

NVL = No value listed

¹EPA Risk-Based Screening Level (November 2023)

< = Analyte not detected. value represents reporting limit.

J = Result is less than reporting limit but greater than method detection limit

F1 = MS and/or MSD recovery exceeds control limits

F2 = MS and/or MSD recovery exceeds control limits

cn = See case narrative below.

5/1/2024 (410-170119-1)

The moisture container for the following samples were received empty: B-10-11.5-12.5-G (410-170119-2) and B-13-13-4-G (410-170119-13). For this reason only dry weight results cannot be reported.

The moisture container for the following sample was received empty: DUP-1 (410-170119-6). There is sufficient volume in the remaining container to proceed with moisture.

Method 8260D: The continuing calibration verification (CCV) associated with batch 410-502191 recovered above the upper control limit for Bromomethane. Non-detections of the affected analytes are reported. Any detections are considered estimated.

Method 8260U: The following sample(s) was unable to be analyzed by the low level analysis due to an excessive amount of soil in the vials. The reported values are from the high level volatile analysis: B-10-4-5-G (410-170119-1), B-10-11.5-12.5-G (410-170119-2), DUP-1 (410-170119-6).

5/2/2024 (410-170307-1)

The following samples were received at the laboratory outside the required temperature criteria: B-22-4-5-G (410-170307-1), B-22-14-15-G (410-170307-2), B-22-0-1-G (410-170307-3), B-22-1-5-G (410-170307-4), B-22-5-15-C (410-170307-5), B-20-4-5-G (410-170307-6), B-20-13-14-G (410-170307-7).

The moisture container for the following sample was received empty: B-20-13-14-G (410-170307-7). For this reason only dry weight results cannot be reported.

Method 8260U: The continuing calibration verification (CCV) associated with batch 410-503247

recovered above the upper control limit for 1,2-Dibromo-3-Chloropropane, Bromoform,

Dibromochloromethane and Dichlorodifluoromethane.

Method 8260D: The following sample(s) was unable to be analyzed by the low level analysis due to an excessive amount of soil in the vials. The reported values are from the high level volatile analysis: B-22-14-15-G (410-170307-2), B-20-13-14-G (410-170307-7), B-8-14-15-G (410-170307-13) and DUP-3 (410-170307-17).

5/6/2024

Method 8260D: The continuing calibration verification (CCV) associated with batch 410-503874 recovered above the upper control limit for 2-Hexanone, Acetone, Chloroethane, Carbon disulfide and Methyl acetate. Non-detections of the affected analytes are reported. Any detections are considered estimated.

Method 8260U: The continuing calibration verification (CCV) analyzed on 410-503874 is compliant

under 8260C/D method criteria for Cyclohexane. The software does not display the % Drift data to

the whole number as is listed in the method (i.e. limit of 20%). When applying the evaluation

Method 8260D: The method requirement for no headspace was not met. The following volatile sample was analyzed with headspace in the sample container(s): TB-20240506 (410-170644-11). The sample container was received with headspace.

5/7/2024 (410-170644-1)

Method 8260U: The continuing calibration verification (CCV) associated with batch 410-504373

recovered outside acceptance criteria, low biased, for 1,2,4-Trichlorobenzene. A reporting limit (RL)

standard was analyzed, and the target analyte was detected. Non-detections

Method 8260D: The following volatiles samples were diluted due to foaming at the time of purging during the original sample analysis: B-6-4-5-G (410-170880-3), B-6-14-15-G (410-170880-4) and B-11-4-5-G (410-170880-6). Elevated reporting limits (RLs) are provided.

5/8/24 (410-171083-1)

Method 8260U: The continuing calibration verification (CCV) associated with batch 410-504373

recovered outside acceptance criteria, low biased, for 1,2,4-Trichlorobenzene. A reporting limit (RL)

standard was analyzed, and the target analyte was detected. Non-detections

5/9/2024

Method 8260U: The continuing calibration verification (CCV) associated with batch 410-505101

recovered above the upper control limit for Acetone, Chloromethane, Chloroethane, Vinyl chloride,

Methylene Chloride, Carbon disulfide, Trichlorofluoromethane and Dichlorodifluoromethane.

Method 8260D: The continuing calibration verification (CCV) associated with batch 410-505568 recovered above the upper control limit for Bromomethane. Non-detections of the affected analytes are reported. Any detections are considered estimated.

Method 8260U: The continuing calibration verification (CCV) associated with batch 410-505568

recovered outside acceptance criteria, low biased, for Methyl acetate. A reporting limit (RL) standard

was analyzed, and the target analyte was detected.

Method 8260D: The following volatiles samples were diluted due to foaming at the time of purging during the original sample analysis: B-16-4-5-G (410-171270-1) and B-16-14-15-G (410-171270-2). Elevated reporting limits (RLs) are provided.

5/10/2024 (410-171270-1)

Method 8260U: The continuing calibration verification (CCV) associated with batch 410-506310

recovered above the upper control limit for Cyclohexane, 1,2,4-Trichlorobenzene, Acetone, Freon

113, Methyl acetate and 1,1,2,2-Tetrachloroethane.

Method 8260D: The continuing calibration verification (CCV) analyzed on 410-506310 is compliant

under 8260C/D method criteria for Vinyl chloride. The software does not display the % Drift data to

the whole number as is listed in the method (i.e. limit of 20%).

Method 8260D: The continuing calibration verification (CCV) associated with batch 410-506522 recovered above the upper control limit for Bromomethane. Non-detections of the affected analytes are reported. Any detections are considered estimated.

Method 8260U: The continuing calibration verification (CCV) associated with batch 410-506522

recovered outside acceptance criteria, low biased, for 2-Hexanone. A reporting limit (RL) standard

was analyzed, and the target analyte was detected. Nondetections of the

Method 8260D: The following volatiles samples were diluted due to foaming at the time of purging during the original sample analysis: B-4-4-5-G (410-171513-6) and B-5-4-5-G (410-171513-11). Elevated reporting limits (RLs) are provided.

Table 3
Soil Data - PAHs
Bauxite Interim Route Distribution Line
Frederick, MD

Source			ERM Phase II ESA (Bauxite 3) 2024										
Location ID			B-4	B-4	B-4	B-6	B-6	B-6	B-7/ MW-2	B-7/ MW-2	B-7/ MW-2	B-8	B-8
Depth (ft)			0-1	1-5	5-14	0-1	1-5	5-15	0-1	1-5	5-13.5	0-1	1-5
Sample ID			B-4-0-1-G	B-4-1-5-C	B-4-5-14-C	B-6-0-1-G	B-6-1-5-C	B-6-5-15-C	B-7-0-1-G	B-7-1-5-C	B-7-5-13.5-C	B-8-0-1-G	B-8-1-5-C
Sample Date			5/10/2024	5/10/2024	5/10/2024	5/7/2024	5/7/2024	5/7/2024	5/6/2024	5/6/2024	5/6/2024	5/2/2024	5/2/2024
Parameter	MDE Non-Residential Cleanup Standard	Units											
Acenaphthene	4500000	ug/kg	82	< 19	< 24	< 190 cn	< 21	< 23	< 190	< 22	< 22	3.7 J	< 190 cn
Acenaphthylene	NVL	ug/kg	8.6 J	< 19	< 24	< 190 cn	< 21	< 23	< 190	< 22	< 22	< 18	< 190 cn
Anthracene	23000000	ug/kg	170	6.2 J	< 24	120 J cn	< 21	< 23	39 J cn	< 22	< 22	5.4 J	< 190 cn
Benzo[a]anthracene*	21000	ug/kg	950	120	< 24	1300 cn	12 J	< 23	360 cn	15 J	< 22	47	160 J cn
Benzo[a]pyrene*	2100	ug/kg	1300	160	< 24	1100 cn	15 J	< 23	640 cn	22	< 22	62	240 cn
Benzo[b]fluoranthene*	21000	ug/kg	1500	270	< 24	2800 cn	30	< 23	940 cn	27	< 22	93	340 cn
Benzo[g,h,i]perylene	NVL	ug/kg	990	130	< 24	1100 cn	18 J	< 23	700 cn	18 J	< 22	61	240 cn
Benzo[k]fluoranthene*	210000	ug/kg	480	85	< 24	1100 cn	7.7 J	< 23	340 cn	9.3 J	< 22	40	96 J cn
Chrysene*	2100000	ug/kg	920	170	< 24	3600 cn	15 J	< 23	500 cn	19 J	< 22	50	220 cn
Dibenzof[a,h]anthracene*	2100	ug/kg	240	36	< 24	400 cn	< 21	< 23	180 J cn	< 22	< 22	16 J	< 190 cn
Fluoranthene	3000000	ug/kg	1200	110	< 24	1200 cn	17 J	< 23	430 cn	24	< 22	62	240 cn
Fluorene	3000000	ug/kg	37	< 19	< 24	< 190 cn	< 21	< 23	< 190	< 22	< 22	< 18	< 190 cn
Indeno[1,2,3-cd]pyrene*	21000	ug/kg	830	100	< 24	860 cn	14 J	< 23	500 cn	18 J	< 22	49	160 J cn
Naphthalene	17000	ug/kg	11 J	< 19	< 24	< 190 cn	36	< 23	< 190	< 22	< 22	< 18	< 190 cn
Phenanthrene	2300000	ug/kg	510	22	< 24	290 cn	6.6 J	< 23	150 J cn	8.0 J	< 22	19	110 J cn
Pyrene	2300000	ug/kg	1200	100	< 24	1200 cn	16 J	< 23	480 cn	22	< 22	62	230 cn

Table 3
Soil Data - PAHs
Bauxite Interim Route Distribution Line
Frederick, MD

Source			ERM Phase II ESA (Bauxite 3) 2024									
Location ID			B-8	B-11	B-11	B-11	B-14	B-14	DUP-4	B-14	B-15/ MW-5	B-15/ MW-5
Depth (ft)			5-15	0-1	1-5	5-15	0-1	1-5	1-5	5-15	0-1	1-5
Sample ID			B-8-5-15-C	B-11-0-1-G	B-11-1-5-C	B-11-5-15-C	B-14-0-1-G	B-14-1-5-C	DUP 4	B-14-5-15-C	B-15-0-1-G	B-15-1-5-C
Sample Date			5/2/2024	5/7/2024	5/7/2024	5/7/2024	5/10/2024	5/10/2024	5/10/2024	5/10/2024	5/6/2024	5/6/2024
Parameter	MDE Non-Residential Cleanup Standard	Units										
Acenaphthene	4500000	ug/kg	< 21	7.6 J	170	< 22 F1 F2	< 19	< 19	< 20	< 20	< 19	30
Acenaphthylene	NVL	ug/kg	< 21	6.7 J	6.3 J	< 22 F1 F2	< 19	< 19	< 20	< 20	< 19	< 20
Anthracene	23000000	ug/kg	< 21	94	440	19 J F1 F2	< 19	< 19	< 20	< 20	6.1 J	46
Benzo[a]anthracene*	21000	ug/kg	< 21	1800	1700	5.1 J F1 F2	16 J	< 19	< 20	< 20	31	330
Benzo[a]pyrene*	2100	ug/kg	< 21	1100	1200	< 22 F1 F2	23	< 19	< 20	< 20	40	430
Benzo[b]fluoranthene*	21000	ug/kg	< 21	4400	1800	< 22 F1 F2	32	< 19	< 20	< 20	54	500
Benzo[g,h,i]perylene	NVL	ug/kg	< 21	1900	740	< 22 F1 F2	14 J	< 19	< 20	< 20	33	330
Benzo[k]fluoranthene*	210000	ug/kg	< 21	1200	680	< 22 F1 F2	9.2 J	< 19	< 20	< 20	17 J	170
Chrysene*	2100000	ug/kg	< 21	3200	2200	< 22 F1 F2	18 J	< 19	< 20	< 20	34	320
Dibenzof[a,h]anthracene*	2100	ug/kg	< 21	480	180	< 22 F1 F2	< 19	< 19	< 20	< 20	10 J	80
Fluoranthene	3000000	ug/kg	< 21	1300	---	24 F1 F2	25	< 19	< 20	< 20	44	500
Fluorene	3000000	ug/kg	< 21	< 22	82	< 22 F1 F2	< 19	< 19	< 20	< 20	< 19	11 J
Indeno[1,2,3-cd]pyrene*	21000	ug/kg	< 21	1200	60	< 22 F1 F2	9.4 J	< 19	< 20	< 20	25	280
Naphthalene	17000	ug/kg	< 21	< 22	< 20	< 22 F1 F2	< 19	< 19	< 20	< 20	< 19	< 20
Phenanthrene	2300000	ug/kg	< 21	180	2000	8.7 J F1 F2	7.1 J	< 19	< 20	< 20	16 J	160
Pyrene	2300000	ug/kg	< 21	1300	3700	18 J F1 F2	22	< 19	< 20	< 20	48	450

Table 3
Soil Data - PAHs
Bauxite Interim Route Distribution Line
Frederick, MD

Source			ERM Phase II ESA (Bauxite 3) 2024							
Location ID			B-15/ MW-5	B-16	B-16	B-16	RB1-20N	RB1-20N	DUP-5	RB1-0
Depth (ft)			5-15	0-1	1-5	5-15	0-0.5	0.5-2		0-0.5
Sample ID			B-15-5-15-C	B-16-0-1-G	B-16-1-5-C	B-16-5-15-G	RB-1-20N-0-0.5	RB-1-20N-0.5-2		RB-1-0-0-0.5
Sample Date			5/6/2024	5/9/2024	5/9/2024	5/9/2024	5/13/2024	5/13/2024	5/13/2024	5/13/2024
Parameter	MDE Non-Residential Cleanup Standard	Units								
Acenaphthene	4500000	ug/kg	< 21	11 J	< 20	< 23	< 20	< 19	< 19	23 J cn
Acenaphthylene	NVL	ug/kg	< 21	8.5 J	< 20	< 23	5.1 J	< 19	< 19	< 90 cn
Anthracene	23000000	ug/kg	< 21	20	7.6 J	< 23	< 20	< 19	< 19	39 J cn
Benzo[a]anthracene*	21000	ug/kg	< 21	130	7.6 J	< 23	39	< 19	< 19	610 cn
Benzo[a]pyrene*	2100	ug/kg	< 21	180	6.6 J	< 23	54	< 19	< 19	820 cn
Benzo[b]fluoranthene*	21000	ug/kg	4.4 J	220	18 J	< 23	71	< 19	< 19	1100 cn
Benzo[g,h,i]perylene	NVL	ug/kg	< 21	150	9.4 J	< 23	49	< 19	< 19	670 cn
Benzo[k]fluoranthene*	210000	ug/kg	< 21	86	4.8 J	< 23	29	< 19	< 19	430 cn
Chrysene*	2100000	ug/kg	< 21	160	19 J	< 23	48	< 19	< 19	710 cn
Dibenzof[a,h]anthracene*	2100	ug/kg	< 21	36	< 20	< 23	< 20	< 19	< 19	150 cn
Fluoranthene	3000000	ug/kg	< 21	240	21	< 23	53	< 19	< 19	810 cn
Fluorene	3000000	ug/kg	< 21	5.9 J	7.3 J	< 23	< 20	< 19	< 19	< 90 cn
Indeno[1,2,3-cd]pyrene*	21000	ug/kg	< 21	120	7.8 J	< 23	44	< 19	< 19	530 cn
Naphthalene	17000	ug/kg	< 21	11 J	16 J	< 23	< 20	< 19 F1	< 19	< 90 cn
Phenanthrene	2300000	ug/kg	< 21	130	31	< 23	15 J	< 19	< 19	190 cn
Pyrene	2300000	ug/kg	< 21	220	17	< 23	52	< 19	< 19	820 cn

Table 3
Soil Data - PAHs
Bauxite Interim Route Distribution Line
Frederick, MD

Source			ERM Phase II ESA (Bauxite 3) 2024							
Location ID			RB1-20S	RB1-20S	RB2-20N	RB2-20N	RB2-0	RB2-0	RB2-20S	RB2-20S
Depth (ft)			0-0.5	0.5-2	0-0.5	0.5-2	0-0.5	0.5-2	0-0.5	0.5-2
Sample ID			RB-1-20S-0-0.5	RB-1-20S-0.5-2	RB-2-20N-0-0.5	RB-2-20N-0.5-2	RB-2-0-0-0.5	RB-2-0-0.5-2	RB-2-20S-0-0.5	RB-2-20S-0.5-2
Sample Date			5/13/2024	5/13/2024	5/13/2024	5/13/2024	5/13/2024	5/13/2024	5/13/2024	5/13/2024
Parameter	MDE Non-Residential Cleanup Standard	Units								
Acenaphthene	4500000	ug/kg	15 J	11 J	19 J	< 20	210 cn	72	< 17	25
Acenaphthylene	NVL	ug/kg	< 17	< 19	23	5.3 J	570 cn	390	< 17	4.8 J
Anthracene	23000000	ug/kg	24	18 J	57	9.5 J	710 cn	490	3.8 J	52
Benzo[a]anthracene*	21000	ug/kg	230	76	450	52	3000 cn	2000	18	670
Benzo[a]pyrene*	2100	ug/kg	340	97	530	74	3700 cn	2000	17	870
Benzo[b]fluoranthene*	21000	ug/kg	460	120	700	100	5600 cn	3100	30	1100
Benzo[g,h,i]perylene	NVL	ug/kg	320	93	470	66	2900 cn	1600	13 J	750
Benzo[k]fluoranthene*	210000	ug/kg	130	55	260	29	2000 cn	1200	7.6 J	390
Chrysene*	2100000	ug/kg	240	77	490	60	3500 cn	2200	25	680
Dibenzo[a,h]anthracene*	2100	ug/kg	67	21	110	14 J	880 cn	490	< 17	180
Fluoranthene	3000000	ug/kg	320	130	650	74	4400 cn	2700	32	830
Fluorene	3000000	ug/kg	5.3 J	4.1 J	11 J	< 20	99 J cn	46	< 17	11 J
Indeno[1,2,3-cd]pyrene*	21000	ug/kg	250	74	380	53	2200 cn	1300	9.1 J	600
Naphthalene	17000	ug/kg	< 17	< 19	13 J	< 20	77 J cn	40	< 17	< 18
Phenanthrene	2300000	ug/kg	85	61	150	19 J	1100 cn	530	11 J	210
Pyrene	2300000	ug/kg	320	110	620	76	4200 cn	2400	34	860

Table 3
Soil Data - PAHs
Bauxite Interim Route Distribution Line
Frederick, MD

Source			ERM Phase II ESA (Bauxite 3) 2024					
Location ID			RB3-20N	RB3-20N	RB3-0	RB3-0	RB3-20S	RB3-20S
Depth (ft)			0-0.5	0.5-2	0-0.5	0.5-2	0-0.5	0.5-2
Sample ID			RB-3-20N-0-0.5	RB-3-20N-0.5-2	RB-3-0-0-0.5	RB-3-0-0.5-2	RB-3-20S-0-0.5	RB-3-20S-0.5-2
Sample Date			5/13/2024	5/13/2024	5/13/2024	5/13/2024	5/13/2024	5/13/2024
Parameter	MDE Non-Residential Cleanup Standard	Units						
Acenaphthene	4500000	ug/kg	5.7 J	6.8 J	2000 cn	1200 cn	26	14 J
Acenaphthylene	NVL	ug/kg	8.8 J	< 19	480 cn	610 cn	14 J	< 19
Anthracene	23000000	ug/kg	12 J	11 J	2800 cn	3900 cn	38	17 J
Benzo[a]anthracene*	21000	ug/kg	94	50	12000 cn	11000 cn	290	110
Benzo[a]pyrene*	2100	ug/kg	120	58	15000 cn	13000 cn	370	160
Benzo[b]fluoranthene*	21000	ug/kg	240	96	19000 cn	16000 cn	530	280
Benzo[g,h,i]perylene	NVL	ug/kg	120	56	10000 cn	9400 cn	320	140
Benzo[k]fluoranthene*	210000	ug/kg	59	26	5600 cn	6300 cn	160	72
Chrysene*	2100000	ug/kg	120	59	12000 cn	11000 cn	330	140
Dibenzof[a,h]anthracene*	2100	ug/kg	32	19	2600 cn	2300 cn	75	35
Fluoranthene	3000000	ug/kg	100	86	18000 cn	16000 cn	400	130
Fluorene	3000000	ug/kg	< 18	4.2 J	650 cn	460 cn	10 J	6.9 J
Indeno[1,2,3-cd]pyrene*	21000	ug/kg	100	43	9200 cn	8300 cn	260	110
Naphthalene	17000	ug/kg	< 18	< 19	330 cn	220 cn	< 21	< 19
Phenanthrene	2300000	ug/kg	31	51	7700 cn	5600 cn	140	65
Pyrene	2300000	ug/kg	96	74	15000 cn	13000 cn	390	120

Table 3
Soil Data - PAHs
Bauxite Interim Route Distribution Line
Frederick, MD

Source			GTA Site Management Plan 2017										
Location ID			CD-GTA-04	CD-GTA-04	CD-GTA-07	CD-GTA-07	SW-GTA-01	SW-GTA-01	SW-GTA-03	SW-GTA-03	SP-GTA-02	SP-GTA-02	SP-GTA-03
Depth (ft)			0-1	4-5	0-1	4-5	0-1	4-5	0-1	4-5	0-1	4-5	0-1
Sample ID			--	--	--	--	--	--	--	--	--	--	--
Sample Date			9/22/2014	9/22/2014	9/22/2014	9/22/2014	10/22/2015	10/22/2015	9/22/2015	9/22/2015	11/12/2015	11/12/2015	11/12/2015
Parameter	MDE Non-Residential Cleanup Standard	Units											
Acenaphthene	4500000	ug/kg	ND	ND	ND	ND	ND	ND	ND	370	ND	ND	ND
Acenaphthylene	NVL	ug/kg	ND	ND	ND	NA	NA	ND	ND	ND	ND	ND	ND
Anthracene	23000000	ug/kg	280	ND	220	ND	ND	ND	ND	370	ND	ND	840
Benzo[a]anthracene*	21000	ug/kg	1800	ND	2100	ND	ND	ND	100	1500	690	ND	21,000
Benzo[a]pyrene*	2100	ug/kg	2000	ND	2300	ND	ND	ND	1200	2000	690	ND	13,000
Benzo[b]fluoranthene*	21000	ug/kg	2700	ND	3800	ND	ND	ND	1800	1500	1,300	ND	39,000
Benzo[g,h,i]perylene	NVL	ug/kg	1500	ND	1900	ND	ND	ND	870	1300	350	ND	5,600
Benzo[k]fluoranthene*	210000	ug/kg	ND	ND	1300	ND	ND	ND	580	1500	460	ND	11,000
Chrysene*	2100000	ug/kg	1800	ND	2300	ND	ND	ND	1000	1500	730	ND	36,000
Dibenzo[a,h]anthracene*	2100	ug/kg	3400	ND	500	ND	ND	ND	210	480	ND	ND	2,300
Fluoranthene	3000000	ug/kg	2100	ND	ND	ND	ND	ND	1600	2200	570	ND	50,000
Fluorene	3000000	ug/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno[1,2,3-cd]pyrene*	21000	ug/kg	1600	ND	200	ND	ND	ND	900	1500	370	ND	6,600
Naphthalene	17000	ug/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	2300000	ug/kg	1100	ND	850	ND	ND	ND	500	1200	250	ND	1,200
Pyrene	2300000	ug/kg	2300	ND	2500	ND	ND	ND	1400	1200	620	ND	46,000

Table 3
Soil Data - PAHs
Bauxite Interim Route Distribution Line
Frederick, MD

Source			GTA Site Management Plan 2017										GTA Phase II ESA 2022	
Location ID			SP-GTA-03	SP-GTA-04	SP-GTA-04	SP-GTA-05	SP-GTA-05	SP-GTA-06	SP-GTA-06	SP-GTA-06	SP-GTA-06		SA-1F	
Depth (ft)			4-5	0-1	4-5	0-1	4-5	0-1	4-5	0-1	4-5		0-1	1-19
Sample ID														
Sample Date			11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015		9/15/2022	9/15/2022
Parameter	MDE Non-Residential Cleanup Standard	Units												
Acenaphthene	4500000	ug/kg	ND	ND	ND	ND	ND	290	ND	ND	ND		12	< 11
Acenaphthylene	NVL	ug/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND		< 11	< 11
Anthracene	23000000	ug/kg	ND	ND	ND	ND	ND	290	ND	ND	ND		15	< 11
Benzo[a]anthracene*	21000	ug/kg	ND	180	ND	230	ND	1,100	ND	ND	ND		110	< 11
Benzo[a]pyrene*	2100	ug/kg	ND	230	ND	250	ND	1,600	ND	ND	ND		150	< 11
Benzo[b]fluoranthene*	21000	ug/kg	ND	390	ND	550	ND	1,800	ND	ND	ND		140	< 11
Benzo[g,h,i]perylene	NVL	ug/kg	ND	ND	ND	210	ND	800	ND	ND	ND		110	< 11
Benzo[k]fluoranthene*	210000	ug/kg	ND	ND	ND	ND	ND	760	ND	ND	ND		110	< 11
Chrysene*	2100000	ug/kg	ND	350	ND	350	ND	1,000	ND	ND	ND		130	< 11
Dibenzo[a,h]anthracene*	2100	ug/kg	ND	ND	ND	ND	ND	220	ND	ND	ND		34	< 11
Fluoranthene	3000000	ug/kg	ND	220	ND	310	ND	1,700	ND	ND	ND		160	< 11
Fluorene	3000000	ug/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND		< 11	< 11
Indeno[1,2,3-cd]pyrene*	21000	ug/kg	ND	ND	ND	210	ND	1,200	ND	ND	ND		110	< 11
Naphthalene	17000	ug/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND		< 11	< 11
Phenanthrene	2300000	ug/kg	ND	ND	ND	ND	ND	1,300	ND	ND	ND		55	< 11
Pyrene	2300000	ug/kg	ND	230	ND	300	ND	1,600	ND	ND	ND		160	< 11

Table 3
Soil Data - PAHs
Bauxite Interim Route Distribution Line
Frederick, MD

Source			GTA Phase II ESA 2022							
Location ID			SA1-H		SA2-E		SA4-E		SA4-M	
Depth (ft)			0-1	1-19	0-1	4-5	0-1	1-15	0-1	1-15
Sample ID										
Sample Date			9/9/2022	9/9/2022	9/9/2022	9/9/2022	9/8/2022	9/8/2022	9/8/2022	9/8/2022
Parameter	MDE Non-Residential Cleanup Standard	Units								
Acenaphthene	4500000	ug/kg	< 9.5	< 11	< 11	< 11	< 9.1	< 10	< 9.4	< 11
Acenaphthylene	NVL	ug/kg	< 9.5	< 11	< 11	< 11	< 9.1	< 10	< 9.4	< 11
Anthracene	23000000	ug/kg	< 9.5	< 11	< 11	< 11	< 9.1	< 10	< 9.4	< 11
Benzo[a]anthracene*	21000	ug/kg	13	< 11	< 11	< 11	< 9.1	< 10	< 9.4	< 11
Benzo[a]pyrene*	2100	ug/kg	15	< 11	< 11	< 11	< 9.1	< 10	< 9.4	< 11
Benzo[b]fluoranthene*	21000	ug/kg	14	< 11	< 11	< 11	< 9.1	< 10	< 9.4	< 11
Benzo[g,h,i]perylene	NVL	ug/kg	11	< 11	< 11	< 11	< 9.1	< 10	< 9.4	< 11
Benzo[k]fluoranthene*	210000	ug/kg	12	< 11	< 11	< 11	< 9.1	< 10	< 9.4	< 11
Chrysene*	2100000	ug/kg	12	< 11	< 11	< 11	< 9.1	< 10	< 9.4	< 11
Dibenzo[a,h]anthracene*	2100	ug/kg	< 9.5	< 11	< 11	< 11	< 9.1	< 10	< 9.4	< 11
Fluoranthene	3000000	ug/kg	16	< 11	< 11	< 11	< 9.1	< 10	< 9.4	< 11
Fluorene	3000000	ug/kg	< 9.5	< 11	< 11	< 11	< 9.1	< 10	< 9.4	< 11
Indeno[1,2,3-cd]pyrene*	21000	ug/kg	11	< 11	< 11	< 11	< 9.1	< 10	< 9.4	< 11
Naphthalene	17000	ug/kg	< 9.5	< 11	< 11	< 11	< 9.1	< 10	< 9.4	< 11
Phenanthrene	2300000	ug/kg	< 9.5	< 11	< 11	< 11	< 9.1	< 10	< 9.4	< 11
Pyrene	2300000	ug/kg	16	< 11	< 11	< 11	< 9.1	< 10	< 9.4	< 11

Table 3
Soil Data - PAHs
Bauxite Interim Route Distribution Line
Frederick, MD

Source			GTA Phase II ESA 2022					
Location ID			SA7-J		SA7-K		SA10-A	
Depth (ft)			0-1	1-5	0-1	1-11	0-1	1-10
Sample ID								
Sample Date			9/9/2022	9/9/2022	9/9/2022	9/9/2022	9/9/2022	9/9/2022
Parameter	MDE Non-Residential Cleanup Standard	Units						
Acenaphthene	4500000	ug/kg	< 10	< 11	< 9.1	< 9.1	< 9.8	< 11
Acenaphthylene	NVL	ug/kg	< 10	< 11	ND	ND	< 9.8	< 11
Anthracene	23000000	ug/kg	< 10	< 11	< 9.1	36	< 9.8	< 11
Benzo[a]anthracene*	21000	ug/kg	< 10	< 11	50	30	< 9.8	< 11
Benzo[a]pyrene*	2100	ug/kg	< 10	< 11	43	22	< 9.8	< 11
Benzo[b]fluoranthene*	21000	ug/kg	< 10	< 11	110	18	< 9.8	< 11
Benzo[g,h,i]perylene	NVL	ug/kg	< 10	< 11	49	14	< 9.8	< 11
Benzo[k]fluoranthene*	210000	ug/kg	< 10	< 11	55	21	< 9.8	< 11
Chrysene*	2100000	ug/kg	< 10	< 11	85	28	< 9.8	< 11
Dibenzo[a,h]anthracene*	2100	ug/kg	< 10	< 11	12	< 11	< 9.8	< 11
Fluoranthene	3000000	ug/kg	< 10	< 11	48	79	< 9.8	< 11
Fluorene	3000000	ug/kg	< 10	< 11	< 9.1	20	< 9.8	< 11
Indeno[1,2,3-cd]pyrene*	21000	ug/kg	< 10	< 11	39	14	< 9.8	< 11
Naphthalene	17000	ug/kg	< 10	< 11	< 9.1	< 11	< 9.8	< 11
Phenanthrene	2300000	ug/kg	< 10	< 11	15	100	< 9.8	< 11
Pyrene	2300000	ug/kg	< 10	< 11	58	63	< 9.8	< 11

Table 3
Soil Data - PAHs
Bauxite Interim Route Distribution Line
Frederick, MD

NOTES:
A = Results reported in Site Management Plan dated June 5, 2017, sample collection date not reported.
3100 Exceeds MDE Non-Residential Soil Cleanup Standard
NVL = No value listed
*Carcinogenic chemicals with a Mutagenic Mode of Action (MOA)
NA Sample not submitted for specified method
Sample not collected (boring refusal)
< = Analyte not detected, value represents reporting limit.
J = Result is less than the reporting limit, but greater than or equal to the method detection limit
ND - Parameter not detected, reporting limit not specified.
F1 = MS and/or MSD recovery exceeds control limits.
F2 = MS/MSD RPD exceeds control limits
ND - Parameter not detected (detection limit not reported)
cn = see case narrative
5/1/2024 (410-170119-1)
Method 8270A: The DCS Decachlorodiphenyl (Surr) surrogate recovery for the following samples was outside acceptance limits (low biased) on the primary column: B-10-0-1-G (410-170119-3). The recovery is 60.82%.
Method 8270A: The Tetrachloro-m-xylene surrogate recovery for the following samples was outside acceptance limits (low biased) on the primary column: B-21-1-5-C (410-170119-24) and B-21-0-1-G (410-170119-26). The recovery is 21.15%.
Method 8270A: The Tetrachloro-m-xylene surrogate recovery for the following samples was outside acceptance limits (high biased) on the primary column due to matrix interference: B-13-5-14-C (410-170119-15). The recovery is 52.20%.
5/2/2024 (410-170307-1)
The following samples were received at the laboratory outside the required temperature criteria: B-22-4-5-G (410-170307-1), B-22-14-15-G (410-170307-2), B-22-0-1-G (410-170307-3), B-22-1-5-C (410-170307-4), B-22-5-15-C (410-170307-5), B-20-4-5-G (410-170307-6), B-20-13-14-G (410-170307-7), B-20-0-1-G (410-170307-8).
Method 8270E: The following sample was diluted due to the nature of the sample matrix: B-8-1-5-C (410-170307-15). Elevated reporting limits (RLs) are provided.
5/6/2024 (410-170644-1)
Method 8270E: The following sample was diluted due to the nature of the sample matrix: B-7-0-1-G (410-170644-6). Elevated reporting limits (RLs) are provided.
5/7/2024 (410-170880-1)
Method 8270E: The following sample was diluted due to the nature of the sample matrix: B-6-0-1-G (410-170880-1). Elevated reporting limits (RLs) are provided.
5/8/24 (410-171083-1)
Method 8270E: Surrogate recovery was outside acceptance limits for the following matrix spike (MS) sample: B-2-1-5-C-MS (410-171083-10[MS]). The parent sample's and matrix spike duplicate (MSD) surrogate recovery was 51.3%.
5/13/2024 (410-171693-1)
Method 8270E: The following samples were diluted due to the nature of the sample matrix: RB-1-0-0-0.5 (410-171693-1), RB-2-0-0-0.5 (410-171693-9), RB-3-0-0-0.5 (410-171693-15) and RB-3-0-0.5-2 (410-171693-16). Elevated reporting limits (RLs) are provided.
5/14/2024 (410-171693-1)
Method 8270E: The following sample was diluted due to the nature of the sample matrix: RB-7-20S-0-0.5 (410-171877-19). Elevated reporting limits (RLs) are provided.

Table 4
Soil Data - Inorganics
Bauxite Interim Route Distribution Line
Frederick, MD

Source				ERM Phase II ESA (Bauxite 3) 2024												
Location ID				B-4	B-4	B-4	B-6	B-6	B-6	B-7/ MW-2	B-7/ MW-2	B-7/ MW-2	B-8	B-8	B-8	B-11
Depth (ft)				0-1	1-5	5-14	0-1	1-5	5-15	0-1	1-5	5-15	0-1	1-5	5-15	0-1
Sample ID				B-4-0-1-G	B-4-1-5-C	B-4-5-14-C	B-6-0-1-G	B-6-1-5-C	B-6-5-15-G	B-7-0-1-G	B-7-1-5-C	B-7-5-13.5-C	B-8-0-1-G	B-8-1-5-C	B-8-5-15-C	B-11-0-1-G
Sample Date				5/10/2024	5/10/2024	5/10/2024	5/7/24	5/7/24	5/7/24	5/6/24	5/6/24	5/6/24	5/2/2024	5/2/2024	5/2/2024	5/7/2024
Parameter	MDE Non-Residential Cleanup Standard	Anticipated Typical Concentrations (CMBG)	Units													
Antimony	47	NVL	mg/kg	0.095	0.12 J	0.19 J	0.18 J	0.11 J	0.015 J	0.18 J	0.16 J	0.18 J	0.11 J	0.67	0.13 J	0.14 J
Arsenic	3	11	mg/kg	1.8	3	4.5	4.7	5.4	7.1	3.8	12	12	3.3	6.7	6.8	5.5
Beryllium	230	NVL	mg/kg	0.58	0.61	3.6	1.3	2	2.8	0.61	1.3	3	1.1	1.3	1.3	2.2
Cadmium	98	NVL	mg/kg	0.066 J	0.16	0.16	0.14	0.087 J	0.21	0.16	0.078 J	0.13	0.085	0.84	0.081 J	0.63
Tot Chromium ¹	NVL	42	mg/kg	16	20	40	23	22	25	16	34	20	24	31	24	35
Chromium (VI)	6.3	NVL	mg/kg	NA	NA	NA	< 0.52	< 0.51	< 0.61	NA	NA	NA	NA	NA	NA	NA
Copper	4700	NVL	mg/kg	9.9	13	28	17	27	32	14	49	40	37	25	24	23
Lead	800	NVL	mg/kg	6.9 ^2	14	12	18	16	8.9	11	18	28	10	160	13	39
Mercury	4.6	NVL	mg/kg	0.051 J	0.027 J	0.034 J	0.033	0.037 J	0.040 J	0.031 J	0.22	0.065 J	0.027 J	0.022 J	0.059 J	0.028 J
Nickel	2200	NVL	mg/kg	16	17	49	29	55 ^2	71 ^2	22	39	64	30	53	29	44 ^2
Selenium	580	NVL	mg/kg	0.088 J	0.16 J	< 0.52	0.17 J	0.18 J	< 0.45	0.19 J	0.30 J	0.20 J	0.15 J	0.42	0.15 J	0.25 J
Silver	580	NVL	mg/kg	< 0.085	< 0.094	< 0.13	< 0.1	< 0.12	< 0.11	< 0.098	< 0.13	< 0.13	< 0.084	0.031 J	< 0.1	< 0.89
Thallium	1.2	4.6	mg/kg	0.072 J	0.077	0.15	0.17	0.17	0.12	0.088 J	0.3	0.27	0.11	0.1	0.17	0.25
Zinc	35000	NVL	mg/kg	31	41	91	59	92	160	42	66	84	67	140	50	170
Fluoride ²	47,000	NVL	mg/kg	33	15	110	53	27	130	29	1.6	< 1.4 F1	26	180	1.8	53
Cyanide	15	NVL	mg/kg	< 0.58 *+ cn	< 0.052 *+ cn	< 0.69 *+ cn	0.28 J	< 0.56	< 0.65	0.29 J	0.33 J	< 0.68	< 0.54	< 0.51	< 0.63	< 0.61

Table 4
Soil Data - Inorganics
Bauxite Interim Route Distribution Line
Frederick, MD

Source				ERM Phae II ESA (Bauxite 3) 2024											
Location ID				B-11	B-11	B-14	B-14	DUP-4	B-14	B-15/ MW-5	B-15/ MW-5	B-15/ MW-5	B-16	B-16	B-16
Depth (ft)				1-5	5-15	0-1	1-5	1-5	5-15	0-1	1-5	5-15	0-1	1-5	5-15
Sample ID				B-11-1-5-C	B-11-5-15-C	B-14-0-1-G	B-14-1-5-C	Dup 4	B-14-5-15-C	B-15-0-1-G	B-15-1-5-C	B-15-5-15-C	B-16-0-1-G	B-16-1-5-C	B-16-5-15-G
Sample Date				5/7/2024	5/7/2024	5/10/24	5/10/24	5/10/24	5/10/24	5/6/24	5/6/24	5/6/24	5/9/24	5/9/24	5/9/24
Parameter	MDE Non-Residential Cleanup Standard	Anticipated Typical Concentrations (CMBG)	Units												
Antimony	47	NVL	mg/kg	0.12 J	0.15 J F1 F2	0.13 J	0.24	< 0.21	0.19 J F2	0.16 J	0.13 J	0.20 J	0.25	0.32	0.19 J
Arsenic	3	11	mg/kg	7	6.2 F2	2.7	5.4	1.9	13 F2 F1	6	5.8	8.2	6.5	8.8	6.8
Beryllium	230	NVL	mg/kg	1.9	3.3 F2	0.46	0.39	0.069 J	2.4 F1	1.2	1.1	2.5	1.3 B	1.3 B	1.4 B
Cadmium	98	NVL	mg/kg	0.11	0.22 F2	0.039 J	< 0.11	< 0.10	0.20	0.12	0.12	0.13	0.11	0.12	0.89
Tot Chromium ¹	NVL	42	mg/kg	31	25 F2	18	48	17	24 F2	35	25	21	27	36	31
Chromium (VI)	6.3	NVL	mg/kg	NA	NA	NA	NA	NA	NA	3.6	< 0.5	< 0.5	NA	NA	NA
Copper	4700	NVL	mg/kg	24	23 F2	6.7	14	1.3	19 F1	17	26	30	15	17	26
Lead	800	NVL	mg/kg	16	17 F1 F2	11	15	4.6	27 F2	20	15	17	21	25	15 F1
Mercury	4.6	NVL	mg/kg	0.035 J	0.050 J	0.063 J	0.031 J	0.036 J	0.031 J	0.032 J	< 0.068	< 0.077	0.043 J	0.032 J	< 0.08
Nickel	2200	NVL	mg/kg	36 ^2	39	13	14	1.6	28 F1	22	25	37	25	27	47 F1
Selenium	580	NVL	mg/kg	0.25 J	0.11 J F2	0.15 J	0.22 J	< 0.41	0.16 J	0.35 J	0.30 J	0.31 J	0.38	0.44 J	0.18 J
Silver	580	NVL	mg/kg	< 0.095	0.085 J F2	< 0.094	< 0.11	< 0.10	< 0.10	0.056 J	< 0.11	< 0.12	0.059 J	0.046 J	0.056 J
Thallium	1.2	4.6	mg/kg	0.2	0.24 F2	0.11	0.24	< 0.10	0.30	0.21	0.17	0.22	0.22	0.3	0.24
Zinc	35000	NVL	mg/kg	78	69 F2	36	31 J	< 31	58 F1	65	64	79	65	72	96 F1
Fluoride ²	47,000	NVL	mg/kg	8.6	33 F1	33	1.3	< 1.2	< 1.2 F1	6.6	29	4.6	7.6	6.1	3.4 F1
Cyanide	15	NVL	mg/kg	< 0.59	0.3 J	< 0.57 *+ cn	< 0.58 *+ cn	< 0.59 *+ cn	< 0.57 *+ cn	0.52 J	< 0.54	< 0.63	< 0.54	0.27 J	< 0.68

Table 4
Soil Data - Inorganics
Bauxite Interim Route Distribution Line
Frederick, MD

Source				ERM Phase II ESA (Bauxite 3) 2024										
Location ID				RB1-20N	RB1-20N	DUP-5	RB1-0	RB1-0	RB1-20S	RB1-20S	RB2-20N	RB2-20N	RB2-0	RB2-0
Depth (ft)				0-0.5	0.5-2	0-0.5		0.5-2	0-0.5	0.5-2	0-0.5	0.5-2	0-0.5	0.5-2
Sample ID				RB-1-20N-0-0.5	RB-1-20N-0.5-2	RB-1-0-0-0.5		RB-1-0-0.5-2.0	RB-1-20S-0-0.5	RB-1-20S-0.5-2	RB-2-20N-0-0.5	RB-2-20N-0.5-2	RB-2-0-0-0.5	RB-2-0-0.5-2
Sample Date				5/13/24	5/13/24	5/13/24	5/13/24	5/13/24	5/13/24	5/13/24	5/13/24	5/13/24	5/13/24	5/13/24
Parameter	MDE Non-Residential Cleanup Standard	Anticipated Typical Concentrations (CMBG)	Units											
Antimony	47	NVL	mg/kg	0.23	0.12 J	0.21	< 0.15	0.088 J	0.071 J	0.16 J	0.30	0.19	0.31	< 0.17
Arsenic	3	11	mg/kg	5.3	4.3	7.5	1.9	6.9	4.3	5.9	4.8	6.6	3.4	1.1
Beryllium	230	NVL	mg/kg	0.91	0.59	1.3	0.27	0.7	0.49	1.3	1.1	0.91	0.64	0.15
Cadmium	98	NVL	mg/kg	< 0.097	< 0.091	< 0.10	0.037 J	0.065 J	0.053 J	0.12	0.40	0.044 J	0.63	0.12
Tot Chromium ¹	NVL	42	mg/kg	38	29	93	10	13	10	27	28	22	18	3.1
Chromium (VI)	6.3	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	4700	NVL	mg/kg	19	8.9	17	5.3	7.4	6.1	17	21	25	17	2.9
Lead	800	NVL	mg/kg	17	12	17	4.1	6.8	5.2	11	19	20	23	4.7
Mercury	4.6	NVL	mg/kg	0.093	0.040 J	0.082	< 0.065	0.023 J	0.026 J	0.053 J	0.046 J	0.073	0.045 J	0.055 J
Nickel	2200	NVL	mg/kg	23 ^2	14	22	9.7	15 ^2	11 ^2	29	29	34 ^2	21 ^2	4.2
Selenium	580	NVL	mg/kg	0.37 J	0.21 J	0.45	<0.30	0.091 J	< 0.33	0.16 J	0.13 J	0.30 J	< 0.36	< 0.34
Silver	580	NVL	mg/kg	< 0.097	< 0.091	< 0.10	< 0.075	< 0.071	< 0.082	< 0.098	< 0.095	< 0.093	<0.091	< 0.084
Thallium	1.2	4.6	mg/kg	0.22	0.26	0.23	< 0.075	0.096	0.057 J	0.16	0.22	0.22	0.091	< 0.084
Zinc	35000	NVL	mg/kg	45	37	54	16 J	21	18 J	52	65	43	73	16 J
Fluoride ²	47,000	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide	15	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 4
Soil Data - Inorganics
Bauxite Interim Route Distribution Line
Frederick, MD

Source				ERM Phase II ESA (Bauxite 3) 2024							
Location ID				RB2-20S	RB2-20S	RB3-20N	RB3-20N	RB3-0	RB3-0	RB3-20S	RB3-20S
Depth (ft)				0-0.5	0.5-2	0-0.5	0.5-2	0-0.5	0.5-2	0-0.5	0.5-2
Sample ID				RB-2-20S-0-0.5	RB-2-20S-0.5-2	RB-3-20N-0-0.5	RB-3-20N-0.5-2	RB-3-0-0-0.5	RB-3-0-0.5-2	RB-3-20S-0-0.5	RB-3-20S-0.5-2
Sample Date				5/13/24	5/13/24	5/13/24	5/13/24	5/13/24	5/13/24	5/13/24	5/13/24
Parameter	MDE Non-Residential Cleanup Standard	Anticipated Typical Concentrations (CMBG)	Units								
Antimony	47	NVL	mg/kg	< 0.18	0.12 J	0.18	0.11 J	0.65	0.57	< 0.24	0.087 J
Arsenic	3	11	mg/kg	2.2	4.5	4.6	2.4	4.7	3.9	3.2	4.5
Beryllium	230	NVL	mg/kg	0.30	0.46	0.80	0.4	0.88	0.99	0.39	0.46
Cadmium	98	NVL	mg/kg	< 0.090	0.15	0.12	0.086	0.65	0.59	< 0.12	0.033 J
Tot Chromium ¹	NVL	42	mg/kg	11	11	20	15	36	49	18	20
Chromium (VI)	6.3	NVL	mg/kg	NA	NA	NA	NA	0.20 J	<0.17	NA	NA
Copper	4700	NVL	mg/kg	6.4	6.5	15	6.5	49	59	7.3	8.6
Lead	800	NVL	mg/kg	3.3	8.5	31	8.8	92	100	8.9	8.3
Mercury	4.6	NVL	mg/kg	< 0.061	0.021 J	0.040 J	0.027 J	0.030 J	0.031 J	< 0.071	0.036 J
Nickel	2200	NVL	mg/kg	9.7	14 ^2	19 ^2	11	27	26	12	21
Selenium	580	NVL	mg/kg	< 0.36	0.11 J	0.12 J	0.13 J	< 0.45	< 0.39	< 0.47	0.098 J
Silver	580	NVL	mg/kg	< 0.090	< 0.081	< 0.083	< 0.076	< 0.11	< 0.098	< 0.12	0.22
Thallium	1.2	4.6	mg/kg	< 0.090	0.059 J	0.15	0.038 J	0.12	0.090 J	0.059 J	0.088
Zinc	35000	NVL	mg/kg	12 J	21 J	46	17 J	170	190	24 J	26
Fluoride ²	47,000	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide	15	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA

Table 4
Soil Data - Inorganics
Bauxite Interim Route Distribution Line
Frederick, MD

Source				GTA Site Management Plan 2017													
Location ID				SW-GTA-01	SW-GTA-01	SW-GTA-03	SW-GTA-03	PL-GTA-08	PL-GTA-08	PL-GTA-12	PL-GTA-12	PL-GTA-18	PL-GTA-18	SP-GTA-02	SP-GTA-02	SP-GTA-03	SP-GTA-03
Depth (ft)				0-1	4-5	0-1	4-5	0-1	4-5	0-1	4-5	0-1	4-5	0-1	4-5	0-1	4-5
Sample ID				10/22/2015	10/22/2015	9/22/2015	9/22/2015	9/23/2014	9/23/2014	9/23/2014	9/23/2014	9/23/2014	9/29/2015	9/29/2015	11/12/2015	11/12/2015	11/12/2015
Sample Date																	
Parameter	MDE Non-Residential Cleanup Standard	Anticipated Typical Concentrations (CMBG)	Units														
Antimony	47	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	3	11	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	230	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	98	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tot Chromium ¹	NVL	42	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium (VI)	6.3	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	4700	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	800	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	4.6	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	2200	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	580	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	580	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	1.2	4.6	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	35000	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoride ²	47,000	NVL	mg/kg	93	20	31	54	17	4.8	13	9.4	47	28	160	260	110	36
Cyanide	15	NVL	mg/kg	0.11	0.068	1.5	0.15	NA	NA	NA	NA	NA	NA	0.11	1.8	0.23	0.068

Table 4
Soil Data - Inorganics
Bauxite Interim Route Distribution Line
Frederick, MD

Source				GTA Site Management Plan 2017								GTA Phase II 2022	
Location ID				SP-GTA-04	SP-GTA-04	SP-GTA-05	SP-GTA-05	SP-GTA-06	SP-GTA-06	SP-GTA-06	SP-GTA-06	SA1-F	
Depth (ft)				0-1	4-5	0-1	4-5	0-1	4-5	0-1	4-5	0-1	1-17
Sample ID				11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015	11/12/2015		
Sample Date													
Parameter	MDE Non-Residential Cleanup Standard	Anticipated Typical Concentrations (CMBG)	Units										
Antimony	47	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	< 2.1	< 2.2
Arsenic	3	11	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	2.7	4.8
Beryllium	230	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	< 0.42	1.3
Cadmium	98	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	< 0.42	< 4.3
Tot Chromium ¹	NVL	42	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	14	33
Chromium (VI)	6.3	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	4700	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	6.6	18
Lead	800	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	4.9	8.5
Mercury	4.6	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	< 0.088	< 0.087
Nickel	2200	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	16	38
Selenium	580	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	< 0.42	< 0.43
Silver	580	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	< 0.42	< 0.43
Thallium	1.2	4.6	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	< 0.42	< 0.43
Zinc	35000	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	41	57
Fluoride ²	47,000	NVL	mg/kg	31	18	170	15	160	NA	100	200	NA	NA
Cyanide	15	NVL	mg/kg	NA	NA	NA	0.081	0.59	3.8	2	0.79	NA	NA

Table 4
Soil Data - Inorganics
Bauxite Interim Route Distribution Line
Frederick, MD

Source				GTA Phase II 2022								
Location ID				SA1-H		SA2-E	SA4-E		SA4-M		SA7-J	
Depth (ft)				0-1	1-19	0-1	0-1	1-15	0-1	1-15	0-1	1-5
Sample ID				9/9/2022	9/9/2022	9/9/2022	9/8/2022	9/8/2022	9/8/2022	9/8/2022	9/9/2022	9/9/2022
Sample Date												
Parameter	MDE Non-Residential Cleanup Standard	Anticipated Typical Concentrations (CMBG)	Units									
Antimony	47	NVL	mg/kg	< 2.5	< 2.9	< 2.9	< 1.9	< 2.5	< 2.5	< 2.9	< 2.2	< 3.1
Arsenic	3	11	mg/kg	5.6	6.6	7.6	3.2	6	1.8	4.8	5.5	5.1
Beryllium	230	NVL	mg/kg	1.7	1.5	1.5	1.2	2.4	< 0.49	1.9	1.4	0.99
Cadmium	98	NVL	mg/kg	< 0.49	< 0.58	< 0.59	< 0.38	< 0.49	< 0.49	< 0.58	< 0.44	< 0.62
Tot Chromium ¹	NVL	42	mg/kg	32	16	29	37	29	8.5	21	21	17
Chromium (VI)	6.3	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	4700	NVL	mg/kg	20	22	21	14	25	6.2	13	31	27
Lead	800	NVL	mg/kg	12	11	19	13	16	3.9	13	7.9	8.8
Mercury	4.6	NVL	mg/kg	< 0.099	0.12	< 0.12	0.077	0.098	< 0.099	< 0.12	< 0.087	< 0.12
Nickel	2200	NVL	mg/kg	40	34	36	29	44	8.3	52	30	25
Selenium	580	NVL	mg/kg	< 0.49	< 0.58	< 0.59	< 0.38	< 0.49	< 0.49	< 0.58	< 0.44	< 0.62
Silver	580	NVL	mg/kg	< 0.49	< 0.58	< 0.59	< 0.38	< 0.49	< 0.49	< 0.58	< 0.44	< 0.62
Thallium	1.2	4.6	mg/kg	< 0.49	< 0.58	< 0.59	< 0.38	< 0.49	< 0.49	< 0.58	< 0.44	< 0.62
Zinc	35000	NVL	mg/kg	75	50	65	71	78	85	110	42	34
Fluoride ²	47,000	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide	15	NVL	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 4
Soil Data - Inorganics
Bauxite Interim Route Distribution Line
Frederick, MD

Source				GTA Phase II 2022			
Location ID				SA7-K		SA10-A	
Depth (ft)				0-1	1-11	0-1	1-10
Sample ID				9/9/2022	9/9/2022	9/9/2022	9/9/2022
Sample Date				9/9/2022	9/9/2022	9/9/2022	9/9/2022
Parameter	MDE Non-Residential Cleanup Standard	Anticipated Typical Concentrations (CMBG)	Units				
Antimony	47	NVL	mg/kg	< 2.5	< 2.3	< 2.6	< 2.8
Arsenic	3	11	mg/kg	4.3	11	6.2	5.4
Beryllium	230	NVL	mg/kg	1.00	2.5	1.1	2.3
Cadmium	98	NVL	mg/kg	< 0.50	< 0.46	< 0.52	< 0.56
Tot Chromium ¹	NVL	42	mg/kg	21	31	34	17
Chromium (VI)	6.3	NVL	mg/kg	NA	NA	NA	NA
Copper	4700	NVL	mg/kg	13	25	13	20
Lead	800	NVL	mg/kg	20	22	17	14
Mercury	4.6	NVL	mg/kg	< 0.10	< 0.093	< 0.10	< 0.11
Nickel	2200	NVL	mg/kg	21	44	23	30
Selenium	580	NVL	mg/kg	< 0.50	< 0.56	0.53	< 0.56
Silver	580	NVL	mg/kg	< 0.50	< 0.56	< 0.52	< 0.56
Thallium	1.2	4.6	mg/kg	< 0.50	< 0.56	< 0.52	< 0.56
Zinc	35000	NVL	mg/kg	71	70	49	54
Fluoride ²	47,000	NVL	mg/kg	NA	NA	NA	NA
Cyanide	15	NVL	mg/kg	NA	NA	NA	NA

Table 4
Soil Data - Inorganics
Bauxite Interim Route Distribution Line
Frederick, MD

NOTES:
A = Results reported in Site Management Plan dated June 5, 2017, sample collection date not reported.

4.6

Exceeds MDE Non-Residential Soil Cleanup Standard

7.1

Exceeds Anticipated Typical Concentrations for Central Maryland (CMBG)

CMBG = Western Maryland Background
NVL = No value listed
¹Analytical results for total chromium are compared to the MDE
²Soil cleanup
< = Analyte not detected, value represents reporting limit.
J = Result is less than reporting limit but greater than method detection limit.

NA

Sample not submitted for specified method

Sample not collected (boring refusal)

J = Result is less than reporting limit but greater than method detection limit
F1 = MS and/or MSD recovery exceeds control limits.
F2 = MS/MSD RPD exceeds control limits
^2 = Calibration Blank (ICB and/or CCB) is outside of acceptable limits.
B = Compound was found in the blank and sample.
*+ = LCS and/or LCSD is outside acceptance limits, high biased.
cn = See case narrative below
5/10/2024 (410-171513-1)
Method 9012B: The laboratory control sample (LCS) for preparation
batch 410-505456 and analytical batch 410-506045 recovered

Table 5
Soil Data - PCBs and TPH DRO
Bauxite Interim Route Distribution Line
Frederick, MD

Source			ERM Phase II ESA (Bauxite 3) 2024											
Location ID			B-4	B-4	B-4	B-6	B-6	B-6	B-7/ MW-2	B-7/ MW-2	B-7/ MW-2	B-8	B-8	B-8
Depth (ft)			0-1	1-5	5-14	0-1	1-5	5-12	0-1	1-5	7.5-13.5	0-1	1-5	5-15
Sample ID			B-4-0-1-G	B-4-1-5-G	B-4-5-14-C	B-6-0-1-G	B-6-1-5-C	B-6-5-15-C	B-7-0-1-G	B-7-1-5-C	B-7-5-13.5-C	B-8-0-1-G	B-8-1-5-C	B-8-5-15-C
Sample Date			5/10/2024	5/10/2024	5/10/2024	5/7/24	5/7/24	5/7/24	5/6/24	5/6/24	5/6/24	5/2/2024	5/2/2024	5/2/2024
Parameter	MDE Non-Residential Cleanup Standard	Units												
Aroclor 1016	5100	ug/kg	< 21 cn	< 19	< 24 cn	< 20 cn	< 21	< 23 cn	< 19	< 23	< 23	< 18	< 19 cn	< 21
Aroclor 1221	830	ug/kg	< 21 cn	< 19	< 24 cn	< 20	< 21	< 23	< 19	< 23	< 23	< 18	< 19 cn	< 21
Aroclor 1232	720	ug/kg	< 21 cn	< 19	< 24 cn	< 20	< 21	< 23	< 19	< 23	< 23	< 18	< 19 cn	< 21
Aroclor 1242	950	ug/kg	< 21 cn	< 19	< 24 cn	< 20	< 21	< 23	< 19	< 23	< 23	< 18	< 19 cn	< 21
Aroclor 1248	950	ug/kg	360 cn	< 19	< 24 cn	18 J	< 21	< 23	19	< 23	< 23	10 J	22 cn	< 21
Aroclor 1254	970	ug/kg	< 21 cn	< 19	< 24 cn	8.9 J	< 21	< 23	< 19	< 23	< 23	< 18	< 19 cn	< 21
Aroclor 1260	990	ug/kg	< 21 cn	< 19	< 24 cn	< 20 cn	< 21	< 23 cn	< 19	< 23	< 23	< 18	< 19 cn	< 21
Total PCBs	940	ug/kg	360 cn	< 19	< 24 cn	26.9 J	< 21	< 23 cn	19	< 23	< 23	10 J	22 cn	< 21
TPH DRO			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 5
Soil Data - PCBs and TPH DRO
Bauxite Interim Route Distribution Line
Frederick, MD

Source			ERM Phase II ESA (Bauxite 3) 2024										
Location ID			B-11	B-11	B-11	B-14	B-14	DUP-4	B-14	B-15/ MW-5	B-15/ MW-5	B-15/ MW-5	B-16
Depth (ft)			0-1	1-5	5-15	0-1	1-5	1-5	5-15	0-1	1-5	5-15	0-1
Sample ID			B-11-0-1-G	B-11-1-5-C	B-11-5-15-C	B-14-0-1-G	B-14-1-5-C	DUP 4	B-14-5-15-C	B-15-0-1-G	B-15-1-5-C	B-15-5-15-C	B-16-0-1-G
Sample Date			5/7/2024	5/7/2024	5/7/2024	5/10/24	5/10/24	5/10/24	5/10/24	5/6/24	5/6/24	5/6/24	5/9/24
Parameter	MDE Non-Residential Cleanup Standard	Units											
Aroclor 1016	5100	ug/kg	< 22	< 21 cn	< 23 cn	< 20	< 20	< 20	< 20	< 20	< 20	< 22	< 19
Aroclor 1221	830	ug/kg	< 22	< 21	< 23	< 20	< 20	< 20	< 20	< 20	< 20	< 22	< 19
Aroclor 1232	720	ug/kg	< 22	< 21	< 23	< 20	< 20	< 20	< 20	< 20	< 20	< 22	< 19
Aroclor 1242	950	ug/kg	< 22	< 21	< 23	< 20	< 20	< 20	< 20	< 20	< 20	< 22	< 19
Aroclor 1248	950	ug/kg	14 J	97	< 23	< 20	< 20	< 20	< 20	< 20	120	< 22	< 19
Aroclor 1254	970	ug/kg	< 22	< 21	< 23	< 20	< 20	< 20	< 20	< 20	< 20	< 22	< 19
Aroclor 1260	990	ug/kg	< 22	< 21	< 23 cn	< 20	< 20	< 20	< 20 F1	< 20	< 20	< 22	< 19
Total PCBs	940	ug/kg	14 J	97	< 23 cn	< 20	< 20	< 20	< 20	< 20	< 20	< 22	< 19
TPH DRO	620000	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 5
Soil Data - PCBs and TPH DRO
Bauxite Interim Route Distribution Line
Frederick, MD

Source			ERM Phase II ESA (Bauxite 3) 2024							
Location ID			B-16	B-16	RB1-20N	RB1-0	RB2-20N	RB2-20S	RB3-0	RB3-20S
Depth (ft)			1-5	5-15	0-0.5	0.5-2	0.5-2	0.5-2	0.5-2	0-0.5
Sample ID			B-16-1-5-C	B-16-5-15-C	RB-1-20N-0-0.5	RB-1-0-0.5-2.0	RB-2-20N-0.5-2	RB-2-20S-0.5-2	RB-3-0-0.5-2	RB-3-20S-0-0.5
Sample Date			5/9/24	5/9/24	5/13/24	5/13/24	5/13/24	5/13/24	5/13/24	5/13/24
Parameter	MDE Non-Residential Cleanup Standard	Units								
Aroclor 1016	5100	ug/kg	< 20	< 23 F2 F1	< 20	< 18	< 20	< 18	< 200	< 21
Aroclor 1221	830	ug/kg	< 20	< 23	< 20	< 18	< 20	< 18	< 200	< 21
Aroclor 1232	720	ug/kg	< 20	< 23	< 20	< 18	< 20	< 18	< 200	< 21
Aroclor 1242	950	ug/kg	< 20	< 23	< 20	< 18	< 20	< 18	< 200	< 21
Aroclor 1248	950	ug/kg	< 20	< 23	< 20	< 18	< 20	21	210	< 21
Aroclor 1254	970	ug/kg	< 20	< 23	< 20	< 18	< 20	< 18	< 200	< 21
Aroclor 1260	990	ug/kg	< 20	< 23 F2 F1	< 20	< 18	< 20	< 18	< 200	< 21
Total PCBs	940	ug/kg	< 20	< 23 F2 F1	< 20	< 18	< 20	21	210	< 21
TPH DRO			NA	NA	9700 J	9900 J	8000 J	10000 J	220,000	< 15000 cn

Table 5
Soil Data - PCBs and TPH DRO
Bauxite Interim Route Distribution Line
Frederick, MD

NOTES:

Exceeds MDE Non-Residential Soil Cleanup Standard

NVL = No value listed

n.o.s. = not otherwise specified

TPH DRO = Total Petroleum Hydrocarbons Diesel Range Organics

NA Sample not submitted for specified method

Sample not collected (boring refusal)

< = Analyte not detected, value represents reporting limit.

J = Result is less than reporting limit but greater than method detection limit.

F1 = MS and/or MSD recovery exceeds control limits

F2 = Duplicate RPD exceeds limit, and one or both sample results are less than 5 times RL, and the absolute difference between results is < the upper reporting limits for both.

cn = See case narrative

5/1/2024 (410-170307-1)

Method 8082A: The DCB Decachlorobiphenyl (Surr) surrogate recovery

for the following samples was outside acceptance limits (low biased) on

the primary column: B-10-0-1-G (410-170119-3). The recovery is within

Method 8082A: The Tetrachloro-m-xylene surrogate recovery for the

following samples was outside acceptance limits (low biased) on the

primary column: B-21-1-5-G (410-170119-24) and B-21-0-1-G (410-

Method 8082A: The Tetrachloro-m-xylene surrogate recovery for the

following samples was outside acceptance limits (high biased) on the

primary column due to matrix interference: B-13-5-14-C (410-170119-15).

The following samples were received at the laboratory outside the

required temperature criteria: B-22-4-5-G (410-170307-1), B-22-14-15-G

(410-170307-2), B-22-0-1-G (410-170307-3), B-22-1-5-C (410-170307-4),

B-22-5-15-C (410-170307-5),

B-20-4-5-G (410-170307-6), B-20-13-14-G (410-170307-7), B-20-0-1-

Method 8082A: The DCB Decachlorobiphenyl (Surr) surrogate recovery

for the following samples was outside acceptance limits (low biased) on

the primary column: B-3-0-1-G (410-170307-11). The recovery is within

Method 8082A: Surrogate recovery for the following samples were outside control limits: B-8-1-5-C (410-170307-15) and B-8-5-15-C (410-170307-16). Evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed.

5/7/2024 (410-170880-1)

Method 8082A: The DCB Decachlorobiphenyl (Surr) surrogate recovery

for the following samples was outside acceptance limits (high biased) on

the primary column due to matrix interference: B-11-0-1-G (410-170880-8).

Method 8082A: The Tetrachloro-m-xylene surrogate recovery for the

following samples was outside acceptance limits (low biased) on the

confirmation column: B-11-1-5-C (410-170880-9). The recovery is within

Method 8082A: The continuing calibration verification (CCV) associated

with batch 410-504178 recovered above the upper control limit for PCB-

1016. PCB-1260 and Tetrachloro-m-xylene on one column. Results are

5/8/24 (410-171083-1)

Method 8082A: The DCB Decachlorobiphenyl (Surr) surrogate recovery for the following sample was outside acceptance limits (low biased) on the primary column: B-2-1-5-C-MS (410-171083-10[MS]). Results are reported from the passing column.

5/9/2024 (410-171270-1)

Method 8082A: Surrogate recovery for the following sample was outside control limits: B-16-5-15-C-MSD (410-171270-5[MSD]). Low surrogates due to poor sample matrix, brown clay.

5/10/2024 (410-171513-1)

Method 8082A: The Tetrachloro-m-xylene surrogate recovery for the

following samples was outside acceptance limits (low biased) on the

confirmation column: B-14-5-15-C-MSD (410-171513-5[MSD]). The

Method 8082A: Surrogate recovery for the following samples were outside control limits: B-4-0-1-G (410-171513-8), B-4-5-14-C (410-171513-10) and B-5-0-1-G (410-171513-13). Low surrogates due to poor sample matrix, clay, rocks, roots.

5/13/2024 (410-171693-1)

Method 8082A: The Tetrachloro-m-xylene surrogate recovery for the following sample was outside acceptance limits (low biased) on the confirmation column: RB-3-0-0.5-2 (410-171693-16). Results are reported from the passing column.

5/14/2024 (410-171693-1)

Method 8082A: Surrogate recovery for the following sample was outside control limits: RB-6-0-0-0.5 (410-171877-11). Low surrogates due to poor sample matrix, rocky black/brown clay.

Method 8082A: The Tetrachloro-m-xylene surrogate recovery for the

following samples was outside acceptance limits (low biased) on the

<confirmation column: RB-6-20N-0-0.5 (410-171877-9) and RB-7-0-0.5-2

Method 8082A: The following sample was diluted due to the nature of the sample matrix: RB-5-0-0.5-2 (410-171877-6). Elevated reporting limits (RLs) are provided.

5/13/2024 (410-171693-1)

Method 8015D_DRO: Surrogate recovery for the following sample was outside control limits: RB-3-20S-0-0.5 (410-171693-17). Low surrogates due to poor sample matrix and brown clay.

Table 6
Soil Data - Pesticide/Herbicide
Bauxite Interim Route Distribution Line
Frederick, MD

Source			ERM Phase II ESA (Bauxite 3) 2024					GTA Phase II ESA 2022	
Location ID			RB1-20N	RB1-20S	RB2-0	RB3-20N	RB3-20S	SA1-F	
Depth (ft)			0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-1	1-17
Sample ID			RB-1-20N-0-0.5	RB-1-20S-0-0.5	RB-2-0-0-0.5	RB-3-20N-0-0.5	RB-3-20S-0-0.5		
Sample Date			5/13/2024	5/13/2024	5/13/2024	5/13/2024	5/13/2024		
Parameter	MDE Non-Residential Cleanup Standard	Units							
Aldrin	180	ug/kg	< 0.98 cn	< 4.4 cn	< 20 cn	< 4.6 cn	< 5.1 cn	< 4.2	NA
Alpha-BHC	360	ug/kg	< 0.98 cn	< 4.4 cn	< 20 cn	< 4.6 cn	< 5.1 cn	< 4.2	NA
Beta-BHC	1300	ug/kg	< 1.2 cn	< 5.3 cn	< 24 cn	< 5.6 cn	< 6.2 cn	< 4.2	NA
Delta-BHC	2500	ug/kg	< 1.2 cn	< 5.3 cn	< 20 cn	< 5.6 cn	< 6.2 cn	< 4.2	NA
Gamma-BHC (Lindane)	NVL	ug/kg	< 0.98 cn	< 4.4 cn	< 24 cn	< 4.6 cn	< 5.1 cn	NA	NA
cis-Chlordane								< 4.2	NA
trans-Chlordane								< 4.2	NA
Chlordane (n.o.s.)	7700	ug/kg	< 20 cn	< 90 cn	< 410 cn	< 94 cn	< 100 cn	< 110	NA
4,4'-DDD	2500	ug/kg	< 2.0 cn	< 9.0 cn	< 41 cn	< 9.4 cn	< 10 cn	< 4.2	NA
4,4'-DDE	9300	ug/kg	< 2.0 cn	< 9.0 cn	< 41 cn	< 9.4 cn	< 10 cn	< 4.2	NA
4,4'-DDT	8500	ug/kg	< 2.0 cn	< 9.0 cn	< 41 cn	< 9.4 cn	< 10 cn	< 4.2	NA
Dieldrin	140	ug/kg	< 2.0 cn	< 9.0 cn	< 41 cn	< 9.4 cn	< 10 cn	< 4.2	NA
Endosulfan I	NVL	ug/kg	< 0.98 cn	< 4.4 cn	< 20 cn	< 4.6 cn	< 5.1 cn	< 4.2	NA
Endosulfan II	NVL	ug/kg	< 2.7 cn	< 12 cn	< 55 cn	< 13 cn	< 14 cn	< 4.2	NA
Endosulfan Sulfate	NVL	ug/kg	< 2.0 cn	< 9.0 cn	< 41 cn	< 9.4 cn	< 10 cn	< 4.2	NA
Endrin	25000	ug/kg	< 2.0 cn	< 9.0 cn	< 41 cn	< 9.4 cn	< 10 cn	< 4.2	NA
Endrin aldehyde	NVL	ug/kg	< 2.0 cn	< 9.0 cn	< 41 cn	< 9.4 cn	< 10 cn	< 4.2	NA
Endrin ketone								< 4.2	NA
Heptachlor	630	ug/kg	< 0.98 cn	< 4.4 cn	< 20 cn	< 4.6 cn	< 5.1 cn	< 4.2	NA
Heptachlor epoxide	330	ug/kg	< 0.98 cn	< 4.4 cn	< 20 cn	< 4.6 cn	< 5.1 cn	< 4.2	NA
Methoxychlor								< 4.2	NA
Toxaphene	2100	ug/kg	< 39 cn	< 170 cn	< 790 cn	< 180 cn	< 200 cn	< 100	NA
2,4-D	960000	ug/kg	< 110	< 38 cn	< 43	< 40 cn	< 45	< 200	NA
2,4-DB	NVL	ug/kg	< 73 cn	< 26 cn	< 30 cn	< 28 cn	< 31 cn	< 210	NA
2,4,5-TP (Silvex)	660000	ug/kg	< 5.0	< 1.8 cn	< 2.0	< 1.9 cn	< 2.1	< 20	NA
2,4,5-T	NVL	ug/kg	< 5.0 cn	< 1.8 cn	< 2.0	< 1.9 cn	< 2.1 cn	< 20	NA
Dalapon	2500000	ug/kg	< 290 *+	< 110 *+ cn	< 120 *+	< 110 *+ cn	< 120 *+	< 490	NA
Dicamba	NVL	ug/kg	< 85	< 31 cn	< 35	< 32 cn	< 36	< 20	NA
Dichloroprop	NVL	ug/kg	< 59	< 21 cn	< 24	< 22 cn	< 25	< 200	NA
Dinoseb	82000	ug/kg	< 70 *-	< 9.5 *- cn	< 11 *-	< 27 *- cn	< 30 *-	< 100	NA
MCPA	NVL	ug/kg	< 2200	< 2600 cn	< 3000	< 2800 cn	< 3100	< 23,000	NA
MCPP	NVL	ug/kg	< 23000	< 8100 cn	< 9200	< 8600 cn	< 9500	< 23,000	NA
Pentachlorophenol	NVL	ug/kg	< 0.97	< 1.8 cn	1.2 J	< 1.9 cn	0.60	NA	NA

Table 6
Soil Data - Pesticide/Herbicide
Bauxite Interim Route Distribution Line
Frederick, MD

Source			GTA Phase II ESA 2022									
Location ID			SA1-H		SA2-E		SA4-E		SA4-M		SA7-J	
Depth (ft)			0-1	1-19	0-1	4-5	0-1	1-15	0-1	1-15	0-1	1-5
Sample ID			9/9/2022	9/9/2022	9/9/2022	9/9/2022			9/8/2022	9/8/2022	9/9/2022	9/9/2022
Parameter	MDE Non-Residential Cleanup Standard	Units										
Aldrin	180	ug/kg	< 4.7	NA	< 5.3	NA	< 4.2	NA	< 4.4	NA	< 5.1	NA
Alpha-BHC	360	ug/kg	< 4.7	NA	< 5.3	NA	< 4.2	NA	< 4.4	NA	< 5.1	NA
Beta-BHC	1300	ug/kg	< 4.7	NA	< 5.3	NA	< 4.2	NA	< 4.4	NA	< 5.1	NA
Delta-BHC	2500	ug/kg	< 4.7	NA	< 5.3	NA	< 4.2	NA	< 4.4	NA	< 5.1	NA
Gamma-BHC (Lindane)	NVL	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis-Chlordane			< 4.7	NA	< 5.3	NA	< 4.2	NA	< 4.4	NA	< 5.1	NA
trans-Chlordane			< 4.7	NA	< 5.3	NA	< 4.2	NA	< 4.4	NA	< 5.1	NA
Chlordane (n.o.s.)	7700	ug/kg	< 120	NA	< 130	NA	< 110	NA	< 110	NA	< 130	NA
4,4'-DDD	2500	ug/kg	< 4.7	NA	< 5.3	NA	< 4.2	NA	< 4.4	NA	< 5.1	NA
4,4'-DDE	9300	ug/kg	< 4.7	NA	< 5.3	NA	< 4.2	NA	< 4.4	NA	< 5.1	NA
4,4'-DDT	8500	ug/kg	< 4.7	NA	< 5.3	NA	< 4.2	NA	< 4.4	NA	< 5.1	NA
Dieldrin	140	ug/kg	< 4.7	NA	< 5.3	NA	< 4.2	NA	< 4.4	NA	< 5.1	NA
Endosulfan I	NVL	ug/kg	< 4.7	NA	< 5.3	NA	< 4.2	NA	< 4.4	NA	< 5.1	NA
Endosulfan II	NVL	ug/kg	< 4.7	NA	< 5.3	NA	< 4.2	NA	< 4.4	NA	< 5.1	NA
Endosulfan Sulfate	NVL	ug/kg	< 4.7	NA	< 5.3	NA	< 4.2	NA	< 4.4	NA	< 5.1	NA
Endrin	25000	ug/kg	< 4.7	NA	< 5.3	NA	< 4.2	NA	< 4.4	NA	< 5.1	NA
Endrin aldehyde	NVL	ug/kg	< 4.7	NA	< 5.3	NA	< 4.2	NA	< 4.4	NA	< 5.1	NA
Endrin ketone			< 4.7	NA	< 5.3	NA	< 4.2	NA	< 4.4	NA	< 5.1	NA
Heptachlor	630	ug/kg	< 4.7	NA	< 5.3	NA	< 4.2	NA	< 4.4	NA	< 5.1	NA
Heptachlor epoxide	330	ug/kg	< 4.7	NA	< 5.3	NA	< 4.2	NA	< 4.4	NA	< 5.1	NA
Methoxychlor			< 4.7	NA	< 5.3	NA	< 4.2	NA	< 4.4	NA	< 5.1	NA
Toxaphene	2100	ug/kg	< 120	NA	< 130	NA	< 110	NA	< 110	NA	< 130	NA
2,4-D	960000	ug/kg	< 220	NA	< 230	NA	< 210	NA	< 220	NA	< 230	NA
2,4-DB	NVL	ug/kg	< 220	NA	< 230	NA	< 210	NA	< 220	NA	< 230	NA
2,4,5-TP (Silvex)	660000	ug/kg	< 22	NA	< 24	NA	< 21	NA	< 22	NA	< 23	NA
2,4,5-T	NVL	ug/kg	< 22	NA	< 24	NA	< 21	NA	< 22	NA	< 23	NA
Dalapon	2500000	ug/kg	< 530	NA	< 570	NA	< 500	NA	< 520	NA	< 550	NA
Dicamba	NVL	ug/kg	< 22	NA	< 23	NA	< 21	NA	< 21	NA	< 23	NA
Dichloroprop	NVL	ug/kg	< 220	NA	< 230	NA	< 210	NA	< 210	NA	< 230	NA
Dinoseb	82000	ug/kg	< 110	NA	< 120	NA	< 100	NA	< 110	NA	< 120	NA
MCPA	NVL	ug/kg	< 22,000	NA	< 23,000	NA	< 21,000	NA	< 21,000	NA	< 23,000	NA
MCPP	NVL	ug/kg	< 22,000	NA	< 23,000	NA	< 21,000	NA	< 21,000	NA	< 23,000	NA
Pentachlorophenol	NVL	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 6
Soil Data - Pesticide/Herbicide
Bauxite Interim Route Distribution Line
Frederick, MD

Source			GTA Phase II 2022			
Location ID			SA7-K		SA10-A	
Depth (ft)			0-1	1-11	0-1	1-10
Sample ID						
Sample Date			9/9/2022	9/9/2022	9/9/2022	9/9/2022
Parameter	MDE Non-Residential Cleanup Standard	Units				
Aldrin	180	ug/kg	< 21	NA	< 4.4	NA
Alpha-BHC	360	ug/kg	< 21	NA	< 4.4	NA
Beta-BHC	1300	ug/kg	< 21	NA	< 4.4	NA
Delta-BHC	2500	ug/kg	< 21	NA	< 4.4	NA
Gamma-BHC (Lindane)	NVL	ug/kg	NA	NA	NA	NA
cis-Chlordane			< 21	NA	< 4.4	NA
trans-Chlordane			< 21	NA	< 4.4	NA
Chlordane (n.o.s.)	7700	ug/kg	< 53	NA	< 110	NA
4,4'-DDD	2500	ug/kg	< 21	NA	< 4.4	NA
4,4'-DDE	9300	ug/kg	< 21	NA	< 4.4	NA
4,4'-DDT	8500	ug/kg	< 21	NA	< 4.4	NA
Dieldrin	140	ug/kg	< 21	NA	< 4.4	NA
Endosulfan I	NVL	ug/kg	< 21	NA	< 4.4	NA
Endosulfan II	NVL	ug/kg	< 21	NA	< 4.4	NA
Endosulfan Sulfate	NVL	ug/kg	< 21	NA	< 4.4	NA
Endrin	25000	ug/kg	< 21	NA	< 4.4	NA
Endrin aldehyde	NVL	ug/kg	< 21	NA	< 4.4	NA
Endrin ketone			< 21	NA	< 4.4	NA
Heptachlor	630	ug/kg	< 21	NA	< 4.4	NA
Heptachlor epoxide	330	ug/kg	< 21	NA	< 4.4	NA
Methoxychlor			< 21	NA	< 4.4	NA
Toxaphene	2100	ug/kg	< 53	NA	< 110	NA
2,4-D	960000	ug/kg	< 210	NA	< 220	NA
2,4-DB	NVL	ug/kg	< 210	NA	< 220	NA
2,4,5-TP (Silvex)	660000	ug/kg	< 21	NA	< 22	NA
2,4,5-T	NVL	ug/kg	< 21	NA	< 22	NA
Dalapon	2500000	ug/kg	< 510	NA	< 540	NA
Dicamba	NVL	ug/kg	< 21	NA	< 22	NA
Dichloroprop	NVL	ug/kg	< 210	NA	< 220	NA
Dinoseb	82000	ug/kg	< 110	NA	< 110	NA
MCPA	NVL	ug/kg	< 210	NA	< 22,000	NA
MCPP	NVL	ug/kg	< 210	NA	< 22,000	NA
Pentachlorophenol	NVL	ug/kg	NA	NA	NA	NA

Table 6
Soil Data - Pesticide/Herbicide
Bauxite Interim Route Distribution Line
Frederick, MD

NOTES:

Exceeds MDE Non-Residential Soil Cleanup Standard

NVL = No value listed

n.o.s. = not otherwise specified

*+ = LCS and/or LCSD is outside acceptance limits, high biased

*- = LCS and/or LCSD is outside acceptance limits, low biased

J = Result is less than reporting limit but greater than method detection limit

F1 = MS and/or MSD recovery exceeds control limits

F2 = Duplicate RPD exceeds limit, and one or both sample results are less than 5 times RL, and the absolute difference between results is < the upper reporting limits for both.

NA Sample not submitted for specified method

< = Analyte not detected, value repres Sample not collected (boring refusal)

cn = See case narrative below.

5/13/2024 (410-171693-1)

Method 8151A: The continuing calibration verification (CCV) associated with batch 410-507780 recovered above the upper control limit for 2,4,5-T and 2,4-DB. The samples associated with this CCV were non-detects for the affected analytes;

therefore, the data have been reported. RB-1-20N-0-0.5 (410-171693-3), RB-1-20S-0-0.5 (410-171693-5), RB-2-0-0-0.5 (410-171693-9), RB-3-20N-0-0.5 (410-171693-13), RB-3-20S-0-0.5 (410-171693-17)

Method 8151A: The following sample was diluted due to the nature of the sample matrix: RB-4-0-0-0.5 (410-171693-21). Elevated reporting limits (RLs) are provided.

Method 8151A: Surrogate recovery for the following samples were outside control limits: RB-1-20S-0-0.5 (410-171693-5), RB-3-20N-0-0.5 (410-171693-13) and RB-4-0-0-0.5 (410-171693-21). Evidence of matrix interference is present; therefore, reextraction

and/or re-analysis was not performed.

5/14/2024 (410-171693-1)

Method 8151A: The following samples were diluted due to the nature of the sample matrix: RB-6-0-0-0.5 (410-171877-11), RB-7-20N-0-0.5 (410-171877-15), RB-7-20S-0-0.5 (410-171877-19) and DUP-7 (410-171877-22). Elevated reporting limits (RLs)

5/13/2024 (410-171693-1)

Method 8081B: The continuing calibration verification (CCV) associated with batch 410-506787 recovered above the upper control limit for Ioxaprene. The samples associated with this CCV were non-detects for the affected analytes; therefore,

the data have been reported. The associated samples are: RB-1-20N-0-0.5 (410-171693-3), RB-1-20S-0-0.5 (410-171693-5), RB-2-0-0-0.5 (410-171693-9), RB-3-20N-0-0.5 (410-171693-13), RB-3-20S-0-0.5 (410-171693-17) and RB-4-0-0-0.5 (410-171693-21).

Elevated reporting limits (RLs) are provided.

5/14/2024 (410-171693-1)

Method 8081B: The following samples were diluted due to the nature of the sample matrix: RB-5-20N-0-0.5 (410-171877-3), RB-5-20S-0-0.5 (410-171877-7), RB-6-0-0-0.5 (410-171877-11), RB-7-20N-0-0.5 (410-171877-15), RB-7-20S-0-0.5 (410-171877-19)

and DUP-7 (410-171877-22). Elevated reporting limits (RLs) are provided.

Method 8081B: The continuing calibration verification (CCV) associated with batch 410-506787 recovered above the upper control limit for Ioxaprene. The samples associated with this CCV were non-detects for the affected analytes; therefore, the

data have been reported. The associated samples are: RB-5-20N-0-0.5 (410-171877-3), RB-5-20S-0-0.5 (410-171877-7), RB-6-0-0-0.5 (410-171877-11), RB-7-20N-0-0.5 (410-171877-15), RB-7-20S-0-0.5 (410-

Table 7
Groundwater - TCL VOCs
Bauxite 3
Frederick, MD

		Location ID	MW-2	GW-DUP-1	MW-3	MW-4	MW-5
		Sample ID	MW-2-Bauxite3-May2024		MW-3-Bauxite3-May2024	MW-4-Bauxite3-May2024	MW-5-Bauxite3-May2024
		Sample Date	5/21/2024	5/21/2024	5/21/2024	5/21/2024	5/21/2024
Parameter	Type I and II Aquifers	Units					
Acetone	1,400	ug/L	1.0 J	< 20	1.7 J cn	< 20	< 20
Benzene	5	ug/L	< 1.0	< 1.0	< 1.0 cn	< 1.0	< 1.0
Bromodichloromethane (THM)	80	ug/L	< 1.0 cn	< 1.0 cn	< 1.0 cn	< 1.0 cn	< 1.0 cn
Bromoform (THM)	80	ug/L	< 4.0 cn	< 4.0 cn	< 4.0 cn	< 4.0 cn	< 4.0 cn
Bromomethane	0.75	ug/L	< 1.0	< 1.0	< 1.0 cn	< 1.0	< 1.0
2-Butanone (Methyl Ethyl Ketone)	560	ug/L	< 10	< 10	1.8 J cn	< 10	< 10
Carbon Disulfide	81	ug/L	< 5.0	< 5.0	< 5.0 cn	< 5.0	< 5.0
Carbon Tetrachloride	5	ug/L	< 1.0 cn	< 1.0 cn	< 1.0 cn	< 1.0 cn	< 1.0 cn
Chlorobenzene	100	ug/L	< 1.0	< 1.0	< 1.0 cn	< 1.0	< 1.0
Chloroform	80	ug/L	< 1.0	< 1.0	< 1.0 cn	< 1.0	< 1.0
Chloromethane	19	ug/L	< 2.0	< 2.0	< 2.0 cn	< 2.0	< 2.0
Cumene (Isopropylbenzene)	45	ug/L	< 5.0	< 5.0	< 5.0 cn	< 5.0	< 5.0
Dibromochloromethane	80	ug/L	< 1.0	< 1.0	< 1.0 cn	< 1.0	< 1.0
1,2-Dibromoethane	0.05	ug/L	< 5.0	< 1.0	< 1.0 cn	< 1.0	< 1.0
1,1-Dichloroethane	2.80	ug/L	< 1.0	< 1.0	< 1.0 cn	< 1.0	< 1.0
1,2-Dichloroethane	5	ug/L	< 1.0 cn	< 1.0 cn	< 1.0 cn	< 1.0 cn	< 1.0 cn
1,1-Dichloroethylene	7	ug/L	< 1.0	< 1.0	< 1.0 cn	< 1.0	< 1.0
cis-1,2-Dichloroethene	70	ug/L	< 1.0	< 1.0	< 1.0 cn	< 1.0	< 1.0
trans-1,2-Dichloroethene	100	ug/L	<2.0	< 2.0	< 2.0 cn	< 2.0	< 2.0
1,2-Dichloropropane	5	ug/L	< 1.0	< 1.0	< 1.0 cn	< 1.0	< 1.0
Ethyl Chloride (chloroethane)	2,100	ug/L	< 1.0	< 1.0	< 1.0 cn	< 1.0	< 1.0
Ethylbenzene	700	ug/L	< 1.0	< 1.0	< 1.0 cn	< 1.0	< 1.0
4-Methyl-2-pentanone (Methyl Isobutyl Ketone)	630	ug/L	< 10	< 10	< 10 cn	< 10	< 10
Methylene Chloride (Dichloromethane)	5	ug/L	< 1.0	< 1.0	< 1.0 cn	< 1.0	< 1.0
Methyl tert-butyl ether (MTBE)	20	ug/L	< 1.0	< 1.0	< 1.0 cn	< 1.0	< 1.0
Styrene	100	ug/L	< 5.0	< 5.0	< 5.0 cn	< 1.0	< 5.0
Tetrachloroethene	5	ug/L	< 1.0	< 1.0	< 1.0 cn	< 1.0	0.31 J
1,1,2,2-Tetrachloroethane	0.076	ug/L	< 1.0	< 1.0	< 1.0 cn	< 1.0	< 1.0
Toluene	1,000	ug/L	< 1.0	< 1.0	< 1.0 cn	< 1.0	< 1.0
1,1,1-Trichloroethane	200	ug/L	< 1.0 cn	< 1.0 cn	< 1.0 cn	< 1.0 cn	< 1.0 cn
1,1,2-Trichloroethane	5	ug/L	< 1.0	< 1.0	< 1.0 cn	< 1.0	< 1.0
Vinyl Chloride	2	ug/L	< 1.0	< 1.0	< 1.0 cn	< 1.0	< 1.0
Xylenes	10,000	ug/L	< 1.0	< 1.0	< 1.0 cn	< 1.0	< 1.0
Trichloroethylene	5	ug/L	< 1.0	< 1.0	< 1.0 cn	< 1.0	< 1.0
1,4-Dichlorobenzene	75	ug/L	< 5.0	< 5.0	< 5.0 cn	< 1.0	< 5.0
Methylcyclohexane	NVL	ug/L	< 5.0	< 5.0	< 5.0 cn	< 5.0	< 5.0
Cyclohexane ¹	4	ug/L	< 5.0	< 5.0	< 5.0 cn	< 5.0	< 5.0
1,3-Dichlorobenzene	NVL	ug/L	< 5.0	< 5.0	< 5.0 cn	< 5.0	< 5.0
2-Hexanone ¹	38	ug/L	< 10	< 10	< 10 cn	< 10	< 10
Freon 113	NVL	ug/L	< 10	< 10	< 5.0 cn	< 10	<10
Methyl acetate ¹	20,000	ug/L	< 5.0	< 5.0	< 5.0 cn	< 5.0	0.40 J
1,2-Dichlorobenzene	600	ug/L	< 5.0	< 5.0	< 5.0 cn	< 5.0	< 5.0
1,2-Dibromo- 3-Chloropropane	0.20	ug/L	< 5.0	< 5.0	< 5.0 cn	< 5.0	< 5.0
1,2,4-Trichlorobenzene	70	ug/L	< 5.0	< 5.0	< 5.0 cn	< 5.0	< 5.0
cis-1,3-dichloropropene ¹	0.47	ug/L	< 1.0	< 1.0	< 1.0 cn	< 1.0	< 1.0
trans-1,3-dichloropropene ¹	0.47	ug/L	< 1.0	< 1.0	< 1.0 cn	< 1.0	< 1.0
Trichlorofluoromethane ¹	5,200	ug/L	< 1.0	< 1.0	< 1.0 cn	< 1.0	< 1.0
Dichlorodifluoromethane	NVL	ug/L	< 1.0	< 1.0	< 1.0 cn	< 1.0	< 1.0

Notes

	Exceeds MDE Groundwater Cleanup Standard
NA	Sample not submitted for specified method

CMBG = Central Maryland Background

NVL = No value listed

¹EPA Risk-Based Screening Level (November 2023).

< = Analyte not detected. Value represents detection limit.

J = Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

F1 = MS and/or MSD recovery exceeds control limits.

F2 = MS/MSD RPD exceeds control limits.

cn = See Case Narrative

5/20/21 (410-172652-1)

Method 8260D: The continuing calibration verification (CCV) associated with batch 410-509513 recovered above the upper control limit for Acetone. Non-detections of the affected analytes are reported. Any detections are considered estimated.

Method 8260D: The continuing calibration verification (CCV) associated with batch 410-509513 recovered outside acceptance criteria, low biased, for Dichlorodifluoromethane. A reporting limit (RL) standard was analyzed, and the target analyte was detected. Non-detections of the affected analytes are reported. Any detections are considered estimated.
5/21/24 – 410-172841-1

The following samples were received at the laboratory outside the required temperature criteria: EB-1-May2024 (410-172841-1),TB-20240521 (410-172841-2), MW-6-Bauxite3-May2024 (410-172841-3), MW-5-Bauxite3-May2024 (410-172841-4), MW-4-Bauxite3-May2024 (410-172841-5), MW-3-Bauxite3-May2024 (410-172841-6), MW-2-Bauxite3-May2024 (410-172841-7) and GWDUP-1 (410-172841-8). The sample(s) is considered acceptable since it was collected and submitted to the laboratory on the same day and there is evidence that the chilling process has begun.

Method 8260D: The continuing calibration verification (CCV) associated with batch 410-510030 recovered outside acceptance criteria, low biased, for 1,2-Dichloroethane, Carbon tetrachloride, 1,1,1-Trichloroethane and Bromoform. A reporting limit (RL) standard was analyzed, and the target analyte was detected. Non-detections of the affected analytes are reported. Any detections are considered estimated.

Method 8260D: The continuing calibration verification (CCV) analyzed on 410-510030 is compliant under 8260C/D method criteria for Bromodichloromethane . The software does not display the % Drift data to the whole number as is listed in the method (i.e. limit of 20%). When applying the evaluation to a whole number, the check passes the criteria with a value of 20% Drift.

Method 8260D: The method requirement for no headspace was not met. The following volatile sample was analyzed with headspace in the sample container(s): MW-3-Bauxite3-May2024 (410-172841-6). The sample container was received with headspace.

Table 8
Groundwater - PAHs
Bauxite 3
Frederick, MD

Location ID			MW-2	GW-DUP-1	MW-3	MW-4	MW-5
Sample ID			MW-2-Bauxite3-May2024		MW-3-Bauxite3-May2024	MW-4-Bauxite3-May2024	MW-5-Bauxite3-May2024
Sample Date			5/21/2024	5/21/2024	5/21/2024	5/21/2024	5/21/2024
Parameter	Type I and II Aquifers	Units					
Acenaphthene	53	ug/L	< 0.55	< 0.52	< 0.50	< 0.50	< 0.51
Acenaphthylene	NVL	ug/L	< 0.55	< 0.52	< 0.50	< 0.50	< 0.51
Anthracene	180	ug/L	< 0.55	< 0.52	< 0.50	0.22 J	< 0.51
Benzo[a]anthracene*	0.03	ug/L	< 0.55	< 0.52	< 0.50	< 0.50	< 0.51
Benzo[a]pyrene*	0.2	ug/L	< 0.55	< 0.52	< 0.50	< 0.50	< 0.51
Benzo[b]fluoranthene*	0.25	ug/L	< 0.55	< 0.52	< 0.50	< 0.50	< 0.51
Benzo[g,h,i]perylene	NVL	ug/L	< 0.55	< 0.52	< 0.50	< 0.50	< 0.51
Benzo[k]fluoranthene*	2.5	ug/L	< 0.55	< 0.52	< 0.50	< 0.50	< 0.51
Chrysene*	25	ug/L	< 0.55	< 0.52	< 0.50	< 0.50	< 0.51
Dibenzo[a,h]anthracene*	0.025	ug/L	< 0.55	< 0.52	< 0.50	< 0.50	< 0.51
Fluoranthene	80	ug/L	< 0.55	< 0.52	< 0.50	7.7	< 0.51
Fluorene	29	ug/L	< 0.55	< 0.52	< 0.50	0.95	< 0.51
Indeno[1,2,3-cd]pyrene*	0.25	ug/L	< 0.55	< 0.52	< 0.50	< 0.50	< 0.51
Naphthalene	0.17	ug/L	0.17 J	0.47 J	0.34 J	1	0.91
Phenanthrene	12	ug/L	< 0.55	< 0.52	< 0.50	0.25 J	< 0.51
Pyrene	12	ug/L	< 0.55	< 0.52	< 0.50	4	< 0.51

Notes

	Exceeds MDE Groundwater Cleanup Standard
NA	Sample not submitted for specified method

NVL = No value listed

*Carcinogenic chemicals with a Mutagenic Mode of Action (MOA)

< = Analyte not detected. Value represents detection limit.

J = Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

Table 9
Groundwater Data - Inorganics
Bauxite 3
Frederick, MD

Location ID Sample ID Sample Date			MW-2 MW-2-Bauxite3-May2024 5/21/2024	GW-DUP-1 5/21/2024	MW-3 MW-3-Bauxite3-May2024 5/21/2024	MW-4 MW-4-Bauxite3-May2024 5/21/2024	MW-5 MW-5-Bauxite3-May2024 5/21/2024
Parameter	Type I and II Aquifers	Units					
Total Inorganics (unfiltered)							
Antimony	0.006	mg/L	0.0012	0.0011	< 0.0010	< 0.0010	< 0.0010
Arsenic	0.01	mg/L	0.0047	0.0045	< 0.0020	0.0018 J	< 0.0020
Beryllium	0.004	mg/L	< 0.00050	< 0.00050	< 0.00050	0.00020 J	< 0.00050
Cadmium	0.005	mg/L	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
Total Chromium	0.1	mg/L	0.0042	0.0041	< 0.0020	< 0.002	0.00077 J
Chromium (VI)	0.000035	mg/L	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030
Copper	1.3	mg/L	0.0042 J	0.0017	0.00040 J	< 0.0010	0.0027
Lead	0.015	mg/L	< 0.00050	< 0.00050	< 0.00050	< 0.00052	0.00014 J
Mercury	0.0002	mg/L	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020
Nickel	0.039	mg/L	< 0.0010	< 0.0010	0.0026	0.00058 J	< 0.0010
Selenium	0.05	mg/L	0.0026	0.0025	0.00029 J	< 0.0010	0.001
Silver	0.0094	mg/L	< 0.00050	< 0.00050	< 0.00050	< 0.00052	< 0.00052
Thallium	0.002	mg/L	< 0.00050	< 0.00050	< 0.00050	< 0.00052	< 0.00052
Zinc	0.6	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Fluoride ¹	4	mg/L	60	68	0.54 J	13	4.7
Cyanide	0.2	mg/L	0.0082 J	0.011	< 0.010	0.016	< 0.010
Dissolved Inorganics (filtered)							
Antimony	0.006	mg/L	0.0011	0.0011	< 0.0010	< 0.0010	< 0.0010
Arsenic	0.01	mg/L	0.0047	0.0045	< 0.0021	0.0021	< 0.0021
Beryllium	0.004	mg/L	< 0.00052	< 0.00052	< 0.00052	0.00023 J	< 0.00052
Cadmium	0.005	mg/L	< 0.00052	< 0.00052	< 0.00052	< 0.00052	< 0.00052
Total Chromium	0.1	mg/L	0.0044	0.0043	< 0.0021	---	0.00065 J
Copper	1.3	mg/L	0.002	0.0006 J	< 0.001	< 0.001	0.001
Lead	0.015	mg/L	< 0.00052	< 0.00052	< 0.00052	< 0.00052	< 0.00052
Mercury	0.0002	mg/L	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020
Nickel	0.039	mg/L	< 0.0010	< 0.0010	0.0028	0.00062 J	< 0.0010
Selenium	0.05	mg/L	0.0026	0.0026	< 0.001	< 0.001	0.00090 J
Silver	0.0094	mg/L	< 0.00052	< 0.00052	< 0.00052	< 0.00052	< 0.00052
Thallium	0.002	mg/L	< 0.00052	< 0.00052	< 0.00052	< 0.00052	< 0.00052
Zinc	0.6	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Notes

Exceeds MDE Groundwater Cleanup Standard

CMBG = Central Maryland Background

NVL = No value listed

¹EPA Maximum Contaminant Level (MCL) for Fluoride.

< = Analyte not detected. Value represents detection limit.

J = Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

Table 10
Groundwater - PCBs
Bauxite 3
Frederick, MD

Location ID			MW-2	GW-DUP-1	MW-3	MW-4	MW-5
Sample ID			MW-2-Bauxite3-May2024		MW-3-Bauxite3-May2024	MW-4-Bauxite3-May2024	MW-5-Bauxite3-May2024
Sample Date			5/21/2024	5/21/2024	5/21/2024	5/21/2024	5/21/2024
Parameter	Type I and II Aquifers	Units					
Aroclor 1016	0.14	ug/L	< 0.53	< 0.55	< 0.50	< 0.50	< 0.50
Aroclor 1221	0.0047	ug/L	< 0.53	< 0.55	< 0.50	< 0.50	< 0.50
Aroclor 1232	0.0047	ug/L	< 0.53	< 0.55	< 0.50	< 0.50	< 0.50
Aroclor 1242	0.0078	ug/L	< 0.53	< 0.55	< 0.50	< 0.50	< 0.50
Aroclor 1248	0.0078	ug/L	< 0.53	< 0.55	< 0.50	< 0.50	< 0.50
Aroclor 1254	0.0078	ug/L	< 0.53	< 0.55	< 0.50	< 0.50	< 0.50
Aroclor 1260	0.0078	ug/L	< 0.53	< 0.55	< 0.50	< 0.50	< 0.50
Total PCBs	0.5	ug/L	< 0.53	< 0.55	< 0.50	< 0.50	< 0.50

Notes

Exceeds MDE Groundwater
Cleanup Standard

NVL = No value listed

n.o.s. = not otherwise specified

< = Analyte not detected. Value represents detection
limit.

J = Result is less than the reporting limit
but greater than or equal to the method detection
limit and the concentration is an approximate value.

Table 11
Potential Exposure Pathways
Interim Distribution Line and Duct Banks
Frederick County, MD

Media	Potential Exposed Population	Exposure Pathway	COPCs
Soil (SMA explicitly; EC soils are assumed to have the same potential exposure pathways)	Adult On-Site Construction Worker	Dermal Exposure	PAHs
	Child Visitor	Incidental Ingestion	Benzo(a)anthracene
	Youth Visitor	Inhalation of Volatile/TPH constituents in Fugitive	Benzo(a)pyrene
	Adult Visitor		Benzo(b)fluoranthene
	Adult On-Site Worker		Benzo(k)fluoranthene
			Dibenz(a,h)anthracene
			Indeno(1,2,3-cd)pyrene
			PCBs
			Aroclor 1016
			Aroclor 1242
			Aroclor 1248
			Arsenic
			TPH
Groundwater	Adult On-Site Construction Worker	Dermal Exposure	Fluoride
		Incidental Ingestion	Tetrachloroethene
			1,4-dioxane
			TPH
			Lead
			Naphthalene?
Surface Water	No Construction in Surface Water Pathway Incomplete		Cyanide

Notes:

PAH = Poly-Aromatic Hydrocarbons

PCB = Polychlorinated Biphenyls

Table 12
Soil Management Table
Interim Distribution Line and Duct Bank Construction
Frederick, MD

Construction Elements	Within EC?	Within SMA?	Other Soil Conditions	Soil Movement Plan ¹	Approximate Volume - Spoils (ft ³)	Planned Fill Material Source	Approximate Volume - Fill (ft ³)	Permanent End Location for Excess Soil
Distribution Pole Boreholes (within EC only area)	Yes	No	TBD	TBD	~13 cubic ft per 9 ft deep borehole x 4 boreholes = 52 cubic ft	TBD	~4 cubic ft per 9 ft deep borehole x 4 boreholes = 16 cubic ft	TBD
Distribution Pole Boreholes (within EC/SMA area)	Yes	Yes	TBD	TBD	~10 cubic ft per 7 ft deep borehole x 32 boreholes = 320 cubic ft ~13 cubic ft per 9 ft deep borehole x 8 boreholes = 104 cubic ft	TBD	~3 cubic ft per 7 ft deep borehole x 32 boreholes = 96 cubic ft ~4 cubic ft per 9 ft deep borehole x 8 boreholes = 32 cubic ft	TBD
Duct Bank Excavations (within EC only area)	Yes	No	TBD	TBD	~13,200 square ft excavated to 7 ft deep = 92,000 cubic ft ~3,000 square ft excavated to 12 ft deep = 36,000 cubic ft	TBD	~49,000 cubic ft	TBD
Duct Bank Excavations (within EC/SMA area)	Yes	Yes	TBD	TBD	~10,500 square ft excavated to 7 ft deep for duct banks = 73,500 cubic ft ~72 square ft excavated to 7 ft deep for utility vaults x 4 utility vaults = 2,000 cubic ft	TBD	~31,500 cubic ft	TBD

Notes:

EC = Environmental Covenant, SMA = Soil Management Area, yd = yards, TBD = To be determined

¹ Refer to Figure 7

Table 13
Water Management
Interim Distribution Line and Duct Bank Construction
Frederick, MD

Item # ¹	Construction Elements	Within EC?	Within SMA?	Expect to Encounter GW?	GW or SW Dewatering Anticipated?	Estimated GW Dewatering Flowrate (GPD)	Estimated GW Dewatering duration (days)	Estimated GW Volume (gallons)	Containerize and Test? ²	Proposed Disposal Facility ³
1	Distribution Pole Boreholes	Yes	N	No	No	NA	NA	NA	Yes	TBD
2	Distribution Pole Boreholes	Yes	Y	No	No	52058	23	1200000	Yes	TBD
3	Duct Bank Deep Section 1	Yes	TBD	TBD	GW	52058	23	1200000	Yes	TBD
4	Duct Bank Excavations Deep Section 2	Yes	TBD	TBD	GW	52058	23	1200000	Yes	TBD

Notes:

GPD = Gallons per day, GW = Groundwater, SW = Surface water, EC = Environmental Covenant, SMA = Soil Management Area, TBD =To be determined,
WAP = Water Appropriation Permit

¹ Item numbers may be linked to groundwater appropriation permit

² Testing will be conducted in accordance with MDE and proposed disposal facility requirements.

³ Water will be disposed at the appropriate disposal facility if discharge requirements are not met. Test results will be used to determine suitable disposal facility based on facility requirements.

Table 14
Stockpile Tracking
Interim Distribution Line and Duct Bank Construction
Frederick, MD

Stockpile Number: 1
Location: Lot 112D
Contents: SMA spoils from Interim Distribution Pole Boreholes

Date & Time	Volume added (CY)	Source	Sample Number(s)	Approval	Volume Reused (CY) or Disposed (tons)	Comments
11/1/24 8:00	5.5	Borehole 1 through 6	SMA-BH-01-20240901	Not planned for reuse	6.655 tons	Disposed of at Soil Safe facility

Notes:
CY = Cubic Yards
Each soil movement will be recorded at completion or minimum daily.
Maintain copy with associated documentation including stockpile location map, sample data, disposal tickets

Table 15
Tank Status Log
Interim Distribution Line and Duct Bank Construction
Frederick, MD

Location: Lot 112D

Tank ID	Tank Type	Date On-Site	Contents	Sample Number(s)	Approval (Agency and Date)	Status ¹	Comments
1	20,000 gal frac tank	9/1/2024	Borehole dewatering sediment and water (within SMA)	SMA-BH-GW-01-20240901	MDE 9/20/2024	Approved for Disposal	Disposed of at Valicor Environmental Services on 9/5/2024

Notes:

¹Status may include Empty/Clean, In Service, Filling, Full Awaiting Approval, Approved for Disposal. Refer to Table 17 Tank Volume Log and Table 18 Tank Testing Log.

Table 16
Tank Volume Log
Interim Distribution Line and Duct Bank Construction
Frederick, MD

Vessel Type: 50,000 gal frac tank
Tank ID: 1
Tank Location: Lot 112D
Water Source Area: Duct Bank Deep Excavation 1
Water Source Location: TBD

Date and Time	Event Description	Total Volume (gal)	Sediment Volume (gal)	Incremental Volume Generated for WAP Permit	Running Total Volume for WAP Permit
9/1/24 8:00	Total Volume Measurement				

Notes:
 Partial template table, does not include columns for Secondary tank. This can be added, if required.

Table 17
Tank Testing Log
Interim Distribution Line and Duct Bank Construction
Frederick, MD

Vessel Type: 50,000 gal frac tank
Tank ID: 1
Tank Location: Lot 112D
Water Source Area: Duct Bank Deep Excavation 1
Water Source Location: TBD

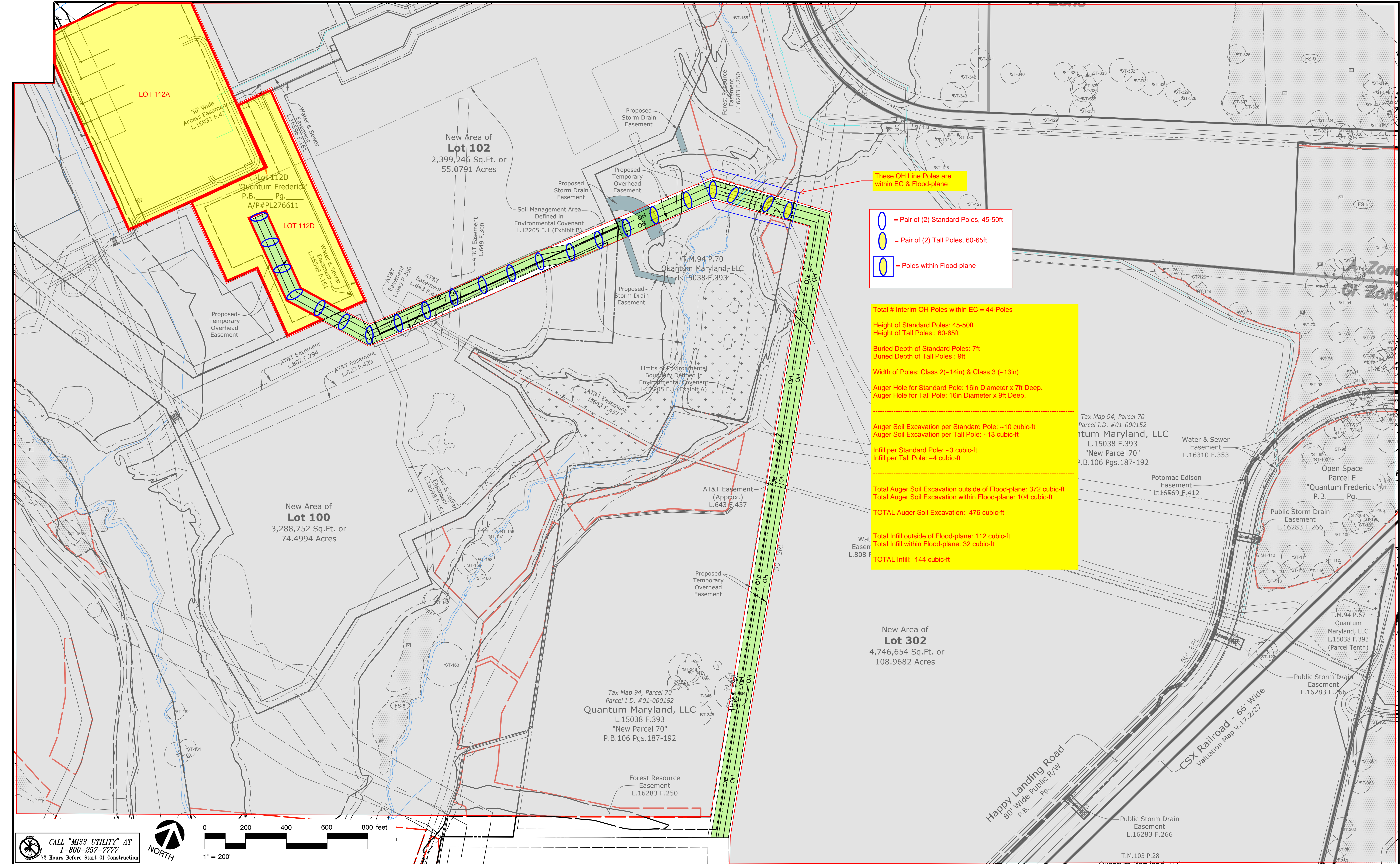
Date and Time	Event Description	Result	Units	Notes
11/1/24 8:00	pH measurement	8	s.u.	

Notes:
Partial template table, does not include columns for Secondary tank. This can be added, if required.



APPENDIX A

PROJECT PLANS AND DRAWINGS



These OH Line Poles are within EC & Flood-plane

- = Pair of (2) Standard Poles, 45-50ft
- = Pair of (2) Tall Poles, 60-65ft
- = Poles within Flood-plane

Total # Interim OH Poles within EC = 44-Poles

Height of Standard Poles: 45-50ft
Height of Tall Poles : 60-65ft

Buried Depth of Standard Poles: 7ft
Buried Depth of Tall Poles : 9ft

Width of Poles: Class 2(-14in) & Class 3 (-13in)

Auger Hole for Standard Pole: 16in Diameter x 7ft Deep.
Auger Hole for Tall Pole: 16in Diameter x 9ft Deep.

Auger Soil Excavation per Standard Pole: ~10 cubic-ft
Auger Soil Excavation per Tall Pole: ~13 cubic-ft

Infill per Standard Pole: ~3 cubic-ft
Infill per Tall Pole: ~4 cubic-ft

Total Auger Soil Excavation outside of Flood-plane: 372 cubic-ft
Total Auger Soil Excavation within Flood-plane: 104 cubic-ft

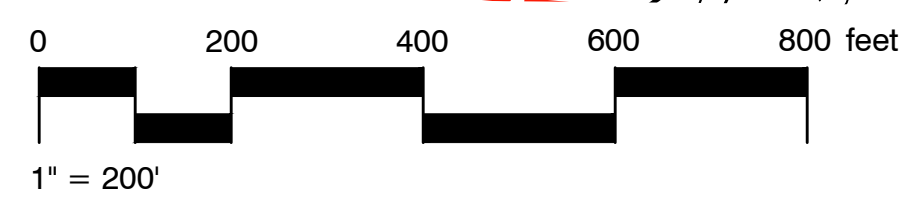
TOTAL Auger Soil Excavation: 476 cubic-ft

Total Infill outside of Flood-plane: 112 cubic-ft
Total Infill within Flood-plane: 32 cubic-ft

TOTAL Infill: 144 cubic-ft

New Area of
Lot 302
4,746,654 Sq.Ft. or
108.9682 Acres

CALL "MISS UTILITY" AT
1-800-257-7777
72 Hours Before Start Of Construction



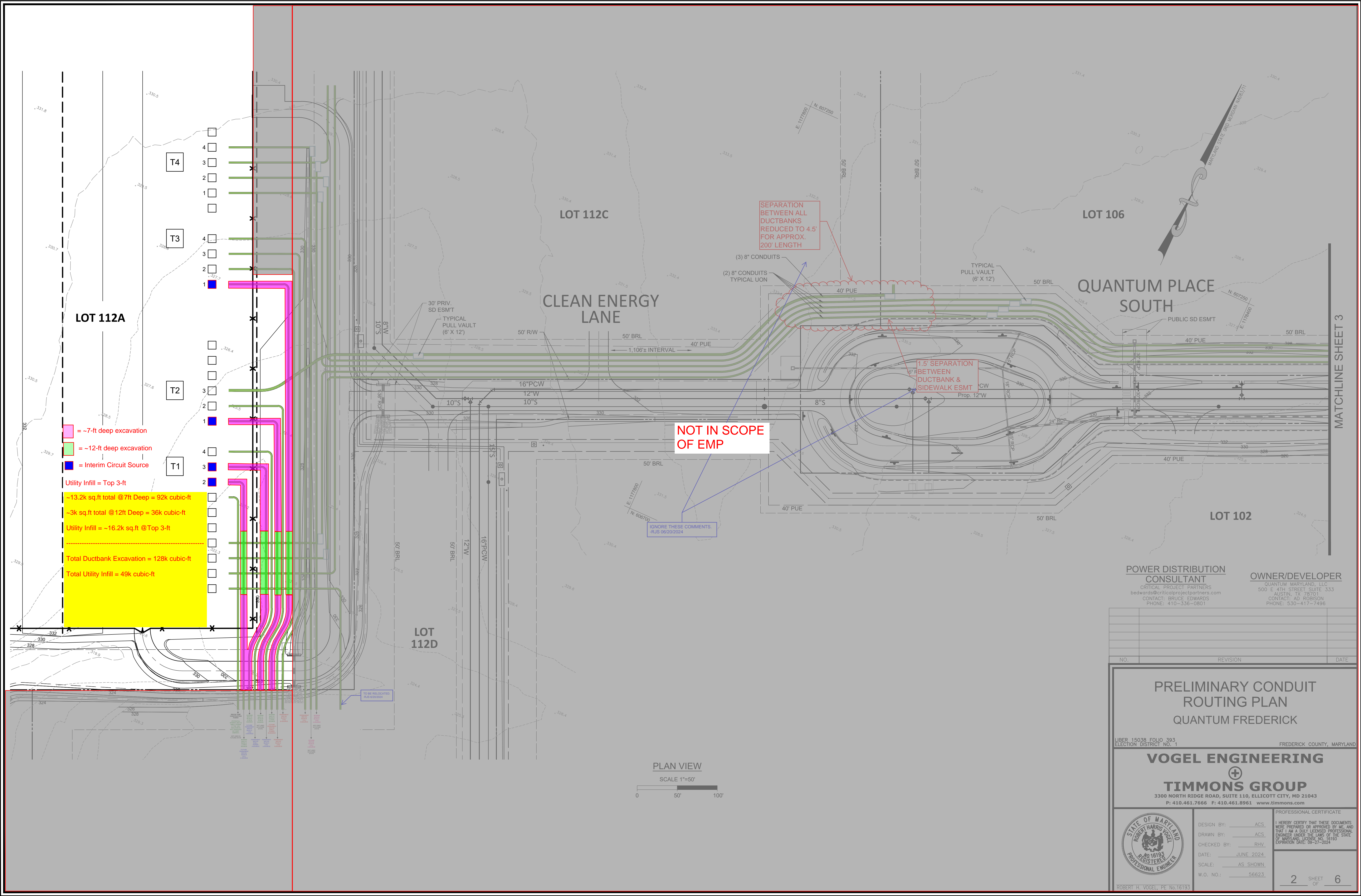
REVISION	DATE	REVISION	DATE	BASE DATA	BY	DATE
				DESIGNED	CADD	
				DRAWN		
				REVIEWED	REVNAME	REVDATE
RELEASE FOR				BY		
				DATE		

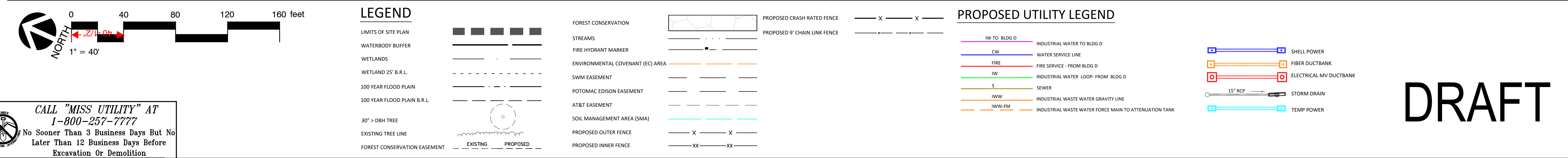
DRAFT
Overhead Electric Easement Exhibit

RODGERS
CONSULTING
19847 Century Boulevard, Suite 200, Germantown, Maryland 20874
Ph: 301.948.4700 Fax: 301.948.6256 www.rodgers.com

Overhead Electric Easement Exhibit
Bauxite II
SP27-----
Liber 15038, Folio 393
Election District No. 1
Frederick County, Maryland

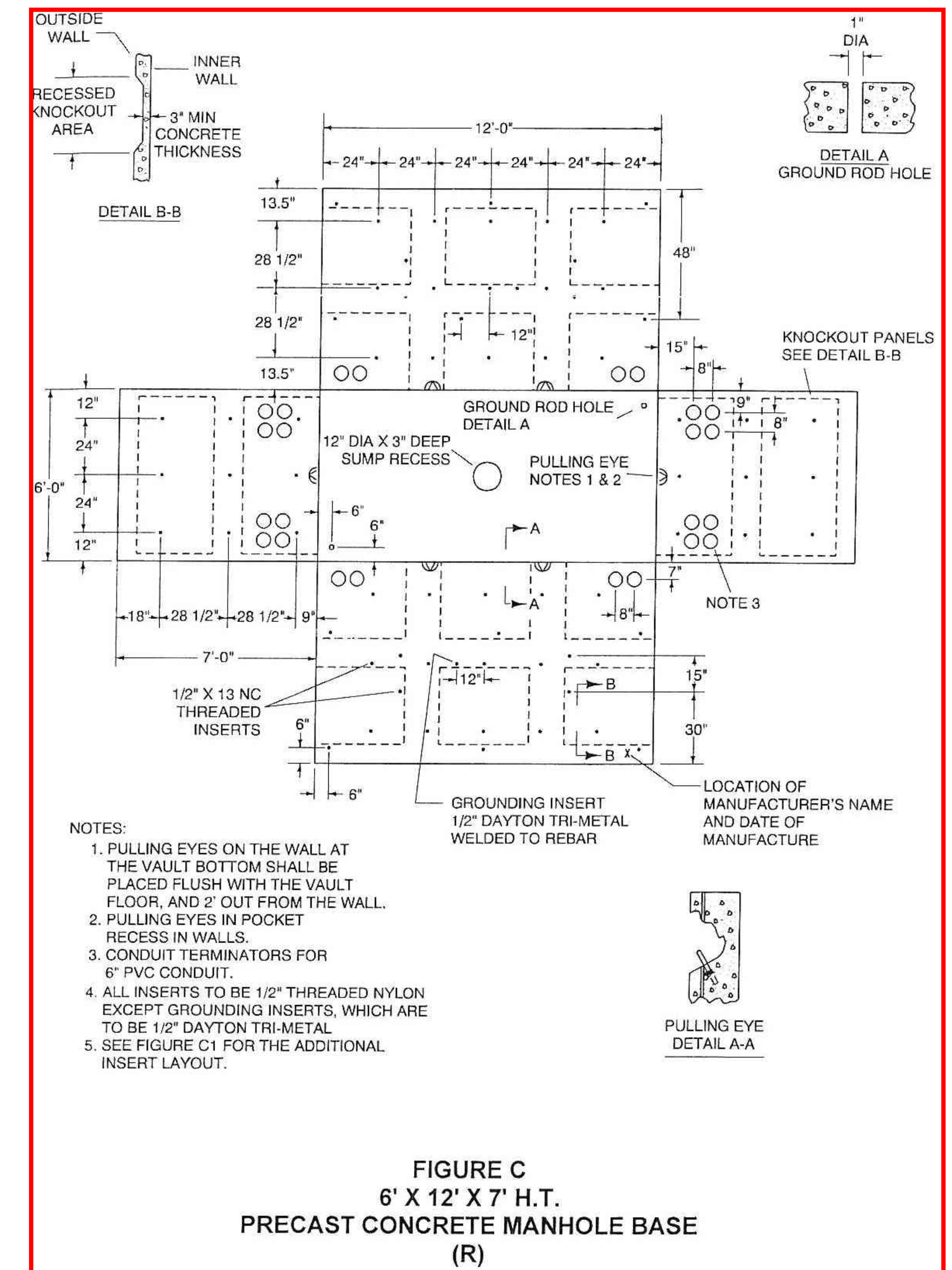
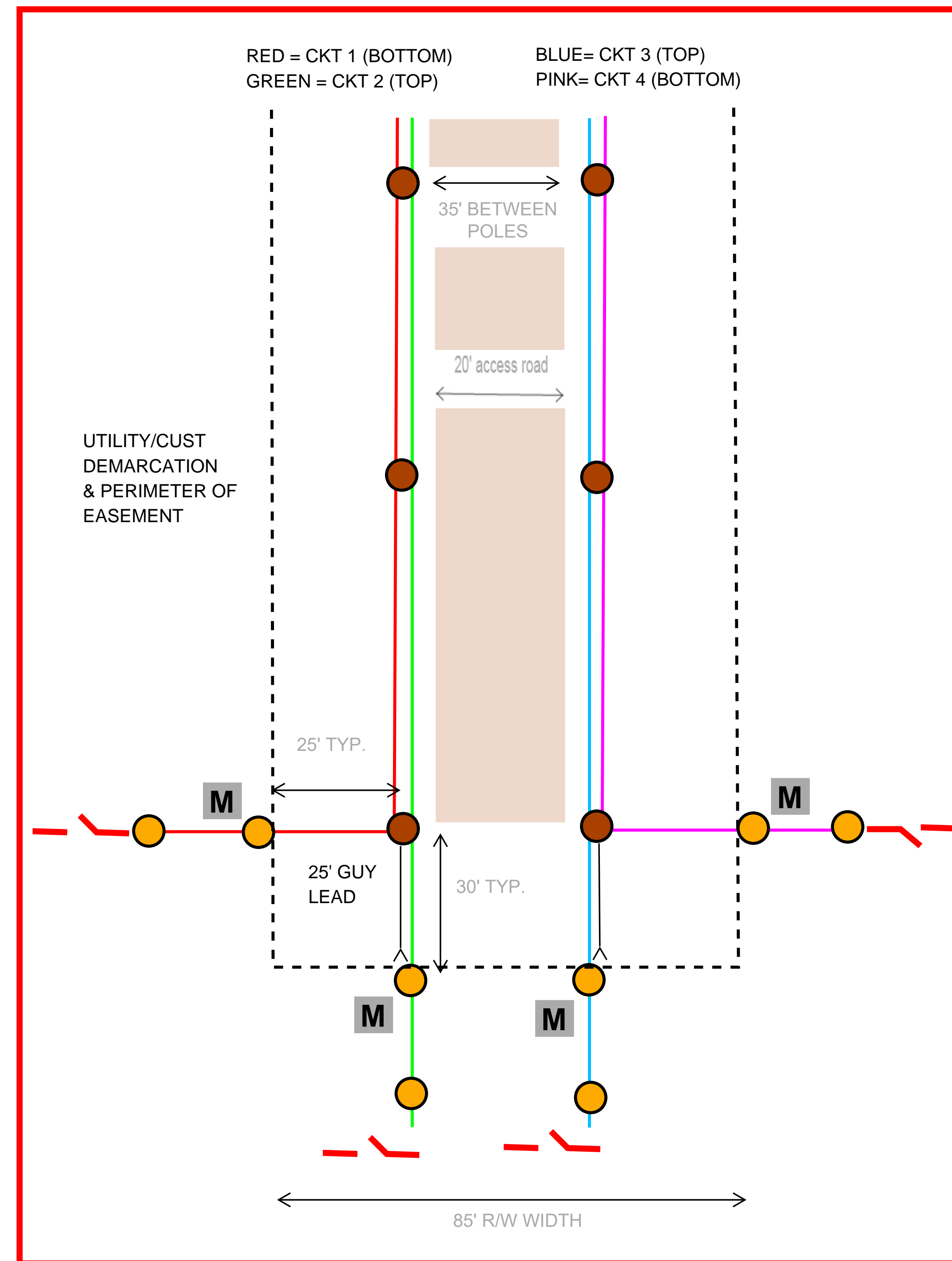
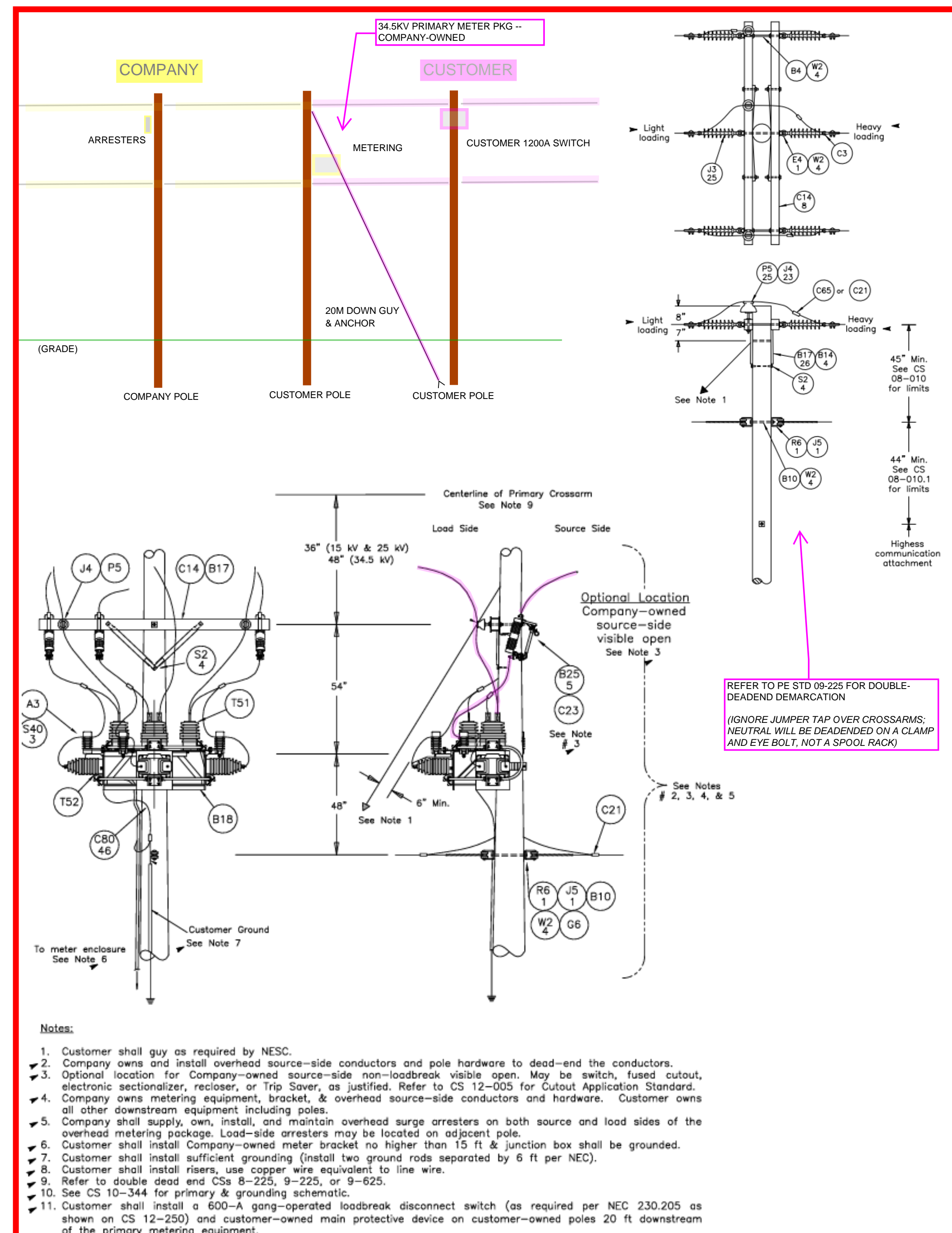
SCALE:	1" = 200'
JOB No.	1364C
DATE:	July 2024
INDEX No.	
SHEET No.	OF





PROJECT: BWI 100			
TITLE: SECTOR UTILITY PLAN			
DRAWING: C100.05			
PAPER SIZE: ARCH D	SCALE: 1" = 40'	AGILE NO:	REV:

DRAFT





APPENDIX B

DEWATERING ESTIMATES

No.	Excavation	Length - L (ft)	Width - W (ft)	Depth - D (ft)	Duration (days)	Dewatering Depth (ft)	Depth to Base of Aquifer	Avg Depth to WT	Aquifer Saturated Thickness - H	Aquifer Thickness to Dewatering Depth - h	Radius of Equiv. Well - A _e (ft)	Hydraulic Conductivity - K (ft/d)	Radius of Influence (ft) - Ro	Q (gpd)	Q design(gpm)	Total withdrawn design (gal)	Peak Month Total Withdrawn (gal)
1	DB 12 ft depth 1																
2	Line 1	90	6	12	23	7	25	10	15	8	15	39.6	263	52,058	36	1,197,334	1,561,740
3	Line 2	90	6	12	23	7	25	10	15	8	15	39.6	263	52,058	36	1,197,334	1,561,740
4	Line 3	90	6	12	23	7	25	10	15	8	15	39.6	263	52,058	36	1,197,334	1,561,740
5	Line 4	90	6	12	23	7	25	10	15	8	15	39.6	263	52,058	36	1,197,334	1,561,740
													Annual Total (gal)			4,789,335	
													Annual Avg (gpd)			13,121	
													Peak Month Total (gal)				6,246,959
													Peak Monthly Daily Rate (gpd)				208,232

																Annual total (gal)		-	
																Annual Avg (gpd)		-	
																Peak Month Total (gal)			-
																Peak Month Pumping Rate (gpd)			-

Annual Avg Pumping Rate (gpd)	13,121
Peak Month Pumping Rate (gpd)	208,232

Notes

Hydraulic conductivity is the highest (most conservative) of calculations completed based on 3 slug tests performed as part of Bauxite III Phase II ESA in April/May 2024.



APPENDIX C

GUIDANCE FOR CONSTRUCTION
CONTRACTOR HEALTH AND SAFETY PLAN

Administrative Information

This HASP is valid for a maximum period of one year from the date of initial completion or last revision.

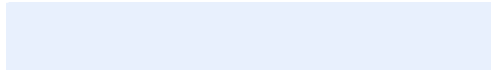
Project Name: Rowan Frederick II Data Center	Site Name & Location: Former Alcoa Eastalco Works Property
Client: Rowan Frederick (Rowan)	GMS Project No: NA
HASP Date: 9/16/2024	Revision Number and Date: NA
Field Work Start Date: TBD	Anticipated Field Work End Date: TBD
Field Safety Officer: <input type="checkbox"/> Standard <input checked="" type="checkbox"/> High Risk <input type="checkbox"/> Waived Click here to enter text.	
Additional personnel on site: NA.	

Safety Team Review

Reviewer Name: NA	Signature File: 
Review Date: NA	

Subject Matter Expert Review

Subject matter expert (SME) review is required if the project includes performing work on, over, near, or in water (including transport), work at mine sites, or using mobile construction equipment (MCE), excluding drilling equipment.

SME Review Required: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Signature File: 
SME Type: <input type="checkbox"/> Aquatic Work <input type="checkbox"/> MCE <input type="checkbox"/> Mine Site Work	
SME Name: Click here to enter text.	
Date of SME Review: Click here to enter a date.	

Project/Construction Manager Review

Name: TBD	Signature File: 
Review Date: Click here to enter a date.	

Partner-in-Charge Review / Approval

Name: TBD	Signature File: 
Review / Approval Date: Click here to enter a date.	

Field Safety Officer Waiver

☐ Waiver of Standard FSO is being requested in accordance with Section 4.10 of **NAM-1110-PR1 – Project Health and Safety**
 (Note: Projects with high-risk activities requires the use of a High Risk FSO and this requirement cannot be waived)

Rationale for waiver of Standard FSO requirement: NA

PIC Name: Click here to enter text.

Approval Date: Click here to enter a date.

Signature File:

Area Manager: Click here to enter text.

Approval Date: Click here to enter a date.

Signature File:

Subcontractors

Subcontractor(s) to be used:

1. TBD
2. Click here to enter text.
3. Click here to enter text.
4. Click here to enter text.
5. Click here to enter text.

Prescreened under Subcontractor Use Basic Standards Policy?

- | | | |
|------------------------------|-----------------------------|--|
| <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Waiver requested/approved |
| <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Waiver requested/approved |
| <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Waiver requested/approved |
| <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Waiver requested/approved |
| <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Waiver requested/approved |

Site Type (check all applicable boxes)

- | | |
|---|--|
| <input checked="" type="checkbox"/> Commercial / Industrial | <input checked="" type="checkbox"/> Hazardous waste release (HAZWOPER) |
| <input type="checkbox"/> Residential | <input checked="" type="checkbox"/> Remote or inactive facility / location |
| <input type="checkbox"/> Unsecured | <input type="checkbox"/> Railroad: |
| <input type="checkbox"/> Aquatic (on, near, over or under water)* | <input type="checkbox"/> Significant vehicle travel** |
| <input type="checkbox"/> Mine (active or inactive)* | <input type="checkbox"/> Other (specify): Click here to enter text. |

* Requires SME review.

** If driving more than 500 km (310 miles) in a single day, driving in excess of 4.5 hours in a single day, or driving in a remote (including off-road driving) or high-risk location, **ERM-1430-FM1 – Journey Management Plan** is required and should be appended to this HASP.

Site Description

Include relevant background information regarding the site, such as location, size, type of facility, topography, weather, infrastructure, security, previous site use, etc. Describe nature and extent of any soil/air/water/groundwater contamination. Describe any other aspects of the site that may potentially affect the health, safety, or security of on-site personnel.

The overall Eastalco property ("the overall property") comprises 796 acres. The central portion of the overall property formerly contained the Eastalco Aluminum Works. The remaining portions of the overall property were primarily used for agricultural purposes. An Environmental Covenant (EC) approved by the Maryland Department of the Environment (MDE) was recorded for portions of the overall property in 2017. The EC provides restrictions to the land use, including restrictions to residential use and groundwater use, and the associated Site Management Plan (SMP) describes requirements associated with construction disturbance of soil and groundwater within the EC. Within the EC is a Soil Management Area (SMA), which includes the central former plant area, two closed/permitted industrial landfills, former waste disposal sites (WDS), and other areas containing constituents of potential concern (COPCs), as shown on Figure 1 of the SMP. The SMP provides additional requirements for the handling of soil within the SMA, including soil generated during construction activities. This EMP incorporates the requirements of the EC, SMP, and SMA with respect to management of soil and groundwater encountered during construction of the overhead temporary electrical distribution line and associated duct banks.

Future development of the overall former Eastalco property (by Rowan and others) will include the construction of multiple data center buildings and associated infrastructure, including the temporary distribution line. The overall property is being redeveloped in separate areas or projects by multiple entities. Therefore, discrete projects subject to the requirements of the EC, SMP, or SMA will be advanced for review by MDE under either individual project EMPs or Remedial Action Plans. This health and safety plan applies only to specific identified work elements of the overhead temporary electrical distribution line and associated duct banks located within the EC and/or the SMA.

Scope of Work

Briefly describe the overall scope of work for this project.

Installation of an overhead temporary distribution line and associated duct banks are to provide temporary power to the planned Bauxite II data center campus. The OH temporary distribution line continues to the southeast for approximately 420 feet, turns slightly and continues running southeast approximately another 420 feet, turns again and runs generally east for approximately 1,875 feet before turning to the south and exiting the SMA and, less than 200 feet beyond that, exiting the EC. The OH temporary distribution line continues southeast approximately another 3,000 feet outside of the EC; however, this work is not part of the EMP LOD and is not further addressed in the EMP or this HASP.

Job Hazard Analyses

Include a list of tasks to be completed by ERM and subcontractors. A site-specific Job Hazard Analysis (JHA; ERM-1115-FM1) must be completed for each task. Reference/example JHAs for common tasks can be found at: North America Safety Page - JHAs. Contractor to add additional tasks and JHAs, as appropriate to work

Task 1: Installation of temporary overhead distribution line	<input checked="" type="checkbox"/> JHA Reviewed?
Task 2: Grading of access road	<input checked="" type="checkbox"/> JHA Reviewed?
Task 3: Installation of wooden poles	<input checked="" type="checkbox"/> JHA Reviewed?



Task 4: Digging to install wooden poles	<input checked="" type="checkbox"/> JHA Reviewed?
Task 5: Soil and GW Management	<input checked="" type="checkbox"/> JHA Reviewed?
Task 6: Dust control	<input checked="" type="checkbox"/> JHA Reviewed?
Task 7: Groundwater management during duct bank work	<input checked="" type="checkbox"/> JHA Reviewed?
Task 8: Fence Install	<input checked="" type="checkbox"/> JHA Reviewed?
Will any client, client contractor, or third-party activities have the potential to expose ERM personnel to hazards? If "Yes", describe mitigation measures below and/or include in task JHAs.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Click here to enter text.	

Main Project Hazards (check all applicable boxes)**High-Risk Hazards**

Use of a High Risk FSO is required for any work involving one or more of the following high risk work hazards, except as noted in Section 4.10.2 of **NAM-1110-PR1 – Project Health and Safety**. Additional control measures may be required beyond the use of a JHA.

- | | |
|--|--|
| <input type="checkbox"/> Chemical mixing/injection processes | <input type="checkbox"/> Unexploded ordnance or explosives use |
| <input type="checkbox"/> Confined space entry | <input checked="" type="checkbox"/> Unprotected falls greater than 4 feet (1.2 meters) (i.e., use of fall arrest systems required) |
| <input checked="" type="checkbox"/> Construction | <input checked="" type="checkbox"/> Work with electricity or other hazardous energy |
| <input checked="" type="checkbox"/> Excavation/Trenching | <input type="checkbox"/> Other (specify): Click here to enter text. |
| <input checked="" type="checkbox"/> Mobile construction equipment, excluding drilling rigs | <input type="checkbox"/> Other (specify): Click here to enter text. |
| <input checked="" type="checkbox"/> Rigging/lifting | |

Other Hazards

- | | |
|---|---|
| <input checked="" type="checkbox"/> Biological hazards | <input type="checkbox"/> Off-road driving |
| <input checked="" type="checkbox"/> Chemical exposure potential (including asbestos) | <input checked="" type="checkbox"/> Natural hazards (e.g., plants, animals, insects) |
| <input type="checkbox"/> Compressed gas | <input checked="" type="checkbox"/> Portable or fixed ladders |
| <input type="checkbox"/> Extended (>14 hours) or nonstandard work shifts (e.g., night work) | <input type="checkbox"/> Radiation (ionizing or non-ionizing) |
| <input type="checkbox"/> Extreme weather | <input checked="" type="checkbox"/> Ground disturbance (mechanized equipment or hand tools) |
| <input checked="" type="checkbox"/> Hand/power tool use | <input checked="" type="checkbox"/> Heat / cold stress |
| <input checked="" type="checkbox"/> High noise (>85 dBA) | <input checked="" type="checkbox"/> Psychological / invisible hazards |
| <input checked="" type="checkbox"/> Body mechanics / muscle exertions | <input checked="" type="checkbox"/> Helicopter use |
| <input type="checkbox"/> Material handling | <input type="checkbox"/> Hot work |
| <input checked="" type="checkbox"/> Slips/trips | <input type="checkbox"/> Other (specify): Click here to enter text. |
| <input type="checkbox"/> Lone work | <input type="checkbox"/> Other (specify): Click here to enter text. |
| | <input type="checkbox"/> Other (specify): Click here to enter text. |

Chemicals of Concern**Chemical Products – Used, Stored, or Shipped**

For each chemical product identified, a Safety Data Sheet (SDS) must be attached to this HASP.

- | | |
|--|---|
| <input type="checkbox"/> Alconox or Liquinox | <input type="checkbox"/> Isopropyl alcohol |
| <input type="checkbox"/> Hydrochloric acid (HCl) | <input type="checkbox"/> Household bleach (NaOCl) |
| <input type="checkbox"/> Nitric acid (HNO ₃) | <input type="checkbox"/> Calibration gas |
| <input type="checkbox"/> Sulfuric acid (H ₂ SO ₄) | <input type="checkbox"/> Other (specify): Click here to enter text. |
| <input type="checkbox"/> Sodium hydroxide (NaOH) | <input type="checkbox"/> Other (specify): Click here to enter text. |

Note: Emergency eyewash solution must be readily available on all project sites where materials are used or stored that pose a risk of getting into the eyes via splashing or through contact with airborne gases, vapors, dusts, or mists. This includes sample preservatives. The size and flushing capability of the eyewash must be proportional to the potential for contact with corrosive or injurious materials in the field and the resulting potential for injury. Contact your Business Unit (BU) Safety Director for additional information or assistance.

Contractor to provide SDS for each chemical and determine where onsite if chemicals are to be stored onsite.

Are chemicals being transported to or from the site hazardous materials or dangerous goods (HM/DG)? ☐ Yes ☒ No

If the answer to the question above is Yes, follow the requirements of NAM-1559-PR1. For additional assistance with interpretation/evaluation of the potential impacts, contact an ERM HM/DG Compliance Specialist. A list of Compliance Specialists can be found [HERE](#).

Regulated Chemicals of Concern

Check any chemicals known or suspected to be present on-site, and which personnel may be exposed, to determine if they are regulated through any federal or provincial laws. These regulations may include OSHA-regulated potential carcinogens (29 CFR 1910.1003 through 1016), those chemicals for which OSHA has established specific respiratory protection requirements (29 CFR 1910.134), or any chemical identified under Canadian provincial regulations. A list of applicable regulations addressing regulated chemicals is provided in Section 5 of **NAM-1340-PR1 – Chemical Hazards**. A list of OSHA-regulated chemicals is provided in Appendix 1 of that procedure.

Is there any known or potential exposure to regulated chemicals as defined in **NAM-1340-PR1** on the site?

☒ Yes ☐ No

If the answer to the question above is Yes, follow the requirements of NAM-1340-PR1. For additional assistance with interpretation /evaluation of the regulatory impacts, contact your BU Safety Director.

Additional Known or Suspected Chemicals of Concern

Are there additional known or suspected chemicals of concern present on the site not identified in the *Regulated Chemicals of Concern* section above? ☒ Yes ☐ No

If the answer to the question above is Yes, NAM-1340-FM1 – Known or Suspected Chemicals of Concern must be completed and attached to this HASP. If work is completed in California, attach NAM-1340-FM2 – Known or Suspected Chemicals of Concern – California Specific. Information on each chemical must be provided to all team members.

Ambient Air Monitoring

Ambient air monitoring should be conducted by the FSO when there is a question of employee exposure to hazardous concentrations of substances to assure the proper selection of engineering controls, work practices, and PPE. Additional monitoring should be conducted under any of the following circumstances:

- Work begins on a different portion of the site,
- Change in job tasks,
- Change in weather,
- Change in ambient levels of hazardous constituents as indicated by the sense of smell or in the physical appearance of the soil or ground water,
- When new hazardous substances are encountered, and
- During high-risk operations (e.g. drum opening, handling of leaking drums, or when working in areas with obvious liquid contamination).

Ambient air monitoring will be conducted using direct-reading real-time instruments. Not all work at the site will require ambient air monitoring for all contaminants. During the mobilization phase of a particular project task or activity, either the PM or the FSO will determine what contaminants may be encountered in order to have the appropriate instrumentation on-site. The Business Unit (BU) Safety Director is available to assist the PM or the FSO in determining the appropriate instrumentation.

Under stable site conditions, ambient air monitoring will be conducted at least once every two hours in the workers' breathing zone and at other locations based on the professional judgment of the FSO or the Subject Matter Expert (SME). Ambient air monitoring results will be recorded on **NAM-1340-FM4 – Ambient Air Monitoring Form**. If site conditions become unstable or change dramatically, ambient air monitoring will be conducted more frequently based on the professional judgment of the FSO or the BU Safety Director.

Monitoring Equipment

Will ERM staff be using equipment on the project site to monitor potential exposures to known or suspected chemicals of concern?

☐ Yes ☒ No

If the answer to the question above is Yes, attach ERM Form NAM-1340-FM5 – Direct-Read Air Monitoring Equipment to define the equipment to be used and the action levels to be applied.

All monitoring equipment on site must be calibrated per manufacturer specifications (including daily bump tests) and results recorded. See ERM Procedure **NAM-1302-PR1 – Equipment Maintenance and Calibration** for additional information. Under stable conditions, measurements must be made in the breathing zone at least once every 30 minutes.

Personal Protective Equipment

Req = Required PPE for one or more tasks to be performed; required on site at all times. NA = Not applicable to this project.

Equipment	Req	NA	Supplies	Req	NA
Safety-Toe Boots	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Chemical Gloves	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Outer Disposable Boots	<input type="checkbox"/>	<input type="checkbox"/>	Leather or Heavy Work Gloves	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Long Sleeve Shirt/Pants	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Cut-Resistant Level 2 or Higher (e.g., Kevlar) Gloves	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Tyvek Suit	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Safety Glasses/Goggles	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Poly-Coated Tyvek Suit	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Face Shield	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Fully Encapsulated Chemical Suit	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Hearing Protection	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Flame Resistant Clothing/Coveralls	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Permethrin Treated Clothing	<input type="checkbox"/>	<input checked="" type="checkbox"/>
High Visibility Traffic Vest	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Half-face Respirator	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Hard Hat/Approved Helmet	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Full-face Respirator	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Wet Suit/Dry Suit	<input type="checkbox"/>	<input checked="" type="checkbox"/>	If either half or full-face respirator checked: <ul style="list-style-type: none"> Define cartridge type: Click here to enter text. Define cartridge change frequency: Click here to enter text. 		
Personal Floatation Device	<input type="checkbox"/>	<input checked="" type="checkbox"/>			
Other (specify): Dust mask (when needed)	<input checked="" type="checkbox"/>	<input type="checkbox"/>			

Respirator selection should be based on the Assigned Protection Factor (APF) and the Maximum Use Concentration (MUC). To determine the appropriate respirator selection, the lowest appropriate published exposure guideline should be known. The BU Safety Director or project H&S consultant can provide assistance in defining the APF and MUC, as necessary. They can also assist in defining actions levels and cartridge change schedules when air-purifying respirators are used. Note that cartridge change schedules must be outlined above and in the JHA for any task requiring respiratory protection.

Use of respiratory protection requires three elements: training in respiratory protection techniques, completion of medical surveillance confirming that you are fit to wear a respirator, and fit testing with the make and model of respirator you will be using. Refer to **NAM-1311-PR1 – Respiratory Protection** for additional information.

Safety Supplies	Req	NA		Req	NA
First Aid Kit	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Toilets	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Emergency Eyewash Solution	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Insect Repellent	<input type="checkbox"/>	<input type="checkbox"/>
Air Horn	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Other (specify): Click here to enter text.	<input type="checkbox"/>	<input type="checkbox"/>
Decontamination Supplies	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Other (specify): Click here to enter text.	<input type="checkbox"/>	<input type="checkbox"/>
Fire Extinguisher	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Other (specify): Click here to enter text.	<input type="checkbox"/>	<input type="checkbox"/>
Potable Water	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Other (specify): Click here to enter text.	<input type="checkbox"/>	<input type="checkbox"/>

Training/Certification and Medical Surveillance (For Contractor Personnel)

If training is required for an employee on this project, mark an "X" in the specific training box under their name. Training requirements are based on the specific tasks performed in the field and the type of environments, chemicals, or hazards encountered. Required training must be documented in ERM Academy for ERM employees; required training for on-site subcontractor personnel must be verified prior to the start of work and documentation should be included with the HASP.

Training/Certification	Employee Name	Employee Name	Employee Name	Employee Name	Employee Name
40-Hour HAZWOPER (with current annual refresher)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8-Hour HAZWOPER Supervisor*	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
40-Hour MSHA New Miner (with current annual refresher)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Field Safety Office or similar	FSO <input type="checkbox"/>	FSO <input type="checkbox"/>	FSO <input type="checkbox"/>	FSO <input type="checkbox"/>	FSO <input type="checkbox"/>
DDD Practice FSO / DM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
First Aid/CPR Certification	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
EPA Hazardous Waste	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hazmat/Dangerous Goods Shipping**	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Respirator Wearer Certification	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Off-Road Driving	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Towing/Trailer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ATV/UTV Usage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Client-Required Training	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (specify): Click here to enter text.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (specify): Click here to enter text.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (specify): Click here to enter text.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medical Surveillance***					
Medical Clearance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Respirator Clearance and Fit Test (current / valid)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Blood Lead and ZPP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other: Click here to enter text.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

* For HAZWOPER sites with multiple personnel, at least one on-site ERM employee must be certified as a HAZWOPER Supervisor.

** In Canada, Workplace Hazardous Materials Information System (WHMIS)/Globally Harmonized System (GHS) and Transportation of Dangerous Goods (TDG) regulations apply.

*** Examination requirements should be discussed with WorkCare well in advance of project to allow adequate time to schedule exams.

Work Zones

Complete if exclusion zones are necessary because of chemical and/or equipment hazards. Describe the set-up of these zones. Include landmarks, dimensions (as necessary), and whether they are for equipment or personnel decontamination.

Exclusion Zone: Any place on the property where designated work activities are taking place. The exclusion zone shall be made clear to all onsite personnel with the use of caution tape, snow fencing, traffic cones, specific PPE use, etc. or whatever the contractor deems to be the most effective for the given work area. The exclusion zone is subject to change based on where the work is taking place. No food, drink or smoking is allowed in the exclusion zone.

Contamination Reduction Zone: Any place outside of the primary exclusion zone. The contamination reduction zone applies to any work where contractor personnel may have been working in an area of the exclusion zone with known site contaminants. Based on understanding of specific areas of the site, the contractors will setup a cleaning area such as a boot wash, kiddie pool, truck wash, etc. or whatever is most applicable based on the contaminants present in the work area. No food, drink or smoking is allowed in the exclusion zone

Support Zone: Anywhere on the site that is not the exclusion zone or contamination reduction zone, such as the onsite work trailer or parking area. PPE is generally not required in this zone and personnel are allowed to move freely and safely. Onsite equipment shall not be present in this zone. Eating and drinking is allowed in this zone. Smoking is only allowed where permitted, deemed by the contractor.

Site Access/Control

Describe procedures for limiting unauthorized entry to the work zone(s). Describe any security requirements.

The site is fully fenced and site workers are required to obtain badges to gain access to work on the site.

Work Permit System(s)

If the client mandates use of a work permit system, please describe the system and the checklists or permits that may be required.

TBD; Contractor to obtain necessary permits.

Decontamination Procedures

Describe procedures for the decontamination of personnel and equipment.

Personnel: If personnel are working in areas with known chemicals of concern, they are to follow the appropriate decontamination procedures set forth by the construction manager at the given work area. No decontamination procedures for personnel where chemicals of concern do not exist.

Equipment: Decontamination procedures are only required in areas where equipment has been in contact with contaminated groundwater, or soil. The areas will be determined prior to work in the area. Should equipment have been in contact with such media, alconox/liquinox will be used with de-ionized water and brushes to clean the materials.

Spill Prevention and Response

Ensure all chemical containers on-site are labeled and lids are secured when not in use. When transferring chemicals from one container to another, or when refueling vehicles or equipment, provide containment beneath the transfer point to capture potential spills. Immediately report all chemical spills to the PIC/PM and submit an ECS entry with 24 hours.

Will ERM staff or ERM-hired subcontractors possess containerized chemicals on the project site? ☐ Yes ☒ No

If the answer is Yes, follow the requirements outlined in ERM Procedure **NAM-1123-PR1 – Spill Prevention and Response**.

Waste Management Planning

Will ERM's project activities generate waste materials? ☒ Yes ☐ No

Will ERM undertake some level of contractual responsibility for handling waste for the client? ☐ Yes ☒ No

If the either answer is Yes, follow the requirements outlined in ERM Procedure **NAM-1122-PR1 – Waste Management Planning**.

Describe any waste reduction/minimization techniques to be used on the site:



Field teams will utilize excavated soils as backfill and limit water utilized to decontaminate equipment, where applicable. Soil cuttings will be used to backfill boreholes where needed, and decontamination water will be discharged to the ground surface. Decontamination water will be kept to a minimum.

Dust Control Contractor to add specific dust control measures

Airborne dust will be monitored visually (refer to EPA Method 9/22, as needed). If airborne dust is noted during work with either known or possibly contaminated soils, dust suppression methods (such as wetting or misting from a water truck) will be enacted. If these methods do not reduce visible dust sufficiently, active dust monitoring will begin to ensure that dust levels stay below the PEL. If nuisance dust levels reach the PEL, earthwork will stop until the dust is no longer visible and levels drop below this limit.

Use these spaces to describe specific dust control measures.

Site-Specific Emergency Response

In the event of an emergency, site-specific emergency response procedures may take precedence over ERM established procedures. While engaging in field-related activities on an active site, measures they have in place to signal either emergency response or evacuation need to be reviewed and documented. Once completed, this summary should be discussed with all visitors, subcontractors, and others subject to HASP review upon site visit.

Lights and/or sounds associated with evacuation: NA

Primary and alternative muster points: TBD based on areas of the site where work is taking place.

Site-specific evacuation procedures: TBD following discussions with Construction Manager

How we will account for the whereabouts and safety of on-site personnel following an evacuation:

TBD following discussions with Construction Manager.

Is a map associated with evacuation attached? ☐ Yes ☒ No

Emergency Drills: Emergency response drills should be rehearsed regularly. The frequency of drills is outlined below. All drills will be documented on the **NAM-1212-FM2 – Emergency Drill Evaluation Form**.

Project Duration	Drill Frequency
<input type="checkbox"/> Less than 30 days	None, cover during review/sign-off of HASP
<input checked="" type="checkbox"/> Greater than one month but less than one year	Once
<input type="checkbox"/> Greater than one year	Annually

Emergency Contacts

Contact	Name	Location	Phone Numbers
Hospital (attach map)	Frederick Health (ER)	400 W 7th St, Frederick, MD 21701	(240) 566-3300
Police	Frederick Police	100 W Patrick St, Frederick, MD	911
Fire	Frederick FD	Frederick, MD	911
Poison Control*	Maryland Poison Center	220 Arch Street, Office Level 1 Baltimore, Maryland 21201	1-800-222-1222
Incident Intervention	WorkCare	NA	1-800-449-7787
Partner-in-Charge	TBD	TBD	+TBD
Project/Construction Manager	TBD	TBD	TBD
Field Safety Officer (or field team lead)	Click here to enter text.	Click here to enter text.	Click here to enter text.
BU Safety Director	Click here to enter text.	Click here to enter text.	Click here to enter text.
Regional H&S Director	TBD	TBD	TBD
Subcontractor Contact(s)	TBD	Click here to enter text.	Click here to enter text.
Client / Site Contact(s)	Click here to enter text.	Click here to enter text.	Click here to enter text.
Additional Contact(s)	Click here to enter text.	Click here to enter text.	Click here to enter text.

* Poison control centers in the US can be contacted at 800-222-1222. In Canada, poison control centers are specific to each province; contact information can be found here: https://safemedicationuse.ca/tools_resources/poison_centres.html.



In Case of an Injury or Illness

FOR ALL MEDICAL EMERGENCIES, CALL 911 OR THE LOCAL EMERGENCY NUMBER.

For ALL non-emergency incidents resulting in any injury or illness, you must:

- Give appropriate first aid care to the injured or ill individual and secure the scene.
- Immediately notify the PM, PIC, and the ERM Safety Team.
- At direction of PM, PIC, or Safety Team, call WorkCare Incident Intervention at 888-449-7787 (US) or 877-514-0546 (Canada).

Site Safety Briefings

Communication and Review of the HASP: An initial review of the site-specific HASP will be held either prior to mobilization or after mobilization but prior to commencing work at the site to communicate HASP details to individuals working at the site and answer any questions.

Daily Safety Meeting: A daily safety meeting will be conducted each morning. The meetings will be documented on **NAM-1501-FM1 – Site Safety Meeting Form.**

Acknowledgement

I have read, understood, and agree with the information set forth in this health and safety plan (HASP), and will follow guidance in the plan and in ERM's Document Control System (DCS). I understand the training and medical monitoring requirements (if any) for conducting activities covered by this HASP and have met these requirements.

[illegible]

Attachments

Check all appropriate documents to be attached to this HASP.

<input checked="" type="checkbox"/> Site-specific JHAs for all tasks (including subcontractors)	<input checked="" type="checkbox"/> Map of route to hospital with turn-by-turn instructions
<input checked="" type="checkbox"/> Subsurface Clearance (SSC) Project Plan (ERM-1511-FM1)	<input type="checkbox"/> SNAP Cards (ERM-1140-FM1)
<input checked="" type="checkbox"/> Site Safety Meeting Form (NAM-1501-FM1)	<input type="checkbox"/> Lone Worker Communication Plan (NAM-1326-FM1)
<input checked="" type="checkbox"/> Vehicle Inspection Forms (ERM-1430-FM2)	<input type="checkbox"/> Industrial Hygiene Sample Data (NAM-1340-FM3)
<input type="checkbox"/> Journey Management Plans (ERM-1430-FM1)	<input type="checkbox"/> Ambient Air Monitoring Form (NAM-1340-FM4)
<input checked="" type="checkbox"/> Safety Data Sheets (SDS) for chemicals brought to site	<input type="checkbox"/> Site-specific requirements
<input type="checkbox"/> Facility site map(s)	<input type="checkbox"/> Subcontractor training/certification documentation
	<input type="checkbox"/> Other: Click here to enter text.

Applicable ERM Safety Standards/Procedures

Check procedures/standards that are applicable to this project. Refer to the documents for guidance and, where applicable, use forms, work instructions, and guidelines associated with these standards/procedures in the completion of site work. Indicated documents must be procured from ERM's Document Control System. Note that this list is not comprehensive!

Global Standards/Procedures

<input type="checkbox"/> Travel Risk Assessment (ERM-1410-PR1)	<input checked="" type="checkbox"/> Subsurface Clearance Standard (ERM-1511-PR1)
<input checked="" type="checkbox"/> Driver and Vehicle Safety (ERM-1430-PR1)	<input type="checkbox"/> Aquatic Work Management (ERM-1530-PR1)
<input checked="" type="checkbox"/> Fixed Wing Aircraft/Helicopter Standard (ERM-1440-ST1)	<input type="checkbox"/> Short Service Employees (ERM-1611-PR1)

Regional Standards/Procedures

<input type="checkbox"/> Fire Prevention (NAM-1213-PR1)	<input checked="" type="checkbox"/> Mobile Construction Equipment (NAM-1339-PR1)
<input type="checkbox"/> Confined Space Entry (NAM-1572-PR1)	<input checked="" type="checkbox"/> Excavation and Trenching (NAM-1512-PR1)
<input checked="" type="checkbox"/> Fall Protection (NAM-1313-PR1)	<input checked="" type="checkbox"/> Hazard Communication (NAM-1301-PR1)
<input checked="" type="checkbox"/> Ladder Safety (NAM-1521-PR1)	<input checked="" type="checkbox"/> Cold Stress (NAM-1323-PR1)
<input checked="" type="checkbox"/> Hearing Conservation (NAM-1312-PR1)	<input type="checkbox"/> Heat Illness (NAM-1323-PR2)
<input checked="" type="checkbox"/> Incident Reporting and Investigation (NAM-1220-PR1)	<input checked="" type="checkbox"/> Medical Services (NAM-1840-PR1)
<input checked="" type="checkbox"/> Medical Surveillance (NAM-1810-PR1)	<input checked="" type="checkbox"/> Personal Protective Equipment (NAM-1310-PR1)
<input type="checkbox"/> Hot Work (NAM-1542-PR1)	<input type="checkbox"/> Respiratory Protection (NAM-1311-PR1)
<input type="checkbox"/> Bloodborne Pathogens (NAM-1325-PR1)	<input type="checkbox"/> Insect Bite Prevention Standard (NAM-1361-PR1)
<input checked="" type="checkbox"/> Hand Tools/Portable Power Equipment (NAM-1329-PR1)	<input checked="" type="checkbox"/> Incident/Illness Management (NAM-1210-PR1)
<input checked="" type="checkbox"/> Electrical Safety (NAM-1561-PR1)	<input checked="" type="checkbox"/> Hazardous Energy Control (NAM-1562-PR1)
<input checked="" type="checkbox"/> Waste Management Planning (NAM-1122-PR1)	<input checked="" type="checkbox"/> Spill Prevention and Response (NAM-1123-PR1)
<input checked="" type="checkbox"/> Fatigue Management (NAM-1328-PR1)	<input type="checkbox"/> Safe Use of Cutting Tools (NAM-1324-PR1)
<input type="checkbox"/> Lone Workers (NAM-1326-PR1)	<input type="checkbox"/> Compressed Gas Cylinders (NAM-1341-PR1)

Stop Work Authority

It is ERM policy that all ERM and ERM Subcontractor employees have the authority, without fear of reprimand or retaliation to:

- Immediately stop any work activity that presents a danger to the site team or the public.
- Get involved, question and rectify any situation or work activity that is identified as noncompliant with the HASP or with broader ERM health and safety policies.
- Report any unsafe acts or conditions to supervision or, preferably, intervene to safely correct such acts or conditions themselves.

Safety Event Reporting

For all incidents (injuries, illnesses, spills, fires, property damage, etc.) and significant near misses, enter the event into ERM's Event Communication System (ECS) within 24 hours. Proactive safety observations and best practices should also be entered into ECS.

Management of Change

The following process will be followed if any changes are identified with respect to schedule, equipment type, equipment installation/configuration, process or procedure, personnel and/or site conditions. The process, as stated below, can be accepted as written or revised depending on project needs.

1. Work in the impacted area will STOP.
2. All impacted personnel (ERM and subcontractor staff) will discuss the change and suggest options for continuation.
3. The ERM FSO or field team lead, after reaching agreement with any impacted subcontractor(s), will discuss options with the PM and PIC.
4. The PIC will determine an appropriate course of action (may need to discuss options with Safety Team and/or SMEs).
5. The PIC will document necessary changes and get formal agreement with any impacted subcontractor(s).
6. The PIC will communicate approved changes to the ERM FSO or field team lead.
7. The ERM FSO or field team lead will communicate changes to all impacted site staff, including subcontractor staff.
8. Work in the impacted area can resume.

Control of Work

The following process will be followed with respect to Control of Work. The process, as stated below, can be accepted as written or revised depending on project needs.



1. The ERM FSO or field team lead will, prior to authorizing any new major definable feature of work, review the JHA and other applicable safety planning documents associated with the activity.
2. Once the JHA and other documents are approved by the ERM FSO or field team lead, the documents will be reviewed with all site staff involved and/or impacted by the activity (including subcontractor staff).
3. Once all staff involved and/or impacted understand and acknowledge they are in agreement with the documents, the ERM FSO or field team lead can authorize work to commence.
4. Once work commences, the ERM FSO or field team lead must observe the work in accordance with defined project procedures to document compliance with agreed procedures and general safety best practices.
5. Once authorized work is completed, the ERM FSO or field team lead will document any opportunities for improvement or other lessons learned within the ERM ECS or CAPA system.

Auditing and HASP Revisions

Selected project field activities and project files should be audited periodically. A full site audit for conformance with the HASP will occur at least once per year for projects with a field duration of one year or longer. Full site audits may also be conducted for shorter duration projects. See ERM Form ERM-1941-FM4 (Field Audit Form). Project documentation audits may be conducted periodically for shorter term projects. See ERM Form ERM-1941-FM3 (Project Audit Form). Revisions made to the site HASP in response to audit feedback, lessons learned from incidents, or other reasons will be explained to all site personnel at the first daily safety meeting following the institution of the HASP revision.

Hospital Route

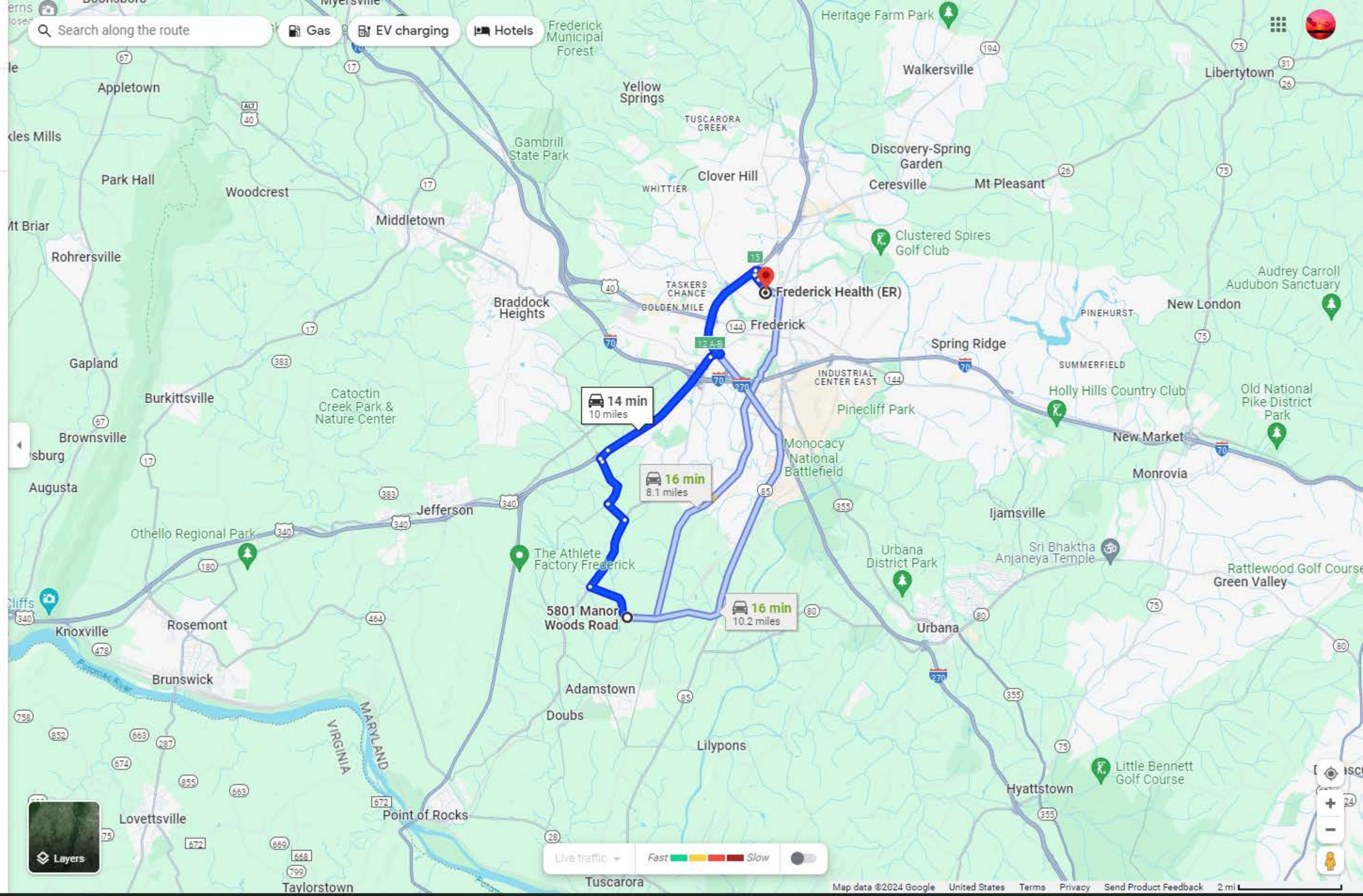
← from 5801 Manor Woods Rd, Frederick, MD 21703
to Frederick Health (ER), Emergency Department, ...

14 min (10.0 miles)   

via US-15 N/US-340 E
Fastest route now due to traffic conditions

- 5801 Manor Woods Rd**
Frederick, MD 21703
- Get on US-15 N/US-340 E in Ballenger Creek from Manor Woods Rd, Ballenger Creek Pike and Cap Stine Rd
7 min (4.3 mi)
 - Follow US-15 N/US-340 E to W 7th St in Frederick. Take exit 15 from US-15 N
6 min (5.3 mi)
 - Continue on W 7th St to your destination
2 min (0.4 mi)

Frederick Health (ER)
Emergency Department, 400 W 7th St, Frederick, MD 21701



Health and Safety Procedures

Vehicle Inspection Form

DOCUMENT DETAILS

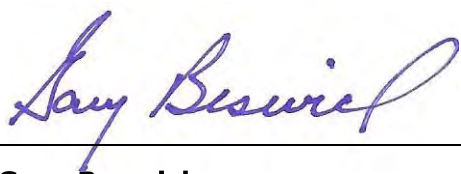
DOCUMENT TITLE	Vehicle Inspection Form
DOCUMENT NUMBER	ERM-1430-FM2
Approval Date	5 May 2023
Version	2
Applicability	Global

DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
2	All	Updated	5 May 2023

This Form Template has been Approved By:

APPROVAL SIGNATURE



Gary Beswick

Global H&S Director

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Date	Operator		Project#		Mileage	
Vehicle Make/Model License#					Company Vehicle? <input type="checkbox"/> Y <input type="checkbox"/> N	
I. Inspection		Before Driving:			Comments	
		OK	Deficient	N/A		
<u>Prior to Use, and Weekly Thereafter</u> for all vehicles used for field work.						
All glass and mirrors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Engine Fluids (oil, radiator coolant)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Headlights (incl Hi/Lo lights)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Horn	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Instrumentation warning lights	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Misc. vibration, noise, loose parts (requires comment)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Overall vehicle cleanliness/damage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Reverse warning/alarm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Seatbelts for all seats	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Tail Lights / Brake lights	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Tires - visual condition/tread/pressure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Turn signal / hazard lights	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Under vehicle – leaks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Windshield cleanliness and lack of damage/cracks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Windshield wipers & fluid	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Required H&S supplies/equipment	<input type="checkbox"/> Anti-lock brakes	<input type="checkbox"/> Air bags	<input type="checkbox"/> First aid kit	<input type="checkbox"/> Reflective safety vest (for all occupants)	<input type="checkbox"/> Spare tire and jack – in good condition	<input type="checkbox"/> Roadside warning (triangles or flares)
Optional H&S supplies/equipment	<input type="checkbox"/> Jumper cables		<input type="checkbox"/> Fire Extinguisher	<input type="checkbox"/> Torch / flashlight	<input type="checkbox"/> Camera	

Name & signature of reviewer :

Safety Reminders

1. Drive defensively - scan road ahead and anticipate actions of other drivers.
2. Ensure sufficient rest before and during the trip. Take a 15 minute break after every 2 hours of continuous driving. Fatigue will impair your driving ability.
3. Seat belts to be worn by all passengers and driver at all times.
4. Adjust seat / mirrors / headrest / steering wheel and ensure clean windows with no obstructions; Secure loose items.
5. Eliminate distractions – do not use mobile phones or any other electronic devices while driving. Refer to ERM's *Global Policy on Mobile/Cellular Telephone and Personal Digital Assistant (PDA) Use While in a Vehicle*.
6. Secure all loose loads.
7. Obey all posted road signs and speed limits.
8. Maintain safe following distance - use "3-second rule." in good weather conditions. Adjust speed / following distance for adverse road/weather conditions.
9. Do not consume any alcohol or drugs, or any other substance or medication that could impair their ability to drive. Refer to ERM's *Global Policy on Drug and Alcohol Use*.



Driver and Vehicle Safety

DOCUMENT DETAILS

DOCUMENT TITLE	Driver and Vehicle Safety
DOCUMENT NUMBER	ERM-1430-PR1
Approval Date	5 September 2024
Version	3.6
Applicability	Global

1. PURPOSE AND SCOPE

This document establishes the requirements for vehicular travel while on ERM company business (excluding public transportation). This procedure defines the minimum requirements; more stringent local requirements may be applicable.

2. ROLES AND RESPONSIBILITIES

Business Unit (BU) Fleet Manager. Implement written procedures to manage the BU fleet in accordance with this procedure.

BU Managing Partner (MP). Establish driver training programs (as applicable); designate a BU Fleet Manager if the BU has leased or owned vehicles.

Employees. Complete the Driver Acknowledgement Certification within one month of hire and annually thereafter; notify their line manager within one day of suspension or revocation of their driver's license, if an Authorized Driver.

Journey Leader. Complete the JMP, pre-departure checks, and required check-in calls. The Journey Leader shall be identified in the JMP, and is typically the primary driver.

Journey Point of Contact. Receive the JMP identified check-in calls, initiate response plan in JMP if check-in call not received.

Partner in Charge (PIC). Ensure client-related driver training requirements have been communicated to the project team and implemented; approve Project-related Journey Management Plans (JMPs).

3. DEFINITIONS

All-terrain vehicle (ATV): An off-road vehicle that travels on low-pressure tires, with a seat that is straddled by the operator, along with handlebars for steering control.

Authorized Driver. ERM employee that has self-identified as someone that drives on company business (using the Driver Acknowledgement Curriculum on the ERM Academy) and does not have a Curriculum status of “In Progress / Past Due”.

Company business: All driving associated with ERM work, with the exception of an employee’s standard commute from home to the office.

Defensive Driving: A driving technique that aims to reduce the likelihood of a serious accident by anticipating dangerous situations, despite adverse driving conditions or the mistakes of other drivers. In some locations, this is also known as Alert Driving.

Gross Vehicle Weight Rating (GVWR): Maximum operating weight of a vehicle as specified by the manufacturer.

High Risk Location: Location/region identified as “High Risk” by International SOS (ISOS) and/or Regional H&S Lead.

Hired vehicle: Vehicle provided by a vehicle rental company that includes a driver.

Leased vehicle: A vehicle under a long-term rental agreement between the vehicle rental company and ERM.

Off-road driving: Any driving that does not occur on a permanently maintained road, with the exception of driving that occurs completely within the project site.

Remote driving: Driving in a location where emergency assistance may not be readily available or present (e.g., unpopulated areas on non-major highways), areas with known security concerns, or any other area deemed “remote” by the driver (i.e. driver is uneasy or uninformed about the destination).

Rented vehicle: Vehicle provided by a vehicle rental company that an ERM employee will be driving.

Vehicle used for Field Work: For the purposes of this Procedure, a vehicle is used for field work if the vehicle is driven for intrusive field activities, gauging, sampling, operations and maintenance (O&M), construction, demolition, or any work at remote sites; including motorcycles, motor bikes and all-terrain vehicles (ATVs).

4. PROCEDURE

4.1 ALL EMPLOYEES

All employees shall complete the Driver Acknowledgement Curriculum on the ERM Academy within one month of hire, and at least annually thereafter. As part of the Driver Acknowledgement, employees shall self-identify as:

- Non-driver: does not drive on company business
- Authorized driver: drives for company business, less than 5000 km/annum (3100 miles/annum)
- High mileage authorized driver: drivers for company business, more than 5000 km/annum (3100 miles/annum)

The Driver Acknowledgement Curriculum shall be updated if an employee's driving status changes. It is the responsibility of all Authorized Drivers to inform their Line Manager within the next working day of a driver license suspension or revocation.

Any employee that self-identifies as a Non-driver or has a "In Progress / Past Due" status on their Driver Acknowledgement Curriculum is not permitted to drive for ERM business.

4.2 DRIVER REQUIREMENTS

4.2.1 MINIMUM EXPECTATIONS

All drivers must meet the following requirements (note: this applies to ERM employees, hired drivers, and subcontractors):

- Hold a valid and current driver license for the class of vehicle to be operated.
- Not use a mobile phone while operating a vehicle (per ***ERM Global Policy – Mobile/Cellular Telephone, Computer and all other Personal Digital Assistant (PDA) Device Use While in a Vehicle***).
- Not be under the influence of alcohol or drugs, or any other substance or medication that could impair their ability to drive (per ***ERM Global Policy – Drug and Alcohol Use***).
- Inspect vehicle prior to each use and confirm that there are no obstacles in the vehicles travel path or under the vehicle by completing a 360° walk around the entire vehicle.
- Follow all posted signs and speed limits, all applicable laws and regulations, and any client-specific or site specific vehicle safety policies.

All drivers should consider the following best practices:

- Utilize a "Back-In" or "First Move Forward" practice when parking a vehicle.
- Plan driving during daylight hours, when practicable.
- Review weather conditions prior to travel and avoid driving in adverse conditions. Consider the anticipated road conditions and terrain and ensure the vehicle is fit for purpose. Carry a reliable method of communication, in case of emergency.
- Obtain written directions prior to travel in an unfamiliar location.
- Be familiar with and comfortable operating the vehicle to be driven.

To avoid fatigued driving, all drivers must:

- Plan a 15 minute break after every two hours of driving.
- Not drive more than 8 hours/day.

To avoid fatigued driving, all drivers should consider:

- Avoid driving between 10 p.m. and 5 a.m.
- Share driving with others, if possible.
- Avoid driving if doing so will result in more than 12 hours of work-related activities (for example, limit driving to 4 hours after an 8 hour field day; limit driving to 6 hours after 6 hours in the office).
- Avoid driving after a flight of six hours or more without appropriate rest.



Project budgeting and trip planning must consider the above. Local regulations may be more stringent.

4.2.2 DRIVER TRAINING

It is the responsibility of the PIC to ensure client-related driver training requirements have been communicated to the project team and implemented. All training required by this procedure shall be documented in ERM Academy (for employees) or in the project files (for non-employees).

All Authorized Drivers that operate a vehicle in excess of 5000 km/annum (3100 miles/annum) on company business must receive Defensive Driver training. Refresher training shall be provided once every three years. It is the responsibility of the BU MP to establish a defensive driving training process, in consultation with the Regional H&S Lead.

Drivers that perform the following high risk activities must have specific training on safe methods for completing these activities:

- Towing of equipment or a trailer
- Off-road driving
- Driving a vehicle with GVWR greater than 10,001 lbs

4.3 VEHICLE OPERATION AND USE

All vehicle events (incidents, accidents, near misses, observations), regardless of whether an ERM employee is the driver or a passenger, must be recorded in ECS.

4.3.1 RISK ASSESSMENT AND PLANNING

All vehicular travel (including travel as a passenger) shall be considered as a distinct task in the health and safety planning process, and shall have a Job Hazard Analysis (JHA) completed in accordance with **ERM-1110-PR1 - Safety Planning Procedure**. In addition to the JHA, a documented and approved Journey Management Plan (JMP) is mandatory for the following conditions:

- Single day journey in excess of 500 km (310 miles)
- Single day estimated driving duration in excess of 4.5 hours
- Driving/travel by vehicle in a remote location (including off-road driving)
- Driving/travel by vehicle in any location/region identified as "High Risk" International SOS (ISOS) and/or Regional H&S Lead

For vehicular travel in high risk locations, **ERM-1430-FM3 – High Risk Location Journey Management Plan Template** shall be completed. The High Risk Location JMP shall include all driver and passenger details, detailed security arrangements for all road travel, detailed meet and greet arrangements at all airports, and detailed schedule for all journey legs and stages. Additionally, an emergency response plan and security details for all accommodations and for all locations where work will be conducted shall be documented.

For all other journeys, **ERM-1430-FM1 – Journey Management Plan Template** shall be completed.

The JMP shall designate a Journey Leader and a Journey Point of Contact, and shall be approved by the PIC (or the Journey Leader's supervisor if the Journey Leader is the PIC or there is no PIC associated with the travel). The Journey Leader is responsible to review the JMP with all travellers, and to ensure a copy of the JMP is available during travel and in the Project File.

4.3.2 MINIMUM REQUIREMENTS

The following minimum requirement shall apply:

- Passengers and drivers are required to wear available passenger restraints (i.e. seatbelts with shoulder harness) while operating or riding in a vehicle.
- The number of passengers carried shall not exceed the seating capacity specified for the vehicle.
- Transporting people in the bed of a pickup truck is prohibited.
- Smoking within a vehicle is prohibited.
- Loose equipment in passenger compartments, in the back of pickup trucks, and on trailers shall be secured before driving.
- Unattended vehicles (even for a short period of time) shall be locked so that all equipment inside them is secured (verify the vehicle is locked before walking away). Critical documents and equipment should be removed from the vehicle if unattended or locked in the trunk/boot of the vehicle.

A vehicle used for field work shall:

- Be inspected before the first use onsite and then on a weekly basis afterwards. These inspections shall be documented using the Vehicle Inspection Checklist.
- Maintain the minimum safety equipment listed in Section 4.5.

4.3.3 TOWING OF TRAILERS OR EQUIPMENT

No ERM employee shall tow a trailer or equipment without having first received documented training on safe towing methods. The BU MP shall establish a safe towing training process (if required), in consultation with the Regional H&S Lead.

At a minimum, an ERM employee towing a trailer or vehicle shall:

- Refer to and comply with the vehicle owner's manual for safe towing capacity.
- Conduct an equipment inspection prior to use to ensure that weight is distributed evenly and that warning/signal lights are working properly.
- Use a spotter when driving in reverse.

The use of straps or chains for towing purposes is prohibited.

4.3.4 MOTORCYCLES, MOTOR BIKES AND ALL-TERRAIN VEHICLES (ATVS)

Where no other means of travel is feasible, the ERM team or employee, can seek approval under the following conditions at a minimum:

- Driver is suitably insured, experienced and licensed where required.

- No passengers shall be permitted.
- Driver must use suitable helmet with face-shield, unless the motorcycle / motor bike is equipped with a windshield.
- Nothing may be carried that is not fully enclosed within a worn backpack or within a permanently installed "saddlebag" or trunk.
- Team has checked that there are no restrictions of use from the client.
- Approval from the BUMP or delegate has been documented via email.
- A specific JHA has been completed and approved by the PIC.

Three-wheeled ATVs are not permitted for use at any time.

4.4 VEHICLES

4.4.1 MINIMUM EXPECTATIONS FOR ALL VEHICLES

All vehicles used for company business (including vehicles provided by and/or driven by external vendors, clients, etc.) shall be in safe working order and suitable for the task. In addition, the vehicle used shall have a valid vehicle registration, valid insurance coverage and be current on all road taxes (where applicable) in accordance with the local regulatory requirements. Vehicles shall meet the following minimum expectations:

- Anti-lock braking system (ABS)
- Air bags fitted for driver and passenger side
- Three point lap/diagonal seat belts for front and rear outboard seats and lap belts for all other seats;

The PIC is required to specifically document and justify a variance from the above requirements in the travel JHA.

4.4.2 RENTED OR HIRED VEHICLES

When possible, the rental company should be a company with which ERM has negotiated rates and contract terms. When renting a vehicle:

- Proof of inspection must be available to the driver.
- If employees cannot rent from a preferred provider with negotiated contract terms, the employee should purchase the collision damage waiver and personal accident insurance.

When hiring a vehicle and driver, ensure that a means for identifying the car and driver has been established prior to pick-up.

4.4.3 TAXI CABS AND OTHER POINT-OF-HIRE VEHICLES

Employees should avoid using taxi cabs without seat belts for all passengers. The employees should encourage the driver to wear their seat belt, not use their mobile devices, and follow all posted speed limits and traffic laws. The use of the **Taxi Card** is encouraged.

4.4.4 PERSONAL VEHICLE

The use of personal vehicles for driving on ERM business should be avoided. If personal vehicles are used, it is the employees responsibility to ensure that the vehicle has all required licensing and insurance coverage for business use, that all maintenance requirements are met and all safety equipment is available.

4.4.5 COMPANY OWNED OR LEASED VEHICLES

For any ERM BU with owned or long-term leased vehicles, it is the BU MP's responsibility to formally designate a BU Fleet Manager. The BU Fleet Manager is responsible for the maintenance, inspection and repair of fleet vehicles, including:

- Vehicles shall receive regular, documented maintenance in accordance with the manufacturer's recommended schedule
- Vehicles shall have appropriate and current insurance coverage and road taxes (where applicable)
- Vehicles shall have the following safety equipment, unless a written waiver is received from the RCEO:
 - Anti-lock braking system (ABS).
 - Air bags fitted for driver and passenger side.
 - Head rests for front seats.
 - High-level third brake light.
 - Functional hazard lights.
 - Laminated glass windscreens/windshields and tempered glass side & rear windows.
 - Mirrors, outboard driver and passenger side and internal rear view mirror.
 - Tires must be fit for purpose, terrain and season (i.e., snow, off-road, all terrain), and in good condition (e.g., with suitable tread depth).
 - Spare tire in new or in relatively good condition, and an operational jack.
 - Three point lap/diagonal seat belts for front and rear outboard seats and lap belts for all other seats.
- Vehicle shall be less than five years old and have fewer than 100,000 miles (160,000 km), unless a written waiver from the RCEO has been obtained. Such waivers must include an expiration date.

Each BU that maintains a fleet shall maintain a written BU-specific Fleet Management Procedure that documents routine maintenance/inspection procedures to ensure vehicles are in safe operating conditions and is sufficiently detailed to ensure that these minimum requirements are achieved.

4.5 VEHICLES USED FOR FIELD WORK

Vehicles used for field work shall maintain the following safety equipment (note: local regulations may require additional equipment):

- First aid kit.
- Spare tire and jack.
- Warning triangles (reflective) or road flares (flares may not be stored in the passenger compartment of the vehicle).
- Reflecting safety vests for all occupants of the vehicle (these should be stored in the passenger compartment and not in the boot/trunk of the vehicle).

Recommended equipment includes:

- Jumper cables with instructions.
- Torch / flashlight.
- Fire extinguisher
- Camera capabilities (either cell phone, digital, or disposable camera) for incident investigation and documentation.

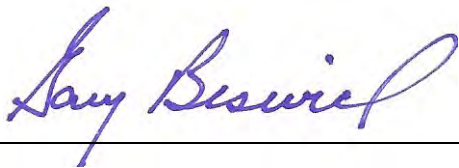
5. REFERENCES

- ERM Global Policy – Mobile/Cellular Telephone and Personal Digital Assistant (PDA) Use While in a Vehicle
- ERM Global Policy – Drug and Alcohol Use
- ERM-1110-PR1 – Safety Planning Procedure
- ERM-1430-FM1 - Journey Management Plan Template
- ERM-1430-FM2 – Vehicle Inspection Form
- ERM-1430-FM3 – High Risk Location Journey Management Plan Template
- ERM-1432-FM1 – Taxi Card

DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
1.0	All	New document.	29 Dec 2014
2.0	4.2.1; 4.4.1; 4.4.5	Included driver 'best practice' considerations and clarified the requirements around driver fatigue management in Section 4.2.1; clarified that the minimum vehicle expectations apply to all vehicles that an ERM employee is riding in Section 4.4.1; modified the requirements on tire tread depth in Section 4.4.5.	20 July 2015
2.1	Header	Modified date to show correct year.	22 July 2015
2.2	All	Updated links, tagline, and document number	28 Dec 2016
3.0	All	Sections reorganized for clarity; included reference to Driver Acknowledgement Curriculum; included reference to High Risk Location JMP requirement and template	6 May 2020
3.1	4.4.5	Require that all RCEO vehicle waivers include an expiration date.	2 Sept 2020
3.2	4.3	Documented the requirement to record vehicle events in ECS	27 Jan 2021
3.3	Reference	Updated reference URLs; changed version number but did not update issue date	13 Aug 2021
3.4	3, 4.3.1	Updated definition of High Risk Country to remove reference to CRG	5 May 2023
3.5	4.2.1, 4.3.1	Included daylight driving and communication methods to best practices; clarified the role of Journey Leader	8 Sept 2023
3.6	3; 4.3.4	Included definition of ATV, updated review and approval requirements for use of motorcycles, motorbikes and ATVs.	5 Sept 2024

APPROVAL SIGNATURE



Gary Beswick
Global H&S Director

Fixed Wing Aircraft and Helicopter Safety

DOCUMENT DETAILS	
DOCUMENT TITLE	Fixed Wing Aircraft and Helicopter Safety
DOCUMENT NUMBER	ERM-1440-PR1
Approval Date	1 April 2024
Version	6
Applicability	Global

1. PURPOSE AND SCOPE

This document establishes the minimum requirements for fixed wing aircraft and helicopter usage.

2. ROLES AND RESPONSIBILITIES

Business Unit Managing Partner (BUMP). Approve the use of all carriers that do not have a JACDEC risk rating, or that have a JACDEC risk rating of 'C'

Global HS Director. Review all carriers with a JACDEC risk rating of "D"

Partner in Charge (Line Manager). Ensure this process is implemented on all projects (Line Manager is responsible in the event of non-project travel).

Regional CEO (RCEO). Approve all carriers with a JACDEC risk rating of "D"

Regional Health and Safety Director (RHSD). Review all carriers that do not have a JACDEC risk rating, or that have a JACDEC risk rating of 'C'

Regional JACDEC Coordinator. Provide travelers with the JACDEC risk rating within two business days of a request

3. DEFINITIONS

Chartered fixed-wing aircraft or helicopter – any fixed-wing aircraft or helicopter where the traveler has not purchased an individual seat on the open market

HUET (Helicopter Underwater Escape Training) – externally provided training required for offshore helicopter transport

JACDEC (Jet Airliner Crash Data Evaluation Center) – organization that provides documented safety analysis of individual air carriers ([JACDEC website](#)).

ERM Approved Airline – an airline identified in the ERM Approved Airline list maintained on SharePoint.

4. REQUIREMENTS

4.1 FIXED-WING AIRCRAFT AND HELICOPTER TRANSPORT REQUIREMENTS

Fixed-wing or helicopter travel does not require additional risk review/mitigation if the carrier meets *either* of the following criteria:

- The carrier is identified and current on the [ERM Recognized Carrier](#) list, or
- The carrier has at least one regularly scheduled flight into or out of an EU country. This requirement is to confirm that the EU has evaluated the carrier; therefore, it is not necessary that the traveler is on an EU flight, only that such a flight exists.

If one of the above criteria is not met, then there must be a documented and Approved risk evaluation associated with that (those) carrier(s). This evaluation shall be documented using **ERM-1440-FM1 - Aircraft Waiver Assessment and Request Form** or equivalent, and maintained in the project file or on Minerva.

4.2 RISK EVALUATION AND APPROVAL PROCESS

Carriers not meeting the criteria defined in Section 4.1, must obtain a JACDEC risk rating, if available. There is no cost to the project team to obtain the JACDEC risk rating – the Safety team maintains licenses in each region and will provide the aircraft risk rating upon request.

To obtain a JACDEC risk rating, do the following:

1. Determine if a rating is available, by reviewing the list of available [JACDEC Airline Safety Reports](#). At this stage of the process, purchase of the report is not required.
2. If available, request the risk rating by providing the airline name and country of operation to an ERM Regional JACDEC coordinator (this is done automatically using **ERM-1440-FM1 - Waiver Assessment and Request Form**, or they can be contacted directly).

It may take two business days to obtain this rating, so plan accordingly.

- JACDEC rated “**A**” or “**B**” airlines are acceptable, as long as documentation of the rating is maintained in the project file or on Minerva (using the **Waiver Assessment and Request Form** or via other means of documentation). No additional review or approval is required.
- JACDEC rated “**C**” airlines or airlines with **no JACDEC risk rating** require a documented risk assessment prepared by the project team and reviewed by the RHSD, and issuance of a waiver by the requester’s BUMP.
- JACDEC rated “**D**” airlines are prohibited, unless a documented risk assessment is prepared by the project team and reviewed by the Global HS Director, and issuance of a waiver by the requester’s RCEO.

A process flowchart is provided as Figure 1.

4.2.1 RISK ASSESSMENT PROCESS IN SUPPORT OF A WAIVER

When required, the documented risk assessment shall consider all of the following:

- An assessment that travel by road or rail would increase the risk of travel.
- Assurance that it is not possible to utilize a carrier not requiring a waiver (e.g., on the ERM Recognized Carrier list, flying into the EU, or with a JACDEC "A" or "B" rating). Cost shall not be a consideration in this evaluation.
- A third-party risk review of the operator (or other reasonable justification), and the conclusion (based on review of the available data) that the risk of using the operator has been mitigated and/or is determined to be acceptable. Sources of third-party risk review information may include published JACDEC Airline Safety Reports, client-provided assessment information, or other published information.

4.2.2 WAIVER APPLICABILITY AND DURATION

Waivers are issued on a project by project basis, and are only applicable to the routes described within the risk assessment process, and for the duration identified. The waiver must be updated when conditions change in a way that would affect the risk assessment (e.g., an alternate means of travel becomes available; the team becomes aware of a JACDEC risk rating change, etc.).

4.3 SPECIAL REQUIREMENTS FOR HELICOPTER TRANSPORT

Rarely are helicopter companies rated automatically by JACDEC; however, in many cases a JACDEC Air Carrier Safety report can be obtained upon request (for a fee). When preparing a waiver request, consideration should be given to assessing / validating pilot training and experience.

In addition, HUET is required for all employees using offshore helicopter transport. This training shall be documented in ERM Academy.

4.4 INSURANCE REQUIREMENTS

The ERM Insurance/Legal Department must be notified prior to finalizing any agreement where ERM is responsible for chartering a helicopter or fixed wing aircraft. Prior to flight, ERM must receive a certificate of insurance from the charter entity that states the following:

- Charter's aircraft liability insurance limit
- ERM must be an additional insured on the charter's aircraft liability insurance

With regard to insurance coverage, all ERM employees are covered during travel outside of employees' domiciled country (for both commercial and chartered flights) under our Business Travel Accident insurance, unless the commercial or chartered flight maintains a lower than required safety rating. In the event of an insurance claim resulting from an airline/helicopter accident, we are required to demonstrate ERM's Duty of Care that we completed and documented ERM's 'due diligence' surrounding the use of that airline/helicopter that maintains a lower than required safety rating. The completion and Approval of the Review and Waiver form will document such an assessment.

4.5 ERM RECOGNIZED CARRIER LIST

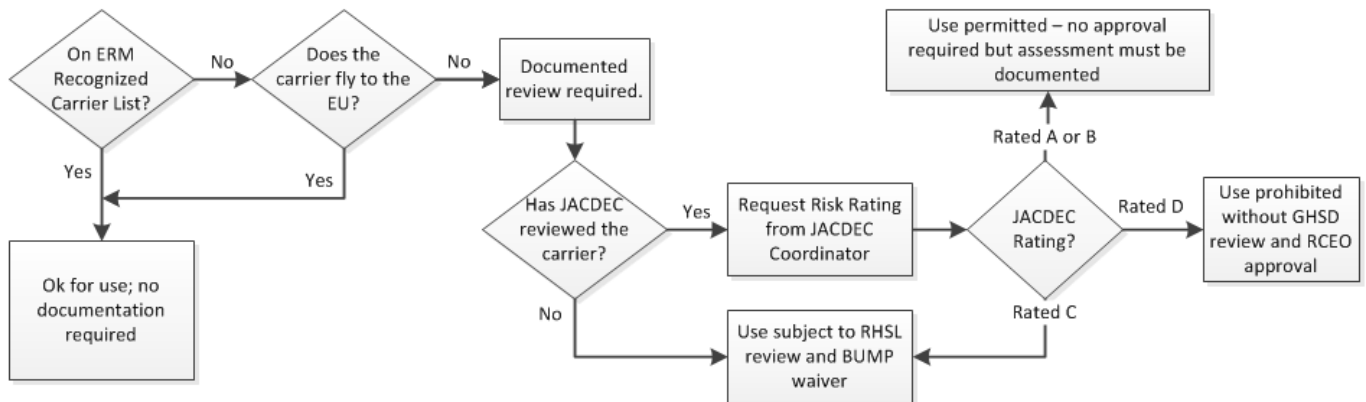
The ERM Recognized Carrier List is based on the following:

- Any airline that is a full member of one of the three global airline alliances: Oneworld, SkyTeam or Star Alliance).
- Frequently used airlines that are nominated by Operations, and confirmed to be acceptable by the Regional Safety Lead (giving consideration to the JACDEC rating). Nominated airlines must be re-evaluated annually.
- Airlines that have been documented as having a JACDEC "A" or "B" rating using **ERM-1440-FM1 - Waiver Assessment and Request Form** may be considered for inclusion by the Regional Safety Lead. Such airlines must be re-evaluated annually.

5. REFERENCES

- ERM-1440-FM1 - Aircraft Waiver Assessment and Request Form

FIGURE 1 PROCESS FLOWCHART



DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
1.0	All	New document.	29 Dec 2014
2.0	All	Modification of prohibition requirements and inclusion of the waiver process	18 Feb 2015
3.0	4.4	Clarified insurance requirements	9 August 2016
4.0	All	Modification of the process for completing a risk evaluation and documenting approval.	30 Sept 2016
4.1	All	Updated links, tagline, and document number	28 Dec 2016
4.2	All	Updated hyperlinks to point to Office365 sites	25 July 2018
5.0	All	Triannual review; clarification to section 4.3 regarding the availability of JACDEC reports for helicopter operators.	13 August 2021
6.0	Name and Number	Changed to a Procedure instead of a Standard	1 April 2024

APPROVAL SIGNATURE



Gary Beswick
Global H&S Director

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Subsurface Clearance Project Plan

Site/Project Name: _____
Client: _____
ERM Project No.: _____

This Subsurface Clearance (SSC) Project Plan must be completed for each phase of ground disturbance activities at a project location. A copy of this document must be maintained at the project location for the duration of ground disturbance activities. The ERM Partner-in-Charge (PIC) and SSC Experienced Person (EP) or field team lead must review and approve the completed SSC Project Plan **prior to any point disturbance clearance or ground disturbance activities** (all approvals appear on final page of this document).

Administrative Information	Date Plan Started:	Field Work Start Date:
	Date Plan Completed:	Field Work End Date:
	Project Manager:	Partner In Charge:
	SSC EP ¹ / Field Team Lead:	Local MP or designee (for any waivers):
	List any additional SSC General Employees (GEs) working on this project:	
	Describe the Scope of Ground Disturbance Activities:	<u>Check all that apply:</u> <input type="checkbox"/> Point disturbances (manual / hand digging only) <input type="checkbox"/> Point disturbances (using mechanized equipment) <input type="checkbox"/> Excavation / trenching / grading <input type="checkbox"/> Removal / coring / drilling of concrete, asphalt, etc. <input type="checkbox"/> Other - Describe:

Project Information Summary	Yes	No	N/A	Comments
Knowledgeable Contact Person(s) identified, and presence requested during site walk. SSC Project Plan reviewed with knowledgeable contact person(s)				Who:
A log or register of all available information sources, including date(s) received, has been developed, and all documents reviewed by SSC EP. Information sources could include: as-built drawings, site plans, maps, aerial photographs, easements, right-of-ways, historical plot plans, current/historical aerial photographs, fire insurance plans, tank [dip] charts, SSC information obtained as part of previous site investigations, soil surveys, boring logs, etc.				List information sources reviewed (including dates):
All subcontractors (including ground disturbance, private utility locating, concrete coring, etc.) prequalified and approved				List Private Utility Locate Subcontractor(s):
Specific SSC scope of work items in all work orders for subcontractors involved in SSC and ground disturbance activities (i.e. point disturbance clearance methods and required tools, field documentation and utility markout methods for private utility locate subcontractors, etc.)				List all Ground Disturbance Subcontractors:
Additional client and/or regulatory requirements apply to the project and have been incorporated into H&S plan documents				If yes, specify:
ERM / client / regulatory SSC requirements have been communicated to all field personnel including subcontractors (refer to SSC Review Checklist for Subcontractors - ERM-1511-FM5)				
Current and valid SSC training certifications confirmed for all ERM staff (including PIC and PM)				
Current and valid additional training certifications (e.g., detection equipment operation) confirmed for all ERM staff and subcontractor personnel				List additional trainings:
UXO/MEC risks assessed: UXO/MEC is present or potentially present				If Yes, stop work and contact PIC
Project meets criteria for "low risk" ground disturbance				If Yes, project teams can elect to complete the SSC Low Risk Project Plan (ERM-1511-FM2) instead of this form

¹ Current certification on ERM Academy is required.



Subsurface Clearance Project Plan

Site Walk						
Identified Visual Clue	Yes	No				
Lights						
Signage						
Sewer drains / cleanouts / drop inlets ²						
Cable markers						
Utility poles with conduit leading to the ground						
Utility vaults / boxes ²						
Manholes ²						
Pavement scarring						
Distressed vegetation or vegetation in linear pattern						
Overhead utility lines						
Solar panels / wind power generation						
Comments:						
Visual clues / site features integrated into Site Services Model			Yes	No	N/A	Comments

[illegible]

² Coordinate with site contacts to safely open and visually inspect any manholes, drains, vaults, cleanouts, or other similar structures.

³ Project teams must verify a response (or document non-response) from each public utility locator, and at least one follow-up notification should be made to the public locate service for any utility owners/operators that do not respond in a timely manner.



Subsurface Clearance Project Plan

Site Services Model

Attach a site plan or drawing (to scale) showing planned ground disturbance location(s), the locations / routes of all identified or suspected subsurface and above-ground utilities and structures, and associated critical zones and excavation buffers.

Utility / Structure	Present?			Anticipated depth (note units)	Located?		Status (active, inactive, abandoned / decommissioned, etc.)	Comments (For each, describe how the utility or structure was located – such as as-built drawings, private locate, public locate, visual clues, etc. – and quality of information available)
	Yes	No	Un-known		Yes	No		
Electricity ⁴								
Gas								
Petroleum Pipeline								
Other Pressurized Lines								
Process Sewer								
Sanitary Sewer								
Storm Sewer								
Potable Water								
Telephone / Communication								
Fiber Optic								
Plant air / steam								
Fuel / oil								
Reclaimed / waste water								
Fire suppression								
Underground tank(s)								
Other (Describe):								

Identify the location(s) and individual(s) responsible for key energy isolation devices and shutoff valves for site services:

Additional Notes on Site Services Model, including identification of any data gaps:

Contact Person(s) Approval of Ground Disturbance at All Locations

Name (Print)	Company	Name (Sign)	Date

Operating Critical Zone Determination

Are there any ground disturbance locations known or suspected to be inside Critical Zones?

☐

YES

PIC and Local MP (or designee) must BOTH grant waiver for work within the Critical Zone. A sketch map must be developed for EACH ground disturbance location inside a Critical Zone (refer to template on last page)

☐

NO

⁴ Work with site contact(s) to identify the presence of any high voltage electrical lines, 3-phase electrical lines, or lights that operate on a photocell / low-light sensor (only come on at night or in low light conditions). If high-voltage or 3-phase power is known or suspected, provide any available information to the private utility locator. Coordinate with the site contact(s) to energize any de-energized lines during the private utility locate to facilitate more accurate tracing.



Subsurface Clearance Project Plan

Overhead Clearance	Yes	No	N/A	Comments
Overhead utility lines in the general vicinity of ERM work onsite?				If NO, check N/A for remaining items in this section
If overhead utilities are present, has nominal voltage been determined? If yes, list in comments section.				Voltage:
Overhead clearances confirmed with equipment operators for safely deploying equipment to the location?				Clearance distance(s):
Proximity alarms, spotters, and /or warning signage necessary to ensure safe clearances?				
If the equipment is closer than the minimum clearance distance to the overhead utility, can utility be de-energized?				
If utility cannot be de-energized, alternate plan developed with approval from the PIC and client/site owner?				

Plan for point disturbance clearance at location(s):	Attach additional sheets to completely describe clearance method, tools and depth if these will vary during the process from location to location.			
(Note that this plan must be reviewed and approved by the PIC before any clearance activities commence)	Yes	No	N/A	Comments
Clearance technique to be used (indicate which method): <input type="checkbox"/> Compressed air excavation (ERM preferred method) <input type="checkbox"/> Pressurized water excavation <input type="checkbox"/> Hand digging <input type="checkbox"/> Hand augering <input type="checkbox"/> Soil probe rod <i>Pick axes, pointed spades, or any other tool that comes to a point are NOT to be used for point disturbance clearance. Note: a waiver is required if no clearance will be performed prior to use of mechanized equipment</i>				Provide rationale if NOT using preferred method of compressed air excavation: <input type="checkbox"/> Scope of work limited to hand digging only <input type="checkbox"/> Equipment not available <input type="checkbox"/> Cannot meet technical objectives (e.g., vapor pins) <input type="checkbox"/> Other (describe):
For locations that will be advanced with mechanized equipment (e.g., drill rig or direct-push) after initial clearance: Diameter of clearance must be to <u>LARGER OF</u> : 4 inches (10 cm), or at least 125% of the diameter of largest downhole tool to be used				Specify diameter (include units) of largest downhole tool: Specify diameter (include units) to be cleared:
Depth of clearance: <input type="checkbox"/> Outside Critical Zones, to a minimum of 5 feet (1.5 meters). <i>Note: typical site utility depths should be considered and may warrant deeper clearance</i> <input type="checkbox"/> Inside Critical Zones, to a minimum of 8 feet (2.4 meters), and deeper if necessary to clear to depths greater than 8 feet for deeper utilities and structures. <input type="checkbox"/> For locations with frozen soils, to 2 feet (0.6 meters) beyond the bottom of the frost line at the site.				Specify depth(s) and units:
Concrete coring / cutting – personnel performing these activities have been verified as trained and competent?				Describe risk mitigation techniques to be employed:

Excavation Plan	Yes	No	N/A	Comments
(Note that this plan must be reviewed and approved by the PIC before any disturbance activities commence)				
Communicate excavation plan and 2-foot (0.6-meter) Excavation Buffer location(s) to subcontractor(s). Delineate all Excavation Buffers.				
If possible, work with contact person / site owner to de-energize subsurface services prior to beginning excavation				
Risk mitigation measures reviewed and acceptable?				Describe:



Subsurface Clearance Project Plan

Approvals

Review Meeting

The SSC Project Plan must be reviewed with the PIC BEFORE any point disturbance clearance or ground disturbance activities occur. It is the responsibility of the SSC EP to schedule this meeting and ensure it occurs; no ground disturbance may occur without receiving start-work authority from the PIC. This review must be completed through a verbal conversation, whether in person or by phone or video conference. Documentation of review can be indicated as “verbal” initially, but must be followed up with signatures in the final SSC Project Plan.

Reviewed by	Signature	Date of Review	Comments
SSC EP or Field Team Lead (required review):			
PIC (required review):			
Project Manager (optional review):			

Waiver Approvals

Two separate Partners are required to approve waivers. Both Partners must be SSC-certified (either GE or EP)

SSC Component Being Waived:	Waived By (PIC)	Waived by (Local MP)	Date	Rationale
Requirement for SSC EP to oversee execution of the SSC Process (can include the entire project or specific SSC-related tasks)				Specify scope of waiver:
Performance of private utility markouts				
Clearance of point disturbance locations prior to advancing with mechanized equipment (including no clearance or partial clearance)				Indicate specific locations and scope of waiver:
Prohibition of ground disturbance inside a Critical Zone				Indicate specific locations:

SSC Project Plan Close-out (SSC EP or Field Team Lead)

Name (Print)	Name (Sign)	Date

Additional Notes or Learnings

--



Site/Project Name: _____

Client: _____

ERM Project No.: _____

SSC EP / Field Team Lead: _____

GROUND DISTURBANCE LOCATION ID:

GROUND DISTURBANCE LOCATION	
DESCRIPTION:	

Instructions:

1. Create a sketch of the disturbance (in the space to left or attach) that is drawn to scale and contains the following information:
 - a. The disturbance location
 - b. Surface landmarks and overhead obstructions (buildings, roads, overhead lines, etc.)
 - c. Subsurface utilities and structures that are:
 - i. Identified in the Site Service Model
 - ii. Marked by public and private utility locators
 - iii. Communicated by knowledgeable contact person(s)
 - d. Any surface visual clues as to potential underground services
 - e. Clearly identify all features or include a legend
2. Use your sketch to mark Critical Zones (3m / 10 feet) around underground utilities and structures.
3. For excavations, use your sketch to mark Excavation Buffers (0.6m or 2 feet) from subsurface utilities and structures.

Subsurface Clearance (SSC) Procedure

DOCUMENT DETAILS

DOCUMENT TITLE	Subsurface Clearance (SSC) Procedure
DOCUMENT NUMBER	ERM-1511-PR1
Approval Date	6 September 2023
Version	5.2
Applicability	Global

1. PURPOSE AND SCOPE

This document establishes the procedures for conducting subsurface clearance (SSC) of utilities and structures prior to any ERM ground disturbance activities. The SSC Procedure applies to all ERM employees and subcontractors for any ERM controlled operation, including supervision or oversight, or where ERM is legally or contractually responsible for SSC activities.

Where a local regulatory, industry, or client requirement differs from ERM's SSC process, the stricter requirement shall be adhered to. When a differing client or regulatory requirement conflicts with or otherwise prevents compliance with the requirements of this procedure (beyond the waivers outlined in Section 5), a project-specific variance plan must be developed by the project team and approved by both the Regional Chief Executive Officer (RCEO) and Local Managing Partner (MP).

The full requirements of this procedure do not apply to:

- "Low risk" ground disturbance activities. Refer to ERM's Subsurface Clearance (SSC) Procedure – Low Risk Projects (*ERM-1511-PR2*) for definition of "low risk" and requirements associated with these activities.
- Ground disturbance activities occurring in water deeper than 6 feet / 2 m. Refer to ERM's Aquatic Work Management procedures for requirements associated with underwater ground disturbances.
- The specific ground disturbance activities outlined in Appendix E – SSC Exempted Activities.

If project teams have any questions about the applicability of the SSC procedure to their activities, they should contact their Local H&S Lead.

2. ROLES AND RESPONSIBILITIES

Phase of SSC Activity	Local MP	PIC	PM	EP	GE	Local Safety
Program Management						
Review and approve individuals as SSC Experienced Persons (EPs)	A	C	C	C		C
Mentor SSC General Employees (GEs) and sign Mentorship Cards		I	I	A	R	I
Perform SSC audits - onsite	A	A	I	I	I	A
Project Planning Phase						
Overall project compliance with SSC process	I	A	R	R	I	C
Include appropriate scope of work items and technical requirements in Subcontractor agreements, including tool/equipment and training requirements		A	R	I	I	C
Determine if project meets "low risk" ground disturbance criteria		A	R	I		C
Assign Trained and Competent Site Personnel		A	R	I	I	I
Identify and comply with all relevant and appropriate client, legal, and regulatory requirements		A	R	I	I	I
Identify Knowledgeable Site Contact(s)		A	R	I	I	
Project-specific variance plans	A ¹	R	I	I	I	C
Field Execution Phase						
SSC Project Plan		A	R	R	C	
Exercise STOP WORK in the event of any change	A	A	A	A	A	A
Lead Implementation of SSC Process		A	I	R	I	C
Complete SSC Documentation			A	R	I	C
Eyes on Supervision of all SSC field tasks		A	I	R	I	
Communicate SSC Process to site team		A	I	R	I	
Verify training and qualification of SSC-related Subcontractor field staff		A	I	R	I	C
Meeting to review completed SSC Project Plan prior to initiation of ground disturbance		A	I	R	I	C
Review and approve SSC waivers	A	A	I	I	I	C
Non-Conformance Management						
High Hazard Near Miss or Incident - Onsite Review	C	A	R	I	I	C
Approve re-start after High Hazard Event		A	R	I	C	C
Investigation, RCA and CAPA development	A	R	I	I	I	C
Participate in formal management review meetings associated with SSC near-miss or incident	I	I	I	I	I	I

¹ Shared accountability with RCEO

Phase of SSC Activity	Local MP	PIC	PM	EP	GE	Local Safety
Program Management						
Review and approve individuals as SSC Experienced Persons (EPs)	A	C	C	C		C
Mentor SSC General Employees (GEs) and sign Mentorship Cards		I	I	A	R	I
Perform SSC audits - onsite	A	A	I	I	I	A

PIC = Partner-in-Charge

PM = Project Manager

EP = SSC Experienced Person

GE = SSC General Employee

R = Responsible for completing activity – review of work product

A = Accountable for completing activity – approval of work product

C = Consulted when necessary

I = Involved in completing activity, when necessary

NOTE: The Local MP may designate another Partner to serve in these roles, provided the Partner has proper SSC-related experience and current SSC GE or EP Certification. A Technical Director that has proper SSC-related experience and current SSC GE or EP Certification may serve in this role with documented approval of the RCEO.

3. DEFINITIONS

Abandoned / Decommissioned – a subsurface structure that has been confirmed by the owner / operator as inactive and in a state of zero energy. For high value / high hazard subsurface structures (as defined later in this section), confirmation must be made on-site by qualified personnel (representing the site and/or owner/operator of the line, unless these entities cannot be identified), witnessed by ERM, and include positive verification of a zero-energy state. Otherwise, these lines must be considered potentially active.

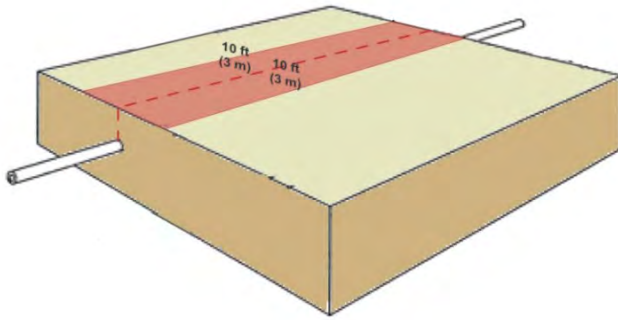
Compressed Air Excavation – the use of compressed air to make a cut, cavity, trench or depression in the earth's surface. Also known as "vacuum extraction," "vac-ex," "air knifing," and/or "soft digging."

Contact Person – a representative of the site where ground disturbance activities will be conducted who is knowledgeable of the subsurface and/or historical operations at the work location. The contact person may be a client employee or the employee of a third party.

Critical Zone – 10 feet (3 meters) distance in all directions from the surface projection of all known or suspected subsurface structures, taking into account the diameter and spatial extent of the structure (e.g., the outer diameter of a pipe or the outer edges of a tank).

Critical Zones do not apply to structures that have been confirmed as abandoned / decommissioned and do not need to be protected.

Example critical zone illustration, associated with an underground pipe:

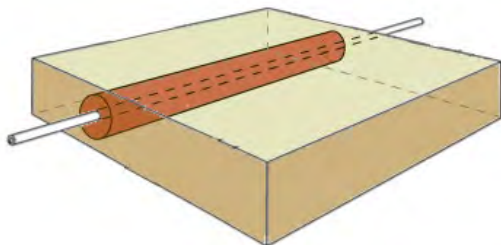


Detection Equipment – any equipment used for the detection of subsurface structures including, but not limited to, devices that utilize electromagnetic detection, magnetic detection, ground penetrating radar (GPR), acoustic detection, and video surveillance (e.g., sewer cameras). Guidance on the selection and applicability of detection equipment is provided in Appendix B.

Excavation – any man-made cut, cavity, trench, or depression in the earth's surface, NOT including point disturbances as defined later in this section.

Excavation Buffer – a 2-foot (0.6-meter) distance in all directions from the outermost extents of subsurface structures that will be exposed or partially exposed during excavation activities, and within which mechanical digging is prohibited. Excavation Buffers do not apply to structures that have been confirmed as abandoned / decommissioned and do not need to be protected.

Example illustration of excavation buffer associated with underground line:



Ground Disturbance Activities – activities which require penetration of the ground surface to any depth, and/or the drilling, coring, or removal of engineered surfaces (pavement, concrete, etc.). Examples of ground disturbance activities include, but are not limited to: hand digging, hand augering, drilling, direct-push or Geoprobe® borings, well installation, well over-drilling, excavation, trenching, grading, coring/drilling into concrete or asphalt, drilling/installation of soil vapor points, and driving of posts, stakes, rods, poles, or sheet piles.

Hand Augering – use of a manual auger to make a cavity or depression in the earth's surface.

Hand Digging – use of manual digging tools and equipment (e.g., shovel, trowel, or post-hole-digger) to make a cut, cavity, trench or depression in the earth's surface.

High Value / High Hazard – subsurface structures including electrical conductors / cable equal or greater than 110V, fiber optic cable, natural gas lines, petroleum pipelines, or structures containing hazardous substances.

Low Risk Ground Disturbance Activities – activities as defined in ERM's Subsurface Clearance (SSC) Procedure – Low Risk Projects (*ERM-1511-PR2*). Examples of "low risk" ground disturbance activities include, but are not limited to: hand digging, hand augering, and driving of posts, stakes, rods or poles with non-mechanized tools / equipment.

Point Disturbance – ground disturbance activities associated with a distinct and definable location that, in general, will result in a ground disturbance that has a larger vertical extent (i.e. depth) than lateral extent (i.e. disturbed surface area). Examples include but are not limited to locations involving the following activities: soil sampling, soil borings (regardless of diameter), hand digging, hand augering, drilling, direct-push, Geoprobe®, well installation, and well over-drilling.

Point Disturbance Clearance – methods used to identify the presence or absence of subsurface structures at a particular point disturbance location by removal of overburden and direct observation and/or contact. Approved point disturbance clearance methods include: compressed air excavation, pressurized water excavation, hand digging, hand auger, and soil probe.

Pressurized Water Excavation – the use of pressurized water to make a cut, cavity, trench or depression in the earth's surface.

Site Services Model – a depiction of both the aboveground and underground utilities and services that are present or unaccounted for at a site. The site services model is developed from all available sources of information including, but not limited to: discussions with knowledgeable contact persons, review of maps and as-built drawings, observation of visual clues, and information obtained from utility locate services.

Soil Probe Rod – a blunt-nosed probe with a T-handle that is pushed manually into the ground to check for obstructions that may indicate the presence of subsurface structures.

SSC Experienced Person (EP) – an ERM employee with requisite qualifications and experience in performing SSC activities, who will ensure execution of the SSC process both in the planning stages and in the field.

SSC General Employee (GE) – an ERM employee that works on, manages, serves as PIC, or is responsible for issuing waivers or making other safety-critical decisions on projects where ground disturbance activities are performed, but does not serve in the role of SSC EP.

Subsurface Structures – man-made structures located beneath the surface of the ground or within or below engineered surfaces (excluding man-made debris or archaeological objects that are being investigated). These may include but are not limited to: pipes, cables, conduits, drains, galleries, tanks or other containers, wells, or any other useful property (as defined later in this section).

Useful Property – a subsurface structure that, if damaged, would need to be repaired or replaced, regardless of who makes the repairs or who is liable for the cost.

Unexploded Ordnance (UXO) / Munitions and Explosives of Concern (MEC) – ammunition that was fired but did not explode, or munitions (unfired ammunition, land mines, etc.) that could explode.

4. PROCEDURE

The primary objective of the SSC process is to develop as complete an understanding as possible of the subsurface structures that are present at a project site. This is done by developing a Site Services Model, as defined in Section 3. The activities outlined in this section are performed in order to construct a Site Services Model. These activities are presented in the general order they should be conducted, and are also summarized graphically in the SSC process flowcharts in Appendix A.

4.1 ASSIGNMENT OF PIC, PM, AND SSC EP ROLES TO THE PROJECT

All employees directly involved in SSC or ground disturbance activities, or who work on, manage, or serve as PIC on ground disturbance projects, must have current SSC GE certification, at a minimum. In addition, Local MPs (or their delegates) who approve waivers or make other safety-critical decisions on ground disturbance projects must also have current SSC GE certification.

All SSC planning and field execution activities outlined in Section 4 must be performed or directly overseen by a currently certified SSC EP, unless a waiver has been issued per the process outlined in Section 5.

The name of the SSC EP must be documented in the SSC Project Plan. The SSC EP role can be shared on a project, provided all employees serving in the role are currently certified as an SSC EP and listed in the SSC Project Plan.

4.2 GATHERING AND REVIEW OF SITE INFORMATION

The following steps are required:

1. Identify any local regulatory, industry, or client requirements that are not otherwise covered by the ERM SSC Procedure. Document these additional SSC requirements in the SSC Project Plan.
2. Assess the potential for the presence of UXO/MEC. If UXO/MEC is present or potentially present, specialist technical assistance must be obtained to assist with project planning and site clearance. In the case of sites where UXO/MEC risks are present, adherence to the clearance plan developed by the specialist provider may supersede certain requirements of the SSC Process. If the UXO/MEC clearance plan deviates in any way from this SSC Procedure, a project-specific variance plan must be developed by the project team and approved by the RCEO and Local MP.
3. Identify any contact persons knowledgeable of the subsurface and/or historical operations at the work location. Request any available information from them and review the preliminary SSC Project Plan with them. Request the participation of the contact person(s) during the site walk and visual clues survey (Section 4.4).

4. Obtain all available (and in particular the most recent) as-built drawings and/or site plans showing subsurface structures. Requests should be made and followed up diligently until all available documents are received, or a positive confirmation is given that no such documents are available.
5. Where available and/or required by local legislative or regulatory requirements, obtain as-built drawings from third-party public agencies or private companies with subsurface structures in the area where ground disturbance will occur. Requests should be made and followed up diligently until all available documents are received, or a positive confirmation is given by the entities contacted that no such documents are available.
6. Obtain and review any additional site-related information such as easements, rights-of-way, historical plot plans, current and historical aerial photographs, fire insurance plans, tank (dip) charts, SSC information obtained as part of previous site investigations or Phase I environmental site assessments, soil surveys, boring logs, etc., as relevant to the planned ground disturbance activities.
7. Maintain a log or register of all received files from contact persons or other third parties, including date received, and ensure all documents are located in the project files and made available to the SSC EP.
8. Document the available preliminary information about the presence of known or suspected subsurface structures at the work location in the SSC Project Plan. This must include a site plan or map (drawn to scale) that identifies:
 - a. The routes and locations of known services
 - b. Gaps – those services suspected but not yet located based on available information
 - c. Any Critical Zones and/or Excavation Buffers.
 - d. The preliminary disturbance location plan (boring location map, excavation plan, etc.) accounting for any Critical Zones, Excavation Buffers, gaps in subsurface information, and project objectives.

4.3 PUBLIC UTILITY LOCATES

The following steps are required:

1. Where they exist, the public utility locator(s) must be utilized in accordance with local regulatory requirements, to provide all available information and services. In jurisdictions where they provide this service, they should also be asked to physically mark utilities at and/or in the vicinity of the work location, in accordance with local regulatory requirements.
2. Ensure compliance with local regulations and guidelines governing public utility locates, including but not limited to:
 - a. The process and required lead times for contacting public utility locators
 - b. Marking planned ground disturbance areas at the work location
 - c. Maintaining any required permits or dig tickets and ensuring public locator markings remain clear and visible for the duration of the project
 - d. Any additional requirements for high hazard/high value subsurface structures

- e. Any restrictions for excavating within close proximity to underground structures (ie, "tolerance zones")
- f. What to do if a subsurface structure or utility is encountered and how to report damage
3. Where public locate services are not available or there are utility owners/operators that are not subscribers to a public utility locate service (e.g., municipal water and sewer), identify and contact the owners/operators of known or suspected utilities in the vicinity of the work area and request they mark area lines.
4. Verify a response (or document non-response) by each public utility locator prior to proceeding with any ground disturbance activities. Contact the public locate service to request a follow-up notification to any utility owners/operators that do not respond in a timely manner.
5. If, at any time during ground disturbance activities, the public utility locator markouts are not clear or visible, do not agree with other available sources of information, or are suspected to be inaccurate for any reason, the locators must be called back to the site to confirm their markouts.
6. Document the activities performed and results of the public utility locate in the SSC Project Plan.

4.4 SITE WALK AND VISUAL CLUES SURVEY

The following steps are required:

1. A visual survey of all planned ground disturbance locations and surrounding areas must be conducted to identify signs of potential subsurface structures. Elevation changes across the site should also be noted and factored into clearance depth determinations.
2. During the site walk, the routes and locations of services should be confirmed using visual clues, which include but are not limited to the following:
 - Utility poles with conduit leading to the ground
 - Lights
 - Signage
 - Sewer drains/cleanouts
 - Cable markers
 - Utility boxes
 - Manholes
 - Pavement scarring
 - Pipeline markers
 - Vegetative evidence (e.g., linear patterns or areas of distressed vegetation)
 - Remote buildings with no visible utilities
 - Equipment locations
 - Fire hydrants
 - Sprinkler systems
 - Water meters
 - Natural gas meters
 - Sewer manholes and drop inlets
 - Underground storage tanks fill ports and vent pipes
 - Steam lines
 - Solar panels / wind power generation

Coordinate with site contacts to safely open and visually inspect any manholes, drains, vaults, cleanouts, or other similar structures. Note that accessing these structures may introduce additional hazards (pinch points from opening/closing lids or covers, exposure to chemicals such as hydrogen sulfide, confined spaces, etc.) that project teams need to be aware of and plan for. Staff should not enter or place body parts into these structures.

3. Confirm overhead clearances with equipment operators for safely deploying equipment to the location. The minimum horizontal distance from any point on the equipment to the nearest overhead utility line must adhere to the minimum clearance requirements stipulated by regulation, utility companies, client requirements, and/or local industry best practice. If the equipment is closer than the minimum clearance distance to the overhead utility, the utility must be de-energized or an alternate plan developed with approval from the PIC and client/site owner. For more information, refer to ERM's Guidance on Avoiding Contact with Overhead Utility Lines (*ERM-1545-GU1*).
4. Where possible and practical (i.e. active industrial sites), work with the site contact(s) to identify the location(s) and individual(s) responsible for key energy isolation devices and shutoff valves for site services. This information is to be included in the SSC Project Plan as part of emergency/contingency planning.
5. Work with the site contact(s) to identify the presence of any high voltage electrical lines, 3-phase electrical lines, or lights that operate on a photocell / low-light sensor (only come on at night or in low light conditions). If high-voltage or 3-phase electrical is known or suspected, provide any available information to the private utility locator (Section 4.5). Coordinate with site contact(s) to energize any de-energized lines during the private utility locate to facilitate more accurate tracing.
6. Whenever available, site contact person(s) are to participate in the site walk and approve planned ground disturbance locations. Approval (or lack thereof) must be documented on the SSC Project Plan.
7. Any proposed changes to ground disturbance locations made by a site contact person must be assessed by the SSC EP using the other available lines of evidence and only accepted after a determination is made that the change is safe. The SSC Project Plan must be updated and the changes approved by the PIC.
8. Similarly, follow-up communication must be made to the site contact person when any changes are made to approved ground disturbance locations without their direct knowledge.
9. Document the activities performed and results of the visual clues survey in the SSC Project Plan.

4.5 PRIVATE UTILITY MARKOUTS

The following steps are required:

1. Engage a qualified private utility locate subcontractor or a trained and competent ERM employee to locate and mark subsurface structures on the project site.
2. If using a private utility locate subcontractor, they must be prequalified and approved to conduct private locates through ERM's Subcontractor Use Basic Standards (SUBS) process. The PIC and PM must ensure the subcontractor work order details the type of equipment to be used, mode(s) of operation, reporting requirements (field summary and final) and method of markouts. Further guidance on this, including example work order language, is provided in Appendix B. Confirm documentation of relevant and currently valid training and experience of

all subcontractor personnel to be used. The SSC EP must be present on site to directly oversee the private utility locate subcontractors.

3. If using an ERM employee to locate and mark subsurface structures, they must have current training documented on ERM Academy to operate the detection equipment to be used, and must be approved by the PIC in the SSC Project Plan.
4. All available and site-appropriate detection equipment and methods must be used, and documented in the SSC Project Plan, including noting any limitations in the methods and equipment used. Guidance on the selection and use of detection equipment for private utility locates is provided in Appendix B.
5. Ensure all detection equipment (whether ERM-owned, rented, or brought to the site by subcontractors) is:
 - a. Maintained according to manufacturer specifications with maintenance records available to ERM site personnel upon request.
 - b. Calibrated (if applicable) according to manufacturer specifications. Calibrations (if applicable) must be documented and available to ERM site personnel upon request.
 - c. Tested at the start of each work day and verified to be functioning properly.
6. Detection equipment owned by ERM must be managed in accordance with ERM's Monitoring and Measurement Procedure (*ERM-1934-PR1*).
7. A Job Hazard Analysis (JHA) must be developed that covers all utility locating tasks. The JHA must be specific to the equipment and methods to be used, and be reviewed by the SSC EP and PIC.
8. Clear any vegetation, vehicles, equipment, or other obstructions to facilitate private utility markouts.
9. Coordinate with site contact(s) to energize any de-energized lines during the private utility locate, to facilitate locating using electromagnetic methods.
10. Using detection equipment, confirm the locations and routes of all identified or suspected subsurface structures, based on the data gathered during the other steps in the SSC process.
11. Using detection equipment, scan the area within a minimum 10-foot (3-m) distance around each planned ground disturbance location (a larger, more inclusive distance may be specified in the SSC Project Plan based on input from SSC EP and PIC), to assess the potential presence of any as-yet unknown subsurface structures. Any identified "anomalies" must be investigated to the extent feasible and presumed to be active unless proven otherwise. Anomalies must be documented in the report from the private locator.
12. When using electromagnetic tools and equipment such as a cable avoidance tool, scanning should be done using passive – "power" mode, passive – "radio" mode, and active mode using conductive or inductive methods with the signal generator. Scanning should confirm the locations of known or suspected structures as well as assess for the presence of any as-yet unknown structures.
13. Mark all subsurface structures and "anomalies" identified within the defined boundaries of the work area with paint or other semi-permanent markings whose meaning is understood by the project team. Markings must remain clear and visible for the duration of the ground

disturbance activities, and re-marked if necessary. Note that markings should be assessed by the SSC EP by evaluating the method(s) used to mark the utility locations, any limitations, and whether or not other lines of evidence corroborate or conflict with the markings.

14. The results and findings of the private utility locate must be documented in the field by either the subcontractor or the SSC EP. If using a subcontractor, ask that they provide a signed and dated report including a summary of equipment used, mode(s) of operation, names of operators, and general map/sketch of findings.
15. Document the activities performed and results of the private utility locate in the SSC Project Plan.

4.6 OPERATING CRITICAL ZONE DETERMINATION

The following steps are required:

1. In conjunction with site contact person(s), public and private utility locators, and any other knowledgeable persons identified during the site walk, confirm the status of all identified services (e.g., energized/de-energized, active/inactive, idled, abandoned/decommissioned, etc.).
2. Use the information gathered from all previous steps in the SSC process to determine the operating Critical Zones near each planned ground disturbance location. Critical Zones must be applied to all known or suspected subsurface structures, including any “anomalies” identified during the private utility locate (Section 4.5). Update the SSC Project Plan.
3. If any disturbance locations (or boundaries of disturbance areas) fall within a Critical Zone, they must be re-located or a waiver must be approved to proceed with work inside the Critical Zone. Any waivers must be documented in the SSC Project Plan.
4. For any work inside a Critical Zone, energized pipes or cables must be de-energized. If this is not possible, a JHA must be developed that covers the specific task steps, equipment, and methods associated with work around these energized structures. Appropriate safety measures, including the need for specialized PPE, must be evaluated with input from subject matter experts. JHAs must be reviewed by the SSC EP and PIC.

4.7 REVIEW MEETING AND APPROVAL OF COMPLETED SSC PROJECT PLAN

The SSC Project Plan must be reviewed and approved by the PIC after completion of the SSC process steps in Sections 4.1 through 4.6, and BEFORE any further SSC or ground disturbance activities occur. This review must be completed through a verbal conversation, whether in person or by phone or video conference. It is the responsibility of the SSC EP to schedule this meeting and ensure it occurs; **no ground disturbance may occur without receiving start-work authority from the PIC.**

Documentation of review and approval can be via e-mail initially, but must be followed up with signatures in the final SSC Project Plan. A copy of the SSC Project Plan must be maintained at the work location for the duration of ground disturbance activities, and filed in the project folder upon completion of the field activity.

4.8 CONCRETE CORING / CUTTING

In the case where concrete coring or cutting must be performed prior to ground disturbance, the following steps are required:

5. The preferred course of action is to use a prequalified and approved subcontractor. Where concrete coring / cutting services are not available for hire, the PIC must determine if there is a sufficiently trained and experienced ERM employee to accomplish the task using rented or ERM-owned equipment. Training documentation must be current on ERM Academy and attached to the HASP, with written approval from the PIC.
6. A JHA must be developed that covers all concrete coring / cutting tasks. The JHA must be specific to the equipment and methods to be used, and be reviewed by the SSC EP and PIC.
7. Concrete coring / cutting equipment must:
 - a. Be inspected prior to use and maintained according to manufacturer specifications with maintenance records available.
 - b. For rig- or stand-mounted coring equipment, be anchored to the floor using proper anchors.
 - c. Be operated with ground fault circuit protection.
 - d. Be operated by trained and qualified personnel.

Any additional safety requirements for this equipment must be outlined in the task-specific JHA.

8. Concrete core diameters must be large enough to allow for visual inspection during subsequent point disturbance clearance. For point disturbance locations that will be advanced with mechanical equipment (e.g., drill rig or direct-push) after initial clearance, core diameters must meet or exceed the larger of: 4 inches or 125% of the outside diameter (OD) of the largest downhole tool to be used.

4.9 POINT DISTURBANCE CLEARANCE

Approved equipment and methods to be utilized for point disturbance clearance include the following:

- Compressed air excavation (ERM's preferred method whenever feasible)
- Pressurized water excavation
- Hand digging tools
- Hand augering tools
- Soil Probe Rod

Blades on shovels and post-hole diggers must have rounded or blunt noses. Pick axes, pointed spades, or any other tool that comes to a point are not to be used for point disturbance clearance. Crow bars, pinch bars or pry bars must not be used to break hardened soil or backfill. The ERM EP or field team lead may authorize the use of bars only to loosen materials like bricks or larger stones so that removal of these materials is possible. Bars must not be used with excessive force.

The following steps are required when clearing point disturbance locations:

1. A JHA must be developed that covers all clearance tasks. The JHA must be specific to the equipment and methods to be used. Unless the project team can positively determine that no subsurface structures are present, all tools and equipment used in the clearance process must be selected based on the potential risks (i.e., energized electrical lines, fiber optic cables, natural gas pipeline, etc.) that cannot be ruled out. In addition to selecting tools and equipment, appropriate safety measures, including the need for specialized PPE, must be evaluated with input from subject matter experts. JHAs must be reviewed by the SSC EP and PIC.
2. Re-verify that appropriate overhead clearance requirements can be maintained at ground disturbance locations prior to mobilizing any equipment.
3. In the case of sites where UXO/MEC risks are present, review and adhere to the clearance plan developed by the specialist provider, which will supersede the instructions in this section.
4. The SSC EP must consider site-specific conditions and soil types when determining the equipment to be used.
5. If a hand auger will be used, select the appropriate cutting head(s) based on the soil type, and if resistance is encountered that would require an inordinate/atypical amount of force to be applied for advancement, then augering must not continue.
6. For point disturbance locations that will be advanced with mechanized equipment (e.g., drill rig or direct-push) after initial clearance, clearance must be performed as follows:
 - a. Clear the location using one of the approved methods outlined in this section. The selected clearance method must be documented in the SSC Project Plan. ERM's preferred clearance method is compressed air excavation. If this method is not used, the rationale and approval for using one of the other approved methods must also be documented in the SSC Project Plan.
 - b. Clearance depths should be determined in conjunction with the SSC EP, PIC, and PM, based on the Site Services Model and anticipated depths of subsurface structures at the site. At a minimum, clearance depths must be as follows:
 - i. Outside Critical Zones, to 5 feet (1.5 meters). Note: typical site utility depths should be considered and may warrant deeper clearance.
 - ii. Inside Critical Zones, to 8 feet (2.4 meters) at a minimum. However, clearance **MUST** extend at least 2 feet (0.6 meters) beyond the known or suspected bottom depth of all subsurface structure(s) in the critical zone; therefore it may be necessary to clear to depths greater than 8 feet for deeper structures.
 - iii. For locations with frozen soils, to 2 feet (0.6 meters) beyond the bottom of the frost line at the site.
 - c. Clear to a minimum diameter that is the **LARGER OF**:
 - i. 4 inches (10 cm); or
 - ii. At least 125% of the outside diameter (OD) of the largest downhole mechanized tool (e.g. drilling auger, direct-push sampler) to be advanced.

In all cases, clearance diameters must be large enough to allow visual inspection of the cleared hole. If hand augers are used to clear, multiple holes may need to be advanced to achieve clearance diameters.

- d. For angled (non-vertical) drilling, clear to a minimum diameter of 125% of the OD of the largest downhole mechanized tool, taking into account the angle of the boring.
 - e. For locations where difficult soil or geologic conditions prevent the full clearance of a point disturbance location, a waiver must be obtained prior to proceeding with mechanized equipment. The waiver can be applied to multiple point disturbance locations across the site, provided each location is specified in the SSC Project Plan.
7. During clearance (and subsequent ground disturbance activities), watch for any warning signs indicating non-native soil, fill materials, and/or the presence of unexpected subsurface structures. If warning signs are observed, work must be stopped, the PM and PIC contacted, and this change managed per the requirements outlined in Section 8. Warning signs may include, but are not limited to:
- a. Any at-grade or above-grade visual clues
 - b. Refusal
 - c. Warning tape
 - d. Pea gravel / sand / non-native materials
 - e. Red concrete
 - f. Colored plastic covers
 - g. Voids/ cavities, or abrupt absence of soil
 - h. Any unexpected change from native soil
 - i. Any signs of damaged utilities in cuttings (broken materials, odors, etc.)
 - j. Any other unexpected condition
8. Once all SSC activities outlined in Section 4.9 have been fully completed, it is preferred to have the SSC EP remain onsite for all subsequent ground disturbance activities. However, once all point disturbance locations have been fully cleared and approved by the PIC, subsequent ground disturbance activities may be performed / overseen by an SSC GE. If the PIC and Local MP (or designee) waive the requirement to clear a point disturbance location prior to the use of mechanized equipment, the SSC EP must be present on site to oversee mechanized ground disturbance at that location until the minimum-required clearance depth (or project-specific clearance depth, if deeper) is reached.

4.10 EXCAVATIONS

Blades on shovels and post-hole diggers must have rounded or blunt noses. Pick axes, pointed spades, or any other tool that comes to a point are not to be used for excavation. Crow bars, pinch bars or pry bars must not be used to break hardened soil or backfill. The ERM EP or field team lead may authorize the use of bars only to loosen materials like bricks or larger stones so that removal of these materials is possible. Bars must not be used with excessive force.

The following steps are required:

1. An SSC EP must present on site to directly oversee all excavation and trenching activities, unless a waiver has been issued per the process outlined in Section 5.
2. JHAs must be developed that cover all excavation / trenching tasks. The JHA must be specific to the equipment and methods to be used. Unless the project team can positively determine that no subsurface structures are present, all tools and equipment used must be selected based on the potential risks (i.e., energized electrical lines, fiber optic cables, natural gas pipeline, etc.) that cannot be ruled out. In addition to selecting tools and equipment, appropriate safety measures, including the need for specialized PPE, must be evaluated with input from subject matter experts. JHAs must be reviewed by the SSC EP and PIC.
3. For excavation involving removal or working in close (2 feet / 0.6 m) proximity to subsurface structures (including those that are abandoned / decommissioned), the JHA must include appropriate emergency response measures, any additional personal protective equipment, and safe excavation and removal methods to prevent spills, damage to other structures, etc.
4. Inform all ERM field personnel and excavation subcontractor(s) of information regarding the location of subsurface structures, Critical Zones, and Excavation Buffers. Ensure that the following are clearly marked and communicated to all site personnel, for all subsurface structures crossing through the excavation/trench perimeter or located within the Critical Zone around the excavation/trench perimeter:
 - a. Locations/routes, including Excavation Buffers
 - b. Expected excavation depths to the Excavation Buffer
5. During ground disturbance activities, watch for any warning signs indicating non-native soil, fill materials, and/or the presence of unexpected subsurface structures. Warning signs may include, but are not limited to:
 - a. Any at-grade or above-grade visual clues
 - b. Refusal
 - c. Warning tape
 - d. Pea gravel / sand / non-native materials
 - e. Red concrete
 - f. Colored plastic covers
 - g. Voids/ cavities, or abrupt absence of soil
 - h. Any unexpected change from native soil
 - i. Any signs of damaged utilities in cuttings (broken materials, odors, etc.)
 - j. Any other unexpected condition

If any warning signs are encountered, stop work and contact the PIC/PM and site contact(s).

6. Material inside an Excavation Buffer can ONLY be removed by the following methods (this is not subject to waiver):
 - a. Compressed air excavation or pressurized water excavation (only with documented approval from the owner/operator of the utility or structure, and where allowed by law)
 - b. Hand digging tools

5. WAIVERS

There are four waivers to the SSC Procedure that can be granted:

1. Waive the requirement for a certified SSC EP to oversee execution of the SSC process, and allow instead for an SSC GE to do so (this could include the entire project or specific tasks);
2. Waive the requirement for private utility locates (performed by ERM subcontractors or ERM employees);
3. Waive the requirement for clearance of point disturbance locations prior to advancing with mechanized equipment (including no clearance or partial clearance); and
4. Waive the requirement prohibiting ground disturbance activities within a Critical Zone.

Both the Project PIC AND Local MP (or designee) must approve any waivers, with documentation in the ERM SSC Project Plan (can be documented in the field via notation of verbal approval or e-mail, with signature after project completion). If the Local MP is also the PIC on the project, then they must delegate the second review to another SSC-certified Partner (certified to GE or EP level) and BOTH must approve the waiver. To reiterate: two separate SSC-certified Partners must review and approve all waivers.

PICs and Local MPs (or designees) must work with the SSC EP and broader project team to ensure the SSC Procedure is executed and to use available information to make safe decisions regarding waivers. A member of the H&S Team and/or a locally identified subject matter expert (SME) may also be consulted regarding waiver decisions, in particular when the project involves some degree of complexity or uncertainty. Additional guidance on conducting this evaluation is presented in Appendix C, along with illustrative examples of waiver decisions.

Waivers should only be issued when both the PIC and Local MP (or designee) are reasonably assured that granting the waiver is a safe decision and will not result in any unacceptable risks. PICs and Local MPs (or designees) cannot waive compliance with any legislative or regulatory requirement; nor can they waive any client-mandated requirements without prior discussion with, and documented approval by, the authorized client representative. Waivers should not be granted solely based on cost.

Provided they are clearly defined in the SSC Project Plan (refer to Section 7) and approved by the PIC and Local MP (or designee), waivers can be applied to individual ground disturbance locations, multiple locations, or across the entire project site. They can also be applied conditionally based on the use of an agreed-upon decision tree approach (e.g., “if competent bedrock is encountered at depths shallower than 5 feet, and we are not in a Critical Zone, then the waiver for clearance of point disturbance locations can be applied to that location”).

6. TRAINING AND COMPETENCY REQUIREMENTS

There are two levels of certification for ERM staff engaged in SSC activities:

SSC GE Certification. SSC GEs (as defined in Section 3) must be certified by completing all of the requirements of the SSC GE Certification on ERM Academy and maintaining a status of “Certified / Renewal in Progress.” Current requirements for SSC GE Certification are summarized in Appendix D.

All employees directly involved in SSC or ground disturbance activities, or who work on, manage, serve as PIC, approve waivers, or make other safety-critical decisions on projects where ground disturbance activities are performed must have current SSC GE certification, at a minimum.

SSC EP Certification. Employees who will serve in the role of SSC EP must be certified as SSC EPs by completing all of the requirements of the SSC EP Certification on ERM Academy and maintaining a status of "Certified / Renewal in Progress." Current requirements for SSC EP Certification are summarized in Appendix D.

The Local MP must assess the skills and experience level of all prospective SSC EPs and provide documented approval to the ERM Academy Team in order for an employee to become fully certified as an SSC EP. The Local MP may also revoke SSC EP certification, at their discretion, based on feedback from others, inability of the EP to demonstrate competency, or other identified performance issues.

SSC GEs that lack the qualifications and experience to be SSC EPs must participate in mentoring to develop the skills and experience to become SSC EPs. SSC GEs can utilize the "SSC Mentorship Card" template (*ERM-1511-FM3*) to document field mentoring received by different SSC EPs.

Note: if an employee no longer requires / desires the above certifications, the Academy Certification must be 'Archived' on the employee's transcript.

Subsurface Utility Detection Equipment Operation Certification. ERM employees and subcontractors operating detection equipment must have experience and current training specific to the equipment they will be operating. Documentation of currently valid training must be obtained and included with the project HASP and in the project files. Training records for ERM employees must also be documented in ERM Academy.

If subsurface or overhead utilities will be de-energized by ERM employees or subcontractors, they must have formal and documented training for their role as required by local legislation and/or regulation.

Each region must develop a list of approved instructors for ERM SSC training, to be approved by the Regional H&S Leader in consultation with the regional management team.

Any changes to SSC training requirements are communicated to all affected employees via the ERM Academy Certification process.

7. DOCUMENTATION

Thorough and complete documentation of the execution of the SSC Procedure must be maintained at the project site for the duration of ground disturbance activities, with copies maintained in the project files.

Documentation and forms associated with the SSC Procedure include the following:

- **SSC Project Plan (ERM-1511-FM1)** – this plan is required for each phase of ground disturbance activities at a project site. The SSC Project Plan includes the scope of authorized ground disturbance and SSC activities to be performed, available sources of information, summary of subsurface structures, documentation of SSC field activities, and approval of any

waivers. The completed SSC Project Plan must be reviewed and approved by the PIC before any point disturbance clearance or ground disturbance activities may begin. If waivers will be granted, the SSC Project Plan must also be approved and signed by the Local MP or designee. Approvals can be initially documented in the field via notation of verbal approval or e-mail, with signature after SSC completion.

- **SSC “Low Risk” Project Plan (ERM-1511-FM2)** – version of the SSC Project Plan that can be used as an alternative for “low risk” ground disturbance sites, as defined in ERM’s Subsurface Clearance (SSC) Procedure – Low Risk Projects (*ERM-1511-PR2*).
- **SSC Audit Form (ERM-1511-FM3)** – used to conduct and document field audits of SSC projects, and found on the Active Leadership Audit Program (ALAP) site.
- **SSC Mentorship Card (ERM-1511-FM4, ERM-1511-FM4A)** – can be used by SSC GEs to document field mentoring received by different SSC EPs.
- **SSC Review Checklist for Subcontractors (ERM-1511-FM5)** – used to conduct and document safety meetings with subcontractor field personnel, to ensure they have been properly briefed on the applicable components of ERM’s SSC Process.
- **SSC EP Review Questionnaire (ERM-1511-FM6)** – used to conduct and document Local MP review of a prospective SSC EP candidate’s experience and competency.

Client required forms and/or equivalent field notes and sketches may be used in place of the SSC documentation outlined in this section, provided that the level and quality of documentation meets or exceeds that of ERM’s forms, as determined and documented by the SSC EP and approved by the PIC.

8. MANAGEMENT OF CHANGE

Any change that occurs during the execution of the SSC Procedure or subsequent ground disturbance activities must be managed safely and effectively. Examples of change may include, but are not limited to:

- Changes to the location, scope, extent, or depth of ground disturbance activities
- Changes to the equipment or methods used
- Changes in personnel
- Changes in schedule
- Changes in encountered field conditions, including subsurface conditions (e.g., change in soil type, presence of “warning signs,” or refusal)
- Changes to preliminary documentation based on encountered conditions in the field
- Previously unidentified / unanticipated safety issues or hazards
- Safety events

To manage change:

1. Work must be stopped or paused and the PIC and PM contacted. As warranted based on the nature of the change (see below for additional guidance), a member of the Safety Team should also be contacted.

2. A re-assessment of the risks must be conducted with the input of the PIC, PM, and SSC EP (or field team lead for sites with no EP assigned). Additional input must be sought from the Local Managing Partner or designee for waivers, and a member of the Safety Team should also be consulted as warranted based on the nature of the risks involved.
3. SSC project documentation must be updated as necessary to reflect the change(s). The HASP, JHA(s), and other Safety planning documents must also be updated as necessary.
4. Any site or client contacts must also be notified of the change(s).
5. If any unexpected subsurface structures or warning signs are encountered during clearance or ground disturbance activities, the area should be classified as a Critical Zone (if it was not already). Any further ground disturbance at the location or within 10 feet (3 m) must follow Critical Zone procedures and have an approved waiver in place.
6. Work cannot be re-started without the concurrence of the PIC, PM, and SSC EP (or field team lead for sites with no EP assigned).

9. SAFETY EVENTS

SSC-related safety events must be reported, managed, and investigated in accordance with ERM's Event and Non-conformity Management Procedure (*ERM-1200-PR1*) and Event Investigation Procedure (*ERM-1220-PR1*).

ERM classifies SSC-related safety events as follows:

1. Incident: Any injury, illness, damage to useful property, fire, explosion, spill, or other consequence that results from intercepting a subsurface utility or structure, either during the SSC process or subsequent ground disturbance activities.
2. Near Miss: Any unexpected encounter with a subsurface structure that is verified as not damaged, or is determined NOT to be useful property (e.g., abandoned) and therefore does not require any repair or replacement.

If a subsurface structure is intentionally exposed through use of a proper clearance technique to verify its location (or to comply with Excavation Buffer requirements), this is NOT considered a near miss. If a subsurface structure is intentionally exposed in order to excavate and remove it, this would also not be considered a near miss.

Refusal caused by rocks, difficult geology, debris, archaeological objects, or other natural matter is not considered a near miss.

Due to the inherent uncertainty associated with SSC, it is possible that unexpected encounters with previously unidentified subsurface structures may occur during clearance, even after having successfully completed all other required steps in the SSC process. If, however, it is determined that there were deviations or a lack of diligence in the execution of the SSC process that may have contributed to the near miss, and/or if there are potential significant learnings to be shared within the organization, then the event can be classified as a "high-learning value" near miss. This classification can be made by the SSC EP, PIC, Regional Safety Leader or Global Health and Safety Director (GHSD).

3. Observation: Any actions or conditions that contradict or reduce the protections to health and safety outlined in the SSC Procedure; OR, any behaviors or best practices that significantly enhance the protections to health and safety beyond those outlined in the SSC Procedure.

In addition to the requirements outlined in ERM's Event and Non-conformity Management Procedure and Event Investigation Procedure, the following requirements apply in the event of an SSC-related incident or near miss:

1. In the event of ANY unexpected encounter with a subsurface structure, immediately contact the owner/operator so they can de-energize or shut off the service(s), as warranted, and assess any potential or actual damage and discuss the need for any repairs. The owner/operator must be contacted EVEN IF we believe no damage has occurred. ERM employees and subcontractors will not attempt to assess the status of any potential damage, or attempt to make any repairs without the involvement of the owner/operator (unless ERM is the owner/operator and a trained ERM employee is available to de-energize or shut off the service). In the event of contact or potential contact with a subsurface structure, ERM and subcontractor personnel must observe a no touch principle. The service is to be considered live and potentially damaged, therefore hazardous, until investigated by a specialist.
2. As noted previously in Section 8, if any unexpected subsurface structures are encountered during clearance or ground disturbance activities, the area should be classified as a Critical Zone (if it was not already). Any further ground disturbance at the location or within 10 feet (3m) must follow Critical Zone procedures and have an approved waiver in place.
3. In the event of an incident or near miss involving high hazard/high value subsurface structures, the PIC must go to the site as soon as practical to lead follow-up activities and initiate the investigation. For all other incidents or near misses, the PIC must consult with the Local MP and Local H&S Lead to determine if a PIC visit to the site is necessary.
4. A Root-Cause Analysis (RCA) is required for all SSC-related incidents and "high-learning-value" near misses. The investigation, RCA, corrective and preventive actions, and Safety Alert must be completed in accordance with the Event Investigation Procedure (*ERM-1220-PR1*) (or in accordance with client or regulatory requirements as applicable).

10. AUDITING

To help assure safe operations on ERM SSC projects, audits will be conducted at a minimum as outlined below, using ERM's SSC Audit Form (or client-required equivalent form).

- Each Local MP (or designee) responsible for granting SSC process waivers must perform a minimum of one SSC audit per year. This audit must be conducted in the field to observe the implementation of the SSC process.
- SSC PICs must audit at least one SSC project per year (unless they do not serve as PIC on any SSC projects during that year). This audit must include both an office review of documentation and field review of implementation.
- Regional and/or Local H&S Leaders must perform at least two SSC audits per year if there are SSC activities that occur within the Country/Entity. These audits must include both an office review of documentation and field review of implementation.



SSC audit findings must be entered into ERM's online Active Leadership Audit Program (ALAP) system to allow for data trending, awareness and communication of lessons learned. Any identified corrective and preventative actions (CAPAs) must be entered into ERM's online CAPA database, which is used to assign, track and close CAPAs. It is the responsibility of the PIC to ensure that all CAPAs are completed by the assigned due date(s).

11. REFERENCES

- [ERM-1140-FM2 – Request for Procedure / Process Deviation](#)
- [ERM-1200-PR1- Event and Non-conformity Management Procedure](#)
- [ERM-1220-PR1 - Event Investigation Procedure](#)
- [ERM-1511-PR2 – Subsurface Clearance \(SSC\) Procedure – Low Risk Projects](#)
- [ERM-1511-FM1 - SSC Project Plan](#)
- [ERM-1511-FM2 - SSC "Low Risk" Project Plan](#)
- [ERM-1511-FM3 - SSC Audit Form](#)
- [ERM-1511-FM4 - SSC Mentorship Card](#)
- [ERM-1511-FM4A - SSC Mentorship Card - Large Size](#)
- [ERM-1511-FM5 - SSC Review Checklist for Subcontractors](#)
- [ERM-1511-FM6 - SSC Experienced Person \(EP\) Review Questionnaire](#)
- [ERM-1530-PR1 – Aquatic Work Management Program](#)
- [ERM-1545-GU1 - Guidance on Avoiding Contact with Overhead Utility Lines](#)
- [ERM-1934-PR1 - Monitoring and Measurement Procedure](#)

DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
5.0	Multiple	Added reference to new SSC procedure for low risk projects (ERM-1511-PR2) and removed reference to remote-greenfield sites (replaced by "low risk" procedure).	10 October 2022
5.1	References	Corrected URL to Low Risk Project Procedure	3 August 2023
5.2	1, App 5	Created reference to SSC exempted activities in new Appendix E	6 Sept 2023

*Additional version history available from obsolete document folder.

APPROVAL SIGNATURE



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Global H&S Director

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Main Process Steps

- Ensure all project personnel meet SSC EP and/or GE training requirements. Assign an EP to the project.
- Identify knowledgeable contact person(s). Request any available information from them and review preliminary Site Services Model with them.
- Obtain all available and relevant site-related information
- Conduct public utility locates (where available)
- Conduct a site walk with knowledgeable contact person(s) and visual clues survey of planned ground disturbance locations and surrounding areas
- Conduct private utility locates to locate and mark utilities on the project site
- Determine Critical Zones
- **Review completed SSC Project Plan with PIC, before any ground disturbance activity occurs**
- Clear each point disturbance location prior to using any mechanized equipment. Adhere to Excavation Buffers for excavations and trenches.

Documentation

- SSC Project Plan (ERM-1511-FM1)
- SSC Audit Form (ERM-1511-FM3)
- SSC Mentorship Card (ERM-1511-FM4)
- SSC Review Checklist for Subcontractors (ERM-1511-FM5)
- SSC EP Review Questionnaire (ERM-1511-FM6)

Managing Change

- Following any change, work must be stopped or paused to review the potential change in risks.
Work cannot be re-started without the concurrence of the SSC EP, PIC, and PM.
Examples include: Changes in the locations, dimensions, or extent of planned ground disturbance locations; Changes in equipment or methods to be used; Changes in personnel; Any safety event or identified hazard

APPENDIX B GUIDANCE ON SELECTION AND USE OF DETECTION EQUIPMENT

Work Order Instructions for Private Utility Locate Subcontractors

Below is example language that can be incorporated into work orders, work authorizations, or subcontract work agreements for private utility locate subcontractors.

- Utility locates must be performed by qualified, trained, and competent personnel.
- Documentation of training and experience on equipment operation for all on-site personnel must be provided to ERM at least two working days in advance, for review by the ERM Partner-in-Charge and Project Manager.
- No work of any kind is to be performed at the project location without authorization by the ERM on-site field lead and direct oversight of ERM personnel.
- A job hazard analysis (JHA) or similar document must be developed for all tasks and provided to ERM at least two working days in advance for review.
- All equipment must be:
 - Maintained according to manufacturer specifications with maintenance records immediately available to ERM on-site personnel, as well as any other personnel with a need to know, upon request.
 - Calibrated according to manufacturer specifications, if applicable. Calibrations (if applicable) must be documented and immediately available to ERM on-site personnel, as well as any other personnel with a need to know, upon request.
 - Tested at the start of each work day and verified to be functioning properly.
- At a minimum, the following types of equipment are to be brought to the site and used to locate utilities (*note: it is best to develop this list in consultation with the private locator*):

-
- For electromagnetic tools and equipment, equipment must be operated in all available/relevant modes, including passive/power, passive/radio, and active modes. Active tracing methods are to be used whenever possible, using the conductive (direct connection) or inductive method.
 - For ground penetrating radar (GPR), the following depths need to be achieved / antennae frequencies used (*note: it is best to develop this list in consultation with the private locator and in due consideration of site specific considerations*):

-
- Based on the site information provided, the locations and routes of all identified or suspected subsurface structures must be investigated by the private utility locate subcontractor and the results of the investigations documented. Known or suspected subsurface structures that

cannot be confirmed via the investigations will be clearly displayed on a map with the types of locating equipment and settings employed, and limitations of said equipment (i.e., depth, interferences, etc.) noted.

- The area within a minimum 10-foot (3-m) distance around all planned ground disturbance locations shall be assessed for the potential presence of any structures. Note that a larger, more inclusive distance may be specified as warranted by site specific conditions.
- All identified or suspected subsurface structures within the defined boundaries of the work area shall be marked with paint or other semi-permanent markings in accordance with local regulatory, client, or industry standards.
- A signed and dated report must be provided upon completion of activities, including:
 - A summary of equipment used and mode(s) of operation, including maintenance and calibration records as noted above;
 - Names of operators and documentation of experience and training;
 - A general map/sketch and summary of findings; And
 - Any limitations

Applicability Matrix

The following guidance should be used as a starting point to assess potentially applicable detection equipment for a project. Each project may have unique conditions, therefore do not use this table as the sole decision criteria for technology selection.

Technology →	Electro-Magnetic Detection ¹					Ground Penetrating Radar (GPR) ³	Acoustic Plastic Pipe Locator	Cesium Magneto meter ⁴
	Cable Avoidance Tool (CAT)			Ground Conductivity Meter (e.g., EM-31 or EM-61)	Probe, Beacon, Sonde, or Trace Wire			
Subsurface Utility / Structure ↓	Passive – “Power” Mode ²	Passive – “Radio” Mode ²	Active Mode Using Signal Generator ²					
Electric / Instrument Line (Energized/Signaled ⁵)	G	G	G	R	R	Y	R	Y
Electric Line (Non-energized)	Y	Y	G	R	R	Y	R	Y
Sewer/Water Line (Metallic)	Y	Y	G	Y	G	>12" diameter G	Y	Y
						<12" diameter Y		
Sewer/Water Line (Non-metallic)	R	R	R	R	G	>12" diameter G	G	Y
						<12" diameter Y		
Instrument/Telecomm (Non-energized)	R	R	Y	R	R	Y	R	R
Fiber Optic Cable	R	R	R	R	Y ⁶	R	R	R
Fiber Optic w/tracer or in with a group of cables	G	Y	Y	Y	N/A	Y	R	
Natural Gas (Metallic)	G	G	G	G	R	>12" diameter G	R	G
						<12" diameter Y		
Natural Gas Line (Non-metallic/PVC) ⁷	R	R	R	R	R	>12" diameter G	R	R
						<12" diameter Y		
Metallic/Non-Metallic Line (w/Tracer Wire)	G	G	G	Y	Y	>12" diameter G	Y	Y
						<12" diameter Y		
Metallic/Non-Metallic Line (w/o Tracer Wire)	R	R	Y	Y	Y	>12" diameter G	Y	R
						<12" diameter Y		
Metal UST	Y	Y	G	G	R	G	R	G
Fiberglass UST	R	R	R	R	R	G	R	Y

Additional Considerations

Technology →	Electro-Magnetic Detection ¹					Ground Penetrating Radar (GPR) ³	Acoustic Plastic Pipe Locator	Cesium Magneto meter ⁴
	Cable Avoidance Tool (CAT)			Ground Conductivity Meter (e.g., EM-31 or EM-61)	Probe, Beacon, Sonde, or Trace Wire			
Variable ↓	Passive – “Power” Mode ²	Passive – “Radio” Mode ²	Active Mode Using Signal Generator ²					
Moist Soil	G	G	G	Y	G	Y	G	Y
Dry Soil	Y	Y	G	Y	G	G	Y	G
Clay	Y	Y	Y	Y	G	R	G	Y
Concrete w/Rebar	R	R	Y	R	G	Y	G	R
Man-made fill such as construction/demolition debris, coal ash, slag, etc	Y	Y	Y	Y	G	Y	Y	Y
Long Horizontal Profile	G	G	G	G	G	G	G	G
Short Horizontal but Deep Vertical Profile	Y	Y	Y	Y	R	G	R	G
Access to Line ⁸	G	G	G	N/A	G	N/A	G	N/A
No Access to Line ⁸	Y	Y	R	G	R	G	Y	G
Ferrous Metal	G	G	G	G	G	G	G	G
Non-ferrous Metal	Y	Y	G	Y	G	G	G	Y

Green (G): Generally an applicable technology

Yellow (Y): May or may not be applicable

Red (R): Not generally applicable

1 = Site structures, rebar in concrete, etc. can significantly affect performance and reliability of any electromagnetic method.

2 = The CAT should be used in 3 modes:

- In the Power mode, the CAT can detect signals radiated by loaded cables. This is used to detect, locate and avoid buried electrical cables.
- In the Radio mode, the CAT detects VLF radio signals re-radiated by buried metallic pipes and cables. This is used to detect, locate and avoid other buried metallic pipes and cables such as natural gas, phone & communication lines, ducts & water services.
- In the Active mode, the CAT detects a tone radiated by a signal generator (“Genny”) to a buried conductor. This is done by directly connecting the signal generator to the source via plug sockets, valves, etc.

3 = Most sensitive to interpretation and soil conditions; the skill, training, and experience of operator are critical. Also note that the size and power of GPR antenna arrays can provide variable results and pick up signals at different depth ranges.

4 = Sensitive to noise and operator error. Generally more applicable for large targets.

5 = Metallic lines that have power running through them or can be connected to a tracer signal generator.

Caution should be exercised when attaching a transmitter to high-voltage lines for active trace with CAT.

6 = If the fiber optic cable is in a conduit, it may be possible to trace the line using a probe

7 = Assumes no tracer wire installed through which a signal can be induced.

= Access: induce unique electronic signature, apply acoustical impulse, or insert probe/beacon/sonde.

Additional Considerations

- Communicate the detailed scope of work and review all available SSC information with private locators in advance, prior to mobilizing to the site. This way they can bring the appropriate equipment and schedule sufficient time to achieve the clearance objectives.
- Provide all available information to locators to help them confirm the routes of all known or suspected services. This includes but may not be limited to: as-builts, public locator responses/markings, knowledgeable site contact(s) information, results of visual cues survey, and known or suspected types of subsurface structures present (including the presence of any high-voltage or 3-phase electrical lines).
- Ensure that utility locators are thorough and use multiple tools and methods. Ground penetrating radar (GPR) surveys should be used wherever possible.
- Consider the need to perform at least two different depth scans with GPR: (1) a higher frequency near-surface scan and (2) a lower-frequency scan within the target depth range for site services. This is especially critical for sites with shallow buried utilities and/or concrete slabs or other engineered surfaces, where utilities may be direct buried within or directly below the surface.
- For electromagnetic (EM) location, insist on active tracing methods using conduction or induction of a signal wherever possible.
- Ask the private locators about any issues or limitations with their surveys, especially if other lines of evidence conflict with their markings, or if they cannot identify known or suspected subsurface structures.

APPENDIX C WAIVER GUIDANCE AND EXAMPLES

Introduction

“Reasonably assured” denotes the standard that must be satisfied for Partners-in-Charge (PICs) and Local Managing Partners (MPs) or their designees to grant waivers to the execution of (or, more precisely, make an explicit decision to allow non-performance of) portions of the Subsurface Clearance (SSC) Procedure. There are four waivers to the SSC Procedure that can potentially be granted:

1. Waive the requirement for a certified SSC EP to oversee execution of the SSC Process, and allow instead for an SSC GE to do so (this could include the entire project or specific tasks
2. Waive the requirement for private utility locates (performed by ERM subcontractors or ERM employees);
3. Waive the requirement for clearance of point disturbance locations prior to advancing with mechanized equipment (including no clearance or partial clearance); and
4. Waive the requirement prohibiting ground disturbance activities within a Critical Zone.

This guidance is intended to present a risk-based framework through which being “reasonably assured” may be assessed.

Definition and Factors to Consider

Being “reasonably assured” means that one would make the same decision as another PIC concerning a waiver, based on the same set of factors. PICs and Local MPs (or designees) should integrate the following two factors into their decisions to issue a waiver:

1. Available pieces of information/data about the services present in the subsurface, and quality of that information/data.
2. Relative hazard of striking the services known or suspected to be present (i.e., not confirmed as absent from the site).

The relative hazard of striking a service can be prioritized in terms of the potential severity of such a strike in terms of health, safety, environmental, or financial / reputational consequences. All other things being equal, an example prioritized list of common underground services – from high hazard to low hazard – might include:

1. High / medium voltage electrical cables
2. Low voltage electrical cables
3. Pressurized gas lines
4. Other pressurized pipelines
5. Fiber optic cables
6. Gravity drain process sewers
7. Gravity drain sanitary sewers
8. Gravity drain storm sewers

The particular circumstances of the site (e.g., active or inactive facility), whether or not the lines are energized, and whether or not the routes of the services are known or would meet the definition of “Useful Property” may change the relative hazard ranking.

Multiple, high-quality pieces of information/data and low relative hazard support granting waivers. Limited and/or low-quality lines of evidence and high relative hazard do not support granting waivers. This can be illustrated using the following diagram:

THE WAIVER MATRIX

		Pieces of Information / Quality	
		Less	More
Relative Hazard of Striking the Service	Higher	No Waiver	Caution
	Lower	Caution	Waiver Possible

The way in which these factors are considered can be illustrated by the example on the following page.

Example Project

An ERM team has been awarded a project to assess suspected impact at an inactive manufacturing site. The client previously demolished all surface structures, but did not fully address the process sewer. Some surface clues are present. The project team is planning to complete 25 soil borings along the run of the former process sewer within 1 m of the sewer lines, looking for potential impact. The site is known to be constructed over man-made ground, and debris is widespread over the site in the 0-1 m depth interval.

The SSC Procedure first asks the project team to evaluate the available information sources about subsurface risks. This is documented in the Project Information Summary section of the SSC Project Plan. The more information sources that are checked “Yes” indicates more lines of evidence potentially established. Comments regarding the quality or reliability of those lines of evidence should also be noted and weighed in subsequent decisions. Project teams are also asked to assess the potential underground services at a site. The goal is to ultimately confirm either the presence or absence of such services from the work area. The presence / absence and knowledge of the routes of subsurface services on the Example Project site are noted in the Site Services Model, as shown in the following example:

EXAMPLE PROJECT SITE SERVICES MODEL (PRE-MOBILIZATION FOR DRILLING)

Site Services Model								
Utility / Structure	Present?			Anticipated depth (note units)	Located?		Status (active, inactive, abandoned, etc)	Comments (For each, describe how located and quality of information available)
	Yes	No	Un-known		Yes	No		
Electricity	x			2m	x		De-energized from substation	On Site Plan; public util. markouts confirm
Gas	x			2m	x			Present on site, but blinded at street
Petroleum Pipeline		x						Not present
Other Pressurized Lines	x			1m		x		H2 pipeline crosses former process area
Process Sewer	x			1m	x		Deactivated, but not abandoned	On Site Plan
Sanitary Sewer	x			??		x	Deactivated, cut and blinded at street	On Site Plan
Storm Sewer		x					Previously abandoned by client	On Site Plan
Potable Water		x						Not present
Telephone / Communication		x						Per phone company, none on-site
Fiber Optic		x						Not present
Plant air / steam		x						Not present
Fuel / oil		x						Not present
Reclaimed / waste water		x						Not present
Fire suppression		x						Not present
Underground tank(s)		x						On Site Plan; public util. markouts confirm
Other (Describe):		x						

Decisions on granting waivers should be based on considerations of what is known (or will be known, based on planned work activity) and what risks are present from the identified services at the site.

In this case, there are three potential waiver decisions for the PIC and Local MP (or designee) to make:

- Waiving the private utility mark-out,
- Waiving the need for point disturbance clearance, and
- Advancing within Critical Zones (within a 3-meter envelope of a sewer line).

The thought process includes weighing the lines of evidence against the relative hazard of the services known or suspected. In the end, the PIC and Local MP (or designee) must ask themselves if they are reasonably assured that the decision to grant a waiver is a safe one.

Consultation with the SSC Experienced Person (EP) and others on the project team, as well as a

member of the H&S Team, may assist the PIC and Local MP (or designee) in making the decision. In the end, both the PIC and Local MP (or designee) are the only ones who may grant a waiver.

What follows is an illustration of the decision-making process, based on the situation presented in the Example Project.

Waiver Decision: Private Markouts

The Project Information Summary suggests that the team has two of four possible lines of evidence in hand (a site plan and public utility markouts). The Site Services Model suggests that while those lines of evidence have provided us with a good idea about the locations and status of some high-hazard services and the former process sewer, they have not provided any sufficient detail about the hydrogen pipeline, which is known to be active and suspected to be running through the work area. That is, we have zero lines of evidence concerning the route of the hydrogen pipeline.

The private utility markout is the only available option for obtaining a line of evidence on the hydrogen pipeline. While that provider is on site, they may also be utilized to verify the route of the process sewer (as a second line of evidence) and the status of the de-energized conductors (i.e., that they are indeed de-energized). Additional lines of evidence never hurt!

THE PRIVATE UTILITY MARKOUT WAIVER DECISION

To continue the example, the PIC and Local MP were not reasonably assured that it would be safe to waive the Private Utility markout and thus decided not to grant the waiver.

For purposes of the example, assume that the private utility markout was used to:

- Verify the route of the process sewer (which was found to align well with available surface clues and the site plan),
- Confirm that the electrical conductors are indeed de-energized, and
- Identify the route of the hydrogen pipeline (which was found to be distant from the process sewer).

		Pieces of Information / Quality	
		Less	More
Relative Hazard of Striking the Service	Higher	No Waiver	Caution
	Lower	Caution	Waiver Possible

Waiver Decision: Allowing Ground Disturbance within a Critical Zone

In addition to being “reasonably assured” about the safety of advancing within a Critical Zone, the PIC and Local MP are also required to factor the following into their decisions:

- If possible, energized pipes or cables within the Critical Zone should be de-energized.
- Ground disturbance activities within the Critical Zone do not present an unacceptable safety, environmental, or operational risk, either on-site or off-site.

In this case, with the process sewer, there is no need to de-energize it (it is inactive). If the sewer were to be struck, however, there is certainly an environmental risk – but there is some

question as to it being an “unacceptable” risk. For the time being, assume that the PIC, Local MP, and project team believe the risk to be “acceptable”.

Even though the first position, of course, is to not advance within the Critical Zone unless absolutely necessary, the technical objectives of the Example Project require that the team advance borings within the Critical Zone (i.e., close to the lines). Taking that into consideration, the PIC and Local MP review the Project Information Summary and the Site Services Model – both of which have evolved with the execution of the private locator service. The PIC, Local MP, SSC EP and project team ask, “Given what we know, are we reasonably assured that we will not strike the sewer line?”

By virtue of the private utility markout, the team now has an additional line of evidence about the route of the former process sewer and a high degree of confidence in it. The process sewer is not energized and is on the lower end of the relative hazard scale.

THE CRITICAL ZONE WAIVER DECISION

All things being equal, the PIC and Local MP are reasonably assured that advancing within the Critical Zone would be a safe decision, and will grant the waiver to allow the work inside the Critical Zone to proceed.

Waiver Decision: Point Disturbance Clearance

Recall that there is widespread subsurface debris at the site, mostly present in the 0-1 meter depth interval. Ground disturbance will occur inside a Critical Zone, which requires point disturbance clearance to the deeper of:

- 2 feet / 0.6 meters beyond the expected bottom depth of the service (in this case, up to 2.4 meters given the depth of the process sewer);
- 8 feet / 2.4 meters; or
- 2 feet / 0.6 meters below the frost line.

In this example, the required depth of clearance is 2 feet beyond the expected bottom depth of the sewer line. However, given the logistical and technical challenges of clearing the locations given the presence of debris, should the PIC and Local MP waive the requirement for point disturbance clearance?

		Pieces of Information / Quality	
		Less	More
Relative Hazard of Striking the Service	Higher	No Waiver	Caution
	Lower	Caution	Waiver Possible

THE POINT DISTURBANCE CLEARANCE WAIVER DECISION

There are multiple, good quality lines of evidence that confirm the routes of nearby services (as well as the absence of others), and the former process sewer ranks low in terms of relative hazard. In this case, the PIC is reasonably assured that waiving the point disturbance clearance requirement is a safe decision.

Another Case to Consider

In the example above, circumstances led to fairly clear-cut decisions for granting waivers to the SSC Process. Considerations of the lines of evidence and relative hazard tended to the regions of "Waiver Possible" in the Waiver Matrix. Real world circumstances may lead to less clear-cut decisions and more ambiguity in being reasonably assured.

As an illustration, replace the former process sewer in the example above with an energized high voltage electrical cable. For the project, it is required to sample within 1 meter of the cable. Assume that the private utility markout was performed, and that the route of the cable determined from that work matches well with what is shown on the site plan. Should the PIC and Local MP allow advancing within the Critical Zone?

THE HIGH VOLTAGE CABLE CRITICAL ZONE WAIVER DECISION

There are several quality lines of evidence that provide the route and location of the high voltage cable. Striking the cable would indeed be very hazardous. The Waiver Matrix indicates approaching the waiver decision cautiously. Indeed, that is exactly what the PIC and Local MP should do.

If the cable can be de-energized to reduce the hazard, then a Waiver to advance inside the Critical Zone would certainly be a safer decision. But what if the local utility says that the cable cannot be de-energized? The project requires advancing borings inside a Critical Zone. Even though the team believes that they have a very good understanding of the location of the service, the potential magnitude of the hazard is high, and presents a level of risk that would likely be unacceptable. In this case, not allowing the disturbance within the Critical Zone (i.e., not granting the waiver) may be the best decision.

Additional considerations may be taken into account here. For example:

- Would it be possible (after discussion with the client and discussing the risks) to advance farther away from the service (i.e., is it really necessary to get within 1 meter of the service)?
- Have we confirmed that the selected point disturbance clearance method uses non-conductive equipment?
- Might another discussion with the utility be useful in terms of de-energizing the high voltage cable?

		Pieces of Information / Quality	
		Less	More
Relative Hazard of Striking the Service	Higher	No Waiver	Caution
	Lower	Caution	Waiver Possible

		Pieces of Information / Quality	
		Less	More
Relative Hazard of Striking the Service	Higher	No Waiver	Caution
	Lower	Caution	Waiver Possible

- Are there any additional safety precautions (e.g., grounding the drilling equipment) that might reduce the relative hazard?

Final Notes

Some waiver decisions may affect other waiver decisions. For example, waiving the private utility markout eliminates a potential high-quality line of evidence. Not having this line of evidence will affect the ability to be reasonably assured that permitting work within a Critical Zone or waiving the point disturbance clearance is a safe decision. Additionally, not being able to conduct point disturbance clearance will affect the ability to be reasonably assured that working inside the Critical Zone is a safe decision. Each waiver that is granted reduces or removes a safeguard, and extreme caution must be exercised when granting multiple waivers on a single project site.

In the end, the PIC and Local MP should err on the side of caution when it comes to making any waiver decision. PICs and Local MPs must ultimately be “reasonably assured” that a waiver decision is a safe one for their project team, subcontractors and client.

APPENDIX D SSC TRAINING CERTIFICATION REQUIREMENTS

SSC GE Certification Process		
Initial Training	Required Element:	How Completed:
	Initial SSC Training	2.5 Hour Event (Instructor-Led Session)
	Post-Work Quiz	Online Test
	Acknowledgement of Procedure Review	Online Material
Refresher Training	Required Element:	How Completed:
	Annual Refresher Class	1 Hour Event (Instructor-Led Session)
	Post-Work Quiz	Online Test
SSC EP Certification Process		
Initial Training	Required Element:	How Completed:
	Initial Training	2.5 Hour Event (Instructor-Led Session)
	Post-Work Quiz	Online Test
	Acknowledgement of Procedure Review	Online Material
	EP Competency Assessment	Online Test
	Documentation of Experience	Online Form – enter 5 to 10 projects
	SSC EP Approval Questionnaire	Standardized questionnaire completed by Local MP (or Partner-level designee) based on input from Line Manager of candidate, PICs the candidate has worked for, and EPs that have mentored the candidate. Upon receipt of completed and signed questionnaire, Academy Team will mark EP status as Certified.
Refresher Training	Required Element:	How Completed:
	Annual Refresher Class	1 Hour Event (Instructor-Led Session)
	Post-Work Quiz	Online Test
	Documentation of EP Assignment during previous 12 month period	Online Form – EP will need to document at least 1 field assignments over the previous 12 months where they served as EP and completed SSC Project Plan. This requirement can only be “exempted” under direction of Local MP via formal request to Academy.
	Documentation of Partner SSC Audit during previous 12 month period	Online Form – EP will need to verify that at least 1 SSC Audit was completed by a SSC certified Partner, TD, or H&S Team Member over previous 12 months on a project where they served as EP. This requirement can only be “exempted” under direction of Local MP.

APPENDIX E SSC EXEMPTED ACTIVITIES

Any ground disturbance activities that could reasonably damage subsurface utilities or structures or cause some other safety consequence should be appropriately assessed using the SSC procedure. If project teams have any questions about the applicability of the SSC procedure to their activities, they should contact their Local H&S Lead.

The following ground disturbance activities have been assessed by the H&S Team and determined not to pose a significant risk of subsurface incidents, and are exempted from ERM's SSC procedure. Note that project teams must still identify and comply with any regulatory, industry, or client requirements that may apply to these activities.

1. Collecting surface sediments with hand tools, where the tools are used to "scrape" across the top surface and are not pushed or driven vertically into the subsurface.
2. Collecting surface sediments with a hand-driven multi-increment sampling tool (for example: <https://www.envirostat.org/sampling-tools/>), where the tool is used in accordance with manufacturer instructions without any modifications, the penetration depth does not exceed 5 cm (2 inches), and an approved risk assessment (HASP, JHA) clearly describes the expectation and use of the tool (to include indications of why/when the tool should NOT be used).
3. Pushing pin flags by hand into the ground to mark planned work locations.
4. Pushing blunted bamboo canes into the ground by hand (without use of hand tools) up to a depth of 15 cm (6 inches) for biodiversity surveys.

Avoiding Contact with Overhead Utility Lines

DOCUMENT DETAILS

DOCUMENT TITLE	Avoiding Contact with Overhead Utility Lines
DOCUMENT NUMBER	ERM-1545-GU1
Approval Date	7 December 2023
Version	1.3
Applicability	Global

1. BACKGROUND

Every year people are killed or seriously injured when they come into contact with overhead utility lines. Many ERM sites contain electrical hazards that must be recognized and controlled. Good management and planning, before and during any work close to overhead lines, will reduce the risk of accidents. Construction equipment such as excavators, cranes, dump trailers, aerial lifts and drill rigs all have the potential for accidental contact with utility lines. If contact or an electric arc occurs, electricity will be conducted to ground. This can cause fire or explosion and electric shock or burns to anyone in the immediate area. You should manage the risks if you intend to work within a distance of 10 m (30ft), measured at ground level horizontally from below the nearest wire.



2. STOP AND LOOK UP!

People do not often “see” utility lines or more likely they blend into the background due to poor visibility, overcast conditions, or blending into the horizon.

3. IF CONTACT IS MADE

- Clear area and suspend all work within 50m (165ft) and assume line is still live.
- If machine is still operable:
 - Lower any raised parts that can be controlled from inside the cab.
 - Drive the machine clear of the line as long as these actions do not risk breaking the line or dragging it to the ground.
- If the machine is inoperable or cannot be cleared from the line:
 - Stay in cab. Instruct everyone outside not to approach.
 - Contact utility company immediately
 - Do not leave machine till given the "all clear" by the utility company
- If the machine is inoperable and there is immediate risk to the operator, the operator should move away from the equipment, but never contact the equipment and ground simultaneously ("jump clear" of machine to avoid creating a path to ground).
- Move away using the "shuffle method". This is done by shuffling your feet with short steps, keeping both feet together and on the ground at all times. Alternatively, "hop" away with feet together until at least 50m (165ft) away.
- Do not return to the machine, or enter the 50m (165ft) exclusion zone, until given confirmation by utility company personnel that it is safe to do so.

5 Rules to Live by...

1. When planning work and before setting up machinery on site always **LOOK UP** and check for overhead utility lines
2. Treat all overhead lines as energized and dangerous. Any contact may be fatal or cause serious injury
3. Lock out or turn off power when possible.
4. Maintain safe distance as electricity can arc or "jump" gaps.
5. Illuminate the work area in poor light conditions.

4. RISK CONTROL

If the overhead line cannot be diverted or locked out, and there is no alternative to carrying out the work near it, you will need to plan how the work can be done safely. Your site-specific **HASP** and associated **JHAs** will inform the decision. Things to consider as part of your HASP include: the voltage and height above ground of the wires; the nature of the work and whether it will be carried out close to or underneath the overhead lines; the size and reach of any machinery or equipment to be used near the overhead line; and the safe clearance distance needed between the wires and the machinery or equipment. If in any doubt, contact the overhead line's owner to advise you on safe clearance distances. Site conditions must be considered, e.g. undulating terrain may affect stability of equipment etc. as well as the competence, supervision and training of people working at the site.

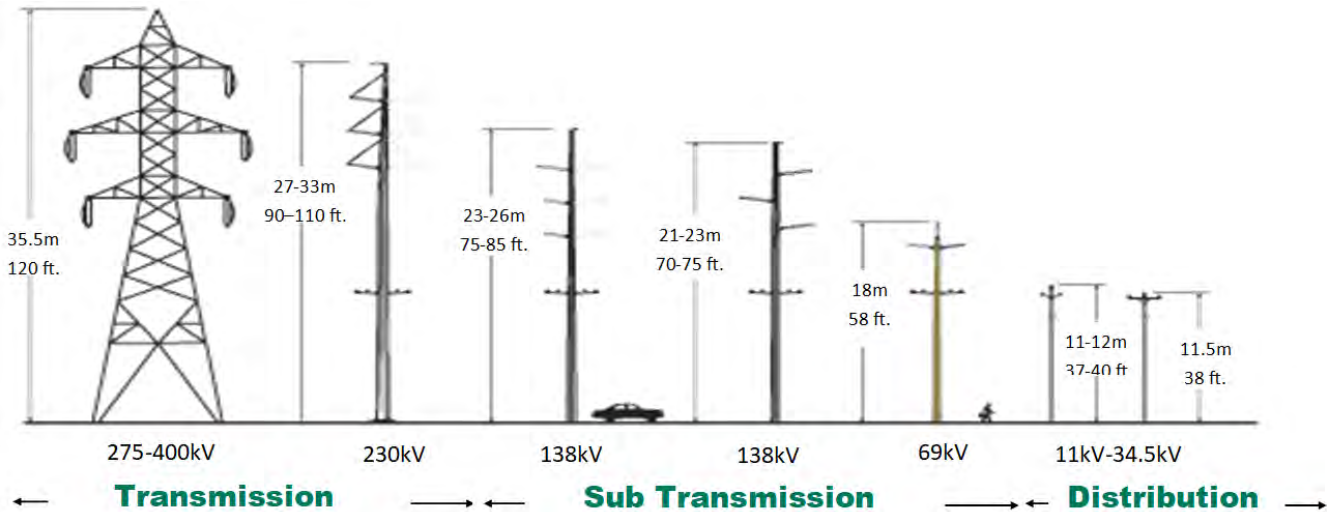
Where there will be no work or passage of machinery or equipment under the line, you can reduce the risk of accidental contact by erecting ground-level barriers to establish a **SAFETY ZONE**. This area should not be used to store materials or machinery. The **SAFETY ZONE** should extend 10m (30ft) (horizontally from the nearest wire on either side of the overhead line. It may

be possible to reduce the width of the safety zone but you will need to make sure that there is no possibility of encroachment into the safe clearance distances in your JHA.

Work should not take place close to or under an overhead line during darkness or poor visibility conditions.

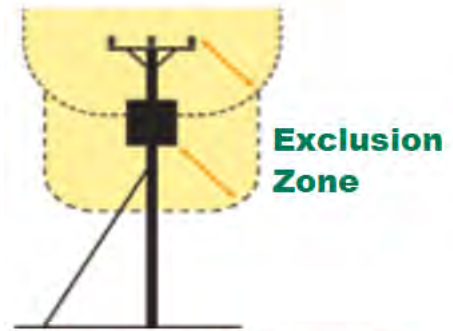
The illustration below provides a general guide to for the height of utility various utility lines.

NOTE: this is general guidance only and actual heights MUST be verified by the utility owner.



5. EXCLUSION ZONES

- Overhead power lines are not normally insulated and so any contact can result in serious or fatal injuries.
- Electricity at high voltages can also arc or “jump” gaps with no warning whatsoever, so it is also dangerous to let your machine approach too close to a line.
- The distance that electricity can arc or “jump” depends on the voltage of the line. The higher the voltage, the further you must stay away from the line and any other equipment that may be fitted to the pole or pylon. This distance is called the **EXCLUSION ZONE**.
- You must not allow any part of your equipment to enter the **EXCLUSION ZONE**.
- The table on the right provides a guide to help assess the minimum **EXCLUSION ZONE DISTANCE** for each voltage range. Check your local regulations to verify distances.



***Distances may vary by country**

Up to 50 kV: 3m (10 ft)

Over 50 to 200 kV: 4.5m (15 ft)

Over 200 to 350 kV: 6m (20 ft)

Over 350 to 500 kV: 8m (25 ft)

Over 500 to 750 kV: 11m (35 ft)

Over 750 to 1,000 kV: 14m (45 ft)

6. SAFE STAND OFF DISTANCE

The best way to make sure you stay out of the **EXCLUSION ZONE** is to position your machine at a **SAFE STAND OFF DISTANCE** so that, even when fully extended, no part of it can accidentally reach inside the **EXCLUSION ZONE**.

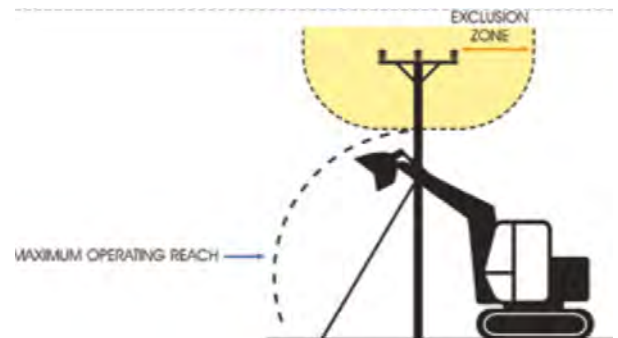
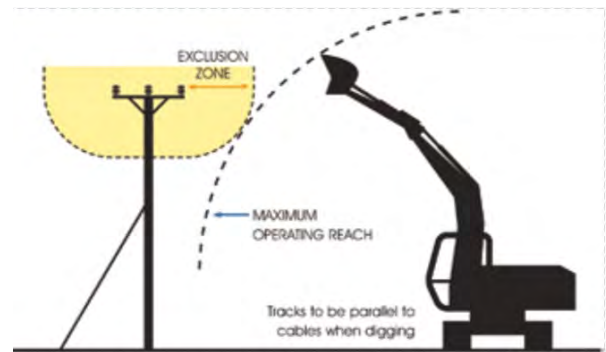
This **SAFE STAND OFF DISTANCE** can be calculated by adding the **EXCLUSION ZONE** distance for the appropriate voltage of the line to the Maximum Operating Reach of your machine. If you position your machine outside of the **SAFE STAND OFF DISTANCE**, there is no risk of accidental contact with the lines.

If you cannot achieve a **SAFE STAND OFF DISTANCE**, your machine must be moved to a safer location. The next best option would be to consider using a smaller machine with a Maximum Operating Reach that cannot enter the **EXCLUSION ZONE**.

You may not be able to achieve either of these options, so, as a last resort, if you cannot avoid operating in the vicinity of lines, you **MUST** make sure that the work area is fitted with restraints to ensure that the **EXCLUSION ZONE** cannot be entered. These restraints may be electrical or hydraulic systems fitted to the machine, or mechanical devices such as chains. Please seek advice from the equipment manufacturer for more information on choices available for your particular machine.

If you are using a mechanical excavator to dig parallel to the line, it is good practice to position the excavator with the tracks or wheels parallel to the line, so as you move along the excavation the **SAFE STAND OFF DISTANCE** is easily maintained.

Care must also be taken to avoid non-mechanical equipment, (e.g. scaffold poles, ladders and long loads such as lengths of steel or timber) from entering the **EXCLUSION ZONE**.



7. PASSING UNDERNEATH OVERHEAD LINES

If equipment or machinery capable of breaching the safety clearance distance has to pass underneath overhead lines, best practice is to create a defined passageway underneath the line(s). The HASP should make provisions to : keep the number of passageways to a minimum; define the route of the passageway; put warning notices at either side of the



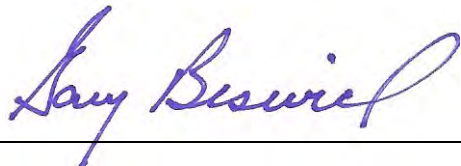
passageway that are on or near the goalposts giving the crossbar clearance height and instructing drivers to lower jibs, booms, truck bodies etc and to keep below this height while crossing; you may need to illuminate the notices and crossbar at night or in poor weather conditions to make sure they are visible; make sure that the barriers and goalposts are maintained.

DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
1.2	All	Update	15 Feb 2021
1.3	All	Moved to new format	12 Dec 2023

*Additional version history available from obsolete document folder.

APPROVAL SIGNATURE



Gary Beswick

Global H&S Director

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Waste Management Planning

DOCUMENT DETAILS

DOCUMENT TITLE	Waste Management Planning
DOCUMENT NUMBER	NAM-1122-PR1
Approval Date	14 August 2023
Version	08
Applicability	North America

1. PURPOSE AND SCOPE

This procedure outlines general planning steps that should be followed on projects where ERM's activities (or those of ERM's subcontractors) are likely to create wastes or where ERM has taken some contractual responsibility for handling waste for the client. ERM generally does not generate significant hazardous or non-hazardous waste as part of its operations, since ERM's role is typically limited to supporting waste management activities of the client (owner or responsible party). In those situations, ERM does not direct or control waste management activities, but will use the waste management plan developed by the client.

This procedure is not intended to address all possible waste management situations. Project-specific adjustments may need to be made as appropriate depending on specific circumstances.

2. ROLES AND RESPONSIBILITIES

Partner in Charge (PIC): Responsible for the following elements:

- Ensure this procedure is implemented, understood, and followed by employees under their charge and working on their projects, and
- Correct any deficiencies in the implementation of this procedure.

Project Manager (PM): Responsible for the following elements:

- Perform observations of ERM work processes to assess employee compliance with this procedure,
- Inform project employees of site-specific waste management procedures,
- Stop work where deviations from this procedure are observed, and
- Correct, in conjunction with the PIC, any observed deficiencies in the implementation of this procedure.

3. DEFINITIONS

None.

4. PROCEDURE

For projects described in Section 1, a waste management plan specific to the project activities should be developed. The plan should address the following basic elements:

- Assessment of the nature and type of waste,
- Estimate of the amount of each waste that may be created,
- Evaluation of the proper handling, storage, transportation and disposal methods appropriate to manage the identified wastes,
- Evaluation of specific personal protective equipment to be worn, including requirements to use appropriate gloves,
- Sampling, analysis, and proper characterization of any wastes,
- Interaction with the client to confirm storage, transportation, and recycling or disposal requirements, and
- Arrangement for proper manifesting and transportation of the materials.

The waste management plan will be reviewed and approved by the PIC and, where necessary, the client prior to execution.

4.1 PRE-MOBILIZATION

Prior to mobilizing to the field, a project health and safety plan (HASP) must be developed, in accordance with **NAM-1110-PR1 – Project Health and Safety** to assess the potential hazards associated with the operations that will be undertaken. As part of the review of project hazards, the ERM Project Manager and PIC will evaluate the scope of work to assess whether the project will likely involve waste generation by ERM or if ERM will be directly responsible for managing waste.

If the evaluation indicates that ERM or its subcontractors will be generating wastes or will be responsible for waste management, the applicable portions of **NAM-1122-FM1 – Pre-Mobilization and Project Execution Activities** will be factored into the project-specific waste management plan. The form provides guidance on the subtasks that generally should be followed during the pre-mobilization phase of the project to address waste management requirements.

Depending on the complexity of the project and client requirements, **NAM-1122-FM1** may be replaced with a more detailed document that addresses each element in **NAM-1122-FM1**, as needed. The documentation will then be combined with the project execution phase (Section 4.2) to complete the project-specific waste management plan.

4.2 PROJECT EXECUTION

The waste management plan must anticipate activities to be conducted in project execution and set the stage for carrying them out within the framework of the plan. A general proposed format for including the necessary components in the plan to address such activities is presented in ***NAM-1122-FM1 – Pre-Mobilization and Project Execution Activities***.

Following the project execution phase and depending on the nature of the project, it may be appropriate to prepare a waste management report. Such a report would provide a discussion on the types, amounts, and disposition of wastes that were handled during the work. The specific format and content of such a report should be discussed with and approved by the client.

5. REFERENCES

ERM Procedure ***NAM-1110-PR1 – Project Health and Safety***

ERM Form ***NAM-1122-FM1 – Pre-Mobilization and Project Execution Activities***

DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
001	All	New document.	9 Jun 2011
002	All	Reformatted document. Revision of document language in several areas.	25 Jun 2015
003	All	Updated Document Number; updated titles (Section 2); updated paragraph alignment throughout; updated referenced document numbers (Section 4); updated References (Section 5).	14 Jan 2017
004	4	Added information on PPE selection.	31 Jul 2018
005	All	Fixed broken links; edited subcontractor references; minor language revisions.	18 Feb 2020
006	4	Minor language revisions.	7 Feb 2023
007	4	Revised references and links to reflect combining Pre-Mobilization and Project Execution forms.	27 Feb 2023
008	2	Added requirement for PM to alert employees to site-specific waste management procedures.	14 Aug 2023

APPROVAL SIGNATURE



Millard P. Griffin, Jr.

Regional Health & Safety Director

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Spill Prevention and Response

DOCUMENT DETAILS

DOCUMENT TITLE	Spill Prevention and Response
DOCUMENT NUMBER	NAM-1123-PR1
Approval Date	7 February 2023
Version	06
Applicability	North America

1. PURPOSE AND SCOPE

A chemical spill is defined as the uncontrolled release of a hazardous chemical, whether solid, liquid, or gas. The purpose of this procedure is to provide guidance to staff with regard to the prevention of spills of chemicals and to allow them to respond to spills quickly and effectively to minimize impact to the environment.

This document applies to all ERM employees who may handle chemicals or oversee the handling of chemicals by ERM-controlled subcontractors.

2. ROLES AND RESPONSIBILITIES

Partner in Charge (PIC): Responsible for the following elements:

- Ensure this program is implemented, understood, and followed by employees under their charge, and
- In the event of a spill on a project site, ensure that quick and effective cleanup is conducted.

Project Manager (PM)/Supervisor: Responsible for ensuring this procedure is implemented on projects which include a risk of chemical spill.

Business Unit (BU) Health and Safety (H&S) Director: Responsible for the following elements:

- Ensure provision and completion of appropriate spill prevention and response training to affected staff, and
- Periodically evaluate the effectiveness of this procedure.

Field Safety Officer (FSO): Responsible for the following elements:

- Take necessary steps to minimize the potential for spills when working with chemicals, and
- Coordinate spill response activities on project sites as needed.

Employees: Responsible for the following elements:

- Demonstrate behavior, knowledge, and skills provided through training,
- Take necessary steps to minimize the potential for spills when working with chemicals, and
- Follow procedures in the event of a chemical spill.

3. DEFINITIONS

None.

4. PROCEDURE

4.1 SPILL PREVENTION ACTIVITIES

The first step in chemical spill response is to prevent a spill from occurring. Worksites should be examined to identify measures that can be taken to minimize the risk of a chemical spill occurring. Such measures can be identified during regular worksite inspections. Chemical spills generally occur during five types of activities: storage, transport, transfers, usage, and disposal.

4.2 SPILL PREVENTION TECHNIQUES

4.2.1 STORAGE

- Avoid storing chemicals in areas where they may be knocked over and broken/ruptured.
- Be aware of the compatibility of chemicals. Do not store incompatibles (e.g., acids and bases) in common areas.
- To the extent possible, minimize the quantity of chemicals stored on site.
 - Regularly inspect chemical storage areas to ensure there are no leaking or deteriorating containers.
 - Keep the outside of containers clean and free of spills/stains.
 - Check that caps and closures are secure and free of deformation.
 - Ensure that containers are free of rust, bulges, or signs of pressure buildup.
- Ensure that all gas cylinders are secured in the upright (vertical) position.

4.2.2 TRANSPORT

- Transport of chemicals should be avoided by ERM personnel.
- Ensure that container lids are tightly secured to prevent spillage in the event of a tip over.
- Chemicals transported in a vehicle should be secured using straps, cargo netting, or containerized (multiple containers in a larger box/container) to minimize potential for tip over.
- Be aware of ambient conditions and avoid storing chemicals in an enclosed, hot space.
- A Safety Data Sheet (SDS) must be possessed for each hazardous chemical being transported.

4.2.3 TRANSFER

- When transferring chemicals between containers, confirm in advance the size of the receiving container to prevent overfilling it.
- When transferring liquids from large containers, use pumps or other mechanical means instead of pouring.
- Use spill containment trays to catch leaks and spills when transferring liquids.
- When transferring flammable liquid from drums, ensure that both the drum and receptacle are grounded and bonded together to avoid an explosion initiated by a static electric spark.
- Ensure a suitable chemical spill kit is readily available.

4.2.4 USAGE

- Employees must wear PPE when handling chemicals that have been selected based on the hazards of the chemical.
- Prior to chemical transfers, ensure that containment is in place to contain potential spillage.
- Always attend to the task at hand. Do not be distracted as this can lead to overspill.

4.2.5 DISPOSAL

- Do not mix incompatible wastes as this may lead to uncontrolled chemical reactions.
- Identify the contents of all waste containers to avoid improper disposal.
- Leave at least 20% air space in containers of liquid waste to allow for vapor expansion and to reduce the potential for spills due to overfilling.
- When not in use, keep waste containers securely closed or capped. Do not leave funnels in waste containers.
- Dispose of waste on a regular basis. Do not allow excess waste to accumulate in the work area.

4.3 SPILL RESPONSE

ERM PMs/FSOs shall:

- Ensure only employees or subcontractors who are adequately trained in spill response procedures will respond to a spill.
- Determine what type of material has been spilled.
- Consider all safety factors. Check the SDS to determine health and physical hazards, PPE requirements, and response recommendations.
- If it is not safe to begin spill response or if the spill is too large to contain:
 - Call the local Fire Department.
 - Notify the PIC and BU H&S Director; and

- Wait for assistance.
- If it is safe for you to begin spill response:
 - Ensure personnel have the proper PPE for the chemical involved,
 - Contain the spill (plug leaks or set the container upright),
 - Use spill absorbent or appropriate spill pads/booms to contain the spill (where appropriate based on the state of the chemical),
 - Sweep up absorbent and properly dispose of contaminant pads/booms, and
 - Contain contaminated waste for proper disposal.
- Notify the BU H&S Director of any spill of fuel, solvents, oxidizers, acids, highly flammable materials, or any spill over five gallons.
- Contact the local Fire Department immediately if any chemical enters storm drains, sewer system, or any other waterway (creek, river, lake, pond, ditch, etc.).

4.4 CHEMICAL SPILL KITS

Spill kits should be readily available on projects where toxic chemicals are used. Spill kits should be appropriate to the hazard and risk associated with the particular chemicals used on the project site and contain sufficient supplies to respond to the type and the quantity of materials that may be spilled. Spill kits can be assembled from individual parts or suitable spill kits can be purchased from most chemical or safety supply companies. Periodic evaluation of the spill kits will be conducted to ensure the availability of adequate spill response supplies. Typical spill kit supplies include:

- Containers for containing contaminated cleanup materials,
- Absorbent pads,
- Spill “socks” or “pigs”,
- Absorbent material, and
- Disposable bags and ties.

4.5 SPILL REPORTING

Any spill shall be immediately reported to the Project Manager and PIC. The event must also be reported via the ERM Event Communication System within 24 hours of the time of the spill.

Note that for US operations, any chemical that presents a threat to the environment is defined by the Environmental Protection Agency (EPA) as a hazardous substance. The Agency assigns each hazardous substance a reportable quantity (RQ), which is based on a chemical's inherent risk properties. A list of reportable quantities can be found in the link in Section 5. Federal law requires reporting of any hazardous substance spill or release that exceeds its RQ to the local authorities. The appropriate agency phone number must be listed in the project HASP. Note that

state, provinces, and local governments often have their own spill-reporting requirements, necessitating calls to state and local emergency response agencies as well.

5. REFERENCES

United States Environmental Protection Agency (USEPA) **Consolidated List of Chemicals**

DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
001	All	New procedure.	11 Mar 2015
002	All	Updated Document Number; updated titles (Section 2); updated paragraph alignment throughout.	11 Jan 2017
003	4	Corrected paragraph numbering; changed references from "MSDS" to "SDS".	29 Jun 2017
004	1, 4, 5	Updated Purpose statement (Section 1); revised procedural elements to eliminate quantity limitations (Section 4); updated Reference section (Section 5).	16 Jul 2018
005	All	Minor language revisions throughout; updated subcontractor references.	18 Feb 2020
006	All	Minor language revisions throughout; updated links in Section 5.	7 Feb 2023

APPROVAL SIGNATURE



Millard P. Griffin, Jr.

Regional Health & Safety Director

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Injury/Illness Management

DOCUMENT DETAILS

DOCUMENT TITLE	Injury/Illness Management
DOCUMENT NUMBER	NAM-1210-PR1
Approval Date	14 August 2023
Version	08
Applicability	North America

1. PURPOSE AND SCOPE

This document establishes the procedures for implementing ERM's incident management strategy in the event of an injury or illness. Developing a strong incident management process is an essential part of promptly responding to occupational injuries and illnesses. This document applies to all ERM field and office locations.

2. ROLES AND RESPONSIBILITIES

Partner in Charge (PIC): Responsible for the following elements:

- Ensure the procedure is implemented, understood, and followed by employees under their charge and working on their projects, and
- Correct deficiencies in the implementation of the procedure as identified by the Business Unit (BU) Health and Safety H&S) Director.

Project Manager (PM)/Supervisor/Area Manager: Responsible for the following elements:

- Perform observations of ERM work processes to assess whether employees are operating in accordance with the procedure, and
- Correct, in conjunction with the PIC and the BU H&S Director, any observed deficiencies in the implementation of the procedure.

BU H&S Director: Responsible for the following elements:

- Evaluate implementation of the procedure by BU personnel during ECS reviews, and
- Communicate identified deficiencies to the PIC and BU management teams.

Employee: Responsible for the following elements:

- Report work-related injuries/illnesses as soon as possible to their PM/Supervisor/Area Manager,

- Comply with the requirements of the procedure during response to injury/illness events,
- Work with ERM Operations, H&S, and Human Resources (HR) teams to ensure the best outcome for the employee, and
- Notify the ERM Operations, H&S, and HR teams of any change in injury/illness status, as well as providing copies of any appropriate paperwork supporting these changes from medical professionals.

3. DEFINITIONS

Illness: Systemic infections, exposure to hazardous materials, repeated stress/strain, and/or other repeated exposures to conditions that result in harm or loss of function, but do not meet the definition of an injury.

Injury: A wound caused by an external force that affects a specific part or function of the body and has an identifiable time and place.

Work-related injury/illness: An injury or illness that arises out of and in the course of employment.

4. PROCEDURE

4.1 PRE-INJURY MANAGEMENT

4.1.1 WORKSITE EVALUATION

Project sites and offices shall evaluate a location for the potential to cause an injury or illness. This evaluation must consider the following, at a minimum:

- The types of injury or illness that could reasonably occur under given site conditions,
- The location of emergency and non-emergency medical centers,
- The anticipated response time for local emergency services (e.g., ambulance, paramedics, site emergency teams, etc.),
- The presence of hazardous materials or conditions,
- The types of training needed for employees to respond to identified hazards,
- The type of training needed for first aid responders, and
- The type of first aid supplies required for potential response to site hazards.

4.1.2 RISK ASSESSMENT

A written health and safety plan (HASP) must be prepared for all field projects. The HASP must contain contact information, including maps and phone numbers, for the nearest emergency medical services/hospital location, as well as for potentially needed emergency services (e.g., fire department, police, ambulance) and for WorkCare, ERM's medical services provider. Advance contact with ambulance services to ensure they are familiar with location, access routes, and hospital locations is advised in remote or new locations.

An Emergency Action Plan (EAP) must be prepared for all ERM office locations. Since ERM offices are typically located in well-populated urban centers, the location of specific emergency medical services locations is not required to be posted in the EAP; however, emergency contact information for potentially needed emergency services, building management staff, and WorkCare must be provided.

4.1.3 FIRST AID SERVICES

The availability and application of first aid services, including first aid kits, is discussed in Section 4.1 of **NAM-1840-PR1 – Medical Services**.

4.1.4 FIRST AID RESPONDERS

Expectations regarding the availability of first aid responders in both field and office settings are discussed in Section 4.1.1 of **NAM-1840-PR1 – Medical Services**. Trained first aid responders should be designated in such a fashion that employees know who they are and how to contact them.

4.1.5 EYEWASH FACILITIES

If corrosive materials are present, eyewash and body flush facilities must be provided. Where possible, these should provide large quantities of clean water. The water source must be pressure controlled and clearly identified.

4.2 TIME OF INJURY MANAGEMENT

4.2.1 TRANSPORTATION

When employees require urgent medical attention as the result of a work-related injury/illness, transportation shall be provided to the emergency room or urgent care facility via ambulance or similar method (if in critical condition) or ERM vehicle. Employees are not permitted to drive themselves.

4.2.2 TREATMENT OF CRITICAL INJURY/ILLNESS

In the event of a critical injury or illness, employees must be seen by a medical professional as quickly as possible. For purposes of this procedure, critical injuries shall include, but not be limited to:

- Uncontrolled bleeding or significant blood loss,
- Chest pains,
- Breathing difficulty,
- Known or suspected bone fractures,
- Known or suspected internal injuries,
- Known or suspected overexposure to chemical, biological, or radiological hazards,
- Severe electric shock or electrocution,

- Second, third, or fourth degree thermal, chemical, electrical, or radiation burns,
- Loss of consciousness, or
- Sudden behavioral changes, including confusion, disorientation, or aggression.

In these situations, an ERM employee should always accompany the injured or ill employee to medical care. The accompanying employee should contact WorkCare, ERM's contracted medical consultant specializing in occupational medicine, as soon as possible to alert them to the injury. Where necessary, WorkCare's occupational physicians will provide peer-to-peer interaction with emergency room physicians to ensure appropriate care is provided to our employees. The accompanying employee shall also be responsible for maintaining contact with appropriate ERM management and H&S team members to alert them to issues relating to the injured/ill employee and their condition.

4.2.3 TREATMENT OF NON-CRITICAL INJURY/ILLNESS

In the event of a non-critical work-related injury or illness, the project management team (or line manager if not project-related), in conjunction with the BU H&S Director, must determine if the incident should be evaluated by WorkCare, ERM's medical incident intervention service (available 24 hours per day, 7 days per week). While evaluation by WorkCare may not be warranted for certain minor injuries/illnesses (e.g., scratches, minor insect bites/stings, minor bruising, etc.), evaluation by WorkCare would be appropriate for more serious issues including, but not limited to, open wounds, significant bruising, pain/ache/discomfort, fever, raised bumps/rashes, allergic reactions, or blows to the head. It is important to note that WorkCare's services are available and recommended for ANY type of known or suspected work-related injury or illness to ensure our employees are given the level of medical treatment appropriate for the injury/illness, as well as comfort in discussing these issues with a medical professional.

4.3 POST-INJURY MANAGEMENT

4.3.1 WORKERS' COMPENSATION

A workers' compensation claim will be filed for each instance where work-related medical treatment is provided to ERM employees. The HR team will be responsible for filing these claims and will be informed by WorkCare whenever a referral to a medical clinic is made for an ERM employee. Additionally, HR staff will:

- Serve as a point of contact for the workers' compensation insurance carrier adjuster and
- Work with ERM providers to coordinate disability benefits associated with work-related injury/illness.

Employees will be notified of ERM's Safe Return to Work process (Section 4.3.2) at the time a worker's compensation claim is filed, provided modified duty is practicable for that employee and their responsibilities at ERM.

4.3.2 SAFE RETURN TO WORK

Employee supervisors, after consultation with the Business Unit Health and Safety Director, the HR team, WorkCare, and any other medical provider treating the employee, may assign an employee who is recovering from a work-related injury or illness transitional employment during their recovery period, if such employment exists. Transitional employment includes temporary modified, restricted, or light duty work covering the time from the injury/illness until the release to full duty by the doctor. Each case will be evaluated individually and will address:

- The physical demands of the modified job duties to ensure they can be safely completed by the injured employee, and
- Comparison of the modified job duties with restrictions imposed by medical providers to ensure consistency.

ERM utilizes WorkCare for post incident evaluation and follow-up coordination. WorkCare has been notified that ERM can provide transitional employment in most situations following an injury or illness.

Application of any transitional employment must be documented in writing and signed by a medical doctor before any action can be taken. The change in status will only be allowed for the period of time designated by the doctor. The employee must continue to comply with all doctor-mandated appointments and treatment during this time. Any changes in duty status as a result of an appointment or treatment visit must be provided to the employee's supervisor in writing.

At a minimum, and regardless of the employee's current case status (i.e., lost time, restricted duty, etc.), the employee's supervisor will maintain contact with the employee on a weekly basis. A written work release for full and unrestricted duty from a medical doctor is required before the injured/ill employee may return to their original job duties.

Medical records associated with any injured employee and their individual cases will remain confidential. Documentation of the injury event, including all follow-up, will be maintained by ERM in our Event Communication System (ECS).

5. REFERENCES

ERM Work Instruction **NAM-1210-WI1 – Injury/Illness Management Flow Chart**

ERM Procedure **NAM-1840-PR1 – Medical Services**

DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
001	All	New document.	5 Aug 2014
002	All	Changed "Case Management" to "Injury/Illness Management".	30 Dec 2014
003	Intro, 4, 5	Updated Applicability. Updated references in Sections 4 and 5.	12 Jan 2016
004	All	Updated Document Number; updated titles (Section 2); updated paragraph alignment throughout; updated referenced document numbers (Section 4); updated References (Section 5).	10 Jan 2017
005	4	Language revisions throughout.	20 Feb 2020
006	4.3	Revised information on return-to-work policies, including transitional work.	19 Aug 2020
007	4.2.3	Added information on applicability of WorkCare Incident Intervention services.	13 Apr 2021
008	4.3	Added information on employee notification and transitional duties.	14 Aug 023

APPROVAL SIGNATURE



Millard P. Griffin, Jr.

Regional Health & Safety Director

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Emergency Drill Evaluation

DOCUMENT DETAILS

DOCUMENT TITLE	Emergency Drill Evaluation
DOCUMENT NUMBER	NAM-1212-FM2
Approval Date	19 April 2023
Version	05
Applicability	North America

DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
005	NA	Revised format.	19 Apr 2023

This Form Template has been Approved By:

APPROVAL SIGNATURE



Millard P. Griffin, Jr.

Regional Health & Safety Director

Project/Office Name/Location: Click or tap here to enter text.

Project Number (where applicable): Click or tap here to enter text.

Drill date: Click or tap to enter a date.

Drill Leader/Facilitator: Click or tap here to enter text.

Describe the drill scenario below.

Click or tap here to enter text.

Post Drill Review

Evaluation Date: Click or tap to enter a date.

List the positive attributes of the drill: [Click or tap here to enter text.](#)

List the opportunities for improvement: Click or tap here to enter text.

List the corrective actions taken and their completion dates. Be sure to include this information in ERM's Corrective and Preventative Action (CAPA) System.

Corrective Actions	Assigned To	Completion Date
Click or tap here to enter text.	Click or tap here to enter text.	Click or tap here to enter text.

Incident Reporting and Investigation

DOCUMENT DETAILS

DOCUMENT TITLE	Incident Reporting and Investigation
DOCUMENT NUMBER	NAM-1220-PR1
Approval Date	15 February 2024
Version	15
Applicability	North America

1. PURPOSE AND SCOPE

This document supports the requirements to ensure that safety events are being properly reported and investigated within ERM operations. This document applies to all ERM North America field and office locations.

2. ROLES AND RESPONSIBILITIES

Partner in Charge (PIC): Responsible for the following elements:

- Ensuring this procedure is implemented, understood, and followed by employees under their charge and working on their projects, and
- Correcting any deficiencies in the implementation of this procedure as identified by the Business Unit (BU) Health and Safety (H&S) Director.

Project Manager (PM)/Supervisor/Area Manager: Responsible for the following elements:

- Performing observations of ERM work processes to assess whether employees are operating in accordance with this procedure, and
- Correcting, in conjunction with the PIC and the BU H&S Director, any observed deficiencies in the implementation of this procedure.

BU H&S Director: Responsible for the following elements:

- Evaluating implementation of this procedure by personnel during Event Communication System (ECS) reviews, and
- Communicating identified deficiencies to the PIC and BU management teams.

Regional H&S Director: Responsible for the following elements:



- Notifying the Occupational Safety and Health Administration (OSHA) of an employee fatality, hospitalization, amputation, or loss of an eye (if incident occurs in the US), and
- Determining, in conjunction with the Global H&S Director, the recordability of incidents.

Employee: Responsible for the following elements:

- Completing ECS entries within 24 hours of a safety event, and
- Participating in the investigation of the event as directed by the ERM management and H&S teams.

3. DEFINITIONS

Event Communication System (ECS): The primary tool for communicating the occurrence of safety events to ERM.

Event Principals: People who may be involved in safety events, including ERM employees, subcontractors, and third parties (including clients).

5 Why: A question-asking technique used to explore the cause-and-effect relationship underlying a problem or event.

Incident: One of the following:

- An employee becomes injured or is made ill,
- Useful property is damaged in some fashion,
- A hazardous material is spilled or released to air, water, or ground,
- Operational security is breached,
- A regulatory citation is issued, or
- A loss of reputation to clients or the public is sustained.

Near Miss: An unplanned event that did not result in an incident but had the potential to do so.

Reporting Person: The ERM employee entering the safety event into the ECS.

Root Cause Analysis: A method of problem solving that tries to identify the root causes of an issue. A root cause is one that, once removed, would have prevented the final undesirable event from occurring.

Safe Behavior: A positive action or attitude toward safety or that promotes safety within the workplace.

Safety Event: An incident, near miss, unsafe act/condition, or safe behavior occurring within or due to the working environment experienced by ERM personnel.

Unsafe Act: A task or activity conducted in a manner that may threaten the health and safety of co-workers.

Unsafe Condition: A condition in the work environment that is likely to lead to an incident if not corrected.

WorkCare: The occupational health consulting firm which assists ERM in management of its medical surveillance programs.

Working Environment: Anywhere ERM, its employees, and its subcontractors are engaged in work activity, including ERM offices, client sites (visits, meetings, field work, etc.), or during travel.

4. PROCEDURE

4.1 INITIAL EVENT RESPONSE

4.1.1 INJURIES OR ILLNESSES

The general steps for responding to an injury or illness incident include the following:

- For emergency situations, employees shall call 911. This would include chest pains, stroke, severe shortness of breath, sudden and severe pain, major injury (including potential fractures and trauma), uncontrolled bleeding, electrocution, second- or third-degree burns, or unconsciousness. If transport to an urgent care center or hospital is required, a second ERM employee must accompany or follow the injured or ill employee to the medical treatment center. Refer to **NAM-1210-PR1 – Injury/Illness Management** for additional information.
- For non-emergency situations, employees shall give necessary first aid care for the injured or ill employee (if qualified to do so) and secure the scene.
- After stabilizing the scene and ensuring appropriate initial treatment is provided to the employee, contact the PM/Supervisor, who will then contact the PIC and/or the Area Manager, as well as the local and/or BU Unit H&S team, to report the event. Verbal communication requirements are provided in **NAM-1220-WI1 – Verbal Communication Matrix**. ERM will also contact the client as soon as possible, but no later than 24 hours after the event. Please note that for serious, life-threatening, or fatal incidents, the scene of the incident should not be disturbed until the root cause analysis investigation is complete (Section 4.2.4)
- The project management team (or line manager if not project-related), in conjunction with the BU Unit H&S Director, must determine if the incident should be evaluated by WorkCare, ERM's medical incident intervention service (available 24 hours per day, 7 days per week). While evaluation by WorkCare may not be warranted for certain minor injuries/illnesses (e.g., scratches, minor insect bites/stings, minor bruising, etc.), it would be appropriate for more serious issues including, but not limited to, open wounds, significant bruising, pain/ache/discomfort, fever, raised bumps/rashes, allergic reactions, or blows to the head. It is important to note that WorkCare's services are available and recommended for ANY type of known or suspected work-related injury or illness to ensure our employees are given the level of medical treatment appropriate for the injury/illness, as well as comfort in discussing these issues with a medical professional.
- Immediately after contacting the ERM management and H&S personnel, an ERM representative shall call ERM's medical service provider (WorkCare) to initiate the Incident

Intervention process if follow-up medical treatment is deemed necessary by the management or health and safety team. The phone number is 888-449-7787.

- Within 24 hours, ERM employees shall enter the basic details of the event into the ECS.

Note that the above direction may change based on site-specific circumstances or client-specific requirements. Emergency response elements, including contact information and directions to urgent care facilities, will be included in the project health and safety plan (HASP) as well as the Emergency Action Plan (EAP) within each office.

In the event of a fatality or if an ERM employee suffers a work-related hospitalization, amputation, or loss of an eye, ERM's management team with the assistance of the Regional H&S Director is responsible for notifying the Occupational Safety and Health Administration (OSHA). Notification must be made within eight hours of a fatality and within 24 hours of all other reportable events.

Note that these notification requirements only pertain to incidents occurring within the United States.

4.1.2 NON-INJURY INCIDENTS AND NEAR MISSES

After the occurrence of a work-related incident (including, but not limited to, motor vehicle incidents, property damage, environmental release, theft, and disruption of business), work will be halted, the scene will be secured, and initial facts gathered regarding the event. All work-related incidents must be reported to ERM (including the employee's line manager and project supervisor) and recorded in ECS within 24 hours. Work should not continue until the causes of the incident or near miss are understood and corrected. ERM will contact the client as soon as possible, but no later than 24 hours after the event.

Note that for motor vehicle accidents, the employee must also contact law enforcement when appropriate and applicable. When ERM fleet vehicles are involved in motor vehicle incidents, ERM's Global Insurance Director should be contacted as well.

4.1.3 UNSAFE ACTS AND CONDITIONS/SAFE BEHAVIORS

When a work-related unsafe act or condition is identified, work will be halted until the act or condition is addressed and corrected. Similarly, when safe behaviors are identified, the employee(s) involved should be commended for their safe performance. Within 24 hours of the observation, ERM employees must enter the basic details of these events into the ECS.

4.2 EVENT FOLLOW-UP

4.2.1 ECS INFORMATION/ROUTING

All safety events, including injuries/illnesses (including first aid cases), near misses, unsafe acts, and unsafe conditions, will be documented in ECS. An investigation into the safety event will be conducted, which will include at a minimum:

- The time, date, and location of the event,
- The type of event,
- The nature and the exact location of the injuries to the injured party,



- The persons involved in the event, including injured personnel and witnesses,
- A brief description of the event,
- Immediate actions taken in response to the event including the nature of first aid treatment given (if applicable),
- Information to support the investigation and response, including additional details, photographs, documents, timelines, etc.,
- An evaluation of causal factors affecting the event,
- Corrective actions to prevent similar occurrences, and
- The names of the investigators and reviewers.

After the basic details of a safety event are entered into the ECS by the employee or designated reporting person, the system will automatically notify appropriate parties. All individuals receiving automatic notification are included on the communication chain for the safety event's ECS record. Note that any ERM employee may be added to the communication chain for an ECS record as an additional affected party.

4.2.2 INITIATING AND CONDUCTING FOLLOW-UP

ERM assigns and tracks corrective actions for all safety events. The required detail of the follow-up and the personnel involved is based on the Event Type and its Actual and/or Potential Severity (see Appendix 1 of **ERM-1200-PR1 – Event and Non-conformity Management**), as judged by the project and/or safety team. The ECS record created by entering the Safety Event is meant to both guide follow-up and document the findings of the investigation.

At the option of ERM's H&S and/or management team, or as required by actual or potential severity of the event, a more robust follow-up may be required, including root cause analysis.

Within 24 hours of the initial communication of the Safety Event into ECS, a member of the BU safety team will contact the Reporting Person to gather initial facts and begin the investigation. The safety team will be responsible for:

- Stewarding the completion of the investigation with the persons involved in the Safety Event, and
- Verifying that all assigned corrective actions have been completed.

4.2.3 DETERMINING RECORDABILITY

If the safety event is an occupational illness or injury, then the Regional H&S Director will determine the recordability of the safety event. This will include a calculation of lost workdays and/or restricted duty/job transfer time, if any. These determinations will be made based on the established facts of the safety Event and in accordance with **ERM-1201-PR1 – Injury or Illness Reporting and Recording**.

At the end of the calendar year, ERM will develop a summary of work-related injuries and illnesses. The summary will be reviewed and signed by a company official (e.g., Regional H&S Director).

4.2.4 ROOT CAUSE ANALYSIS

A root cause analysis (RCA) will be performed for all recordable incidents and high value learning events as determined by the client, ERM management and/or the Regional H&S Director. See **NAM-1221-FM1 – Root Cause Analysis Worksheet** for guidance.

The RCA process should begin as soon as possible after the incident has been reported, all immediate response measures have been taken, and the situation is under control. If possible (given geographical location, site conditions, logistical planning, weather, travel restrictions, etc.), the draft RCA shall be completed within 48 hours of the event, but no later than 10 working days after the event. A final RCA report will be issued within 15 working days.

The default ERM RCA methodology in the “5 Why” technique, but ERM reserves the right to substitute other valid methods as deemed appropriate by management or the Regional H&S Director. All team members associated with the investigation will be trained in the application of their responsibilities and the chosen incident investigation technique.

The first step in the process is to assemble the RCA team. The team shall be led by the PIC and facilitated by a member of the ERM H&S team or another ERM employee trained in RCA methods. Other team members may include:

- The PM of the project,
- The Area Manager (if the Safety Event was based in the office),
- The person directly involved in the event,
- Other employees familiar with the activities during which the event occurred,
- Subcontractor representatives (if a subcontractor was involved), and
- A senior ERM Partner not involved in the event (e.g., Practice Leader or BU Managing Partner [BUMP]).
- The RCA team leader will ensure that any equipment necessary to complete the investigation is assembled. This may include, but not be limited to, writing equipment, measurement equipment, cameras or other recording devices, marking devices, equipment manuals, and personal protective equipment (PPE).

The RCA team leader will facilitate the implementation of the process, which may include:

- Interviews and fact gathering,
- Casual factor determination,
- Root cause identification using the “5 Why” method, and
- Corrective action recommendation.

The final RCA report will be uploaded to the ECS record after the event. Adopted corrective actions will be tracked to completion in the ECS. All corrective actions must be completed within 30 days of the issuance of the RCA report. If additional time is needed to complete a corrective action, the Regional H&S Director must be notified.

4.2.5 APPROVAL AND RECORD FINALIZATION

- When the corrective actions are verified as complete, the following individuals will indicate their approval of the event:
- For incidents, the applicable BU H&S Director, the BUMP, and the Regional H&S Director.
- For all other safety events, the BU H&S Director.

After all approvals are made, the BU H&S Director will initiate the finalization check within ECS to save and close the record. Future changes are locked out after event finalization.

4.3 ADDITIONAL PROCEDURES FOR MINE-RELATED SAFETY EVENTS

For ERM projects covered by the regulatory statutes of the US Mine Safety and Health Administration (MSHA), additional recordkeeping is required when specific safety events occur. Safety events meeting one or more of the following criteria must be reported to both the mine operator and MSHA immediately (i.e., no later than 15 minutes after occurrence):

- Death of an ERM employee,
- Injury to an ERM employee at the mine that had the reasonable potential to cause death,
- Entrapment of an ERM employee for more than 30 minutes or which had the reasonable potential to cause death,
- An unplanned inundation of a mine by liquid or gas,
- An unplanned ignition or explosion of gas or dust,
- In underground mines, an unplanned fire not extinguished within 10 minutes of discovery,
- In surface mines, an unplanned fire not extinguished within 30 minutes of discovery,
- An unplanned ignition or explosion of a blasting agent or explosive,
- An unplanned roof fall at or above the anchorage zone in active workings that impair ventilation or impede passage,
- A coal or rock outburst that causes withdrawal of miners or which disrupts regular mining activity for more than one hour,
- An unstable condition at an impoundment, refusal pile, or culm bank which requires emergency action to prevent failure, or which cause individuals to evacuate an area, or failure of an impoundment, refuse pile, or culm bank,
- Damage to hoisting equipment in a shaft or slope which endangers an individual or which interferes with use of the equipment for more than 30 minutes, and

- An event at a mine which causes death or bodily injury to an ERM employee not at the mine when the event occurs.

Within 10 days of occurrence, ERM must submit a report of any work-related incidents to MSHA using MSHA Form 7000-1. Additionally, each calendar quarter, ERM must submit employment information to MSHA utilizing MSHA Form 7000-2. The form must be completed and submitted to MSHA no later than 15 days after the end of each calendar quarter.

5. REFERENCES

ERM Procedure **ERM-1200-PR1 – Event and Non-conformity Management**

ERM Procedure **ERM-1201-PR1 – Injury or Illness Reporting and Recording**

ERM Procedure **NAM-1210-PR1 – Injury/Illness Management**

ERM Work Instruction **NAM-1220-WI1 – Verbal Communication Matrix**

ERM Form **NAM-1221-FM1 – Root Cause Analysis Worksheet**

DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
001	All	Revised and edited to meet new Global SMS requirements and update procedures.	17 Oct 2014
002	Intro; 5	Updated Applicability; added references to Section 5.	11 Jan 2016
003	4.2.1	Added information on data collected in ECS reports.	14 Jul 2016
004	All	Updated Document Number; updated titles (Section 2); updated paragraph alignment throughout; updated referenced document numbers (Section 4); updated References (Section 5).	10 Jan 2017
005	4.1.1; 4.1.2	Added information on client notification.	7 Feb 2017
006	4.2.3	Added information on OSHA log requirements.	12 Feb 2017
007	4.2.4	Revised language around timing of RCA development and closure.	19 Apr 2018
008	4.2.1	Minor revision in information collected during investigation.	26 Jun 2018
009	4.2.3	Removed references to OSHA logs (ERM is exempt from requirements); identified current practices for injury/illness recordkeeping.	18 Jul 2019
010	All	Removed references to E-mail Notification Matrix and Event Severity Matrix (obsolete documents).	24 Jan 2020
2020	3, 4.1.2	Revise definition of ECS. Included examples of non-injury incidents.	4 Feb 2021
012	4.1.1	Added information on applicability of WorkCare Incident Intervention services.	13 Apr 2021
013	4.2.3; 5	Removed requirement to post injury logs in offices; updated Reference section.	6 Feb 2023
014	4.1.1	Added note for serious, life-threatening, or fatal incidents, the scene of the incident should not be disturbed until the root cause analysis investigation is complete.	16 Aug 2023
015	4.1.2	Added information on reporting for motor vehicle incidents.	15 Feb 2024

APPROVAL SIGNATURE



Millard P. Griffin, Jr.

Regional Health & Safety Director

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Hazard Communication/Workplace Hazardous Materials Information System

DOCUMENT DETAILS

DOCUMENT TITLE	Hazard Communication/Workplace Hazardous Materials Information System
DOCUMENT NUMBER	NAM-1301-PR1
Approval Date	15 March 2023
Version	10
Applicability	North America

1. PURPOSE AND SCOPE

This procedure is designed to ensure that information necessary for the safe use, handling, and storage of hazardous products is provided and made available to all ERM employees. This document applies to all ERM employees who work with or near hazardous products and covers all ERM work activities. The procedure is designed to meet the regulatory requirements of the US's Hazard Communication standard as well as Canada's Workplace Hazardous Materials Information System (WHMIS), each of which incorporates the Globally Harmonized System for Classification and Labelling of Chemicals (GHS).

2. ROLES AND RESPONSIBILITIES

Regional Health and Safety (H&S) Director: Responsible for ensuring that a written hazard communication program is prepared, implemented, and regularly evaluated for applicability.

Partner in Charge (PIC): Responsible for the following elements:

- Ensure this program is implemented, understood, and followed by employees under their charge and working on their projects,
- Ensure, in conjunction with the Area Manager/Project Manager (PM), that employees are properly trained in accordance with this procedure, and

- Correct any deficiencies in the implementation of this program as identified by the Business Unit (BU) H&S Director.

Area Manager/Project Manager (PM): Responsible for the following elements:

- Ensure that any site-specific health and safety plans (HASP) and/or office-specific Emergency Action Plans (EAPs) address hazard communication elements as described herein,
- Maintain a master inventory of all chemicals brought to and/or used in the workplace,
- Ensure that current Safety Data Sheets (SDS) for each chemical on the inventory are readily available to all employees,
- Ensure that all chemical containers are properly labeled upon receipt at the workplace and that labels are not defaced or removed from the container until it is empty,
- Ensure that each ERM employee and affected ERM contractors and subcontractors are familiar with the chemicals present in the work area and their associated hazards, and
- Ensure that, when working on client sites, the client informs the project team of the location of applicable SDS or provides a copy of applicable SDS.

BU H&S Director: Responsible for the following elements:

- Assist PICs, Area Managers, and PMs in the implementation of this program, as needed, and
- Evaluate compliance with this program during office and project audits.

Employee: Responsible for the following elements:

- Complete all ERM-required initial and update training,
- Follow all hazard control information provided on SDS and chemical labels, and
- Notify their Area Manager/PM if unlabeled chemicals are observed in the workplace.

3. DEFINITIONS

Globally Harmonized System (GHS): A system for standardizing and harmonizing the classification and labelling of chemicals.

Hazardous Materials Identification System (HMIS): A numerical hazard rating that incorporates colors to convey broad health warning information for chemical users.

National Fire Protection Association (NFPA) Diamond: A labeling system used by emergency response personnel to quickly and easily define the risks associated with hazardous materials.

Safety Data Sheet (SDS): A document that contains information on the potential hazards of, and how to work safely with, a chemical product.

4. PROCEDURE

4.1 LABELING

Supplier labels must be affixed to all containers of chemicals, whether used, handled, or stored in the field or on ERM property, and will minimally provide the following information:

- A product or chemical identifier,
- Appropriate hazard warnings (i.e., words, statements, pictures, and/or symbols) which provide general information regarding chemical hazards, and
- The identification of the manufacturer, distributor, or supplier of the chemical.

No person shall remove, deface or alter the supplier label as long as any amount of hazardous product remains in the container, unless the container is immediately marked with equivalent information via an alternate labeling format. If a supplier label is missing or illegible, it must be replaced with a workplace label providing equivalent information.

A container is defined as a bag, barrel, bottle, box, can, cylinder, drum, pail, vessel, or storage tank containing a hazardous chemical. Pipes or piping systems, as well as engines, fuel tanks, and other operating systems in a vehicle, are not considered to be containers.

Portable containers into which chemicals are transferred from labeled containers must themselves have an equivalent label except in the following circumstances:

- The portable container is filled directly from a container with a supplier or workplace label affixed to it,
- The person who transferred the chemical into the portable container is the only person who will use the chemical,
- The content of the container is clearly identified, and
- All of the chemicals in the portable container will be used completely by the end of the work shift.

Labels will be legible, in English, and prominently displayed at all times. In addition to English, labels may be presented in other languages. However, if a label is in only one language, that language shall be English. If non-English speaking employees are present in the work area, all labels will be available and presented in their language as well as English.

Sites which utilize chemicals governed by this procedure will periodically audit chemical containers to ensure that labels are present, intact, and legible. Examples of labeling formats, such as the GHS, HMIS, and NFPA systems, are provided in the following sections.

4.1.1 GHS FORMAT

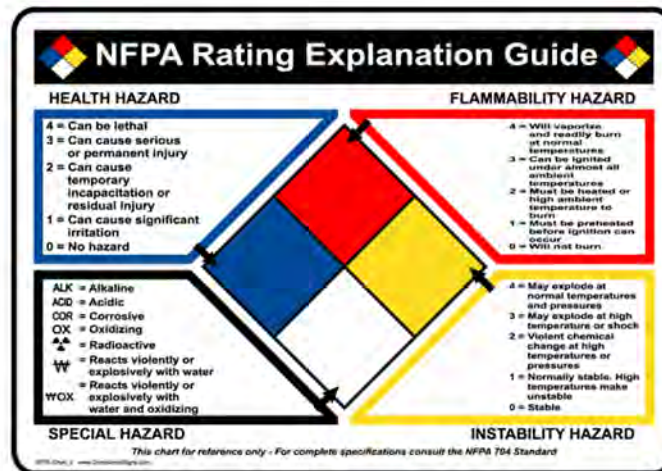
Each container of a classified hazardous chemical is to be labeled, tagged, or marked with the following elements:

- Product or chemical identifier clearly indicated on the label that matches the product or chemical identifier on the SDS.

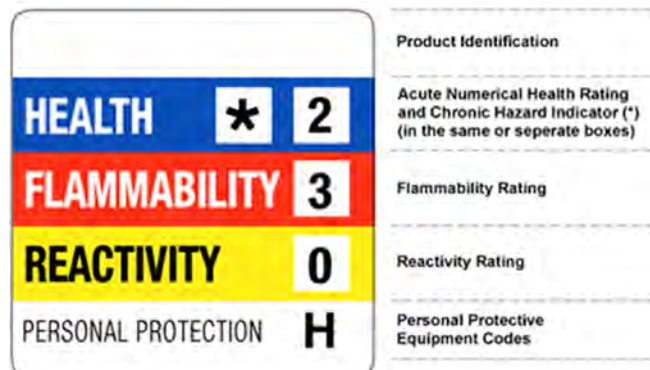
- Contact information for the product supplier, including the company name, address and telephone number.
- Hazard Pictograms. Pictograms have a black symbol on a white background with a red diamond frame.
- The signal word should be clearly marked at the top of the label beneath the product identifier. GHS permits the use of only two signal words (and only one at a time)—DANGER or WARNING— to emphasize the hazard and distinguish between hazard levels.
- A hazard statement that describes the level of hazard should appear under the signal word. Signal words, hazard statements and pictograms have all been harmonized and assigned to each hazard class and category in GHS. Once a chemical has been classified, the relevant harmonized information can be found in HCS under the new Appendix C.
- The label should include appropriate precautionary information. As of now, precautionary statements in the GHS are not harmonized. The intent is to harmonize precautionary statements in the future; until that time, OSHA is mandating the use of the GHS examples, which it anticipates will end up being the harmonized statements.
- OSHA required manufacturers, distributors, and importers to reclassify chemicals and update labels and SDS to meet this format no later than June 1, 2015.



4.1.2 NFPA DIAMOND FORMAT



4.1.3 HMIS FORMAT





4.1.4 ADDITIONAL NOTES

The NFPA and HMIS labeling systems are permitted for workplace containers. However, these labels must provide at least general information regarding the hazards of the chemicals. Hazard warnings or pictograms that conflict with the GHS format may not appear on the workplace label. If these alternate rating systems are used, employees must be trained in how to use and understand the alternative labeling systems so that they are aware of the effects of the hazardous chemicals to which they are potentially exposed.

4.2 CHEMICAL INVENTORY

A chemical inventory must be maintained at any office or project site where chemicals are in use. The inventory must be updated and revised as chemicals are received or depleted. The name/identifier of the chemical as it appears on the chemical inventory must allow employees to be able to match the chemical with the SDS.

The chemical inventory for field projects will be incorporated into the project-specific HASP. The chemical inventory for office locations will be incorporated into the office-specific Emergency Action Plan (EAP).

4.3 SAFETY DATA SHEETS

The SDS provides written information on the chemicals of concern to the employees. The SDS must be compliant with the 16-section GHS recommendations which have been adopted by OSHA and WHMIS. An SDS must be obtained for any hazardous product used, handled or stored in an ERM workplace.

For field projects, PMs will determine during HASP development if ERM employees will use chemicals during execution of the project. During this development and review period, the PM will evaluate any new products which are proposed to be used at the site to determine if they contain extremely hazardous or carcinogenic chemicals. If so, the PM will work with the BU H&S Director to identify potential alternatives. Any new chemical products which will be introduced throughout the course of the job will be similarly evaluated. The SDS for any chemical used on a project site will be attached to the HASP and will be readily available at the site.

For offices, Area Managers will evaluate any new products which are proposed to be used at the office to determine if they contain extremely hazardous or carcinogenic chemicals. If so, the Area Manager will work with the BU H&S Director to identify potential alternatives. The SDS for any chemical used in the office will be attached to the EAP and will be readily available at the site.

SDS shall be readily available to any ERM employee, employee representative, health and safety team member, contractor, or client. Upon receipt of an SDS, the PM/Area Manager shall review the SDS to ensure it is written in English, is legible, appears to be complete, and is current, with an effective date of less than five years. If non-English speaking employees are present in the work area, all labels will be available and presented in their language as well as English. Older SDS will be replaced with updated sheets when they are received.

4.4 CONTRACTORS/SUBCONTRACTORS

The PM will provide the following information to contractors and subcontractors prior to the start of any work at a client's site:

- Chemicals to which they may be exposed, including any soil or groundwater contaminants,
- Hazards associated with specific chemicals,
- Measures taken to reduce the hazard, including use of personal protective equipment (PPE),
- Location of the SDS,
- Locations of any applicable safety equipment, including first aid supplies, safety showers, and/or eye wash stations, and
- Emergency response procedures.

Prior to starting work, the contractor and/or subcontractor will provide the PM with information about any chemicals brought onto the client's site. This information should include, at a minimum, the name of the chemical, the associated hazards, and any PPE required. Contractors and subcontractors will have a legible SDS for each chemical brought onto the project site.

4.5 EMPLOYEE TRAINING AND INFORMATION

Training of all employees potentially exposed to hazardous materials on the job will be conducted as follows:

- Before new employees begin their jobs, and
- Whenever new chemicals are introduced into the workplace.

This training will include:

- Applicable regulatory requirements (including state or province-specific requirements, where applicable),
- Elements of this program,
- Location of the program, chemical inventory, and SDS in the workplace,

- Chemicals used in their work areas and the associated hazards (chemical, physical, and health),
- How to detect the presence or release of chemicals, including monitoring techniques, visual indicators, or odors,
- Protective measures to be used, including safe use, storage, handling, and disposal practices (including those for products contained in piping systems, tanks, vessels, or conveyance systems, as applicable), use of PPE, and emergency response procedures,
- How to read and use SDS, including the purpose and significance of information contained therein,
- How to read and use supplier and workplace labels, including the purpose and significance of the information on the label,
- Procedures to be followed if fugitive emissions are present in the work area,
- Procedures to be followed in the event of an emergency involving workplace chemicals, and
- How to obtain additional hazard information.

Where non-English speaking workers are employed, provisions for training in the appropriate language will be arranged.

All initial training will be documented electronically via ERM's Academy Learning Management System (LMS). Documentation will include a brief description of the training and the trainer's name and will be retained throughout the duration of the employee's tenure with the organization. Information on project-specific chemical hazards, labeling requirements, site-specific issues, and emergency response conditions will be documented as part of daily safety meetings at the project site using ***NAM-1501-FM5 – Site Safety Meeting Form***.

4.6 NON-ROUTINE TASKS

Occasionally, ERM employees may be required to perform non-routine field tasks which include exposure to hazardous chemicals. Prior to any non-routine work involving hazardous chemicals, the PM will ensure that each affected employee is given information about the hazards presented by the chemicals, as well as the protective measures which will be utilized during the work.

4.7 PROCEDURE AVAILABILITY

The most recent version of the procedure will be available electronically at all times to employees and their designated representatives through ERM's Document Control System (DCS).

5. REFERENCES


- ERM Procedure ***NAM-1110-PR1 – Project Health and Safety***
- ERM Procedure ***NAM-1212-PR1 – Emergency Action Plans***
- ERM Form ***NAM-1501-FM5 – Site Safety Meeting Form***

- US Occupational Safety and Health Administration (OSHA) **29 Code of Federal Regulations (CFR) 1910.1200 – Hazard Communication**
- Health Canada **Workplace Hazardous Materials Information System (WHMIS) 2015**
- Ontario Occupational Health and Safety Act (OHSA) **Regulation 860 – WHMIS**

DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
001	All	New document.	29 Jan 2015
002	All	Changed format; updated to meet state and federal regulations.	2 Jun 2015
003	4.1	Require all portable containers to have equivalent labels except where noted.	18 Aug 2016
004	All	Updated Document Number; updated titles (Section 2); updated paragraph alignment throughout; updated referenced document numbers (Section 4); updated References.	16 Jan 2017
005	All	Updated titles and procedures to address WHMIS requirements.	23 Jan 2018
006	1, 4, 5	Revised Purpose statement (Section 1); minor changes to labeling and training requirements (Section 4); added reference to US and Canada regulations.	26 Jun 2018
007	4.1	Added additional information regarding replacement of label information.	15 Feb 2019
008	All	Minor language revisions throughout.	25 Mar 2020
009	4, 5	Removed reference to NAM-1301-WI2. Updated references.	27 Mar 2020
010	4.1	Added GHS, HMIS, and NFPA systems labeling examples.	15 Mar 2023

APPROVAL SIGNATURE



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Regional Health & Safety Director

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Personal Protective Equipment

DOCUMENT DETAILS

DOCUMENT TITLE	Personal Protective Equipment
DOCUMENT NUMBER	NAM-1310-PR1
Approval Date	22 May 2023
Version	09
Applicability	North America

1. PURPOSE AND SCOPE

This document establishes procedures to be used by ERM to minimize injury resulting from various occupational hazards through the use of personal protective equipment (PPE). Other types of hazard mitigation – including elimination, substitution, engineering controls, and administrative controls – are the best methods of hazard mitigation; however, in many cases the nature of consulting requires the use of PPE to supplement or replace those methods.

This procedure is applicable to all ERM North America operations. Note that respiratory protection (**NAM-1311-PR1**) and hearing protection (**NAM-1312-PR1**) are covered in other procedures.

2. ROLES AND RESPONSIBILITIES

Partner in Charge (PIC): Responsible for the following elements:

- Ensure this program is implemented, understood, and followed by employees under their charge, and
- Correct any deficiencies in the implementation of this procedure as identified by the Business Unit (BU) Health and Safety (H&S) Director.

Project Manager (PM)/Supervisor: Responsible for the following elements:

- Implement program during any project activities where the use of PPE is determined to be necessary,
- Perform observations of ERM work processes to assess whether employees are operating in accordance with this procedure, and
- Correct, in conjunction with the PIC and the BU H&S Director, any observed deficiencies in the implementation of this procedure.

BU H&S Director: Responsible for the following elements:

- Evaluate implementation of PPE during health and safety plan reviews and project audits, and



- Communicate identified deficiencies to the PIC.

Employee: Responsible for complying with the requirements stated within the procedure.

3. DEFINITIONS

None.

4. PROCEDURE

4.1 HAZARD ASSESSMENTS

The project management team shall complete a workplace hazard assessment identifying the PPE requirements for the project. The PPE requirements for any work task will be addressed in the appropriate planning document, including health and safety plans (HASP) and job hazard analyses (JHA). Hazard assessments are performed by considering the types of hazards that may be applicable to the work scope. These include, but may not be limited to, impacts, heat or cold, penetration, dusts, compression, radiation, chemical hazards, and electrical hazards.

Site-specific HASPs will include information outlining the actual PPE requirements for the project, including those required by client-specific mandate. All project team members will be briefed on the elements of the site-specific HASP prior to participating in field activities. This briefing will include information on what PPE is required for the various project tasks.

A completed JHA addresses both the hazards specific to a job task and the appropriate controls, which may include PPE. All project team members are required to review the JHA prior to commencement of task-specific activities and use the indicated PPE. The JHA will identify the person(s) performing and certifying the workplace hazard assessment and the dates the hazard assessment was completed.

4.2 PPE SELECTION

- Once hazards have been identified and evaluated, the process of selecting PPE includes:
- Becoming familiar with the potential hazards and the types of PPE available to mitigate those hazards,
- Comparing available PPE to hazards associated with the project site,
- Selecting PPE meeting any applicable regulatory and client requirements that ensures a level of protection greater than the minimum required to protect employees, and
- Fitting the employees with proper, comfortable, and well-fitting PPE and instructing them on its use and care.


If conditions change on a project site or PPE fails for any reason, the PPE originally selected for employee protection must be re-evaluated. Re-evaluation should include the following elements:


- Levels of exposure established through appropriate site monitoring,
- Adequacy of PPE originally selected,

- Number of hours PPE must be worn,
- Training and fitting of PPE,
- Adequacy of PPE program records,
- Recommendations for H&S program improvement and modification, and
- Coordination with the overall H&S program.

4.2.1 EYE AND FACE PROTECTION

When hazards present because of flying particulates, molten metal, liquid chemicals that are highly acidic or basic, chemical gases or vapors, or ionizing or nonionizing radiation, a combination of safety glasses, safety goggles, and/or face shields should be worn. For employees who wear prescription glasses, **NAM-1310-WI1 – Prescription Protective Eyewear** provides additional details regarding purchase and care of prescription safety glasses.

 US requires that protective eyewear must comply with American National Standards Institute /International Safety Equipment Association (ANSI/ISEA) Standard Z87.1. The ANSI/ISEA standard provides minimum requirements for eye and face protective devices including selection, use, and maintenance of selected devices. Note that approved eyewear must be marked with the “Z87” designation, typically on the front of the frame or one of the temples.

 Canada requires the eye protection standard in Canadian Standards Association (CSA) Z94.3. The standard relates to eye and face protectors for industrial and educational processes. A wide variety of physical hazards are covered by the standard (e.g., flying particles/objects, heat/sparks, chemical splashes, etc.). The standard also outlines the performance requirements tests but not comfort, service life or appearance. Note the approved eyewear must be marked with a CSA logo on the lenses. The failure criteria for CSA Z94.3 and ANSI/ISEA Z87.1 are very similar, so either type of approval is accepted for our work in Canada.

4.2.2 FOOT PROTECTION

In most field situations, protective footwear should be worn by employees performing work. Employees performing ancillary work activities, such as client meetings or work in the office environment at a client site, are not required to wear protective footwear unless client requirements dictate their use. **NAM-1310-WI2 – Protective Footwear** provides additional details regarding selection and purchase.

4.2.3 HAND PROTECTION

Gloves provide protection against a wide variety of hazards, including chemical exposure, burns, cuts, heat, cold, and other hand injuries. **NAM-1324-PR1 – Safe Use of Cutting Tools** provides additional information on glove types providing protection from cuts.

4.2.4 HEAD PROTECTION

Hard hats approved by the ANSI/ISEA Standard Z89.1 (2014) must be worn whenever a hazard exists from falling objects, impact/bump hazards, or electrical hazards. The inner suspension of the hard hat must be inspected daily and must ensure that at least 1 to 1-1/4” of gap exists

between the suspension and the hard hat shell. ERM employees required to wear hard hats shall generally utilize Type 1 Class G (General) hard hats, although other types and classes may be appropriate based on-site conditions. Note that hard hats may not be worn backwards unless the hard hat is marked with a reverse donning arrow, indicating they meet testing requirements when worn frontward or backward.

4.2.5 BODY PROTECTION

Body protection may be required for several workplace hazards including, but not limited to:

- Extreme heat or cold,
- Flames and sparks,
- Impacts from equipment and materials,
- Skin exposure to hazardous chemicals,
- Exposure to bloodborne pathogens, and
- Exposure to radiation.

The level of protection must match the office or project-specific hazards. Examples include coveralls, aprons, jackets, high visibility vests, lab coats, surgical gowns, and full body suits. Body protection also comes in a variety of different materials suitable for specific hazards, including cotton, synthetics, Tyvek®, Nomex®, polyvinyl chloride (PVC), neoprene, rubber, and leather. Contact your BU H&S Director for assistance in selecting the appropriate body covering for the workplace hazard.

4.3 TRAINING

Employees receive initial training in risk assessment and hazard identification as part of EMR's See.Own.Share – Beyond Hazard Recognition training. This mandatory training is required to be completed by all ERM employees within the first 90 days of employment. Additionally, ERM consultants are required to complete training on health and safety planning, including evaluation of various levels of risk evaluation and control (including the use of PPE as a last resort).

Employees shall receive training on various types of PPE applicable to their project tasks. Training topics include, but are not limited to:

- Routes of exposure,
- Categories of exposure,
- Selection of chemical protective clothing,
- Eye and face protection,
- Hand protection,
- Foot protection,
- Head protection,
- Limitations of PPE,

- Storage, cleaning, and maintenance of PPE,
- Proper donning and doffing procedures,
- Adjusting PPE and determining proper fit, and
- Disposal of PPE.

Retraining will be conducted if any of the following occur:

- Employee observed not using appropriate PPE for task,
- Employee observed using PPE in a manner that is inconsistent with previous training,
- Changes in types of PPE used, and
- New hazards identified at the site which required the use of a different level or type of PPE.

All training is tracked in ERM's Academy learning Management System (LMS)

4.4 USAGE, STORAGE, AND MAINTENANCE

All PPE must be kept clean and properly maintained by the employee to whom it is assigned. PPE will be inspected, cleaned, and maintained by employees at regular intervals as part of their normal job duties. Project Managers are responsible for ensuring compliance with cleaning of PPE by employees working on their projects.

In ERM's typical role on projects, PPE does not become grossly contaminated. During projects where chemical contamination of PPE occurs, PPE will be decontaminated (if it is to be reused) or discarded in accordance with waste management practices for the project site. If gross contamination with liquid chemicals occurs, employees will immediately stop work and proceed to the decontamination area. Details of PPE and equipment decontamination are specified for each project in the site-specific HASP and/or JHA.

Change rooms and shower rooms are not typically required for ERM projects due to several factors, including the short duration and non-permanency of the projects. In the event change rooms and shower rooms are required for a project, details will be included in the site-specific HASP.

All PPE will be inspected prior to use and any damaged or defective PPE will not be used. All damaged or defective PPE will be immediately discarded.

4.5 ERM-PROVIDED PPE

ERM provides PPE to our employees in accordance with applicable regulatory standards. Prescription safety glasses and protective footwear are subsidized (see **NAM-1310-WI1** and **NAM-1310-WI2**, respectively). Employees are discouraged from providing their own PPE. Employees are responsible for ensuring that ERM-provided PPE is maintained and replaced as needed. During routine inspections of field-based activities, the Field Safety Officer (FSO), PM, or BU H&S Director will observe the condition of employee PPE.

5. REFERENCES

ERM Work Instruction **NAM-1310-WI1 – Prescription Protective Eyewear**

ERM Work Instruction **NAM-1310-WI2 – Protective Footwear**

ERM Procedure **NAM-1311-PR1 – Respiratory Protection**

ERM Procedure **NAM-1312-PR1 – Hearing Conversation**

ERM Procedure **NAM-1324-PR1 – Safe Use of Cutting Tools**

DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
001	All	New document.	10 Feb 2015
002	All	Reformatted to meet ERM Global standards; language changes for clarity.	14 Jan 2016
003	All	Updated Document Number; updated titles (Section 2); updated paragraph alignment throughout; updated referenced document numbers (Section 4); updated References (Section 5).	10 Jan 2017
004	4.3	Included discussion of risk assessment training.	16 Jan 2018
005	4.1	Revised criteria for workplace hazard assessments.	15 Feb 2019
006	All	Minor language changes.	26 Feb 2020
007	4.2.4	Added reference to Z89.1.	15 May 2020
008	4.2.5	Added section on body protection.	26 May 2021
009	4.2.1	Added reference to ANSI Z87.1 and CSA Z94.3.	22 May 2023

APPROVAL SIGNATURE



Millard P. Griffin, Jr.

Regional Health & Safety Director

Hearing Conservation

DOCUMENT DETAILS

DOCUMENT TITLE	Hearing Conservation
DOCUMENT NUMBER	NAM-1312-PR1
Approval Date	14 August 2023
Version	10
Applicability	North America

1. PURPOSE AND SCOPE

This procedure describes the requirements for prevention of occupational noise-induced hearing loss for employees working in high noise areas. Implementation of this hearing conservation procedure is required whenever noise exposures equal or exceed an 8-hour time-weighted average (TWA) of 85 decibels (dB). It is ERM policy that its employees will not be exposed to noise that exceeds 85 dB averaged over an 8-hour workday.

2. ROLES AND RESPONSIBILITIES

Partner in Charge (PIC): Responsible for the following elements:

- Ensure this procedure is implemented, understood, and followed by employees under their charge and working on their projects, and
- Correct any deficiencies in the implementation of this procedure as identified by the Business Unit (BU) Health and Safety (H&S) Director or other staff members.

Project Manager (PM): Responsible for the following elements:

- Perform observations of ERM work processes to assess employee compliance with this procedure,
- Stop work where deviations from this procedure are observed, and
- Correct, in conjunction with the PIC and the BU H&S Director, any observed deficiencies in the implementation of this procedure.

Regional H&S Director: Responsible for the development and implementation of this procedure.

BU H&S Director: Responsible for the following elements:

- Evaluate implementation of this procedure during health and safety plan reviews and project audits; and

- Communicate identified deficiencies to the PIC.

Employee: Responsible for the use of provided hearing protection in all designated areas.

3. DEFINITIONS

Decibel (dB): A unit used to measure the intensity of a sound by comparing it with a given level on a logarithmic scale.

Hearing protectors: Personal protective equipment in the form of hearing protection. Examples include formable foam earplugs, pre-molded earplugs, canal caps, and earmuffs.

Hertz (Hz): A unit of frequency equal to one cycle per second.

High noise area: A work area in which employee noise exposures equal or exceed 85 dB (decibels) averaged over an eight-hour workday.

Standard threshold shift (STS): A change in hearing threshold relative to a baseline audiogram of an average 10 dB or more at 2000, 3000, and 4000 Hz in one or both ears.

4. PROCEDURE

4.1 NOISE MONITORING AND CONTROL

Noise monitoring to characterize potential noise exposure will be conducted either by a subject matter expert familiar with noise monitoring or a Field Safety Officer (FSO) that has received training in conducting noise monitoring. Both personal monitoring using noise dosimeters and area monitoring using a sound level meter may be conducted. Noise monitoring will be repeated whenever a change in production, process equipment, or controls occurs which could affect the number of employees exposed or render the attenuation of hearing protectors no longer effective.

Where high noise levels (as defined in Section 3 of this procedure) are identified, control measures will be implemented to protect ERM employees. Preferred control measures will include avoidance of areas with elevated noise levels and the use of engineering controls, including barriers or isolation devices. Where these control measures are not feasible or do not lower noise to acceptable levels, hearing protectors will be required.

4.2 EMPLOYEE NOTIFICATION

All employees participating in personal noise monitoring will be notified of their results. Any employee whose exposure is determined to have met or exceeded 85 dB as an 8-hour TWA will be notified in writing within 15 calendar days. The results of area noise surveys will be communicated to project team members during daily site safety meetings.

4.3 OBSERVATION OF MONITORING

Employees or their designated representatives will be offered the opportunity to observe any noise monitoring conducted which impacts their job or position.

4.4 AUDIOMETRIC TESTING

ERM employees who are exposed to noise at or above 85 dB as an 8-hour TWA within the working environment will receive a baseline audiogram within six months of the first exposure. Annually after obtaining the baseline audiogram, the employee shall receive a new audiogram for comparison to the baseline.

In preparation for both baseline and annual examinations, employees will be instructed to avoid noisy environments at both work and home for at least 14 hours before audiometric testing. Hearing protectors may be used as a substitute for the requirement that baseline audiograms be preceded by 14 hours without exposure to workplace noise.

Each employee's annual audiogram will be compared to the baseline audiogram. If the results of the annual audiogram indicate a standard threshold shift (STS), an average change in hearing threshold of 10 dB or more at the 2000, 3000, and 4000 Hz frequency in either ear relative to the baseline audiogram, the following actions will be taken (unless the shift is determined to be non-occupational in nature):

- The employee will be notified in writing with 21 days of the determination,
- The employee shall be referred for additional medical follow-up, as appropriate,
- Employees using hearing protectors will be refitted and retrained in their use,
- Where necessary, hearing protectors with greater noise attenuation properties will be offered, and
- Employees not using hearing protectors will be fitted with such, trained in their care and use, and required to use them.

Employees or their designated representatives will be offered the opportunity to observe any noise monitoring conducted. These tests are conducted at no cost to the employee. Results of audiograms and employee physicals will be forwarded directly to each employee within 10 working days of receipt of results.

4.5 HEARING PROTECTORS AND HEARING PROTECTOR ATTENUATION

A variety of hearing protectors will be provided to the employees at no cost. Hearing protectors need to be maintained in good condition by employees. Employees are required to wear hearing protectors in all designated high noise areas, while performing tasks that generate loud noises (e.g., use of portable power tools), and while working within 25 feet (7.6 meters) of noisy operations (e.g., drilling, mobile construction equipment operation, vacuum truck operation, etc.).

The adequacy of the hearing protector will be evaluated to ensure that the hearing protector attenuates the employee's exposure to an 8-hour TWA of 85 dB or less. The FSO, with assistance from the BU H&S Director, is responsible for making this determination.

For work performed at client's location, the employees must observe posted noise signage and implement controls as needed.

4.6 TRAINING

Where employees are required to work regularly in areas where their exposure to noise is determined to be, or has the potential to be, in excess of 85 dB as an 8-hour TWA, baseline training and annual training will be provided. The training will contain at least the following elements:

- Effects of noise on hearing,
- Purpose of hearing protectors and manufacturer's instructions on use and fitting,
- Advantages/disadvantages and attenuation of various types of hearing protectors,
- Instructions on selection, fitting, use, and care of hearing protectors (in accordance with manufacturer instructions),
- Purpose of audiometric testing program including an explanation of the test procedure, and
- Changes in ERM work processes and/or personal protective equipment (PPE) used.

Recognition of completion of this training is provided in ERM's Academy Learning Management System (LMS). A certificate of training is available to all employees.

4.7 RECORDKEEPING

Audiometric testing records will be maintained for each affected employee and contain the following information:

- Name and job classification,
- Date of audiogram,
- Name of person conducting audiogram,
- Date of last acoustic or exhaustive calibration of audiometer, and
- Employee's most recent noise exposure assessment.

Records of audiometric testing will be maintained by ERM's medical consultant WorkCare. All audiometric testing records shall be maintained for the duration of employment plus thirty years. All noise monitoring records shall be maintained for the duration of employment.

5. REFERENCES

US Occupational Safety and Health Administration (OSHA) **29 Code of Federal Regulations (CFR) 1910.95 – Occupational Noise Exposure**

- Ontario Occupational Health and Safety Act (OHSA) Regulation **381/15 – Noise**

DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
001	All	New document.	17 Mar 2014
002	All	Reformatted document. Minor language changes for clarity.	24 Jun 2015
003	1.0	Added line clarifying that ERM employees will not be exposed to noise levels in excess of 85 dB averaged over an 8-hour day.	15 Dec 2015
004	4.6	Updated training requirements.	3 Aug 2016
005	All	Updated Document Number; updated titles (Section 2); updated paragraph alignment throughout; updated referenced document numbers (Section 4); updated References (Section 5).	6 Jan 2017
006	1, 4.5, 5	Revised Purpose statement (Section 1); added information on compliance with client requirements (Section 4.5); added reference to Ontario regulations.	26 Jun 2018
007	All	Minor language revisions and grammar corrections.	13 Apr 2020
008	4.1	Added information on noise control measures.	24 Mar 2021
009	All, 4.6	Minor language revisions and adjustments to training requirements.	13 Mar 2023
010	4.6	Added annual training requirement to all employees exposed to above 85 dBA as an 8-hour TWA	14 Aug 2023

APPROVAL SIGNATURE



Millard P. Griffin, Jr.
Regional Health & Safety Director

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Elevated Work Permit

DOCUMENT DETAILS

DOCUMENT TITLE	Elevated Work Permit
DOCUMENT NUMBER	NAM-1313-FM1
Approval Date	30 March 2023
Version	4
Applicability	North America

DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
004	Na	Minor editorial changes.	30 Mar 2023

This Form Template has been Approved By:

APPROVAL SIGNATURE



Millard P. Griffin, Jr.

Regional Health & Safety Director

Project Description (include identification of elevated work zones, height above ground level, and start/stop dates)

Project Basics	Yes	No	N/A	Comments
ERM Field Manager competent and trained in fall protection techniques?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Subcontractor pre-qualified via ERM SUBS Process?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Subcontractor employees qualified for work at elevation? Verified via training or competency statement?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Subcontractor competency verified via training or competency review?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
General Field Activity	Yes	No	N/A	Comments
Work area is identified and marked?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Work area is appropriately lighted?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Other known activity risks managed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
No activity to be performed below an elevated work area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Weather conditions compatible with works (e.g., no rain, wind, snow)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Lone workers are prohibited for work at height activities?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Other?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Potential Hazards				
<input type="checkbox"/> Holes	<input type="checkbox"/> Trenches	<input type="checkbox"/> Opening in wall	<input type="checkbox"/> Opening in floor	
<input type="checkbox"/> Roofs	<input type="checkbox"/> Unprotected structure edge	<input type="checkbox"/> Falling items	<input type="checkbox"/> Slip/trip	
<input type="checkbox"/> Removal of guardrail	<input type="checkbox"/> Collapse	<input type="checkbox"/> Snow/rain/heat/wind	<input type="checkbox"/> Work over equipment	
<input type="checkbox"/> Weak structures (domes, ceilings, etc.)	<input type="checkbox"/> Other	<input type="checkbox"/> Other	<input type="checkbox"/> Other	

Describe potential hazards:

Equipment and Systems for Work at Elevation or Access to Work Area

<input type="checkbox"/> Portable ladder	<input type="checkbox"/> Step ladder	<input type="checkbox"/> Fixed ladder	<input type="checkbox"/> Aerial lift
<input type="checkbox"/> Stairs	<input type="checkbox"/> Guardrail	<input type="checkbox"/> Scaffold	<input type="checkbox"/> Safety Net
<input type="checkbox"/> Anchorage	<input type="checkbox"/> Lifeline (vertical/horizontal)	<input type="checkbox"/> Mobile platform (e.g., scissors lift)	<input type="checkbox"/> Safety monitoring system

☐ Other (describe):

Personal Protective Equipment

<input type="checkbox"/> Safety shoes/boots	<input type="checkbox"/> Hard hat	<input type="checkbox"/> High visibility vest	<input type="checkbox"/> Gloves
<input type="checkbox"/> Safety glasses	<input type="checkbox"/> Harness and lanyard with shock absorber	<input type="checkbox"/> Double lanyard for 100% tie-off	

Emergency Plan

Describe means to rescue workers and raise the alarm in the event of a fall:

Checklist for equipment and PPE assessment. Use only those parts specific to your work

Scaffolding	Yes	No	N/A	Comments
Setup				
Designee in charge of scaffolding activities? Provide name.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sufficient distance from above ground utilities and electrical lines?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Potential interactions with other site operations managed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Scaffold protected from potential impact with mobile equipment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Training evidence for persons in charge of set-up, modification or dismantling?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
100% tie-off requirement understood by employees in charge of set-up, modification or dismantling?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Scaffold compliance certificate?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Scaffold user's instructions available?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Scaffold design in accordance with loads?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Presence of upper railing, lower railing and toe boards made of rigid materials and securely fixed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
If scaffold located more than 14 inches (36 cm) from the wall, presence of railing and toe board?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
All access to platforms is safe and secure?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Scaffolds are in stable and acceptable condition?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are stabilizers and wheel brakes available for mobile scaffold?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Use				
Experienced person in charge of daily control? Provide name.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Training/competence of scaffold users verified?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Users understand that modification of scaffold is prohibited?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Users understand it is prohibited to stand up on intermediary rail?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Mobile scaffold: prohibited to move scaffold while employee is on scaffold, use of stabilizers and wheel brakes compulsory?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Dismantling				
Designee in charge of scaffolding activities? Provide name.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Training evidence for persons in charge of set-up, modification or dismantling?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
100% tie-off requirement understood by employees in charge of set-up, modification or dismantling?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Fixed or Portable Ladders	Yes	No	N/A	Comments
Fixed ladders with cages, rest platforms according to height?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Ladders are in acceptable condition, securely fixed, and stable on a stable surface?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Options for using other means of access than portable ladder considered?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Always 3 points of contact during use of portable ladder (e.g. 2 feet - 1 hand)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Understanding that hand carrying a load up a ladder is prohibited?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Side rails of portable ladder extending 36 inches (0.9 m) above the upper landing surface?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Temporary Walkways, Staircases, and Work Platforms	Yes	No	N/A	Comments
Design in accordance with expected load?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Walkway with railing, intermediary rail, and toe boards?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are staircases available with railings and in acceptable condition?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Guardrail	Yes	No	N/A	Comments
Railing is made of firmly secured wood, metal tubing, or other suitable material?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Railing includes top rail, mid rail, and toe board (as required)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Studs are safely secured to the ground?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
User(s) understand it is prohibited to stand on mid rail?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Aerial Lift	Yes	No	N/A	Comments
Certificate of periodic inspection is posted/available?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Maintenance logbook is posted/available?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Evidence of training for users is posted/available?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
The lift is adapted to the height of/distance to the works to be performed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
The lift operates on a flat and compact surface?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
The lift route is cleared from obstacles?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
The use of stabilizers of the aerial lift is compulsory?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Use of full body safety harness with lanyard is required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
User understands it is prohibited to stand on mid rails?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Designee in charge of daily inspection of aerial lift prior to use? Provide name.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Safety Nets	Yes	No	N/A	Comments
Certificate of periodic inspection by competent body?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Person in charge of set-up and dismantling? Provide name.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Designee in charge of daily inspection? Provide name.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Calculation notes (appropriate meshing)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Use of full body safety harness with lanyard is required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Anchorage Points	Yes	No	N/A	Comments
Inspection of anchorage points by competent person? Provide name.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Lifelines	Yes	No	N/A	Comments
Evidence of training for designee in charge of set-up or dismantling?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Use of full body safety harness with lanyard is required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
User(s) understand 100% tie-off requirement?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Designee in charge of daily inspection? Provide name.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Rope grabs for vertical lifelines are required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Harnesses and Lanyards	Yes	No	N/A	Comments
Certificate of periodic inspection?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Inspection prior to use by user?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Evidence of training for users?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
User(s) understands 100% tie-off requirement?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Lanyard with shock absorber?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Double lanyard with shock absorber for 100% tie-off?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Work on Roof or at Leading Edge	Yes	No	N/A	Comments
Safe access to work area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Edge protection with handrail or equivalent for all directions?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Identification and protection measures for fragile materials (e.g., sky lights)?

☐☐☐

No unprotected roof edge less than 6 feet (1.8 meters) from walking or working area?

☐☐☐

Provide a sketch or photo of the elevated work area. Provide a description as needed.

List of Authorized Personnel

I have read the Elevated Work Permit, understand the risks, and will adhere to the preventive measures described in this permit. I will stop work and report any condition different from that included in this permit to the Field Manager.

Company		Company		Company	
Name		Name		Name	
Signature		Signature		Signature	

Permit Review and Approval

I have verified that preventive measures described in this permit are necessary and sufficient to control the risks associated with the task at height to be performed. As Project Manager, I have verified that preventive measures are implemented.

ERM	Field Manager	Project Manager	Partner in Charge	Field Safety Officer	Subcontractor	Field Manager	Client/Site	Work Manager

Daily inspection records are required for elevated work activities that occur for more than one day. Daily inspection must occur at the start of the day and before any project work activities commence.

- **Daily equipment inspection by designee.**
- Daily verification by Field Manager that inspections were complete and that permit conditions are met.

Daily Equipment Inspection						
Equipment						
Designee						
Signature						
Date						
Equipment						
Designee						
Signature						
Date						
Daily Field Manager Inspection Record						
Field Manager						
Signature						
Date						

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Fall Protection Equipment Checklist

DOCUMENT DETAILS

DOCUMENT TITLE	Fall Protection Equipment Checklist
DOCUMENT NUMBER	NAM-1313-FM2
Approval Date	20 March 2023
Version	04
Applicability	North America

DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
004	NA	Minor editorial changes.	30 Mar 2023

This Form Template has been Approved By:

APPROVAL SIGNATURE



Millard P. Griffin, Jr.

Regional Health & Safety Director

Check If OK		Comments
<input type="checkbox"/>	Training: Ensure each worker exposed to fall hazards has been properly trained in hazard recognition, fall protection processes and equipment, and site-specific conditions.	Click or tap here to enter text.
<input type="checkbox"/>	Harness: Inspect the surface of webbing for damage. Watch for frayed edges, broken fibers, pulled stitches, cuts, burns, and chemical damage.	Click or tap here to enter text.
<input type="checkbox"/>	Buckles: Note any unusual wear, frayed or cut fiber, or distortion of the buckles. Inspect the buckle for distortion. The outer bars and center bars must be straight.	Click or tap here to enter text.
<input type="checkbox"/>	Straps: Inspect for loose, distorted, or broken grommets. The webbing should not have any additional punched holes. Buckle tongues should be free of distortion in shape and motion. They should overlap the buckle frame and move freely back and forth in their socket. The roller should turn freely on the frame. Check for distortion or sharp edges.	Click or tap here to enter text.
<input type="checkbox"/>	Snap Hooks: Inspect closely for hook and eye distortions, cracks, corrosion, or pitted surfaces. The keeper (latch) should seat into the nose without binding and should not be distorted or obstructed. The keeper spring should exert sufficient force to firmly close the keeper. Keeper locks must prevent the keeper from opening when the keeper closes.	Click or tap here to enter text.
<input type="checkbox"/>	Web Lanyard: Examine the webbing for swelling, discoloration, cracks, or burns. Observe closely for any breaks in the stitching.	Click or tap here to enter text.
<input type="checkbox"/>	Rope Lanyard: Examine the rope for any fuzzy, worn, broken or cut fibers. Weakened areas from extreme loads will appear as a noticeable change from the original diameter. The rope diameter should be uniform throughout, following a short break-in period. Make sure the rope has no knots tied in it, as knots can reduce the strength of the rope up to 60%.	Click or tap here to enter text.
<input type="checkbox"/>	Shock-absorbing Lanyard: Examine per requirements for web lanyards. Also look for signs of deployment. If the lanyard shows signs of having been put under load (e.g., torn out stitching), remove from service.	Click or tap here to enter text.
<input type="checkbox"/>	Hardware: Check "D" rings for distortion, cracks, breaks, and rough or sharp edges. The "D" rings should pivot freely.	Click or tap here to enter text.
<input type="checkbox"/>	Anchorage: Locate the anchor point above the work area (to the extent possible), minimizing swing in the event of a fall. Ensure the anchorage can support 5,000 pounds (2,270 kg) for each attached employee.	Click or tap here to enter text.

Fall Protection

DOCUMENT DETAILS

DOCUMENT TITLE	Fall Protection
DOCUMENT NUMBER	NAM-1313-PR1
Approval Date	3 Aug 2023
Version	08
Applicability	North America

1. PURPOSE AND SCOPE

This document establishes procedures for protection of personnel who could be exposed to fall hazards of six feet (1.8 meters) or greater in the construction and demolition industry and four feet (1.2 meters) or greater in all other industries. This document also addresses steep slope work, where the work surface angle is greater than 30° (degrees) from horizontal. The procedure applies to all North American operations where these hazards have been identified.

2. ROLES AND RESPONSIBILITIES

Partner in Charge (PIC): Responsible for the following elements:

- Ensuring this procedure is implemented, understood, and followed by employees under their charge and working on their projects, and
- Correcting any deficiencies in the implementation of this procedure as identified by the Business Unit (BU) Health and Safety (H&S) Director.

Project Manager (PM)/Supervisor: Responsible for the following elements:

- Performing observations of ERM work processes to assess whether employees are operating in accordance with this procedure,
- Pausing or stopping work where deviations from this procedure are observed, and
- Correcting, in conjunction with the PIC and the BU H&S Director, any observed deficiencies in the implementation of this procedure.

BU H&S Director: Responsible for the following elements:

- Evaluating implementation of this procedure during health and safety plan reviews and project audits; and
- Communicating identified deficiencies to the PIC.

3. DEFINITIONS

Anchorage: A secure point of attachment for lifelines, lanyards or deceleration devices.

Authorized Person: An employee requiring the use of a fall protection system in the workplace.

Body belt: A strap with means for both securing it about the waist and for attaching it to a lanyard, lifeline, or deceleration device. The use of a body belt for fall arrest is prohibited.

Body harness: Straps that may be secured about the person in a manner that distributes the fall-arrest forces over at least the thighs, pelvis, waist, chest, and shoulders with a means for attaching the harness to other components of a personal fall arrest system.

Competent Person: An employee who can identify existing and predictable hazards in the surroundings and working conditions, which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate the hazards.

Connector: A device that is used to connect parts of a personal fall arrest system or positioning device system together.

Controlled access zone: A work area designated and clearly marked in which certain types of work may take place without the use of conventional fall protection systems—guardrail, personal arrest or safety net –to protect the employees working in the zone.

Deceleration device: Any mechanism – such as rope grab, rip-stitch lanyard, specially-woven lanyard, tearing or deforming lanyard, or automatic self-retracting lifeline/lanyard – which serves to dissipate a substantial amount of energy during a fall arrest, or otherwise limits the energy imposed on an employee during fall arrest.

Guardrail system: A barrier erected to prevent employees from falling to lower levels.

Hole: A void or gap 2 inches (5.1 centimeters) or more in the least dimension in a floor, roof, or other walking/working surface.

Lanyard: A flexible line of rope, wire rope, or strap that generally has a connector at each end for connecting the body belt or body harness to a deceleration device, lifeline, or anchorage.

Leading edge: The edge of a floor, roof, or formwork for a floor or other walking/working surface (such as the deck) which changes location as additional floor, roof, decking, or formwork sections are placed, formed, or constructed.

Lifeline: A component consisting of a flexible line for connection to an anchorage at one end to hang vertically (vertical lifeline), or for connection to anchorages at both ends to stretch horizontally (horizontal lifeline) and that serves as a means for connecting other components of a personal fall arrest system to the anchorage.

Opening: A gap or void 30 inches (76 centimeters) or higher and 18 inches (46 centimeters) or wider, in a wall or partition, through which employees can fall to a lower level.

Personal fall arrest system: A system including, but not limited to, an anchorage, connectors, and a body harness used to arrest an employee in a fall from a working level.

Positioning devices: Body belts or body harnesses which are rigged to allow an employee to be supported on an elevated vertical surface and work with both hands free.

Qualified person: A person with training and extensive knowledge in the field of fall protection who is capable of design, analysis, and evaluation of fall hazards and fall protection equipment. Only qualified persons will develop and implement site-specific fall protection plans. They will be responsible for ensuring plans are maintained and current.

Rope grab: A deceleration device that travels on a lifeline and automatically, by friction, engages the lifeline and locks to arrest a fall.

Safety monitoring system: A safety system in which a competent person is responsible for recognizing and warning employees of fall hazards.

Self-retracting lifeline/lanyard: A deceleration device containing a drum-wound line, which can be slowly extracted from, or retracted onto, the drum under minimal tension during normal employee movement and which, after onset of a fall, automatically locks the drum and arrests the fall.

Slope: Also known as pitch, is a comparison of the vertical rise in distance to the horizontal length.

Snap-hook: A connector consisting of a hook-shaped member with a normally closed keeper, or similar arrangement, which may be opened to permit the hook to receive an object and, when released automatically closes to retain the object.

Swing fall hazard: The potential for an employee to contact an object laterally after falling, usually as a result of an anchor point's horizontal distance from the employee's location before falling.

Toeboard: A low protective barrier that prevents material and equipment from falling to lower levels and helps protect personnel from falling off elevated working surfaces.

Unprotected sides and edges: Any side or edge (except at entrances to points of access) of a walking/working surface (e.g., floor, roof, ramp, or runway) where there is no wall or guardrail system at least 39 inches (1 meter) high.

Walking/working surface: Any surface, whether horizontal or vertical, on which an employee walks or works, including but not limited to, the ground, floors, roofs, ramps, bridges, runways, formwork, and concrete reinforcing steel. However, ladders, vehicles, or trailers on which employees must be located to perform their work duties are not included in this definition.

Warning line system: A barrier erected on a roof to warn employees that they are approaching an unprotected roof side or edge, and which designates an area in which roofing work may take place without the use of guardrail, body belt, or safety net systems to protect employees in the area.

4. PROCEDURE

4.1 GENERAL

A qualified person working in areas with known fall hazards should:

- Be properly trained per the requirements of this procedure,
- Ensure that one or more fall protection or prevention systems outlined in this procedure is provided at the locations where the fall hazards exist,
- Ensure that all personnel working with and around fall hazards and fall protection systems are properly trained,
- Ensure that access controls to areas with fall hazards are effective, and
- Ensure that safety monitoring systems or warning line systems, where used, are properly implemented and provided with trained monitors.

Fall hazards at ERM generally take place in one of three categories:

- *General industry*, which would apply where fall hazards greater than 4 feet (1.2 meters) exist. This may include employees conducting inspections of facilities not under construction, performing environmental remediation activities where no construction activities are occurring, or working on elevated structures such as towers or poles.
- *Construction industry*, which would apply where fall hazards greater than 6 feet (1.8 meters) exist. This may include activities such as demolition, renovation, or construction support inspections or surveying.
- *Steep slopes*, which would apply whenever the slope angle exceeds 30 degrees from horizontal. This may include environmental surveys, inspection of dam structures, or other applications where traditional fall protection systems are impractical.

Fall hazards include, but are not limited to, excavations, trenches, unprotected elevations, ladders, scaffolds, floor holes, wall openings, sloped surfaces, and any other location or operation where potential fall hazards exist. Fall hazards must be addressed by one of three means:

- An engineering control, which may include guardrails or other means of segregating the employee from the fall hazard,
- Personal protective equipment (PPE), which may include fall arrest systems, positioning systems, safety nets, or other devices, and
- Administrative procedures, which include safety observers and boundary markings located 6 feet (1.8 meters) or more from an exposed edge.

Where ERM procedures differ from regulatory or client standards, the more conservative procedure shall define when and what fall protective systems are required. In each instance where an employee may be exposed to a fall hazard (as defined in Section 1 of this procedure), the PM/Supervisor shall complete **NAM-1313-FM1 – Elevated Work Permit**. The permit will assist the PM/Supervisor in defining a fall protection strategy to protect the employees. All employees involved with the elevated work will be required to review and sign the permit before

initiation of work. The permit will be a part of the site-specific health and safety plan (HASP) and must be approved by the PIC.

4.2 GUARDRAIL SYSTEMS

Guardrail systems shall be provided, when feasible, at all locations where a fall hazard exists. Where guardrail systems are impractical, an alternative form of fall protection as outlined elsewhere in this procedure must be provided. Guardrail systems must meet the following criteria:

- Toprails must be installed 42 inches (1.1 meters), +/- 3 inches (8 cm), above the walking/working surface and be capable of withstanding, without failure, a minimum force of 200 pounds (91 kg) in any outward or downward direction with no more than 3 inches (8 cm) of deflection.
- Midrails must be installed at a height midway between the toprail and the walking/working surface and be capable of withstanding, without failure, a minimum force of 150 pounds (68 kg) in any outward or downward direction.
- Posts must be spaced not more than 8 feet (2.4 meters) apart on center.
- There shall be no openings more than 19 inches wide (48 cm) in any guardrail system.
- Additional requirements for guardrails systems include:
 - Do not use plastic or steel banding as a toprail or midrail.
 - Toprails and midrails shall be at least one-quarter inch (6 mm) nominal thickness or diameter, and smoothly surfaced to prevent cuts and punctures.
 - The toprail shall be flagged with high-visibility material when using wire rope.
 - Guardrails shall be erected on all sides when using guardrail systems around holes.
 - When guardrails are used around holes that are used for access, such as ladderways, a gate or guardrail offset shall be provided so that a person cannot walk directly into the hole.
 - When guardrails are used at hoisting areas, a chain, gate, or removable guardrail section shall be placed across the access point when hoisting operations are not taking place.
 - Guardrail systems shall be in place at all locations above dangerous equipment or materials, regardless of height above the danger.
 - Guardrails shall be provided at all wall openings where the outside bottom edge of the opening is 6 feet (1.8 meters) or more above lower levels and the inside bottom edge of the wall opening is less than 39 inches (1 meter) above the walking/working surface.
 - Guardrail systems shall be in place on all unprotected sides or edges of ramps and runways when such systems are used.

4.3 PERSONAL FALL ARREST SYSTEMS

Personal fall arrest systems must be provided for all unprotected elevations at the heights indicated in Section 4.1. Where these systems are impractical, an alternative form of fall protection must be provided. An inspection checklist is provided in NAM-1313-FM2 (Fall Protection Equipment Checklist).

All aspects of personal fall arrest protection systems must be designed, installed, and used under the supervision of a qualified person. Body belts are prohibited as part of a personal fall arrest system.

The components of a complete personal fall arrest system typically include full body harnesses, shock-absorbing lanyards, lifelines, and anchorage points. These components must meet the following criteria:

- Body harness and connector design and construction must meet applicable regulatory specifications.
- All snap hooks must be of the locking type.
- Ropes and webbing used in lanyards, lifelines, and body harnesses must be made of synthetic fibers.
- The attachment point (D-ring) of a body harness must be located in the center of the wearer's back near shoulder level, or above the wearer's head.
- Horizontal lifelines must be designed, installed, and used under the supervision of a qualified person; be capable of supporting at least 5,000 pounds (2,270 kg) per employee attached; and maintain a safety factor of at least 2 (i.e., system must be capable of supporting at least twice the potential load imposed upon the system).
- Lanyards and vertical lifelines must have a minimum breaking strength of 5,000 pounds (2,270 kg).
- Self-retracting lifelines and lanyards which limit free fall to 2 feet (60 cm) or less must be capable of sustaining a minimum tensile load of 3000 pounds (1,360 kg) in the fully extended position.
- Self-retracting lifelines and lanyards (those which do not limit free fall to 2 feet (60 cm) or less), rip stitch, and other shock-absorbing lanyards must be capable of sustaining a minimum tensile load of 5,000 pounds (2,270 kg) in the fully extended position.
- Anchorage points for personal fall protection systems must be independent of any anchorage point being used to support or suspend platforms and must be capable of supporting at least 5,000 pounds (2,270 kg) per attached employee, including all connectors and components. The system must be designed for use by the number of employees connected.

All fall protection components must be inspected for wear, damage, and deterioration prior to use. System components should be rigged such that they are protected against cuts, abrasions, and burns throughout use. Additional requirements for personal fall arrest systems:

- Require employees to be familiar with the fitting and donning of body harnesses, proper tie-off techniques, and suitable anchorage points.
- Limit maximum arresting force to 1,800 pounds.
- Instruct employees to rig fall protection such that they can neither free fall more than 6 feet (1.8 meters), nor contact any lower level.
- Ensure, where practical, that the anchor end of the lanyard be secured at a point not lower than the employee's waist.
- Bring the employee to a complete stop and limit maximum deceleration distance an employee travels to 3.5 feet (1 meter).
- Never utilize guardrail systems or hoists as anchorage points.
- Require employees to remain connected to anchorage points 100% of the time by means of horizontal lifelines, vertical lifelines, a double lanyard system, or other suitable means.
- Remove from service any component of a personal fall protection system that has been subjected to impact loading.
- Make provisions for the prompt rescue of personnel in the event of a fall or require that employees are capable of self-rescue (best practice).
- Provide separate vertical lifelines for each employee using a vertical lifeline; 5/8-inch (16 mm) synthetic rope is recommended for lifeline use.
- Use rope grabs to attach to vertical lifelines; never use knots in any portion of a fall protection system.
- Inspect all components for wear and damage prior to use; remove defective components from service. All personal fall arrest components must comply with American National Standards Institute (ANSI)/American Society of Safety Professionals (ASSP) Standard Z359 – Fall Protection and Arrests.
- The authorized person shall inspect fall protection components at the beginning of each work shift to verify that it has not sustained any wear and tear that would require removal from service.
- A competent person shall inspect fall protection and fall rescue equipment on an annual basis (more frequently if required by the manufacturer) to verify that it is safe for use.

4.4 POSITIONING DEVICE SYSTEMS

Positioning device systems are only used to support an employee on a vertical work surface and are not considered part of a fall arrest system. Body belts (which may be used as positioning devices) and connector design and construction must meet applicable regulatory specifications. Positioning devices shall meet the following criteria:

- Rig systems so that an employee cannot free fall more than 2 feet (0.6 m).

- Secure devices to an anchorage capable of supporting at least twice the potential impact load of an employee's fall or 3,000 pounds (1,360 kg), whichever is greater.
- Remove from service any component of a positioning device system that has been subjected to impact loading.
- Ensure that only locking snaphooks are used.
- Inspect all components for wear and damage prior to use; remove defective components from service. All positioning device components must comply with current American National Standards Institute (ANSI)/American Society of Safety Professionals (ASSP) Standard Z359 – Fall Protection and Arrests.

4.5 SAFETY NET SYSTEMS

Safety net systems should be provided where a fall hazard of 6 feet (1.8 meters) or greater exists and other forms of fall protection are not feasible. Where safety nets are not practical, an alternative form of fall protection must be provided. Safety nets should only be installed and inspected by engineers competent in the design and installation of such systems.

Safety net systems should meet the following criteria:

- Comply with all applicable regulatory requirements.
- Install safety nets as close as possible under the walking/working surface on which employees are working, but never more than 30 feet (9 meters) below this level.
- Require that the potential fall area from the walking/working surface to the net is unobstructed.
- Install safety nets with enough clearance under them to prevent contact with the surface or structures below when subjected to an impact force equal to the drop test specified below.
- Extend the outer edge of the net 8 feet (2.4 meters) from the edge of the working surface when the vertical distance from the working level to the net is 5 feet (1.5 meters) or less.
- Extend the outer edge of the net 10 feet (3 meters) from the edge of the working surface when the vertical distance from the working level to the net is 5 feet to 10 feet (1.5 to 3 meters).
- Extend the outer edge of the net 13 feet (4 meters) from the edge of the working surface when the vertical distance from the working level to the net is greater than 10 feet (3 meters).
- Conduct a drop test of the safety net after installation and before being used as a fall protection system, whenever relocated, after major repair, and at 6-month intervals if left in one place.
- Conduct the drop test by dropping a 400-pound (180 kg) sandbag, 30 inches (76 cm) in diameter, into the net from at least 42 inches (107 cm) above the highest walking/working level at which employees are exposed to a fall.

- Inspect safety nets at least once a week, and after any occurrence which could affect the integrity of the system, for wear, damage, and deterioration. Remove defective nets and components from service.
- Remove all materials, scrap, equipment, and tools which have fallen into the net as soon as possible, but at least before the next work shift.

4.6 HOLE COVERS

Where holes covers will be used:

- Provide covers in roadways and vehicle aisles that are capable of supporting at least twice the maximum axle load of the largest vehicle expected to cross over the cover.
- Provide walking/working surface hole covers that are capable of supporting at least twice the weight of employees, equipment, and materials that may be imposed on the cover at any one time.
- Secure covers at the time of installation to prevent displacement by the wind, equipment, or employees.
- Color code or mark all hole covers with the word "HOLE" or "COVER" to provide warning of the hazard.

4.7 SAFETY MONITORING SYSTEMS, WARNING LINE SYSTEMS, AND CONTROLLED ACCESS ZONES

The qualified person shall approve these control measures prior to performing any roofing, leading edge, or other elevated work that may require the use of one or more of these systems.

Safety Monitoring Systems: Safety monitoring systems are typically used on low slop roofs. When no other alternate fall protection can be implemented a safety monitoring system may be implemented. A competent person must be designated to monitor the safety of workers. The safety monitor must be:

- Competent in the recognition of fall hazards,
- Capable of warning workers of fall hazard dangers and in detecting unsafe work practice,
- On the same walking/working surfaces of the workers and can see them,
- Have responsibility for monitoring and communicating with no more workers than can be continuously visually monitored at the same time, and
- Close enough to work operations to communicate orally with workers and has no other duties to distract from the monitoring function.

Mechanical equipment shall not be used or stored in areas where safety monitoring systems are being used to monitor employees engaged in rooftop operations on low-sloped roofs.

No worker, other than one engaged in roof top work (on low-sloped roofs) or one covered by a fall protection plan, shall be allowed in an area where an employee is being protected by a safety

monitoring system. All workers must promptly comply with fall hazard warnings issued by safety monitors.

Warning Line Systems: Warning line systems are typically used on low slope roofs; consist of ropes, wires, or chains, and supporting stanchions; and are set up as follows:

- Flagged at not more than 6-foot (1.8 meter) intervals with high-visibility material, and
- Rigged and supported so that the lowest point (including sag) is no less than 34 inches (86 cm) from the walking/working surface and the highest point is no more than 39 (99 cm) inches from the walking/working surface.

Stanchions, after being rigged with warning lines, shall be capable of resisting without tipping over a force of at least 16 pounds (7.3 kg) applied horizontally against the stanchion, 30 inches (76 cm) above the walking/working surface, perpendicular to the warning line and in the direction of the floor, roof, or platform edge. The rope, wire, or chain shall have a minimum tensile strength of 500 pounds (225 kg) and, after being attached to the stanchions, must support without breaking the load applied to the stanchions as prescribed above.

Warning lines shall be erected around all sides of roof work areas. When mechanical equipment is being used, the warning line shall be erected not less than 6 feet (1.8 meters) from the roof edge parallel to the direction of mechanical equipment operation, and not less than 10 feet (3 meters) from the roof edge perpendicular to the direction of mechanical equipment operation. When mechanical equipment is not being used, the warning line must be erected not less than 6 feet (1.8 meters) from the roof edge.

Controlled Access Zones: Controlled access zones are commonly used along unprotected or leading edges; consist of ropes, wires, tapes, and supporting stanchions; and are set up as follows:

- Erected not less than 6 feet (1.8 meters) and not more than 25 feet (7.6 meters) from the unprotected or leading edge,
- Extend along the entire length of the unprotected or leading edge,
- Erected approximately parallel to the unprotected or leading edge, and
- Connected on each side to a guardrail system or wall.

Each line shall be rigged and supported in such a way that its lowest point, including sag, is not less than 39 inches (1 meter) from the walking/working surface and its highest point is not more than 45 inches (1.1 meters) from the walking/working surface. Each line shall have a minimum breaking strength of 200 pounds (90 kg).

4.8 PROTECTION FROM FALLING OBJECTS

- Install toeboards along the edge of the overhead walking/working surface.
- Require that toeboards are a minimum of 3.5 inches (9 cm) in height; that they are capable of withstanding at least 50 pounds (22 kg) of force applied in any downward or outward

direction; and that there is no more than 0.25 inches (6 mm) clearance between the toeboard and the walking/working surface.

- Install paneling or screening from the top of the toeboard to the top rail or midrail when tools, equipment, or materials are piled higher than the top of the toeboard.
- Provide sidewalk sheds or canopies as appropriate.

4.9 ALTERNATIVE FALL PROTECTION PLANS

When traditional fall protection systems (engineered or personal protective equipment) are impractical, the PIC, in consultation with the Business Unit Health and Safety Director, may authorize an alternative method of fall protection. Typically, this is intended to include steep slope (>30 degrees for horizontal) work along graded roads and in other remote or inaccessible steep work areas. This does not include roofing applications as appropriate equipment and regulatory guidance exists in those cases.

The Fall Protection Plan shall address the following areas thoroughly:

- Fall protection strategy and application,
- Protective system and equipment, in detail,
- Methods and procedures including limitations of the system, and the required numbers of trained workers,
- Rescue capability and procedures,
- Training required, in detail, for all workers,
- Responsibilities of key personnel, including the supervisor, and
- Controlled access zones.

4.10 SCAFFOLDS

While ERM personnel do not assemble or maintain scaffolding systems, they on occasion need to access scaffolding systems to complete work activities. ERM will ensure that any scaffold system that employees must access has been inspected by a competent person experienced in scaffold assembly.

Scaffold tags are commonly used to identify if a scaffold is safe or unsafe for use. Tagging should be completed by the competent person following inspection. Tags should contain a unique identifier for tracking purposes and must be posted at each access point. Tags are color coded as follows:

- Green – Scaffold is safe for use.
- Yellow – Scaffold has been modified and may present a hazard to the user. Special requirements may be posted for safe use.
- Red – Scaffold is undergoing assembly or dismantlement and is unsafe for use.

All ERM employees accessing scaffolding shall receive basic awareness training on access and usage requirements, capacity, and scaffold types. Retraining shall be provided whenever one of the following situations occurs:

- Changes in the workplace render previous training obsolete, or
- Inadequacies in the employee's knowledge or use of scaffold safety processes indicate that the employee has not retained the requisite understanding or skill.

4.11 FALL PROTECTION TRAINING

Training must be provided to each employee who might be exposed to fall hazards. The program shall enable employees to recognize the hazards of falling and shall train employees in the procedures to be followed in order to minimize these hazards. Training should be provided by a competent person and shall include:

- The nature of fall hazards in the work area,
- The correct procedures for assembling, maintaining, disassembling, and inspecting the fall protection systems to be used,
- The use, inspection, and operation of guardrail, personal fall arrest, safety net, warning line, and safety monitoring systems, controlled access zones, and other protection to be used,
- The role of each employee in the safety monitoring system, when used,
- The limitations on the use of mechanical equipment during the performance of roofing work on low-sloped roofs,
- The correct procedures for the handling and storage of equipment and materials and the assembly of overhead protection (as necessary),
- The role of employees in fall protection plans,
- Procedures for rescue if personal fall arrest or safety net systems are used, and
- Applicable regulatory standards.

Retraining shall be provided whenever one of the following situations occurs:

- Changes in the workplace render previous training obsolete,
- Changes in the types of fall protection systems or equipment to be used render previous training obsolete, or
- Inadequacies in affected employee's knowledge or use of fall protection systems or equipment indicate that the employee has not retained the requisite understanding or skill.

4.12 DANGER AREAS

Waste, materials, or tools shall not be thrown from buildings or structures to areas where employees may be located, unless the area where the material falls is guarded by fences, barricades, or other methods/means to prevent employee(s) from entering and being struck by falling objects. Signs shall be posted to warn employees of the hazard.

4.13 INCIDENT INVESTIGATION

If an employee suffers a fall or a serious incident occurs as a result of the implementation of this fall protection program, ERM will investigate the circumstances of the incident in accordance with the provisions of ***NAM-1220-PR1 – Incident Reporting and Investigation***. The goal of the investigation will be to identify the root causes of the event, as well as to determine if this fall protection procedure needs to be changed or amended to prevent similar types of incidents.

5. REFERENCES

ERM Procedure ***NAM-1220-PR1 – Incident Reporting and Investigation***

ERM Form ***NAM-1313-FM1 – Elevated Work Permit***

ERM Form ***NAM-1313-FM2 – Fall Protection Equipment Checklist***

ERM Guideline ***NAM-1313-GU1 – Calculating Total Fall Distance***

American National Standards Institute (ANSI)/American Society of Safety Professionals (ASSP)
Standard ***Z359 – Fall Protection and Arrest Standards***

DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
001	All	New document.	12 Mar 2015
002	4.11, 5.0	Added Section 4.11 (Incident Investigation); added additional reference in Section 5.0.	12 Jul 2016
003	Multiple	Multiple updates to ensure compliance with State of California regulations.	14 Jul 2016
004	All	Updated Document Number; updated titles (Section 2); updated paragraph spacing and references (Section 4); updated References (Section 5).	5 Jan 2017
005	All	Minor language changes throughout. Broken links fixed. Removed regulatory references.	20 Apr 2020
006	3, 4.3	Added definition of authorized person. Updated inspection requirements.	22 Feb 2021
007	4.10	Added section on scaffolding.	18 Jan 2022
008	All	Minor editorial revisions throughout.	3 Aug 2023

APPROVAL SIGNATURE



Millard P. Griffin, Jr.

Regional Health & Safety Director

Cold Stress

DOCUMENT DETAILS

DOCUMENT TITLE	Cold Stress
DOCUMENT NUMBER	NAM-1323-PR1
Approval Date	31 July 2023
Version	05
Applicability	North America

1. PURPOSE AND SCOPE

This procedure establishes minimum requirements for work in environments where exposures to cold stress are encountered and provides guidance to evaluate and control these stressors. This procedure is applicable to all North American operations and will be made available to employees at the work site upon request.

2. ROLES AND RESPONSIBILITIES

Partner in Charge (PIC): Responsible for the following elements:

- Ensure this procedure is implemented, understood, and followed by employees under their charge and working on their projects, and
- Correct any deficiencies in the implementation of this procedure as identified by the Business Unit (BU) Health and Safety (H&S) Director or other staff members.

Project Manager: Responsible for the following elements:

- Perform an assessment of ERM's project and employee responsibilities to determine which employees may be at risk to cold exposure,
- Assess employee compliance with this procedure,
- Stop work where deviations from this procedure are observed, and
- Correct, in conjunction with the PIC and the BU H&S Director, any observed deficiencies in the implementation of this procedure.

BU H&S Director: Responsible for the following elements:

- Evaluate implementation of this procedure during health and safety plan reviews and project audits; and
- Communicate identified deficiencies to the PIC.

3. DEFINITIONS

Cold stress: Initial loss of skin temperature, followed by potential loss of internal core temperature. In a cold environment, most of the body's energy is used to keep the internal core temperature warm. Over time, the body will begin to shift blood flow from the extremities (hands, feet, arms, and legs) and outer skin to the core (chest and abdomen). This shift allows the exposed skin and the extremities to cool rapidly and increases the risk of frostbite and hypothermia.

Frostbite: Injury caused by freezing of the skin and underlying tissues.

Hypothermia: A medical emergency that occurs when the body loses heat faster than it can produce it, creating a dangerously low internal body temperature, typically less than 95 °F (35 °C).

Temperature: The dry bulb temperature in degrees Fahrenheit (°F) or Celsius (°C).

4. PROCEDURE

Cold stress can present a significant hazard to workers and can result in hypothermia or frostbite. Several risk factors contribute to the harmful effects of cold including:

- Damp/wet clothing, improper dress, and fatigue/exhaustion,
- Pre-disposing medical conditions, including hypertension, hyperthyroidism, and diabetes, and
- Poor physical conditioning.

4.1 RECOGNITION AND TREATMENT

4.1.1 HYPOTHERMIA

Hypothermia is a potentially life-threatening condition in which body heat is lost faster than it can be replaced, and the normal body temperature drops to less than 95 °F (35 °C). Mild signs and symptoms of hypothermia include shivering. Moderate to severe symptoms may include dizziness, numbness, confusion, weakness, impaired judgment, impaired vision, and drowsiness. The typical stages of hypothermia are shivering, apathy, loss of consciousness, decreasing pulse and breathing rates, and death.

First aid measures for hypothermia include calling emergency medical services and moving the victim to a warm dry area and into dry clothing. Additional first aid measures may include covering the body with layers of blankets, as well as the introduction of warm sweetened drinks if medical help is more than 30 minutes away.

4.1.2 FROSTBITE

Frostbite is the most common injury caused by cold. It happens when ice crystals form in body tissues, usually the nose, ears, chin, cheeks, fingers, or toes. This restricts blood flow to the injured parts. The effect is worse if the frostbitten parts are thawed and then refrozen.

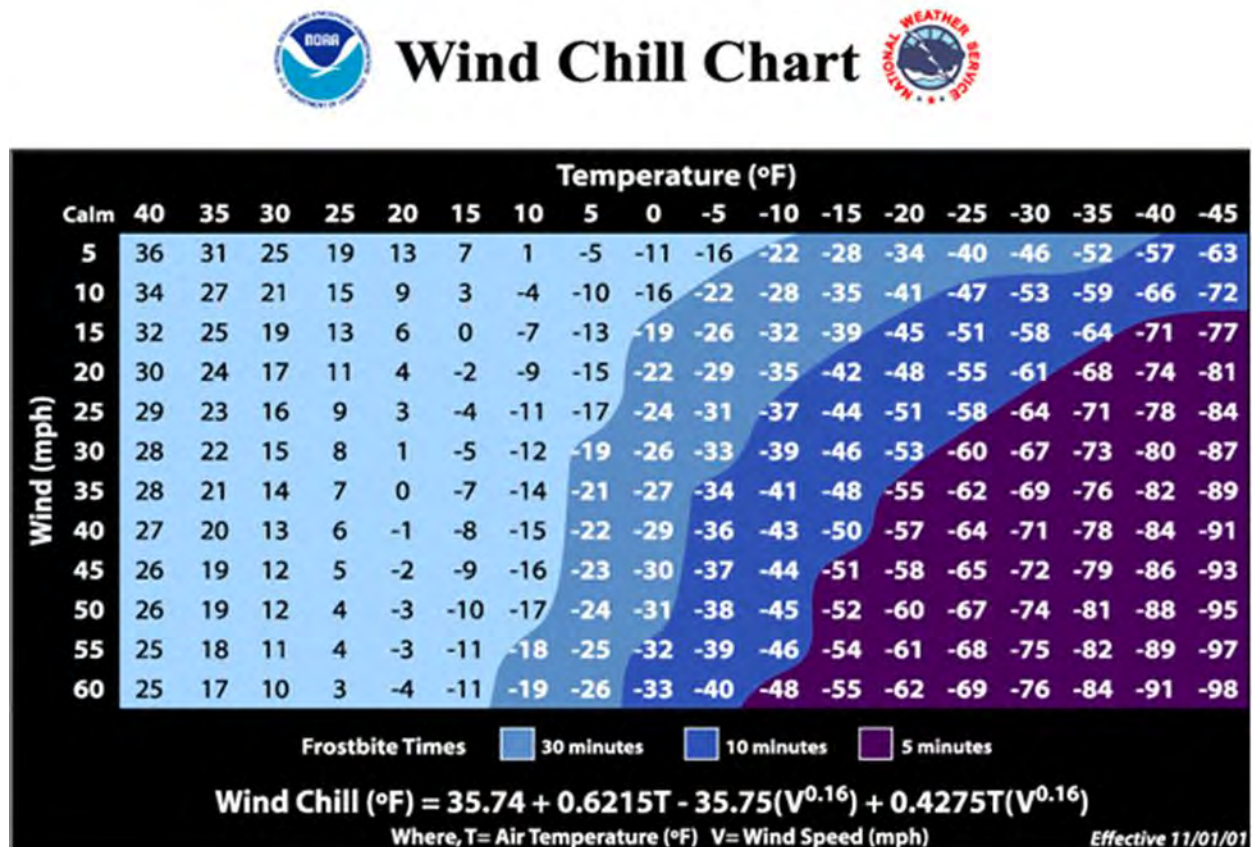
Signs and symptoms of frostbite include an initial slight flushing of the skin. The skin color changes to white and then grayish blue. Pain is sometimes felt early but later goes away. The frostbitten parts feel very cold and numb, and the victim may not be aware of the injury. In severe cases, frostbite may result in blisters or gangrene, which may necessitate amputation.

First aid measures for hypothermia include calling emergency medical services and moving the victim to a warm dry area. Loosely cover any suspect area and protect from contact. Do not attempt to rewarm the frostbitten area before getting medical help. Do not rub or massage the affected areas. Provide the injured individual with warm sweetened drinks if alert.

4.2 PREVENTION AND CONTROL

Protection from cold stress must be considered in addition to provisions for personal protective equipment. Provisions for insulating dry clothing must be provided, regularly inspected, and replaced as required.

Wind chill can substantially reduce the cooling rate experienced by personnel. Prevention of excessive cooling exacerbated by wind chill conditions requires an increased insulation value of the protective work clothing. The effects of wind chill and temperature can be seen in the following tables.



Source: National Oceanic and Atmospheric Administration (NOAA)/National Weather Service (NWS)

WIND CHILL TEMPERATURE INDEX Frostbite Times are for Exposed Facial Skin												
Air Temperature (°C)												
Wind Speed (km/h)	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50
5	4	-2	-7	-13	-19	-24	-30	-36	-41	-47	-53	-58
10	3	-3	-9	-15	-21	-27	-33	-39	-45	-51	-57	-63
15	2	-4	-11	-17	-23	-29	-35	-41	-48	-54	-60	-66
20	1	-5	-12	-18	-24	-30	-37	-43	-49	-56	-62	-68
25	1	-6	-12	-19	-25	-32	-38	-44	-51	-57	-64	-70
30	0	-6	-13	-20	-26	-33	-39	-46	-52	-59	-65	-72
35	0	-7	-14	-20	-27	-33	-40	-47	-53	-60	-66	-73
40	-1	-7	-14	-21	-27	-34	-41	-48	-54	-61	-68	-74
45	-1	-8	-15	-21	-28	-35	-42	-48	-55	-62	-69	-75
50	-1	-8	-15	-22	-29	-35	-42	-49	-56	-63	-69	-76
55	-2	-8	-15	-22	-29	-36	-43	-50	-57	-63	-70	-77
60	-2	-9	-16	-23	-30	-36	-43	-50	-57	-64	-71	-78
65	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79
70	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-80
75	-3	-10	-17	-24	-31	-38	-45	-52	-59	-66	-73	-80
80	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81

FROSTBITE GUIDE

Increasing risk of frostbite for most people in 10 to 30 minutes of exposure
High risk for most people in 5 to 10 minutes of exposure
High risk for most people in 2 to 5 minutes of exposure
High risk for most people in 2 minutes of exposure or less

Source: Canadian Centre for Occupational Health and Safety (CCHOS)

The following work practices should be followed to minimize the effects of cold stress conditions:

- Wear adequate layers of insulating dry clothing. Keep a change of dry clothes available in case clothing becomes wet. Ensure adequate supplies of cold weather gear are available.
- Use the buddy system to look for signs of cold stress.
- If appropriate, use windscreens to reduce the effects of wind.
- Heated warming shelters should be available when the equivalent chill temperature (ECT) is less than 20°F (-29°C).
- To prevent dehydration, which can increase the susceptibility of workers to cold injuries, warm sweet drinks and soups should be provided. Coffee and soft drink intake should be limited due to the potential for diuretic effects related to caffeine consumption.
- Ensure regularly used travel pathways are kept as clear of snow and ice as practicable.

- Be aware of the hazards of unstable snow and ice buildup and avoid working close to areas of accumulated snow and ice.
- Consult the table below for guidance on applications of work/warming regimens in extreme cold situations (-15 °F/-26 °C).

WORK/WARM-UP SCHEDULE											
Air Temperature - Sunny Sky		No Noticeable Wind		Wind 5mph		Wind 10mph		Wind 15mph		Wind 20mph	
°C	°F	Maximum Work Period	Number of Breaks	Maximum Work Period	Number of Breaks	Maximum Work Period	Number of Breaks	Maximum Work Period	Number of Breaks	Maximum Work Period	Number of Breaks
-26 to -28	-15 to -19	Normal Breaks	1	Normal Breaks	1	75 mins	2	55 mins	3	40 mins	4
-29 to -31	-20 to -24	Normal Breaks	1	75 mins	2	55 mins	3	40 mins	4	30 mins	5
-32 to -34	-25 to -29	75 mins	2	55 mins	3	40 mins	4	30 mins	5	Non-emergency work should stop	
-35 to -37	-30 to -34	55 mins	3	40 mins	4	30 mins	5	Non-emergency work should stop			
-38 to -39	-35 to -39	40 mins	4	30 mins	5	Non-emergency work should stop					
-40 to -42	-40 to -44	30 mins	5	Non-emergency work should stop							
-43 and below	-45 and below	Non-emergency work should stop									

Source: American Conference of Governmental Industrial Hygienists (ACGIH)

- Note that the above schedule applies to any 4-hour work period with moderate to heavy work activity; with warm-up periods of ten minutes in a warm location; and an extended break at the end of the 4-hour period in a warm location. For light to moderate work (i.e., limited physical movement), apply the schedule one step lower.
- Apply the following guidance for estimating wind velocity if accurate information is not available: 5 mph = light flag movement; 10 mph = light flag fully extended; 15 mph = raised newspaper sheet; and 20 mph = blowing and drifting snow.

4.3 TRAINING REQUIREMENTS

Worker training should be provided to discuss the hazards of cold stress environments and to review preventative work practices. Training is conducted during daily tailgate safety meetings when working in cold environments. This creates more effective and timely training and ensures that employees will be trained initially and at least annually regarding the health effects of working in cold weather. The training should include:

- Proper clothing and PPE requirements,
- Recognition and prevention of frostbite and hypothermia,
- Administration of first aid treatment of frostbite and hypothermia, including a discussion of re-warming procedures,

- Suggested work/rest regimens and eating/drinking habits, and
- Safe work practices in cold stress environments.

5. REFERENCES

None.

DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
001	All	New document.	8 Jun 2015
002	All	Updated Document Number; updated titles (Section 2); updated paragraph alignment throughout; updated referenced document numbers (Section 4); updated References (Section 5).	6 Jan 2017
003	4	Revised section headers, updated signs and symptoms as well as first aid information.	14 May 2020
004	4	Inserted wind chill and work/warmup schedule charts into document.	7 Mar 2023
005	2, 4	Updated PM oversight requirements; updated training language.	31 Jul 2023

APPROVAL SIGNATURE



Millard P. Griffin, Jr.

Regional Health & Safety Director

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Fatigue Management

DOCUMENT DETAILS

DOCUMENT TITLE	Fatigue Management
DOCUMENT NUMBER	NAM-1328-PR1
Approval Date	4 August 2023
Version	05
Applicability	North America

1. PURPOSE AND SCOPE

This document establishes procedures to assist in reducing the potential for ERM employee fatigue by providing criteria for anticipation, recognition, treatment, and management. This document applies to all ERM employees and work activities.

2. ROLES AND RESPONSIBILITIES

Partner in Charge (PIC): Partner in Charge (PIC): Responsible for the following elements:

- Ensure this program is implemented, understood, and followed by employees under their charge and working on their projects,
- Ensure, in conjunction with the Project Manager (PM)/Supervisor, that employees are properly trained in fatigue management and monitored for fatigue and fatigue-producing factors in their assigned tasks, and
- Correct any deficiencies in the implementation of this program as identified by the Business Unit (BU) Health and Safety (H&S) Director.

PM/Supervisor: Responsible for the following elements:

- Monitor the performance and behavior of the employees they supervise,
- Work with the BU H&S Director to develop task-specific fatigue management guidelines where significant fatigue-producing activities may occur, including workdays of more than 14 hours and work weeks of more than 60 hours,
- Contact the PIC and the BU H&S Safety Director if presented with information that indicates an employee may be fatigued, and
- Keep information related to an employee's medical condition confidential at all times.

BU H&S Director: Responsible for the following elements:



- Review safety observations, near misses, injuries, and incidents that may have occurred as a result of fatigue and use these events as opportunities to revise project- or task-specific fatigue management procedures,
- Work with the PM/Supervisor to develop task-specific fatigue management guidelines where significant fatigue-producing activities may occur, including workdays of more than 14 hours and work weeks of more than 60 hours, and
- Assist PICs and PMs/Supervisors in the implementation of this program, as needed.

Employee: Responsible for the following elements:

- Maintain a safe working environment in accordance with ERM and client-specific policies,
- Manage their health in a manner that allows them to perform their work assignments safely,
- Arrive to work fit for duty and ready to complete their work assignments following established safe working practices and procedures and in a safe and effective manner throughout their scheduled work hours,
- Alert their PM/Supervisor if they are not fit for duty or if their fitness for duty deteriorates during their work hours due to fatigue, and
- Notify their PM/Supervisor or appropriate Human Resources (HR) Manager if they observe a co-worker acting in a manner that indicates the coworker may be unfit for duty.

3. DEFINITIONS

Fatigue: Fatigue includes mental and/or physical exhaustion that prevents a person from being able to function normally. It is typically caused by a lack of restful sleep but may also be associated with prolonged periods of physical and/or mental exertion without sufficient time to recover.

Fatigue can be caused by work-related stresses, non-work-related stresses, or a combination of both. ERM controls work-related fatigue, as it determines the type of work, the number of work hours and employees assigned to a task, and the work environment. The employee has control over non-work-related fatigue including their health, family responsibilities, and lifestyle.

Fatigue, and the level to which it affects an employee, is associated with several factors. These include:

- The quantity and quality of rest obtained before and after a working day,
- The time of day in which work takes place,
- The amount of time spent in work-related activities,
- The type of work and the environment in which it is performed,
- The physical and mental demands of work,
- Extended travel and travel across time zones,

- Personal activities away from work, such as sports, hobbies, family commitments, or second jobs,
- Disruption of normal circadian rhythms (daily rhythmic activity cycles),
- Individual factors, including existing medical conditions, illnesses, or sleep disorders, and
- Extreme alcohol intake or sleep deprivation.

4. PROCEDURE

4.1 FATIGUE RECOGNITION

Employees are expected to carry out their work activities in a manner that does not risk the health and safety of themselves, their fellow employees, or any other personnel on the site (e.g., subcontractors, clients, the public, etc.). If an employee feels that they are unable to perform their work activities safely because of fatigue, they are required to stop work immediately and notify their supervisor.

Similarly, if an employee suspects a co-worker (including subcontractors or clients working with the employee) of suffering from the effects of fatigue, they are required to intervene on behalf of the affected person, stopping work and notifying their supervisor.

Characteristics that may assist in the identification of fatigue may include, but are not limited to:

- Physical Symptoms
 - Bloodshot eyes
 - Poor coordination
 - Slower movements
 - Slower than normal response to verbal queries/commands or radio communications
- Cognitive Function Symptoms
 - Distraction from task
 - Poor or lapsed concentration
 - Inability to complete tasks
 - Short-term memory loss
 - Nodding off momentarily
 - Fixed gaze
 - Reports of blurred vision
- Emotional/Behavioral Symptoms
 - Appears depressed
 - Does not care about work
 - Easily frustrated with task/irritability

- Increased or noticeable level of unexplained or unusual absenteeism

4.2 FATIGUE TREATMENT

Where fatigue has been identified, employees must take action to treat the underlying causes of the fatigue. Suggestions include:

- Getting adequate, regular, and consistent amounts of sleep each night. A minimum of seven hours is recommended.
- Eating well-balanced and healthy meals.
- Ensuring adequate consumption of water throughout the day.
- Exercising regularly.
- Maintaining a reasonable work and personal schedule.
- Avoiding alcohol, smoking, and drugs. Note that stimulants, including caffeine, may provide temporary relief from certain types of fatigue, but can increase the problem when the effect wears off.
- Changing stressful circumstances through vacation or personal leave.
- Contacting ERM's Employee Assistance Program (EAP) for fatigue-related issues beyond normal personal health care (e.g., addictive issues, family concerns, etc.).

When driving, employees should follow the fatigue avoidance techniques identified in Section 4.2 of **ERM-1430-PR1 – Driver and Vehicle Safety**.

4.3 FATIGUE MANAGEMENT

4.3.1 PM/SUPERVISOR RESPONSIBILITIES

PMs/Supervisors are responsible for managing fatigue in the workplace. They are expected to:

- Identify potential fatigue-producing factors at work and inform employees how the work tasks will be addressed to control fatigue,
- Monitor employees for signs of fatigue,
- Provide the use of ergonomic friendly equipment where/when possible,
- Provide employees with sufficient breaks for food, water, and rest,
- Consult with employees regarding fatigue factors when extended work periods or shift work is anticipated,
- Minimize early morning starts before 6:00 AM local time (except where shift work is required), as early start times give employees less time to get adequate sleep,
- Minimize late evening work after 8:00 PM local time (except where shift work is required), as employee alertness tends to wane after these hours,
- Attempt to limit extended workdays to a maximum of 14 hours and extended work weeks to 60 hours,

- Schedule work such that employees are given sufficient time to get a continuous 7 to 8-hour period of sleep in each 24 hours, and at least 50 hours every seven days, where shift work is required,
- Supply adequate supervision for jobs that are physically or mentally demanding, repetitive, or require high vigilance,
- Remove obviously fatigued workers from activities where there is a risk to safety and health, and
- After providing an adequate rest break, consider rotating obviously fatigued workers to tasks that create a much lower immediate risk or advise them to go home (note that if driving home presents a further fatigue risk, the Project Manager/Supervisor should provide transportation to ensure the employee reaches home safely)

4.3.2 EMPLOYEE RESPONSIBILITIES

Employees are responsible for managing personal fatigue in the workplace. Employees are expected to:

- Report to work well-rested and mentally alert,
- Manage personal lifestyle decisions in a manner that enables fitness for duty, including getting sufficient rest and sleep to recover from prior work duties, and managing personal, commuting, medical, and health issues,
- Manage use of any drugs, including over-the-counter medications or prescriptions, which may affect their ability to perform work safely, including notifying supervisors of any prescription or over-the-counter medications which may impair their ability to work safely,
- Seek medical advice for personal conditions affecting sleep, such as apnea or insomnia,
- Notify your manager or supervisor when you are feeling fatigued,
- Take adequate rest breaks for the working conditions,
- Contact ERM's EAP if you need additional assistance for fatigue-related issues, and
- Inform Project Manager/Supervisor when you suspect a co-worker of being fatigued.

4.4 RECORDKEEPING

Copies of any Project Manager/Supervisor notes and any documentation completed as part of a fatigue-based fitness for duty investigation will be maintained by the BU HR Director.

5. REFERENCES

ERM Procedure **ERM-1430-PR1 – Driver and Vehicle Safety**

DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
001	All	New document.	2 Mar 2015
002	All	Updated Document Number; updated titles (Section 2); updated paragraph alignment throughout; updated referenced document numbers (Section 4); updated References (Section 5).	11 Jan 2017
003	4.3.2	Added requirement for employees to notify supervisors regarding medications affecting potential for safe work.	3 Oct 2017
004	2, 3	General updates to provide clarifications to roles and responsibilities (Section 2) and definitions (Section 3).	13 Aug 2020
005	4.3.1	Added requirement for ergonomically friendly equipment use when possible and addressing analysis of work tasks to control fatigue.	4 Aug 2023

APPROVAL SIGNATURE



Millard P. Griffin, Jr.
Regional Health & Safety Director

Hand Tools and Portable Power Equipment

DOCUMENT DETAILS

DOCUMENT TITLE	Hand Tools and Portable Power Equipment
DOCUMENT NUMBER	NAM-1320-PR1
Approval Date	2 August 2023
Version	05
Applicability	North America

1. PURPOSE AND SCOPE

This procedure establishes minimum requirements for work with hand tools and portable powered equipment. The purpose of this procedure is to ensure that hand tools and portable power equipment meet minimum safety requirements, are used in the manner for which they are intended and are maintained in a safe condition. This procedure is applicable to all North American operations.

2. ROLES AND RESPONSIBILITIES

Partner in Charge (PIC): Responsible for the following elements:

- Ensure this procedure is implemented, understood, and followed by employees under their charge and working on their projects, and
- Correct any deficiencies in the implementation of this procedure as identified by the Business Unit (BU) Health and Safety (H&S) Director or other staff members.

Project Manager (PM): Responsible for the following elements:

- Perform observations of ERM work processes to assess employee compliance with this procedure,
- Stop work where deviations from this procedure are observed, and
- Correct, in conjunction with the PIC and the BU H&S Director, any observed deficiencies in the implementation of this procedure.

BU H&S Director: Responsible for the following elements:

- Evaluate implementation of this procedure during project audits, and



- Communicate identified deficiencies to the PIC.

3. DEFINITIONS

Ground Fault Circuit interrupters (GFCI): A device that shuts off an electric power circuit when it detects that current is flowing along an unintended path, such as through water or a person.

Portable Power Equipment: Electric, pneumatic, gasoline or explosive-actuated hand tools.

UL: A global product safety testing and certification organization; formerly known as Underwriters Laboratory.

4. PROCEDURE

4.1 GENERAL EQUIPMENT REQUIREMENTS

- All hand and portable power tools shall be maintained in safe working order and used only for the task for which they were designed.
- Hand and portable power tools, power supplies, and flexible cord sets (i.e., extension cords, see **NAM-1561-GU1 – Extension Cord Sets**) shall be inspected prior to each use to identify any defects. Damaged or defective tools shall be immediately removed from service and identified through tagging or lockout of controls.
- Tool surfaces and handles shall be kept clean and free of dirt, grime, and excess oil to prevent slipping.
- Tools shall be cleaned and properly stored when not in use to prevent possible injuries and tool damage. For additional housekeeping information, see **NAM-1573-PR1 – Housekeeping**.
- Non-sparking tools shall be used in atmospheres with fire or explosive characteristics.
- Eye protection shall be used at all times during tool operation. Additional personal protective equipment (PPE) appropriate to the tool operation or work task shall be required and used, including face shields, hearing protection, respiratory protection, and protective gloves. Refer to **NAM-1310-PR1 – Personal Protective Equipment** for additional information.
- During the selection process, hand and portable power tools will be evaluated for appropriate ergonomic fit and function. This would include evaluating the tool, the task, and the user to ensure the tool fits into the employee's hands without causing awkward postures, harmful contact pressures, or health and safety risks.

4.2 HAND TOOL USE

- Determine and use the correct tool for the job with the appropriate Job Hazard Analysis (JHA). For cutting tools, refer to **NAM-1324-PR1 – Safe Use of Cutting Tools** for additional information.
- Follow the manufacturer's instructions for tool inspection, use, and maintenance.
- Use proper ergonomics when using the tool, including:

- Stand square to your subject,
- Secure your footing and maintain a stable stance,
- Cut away from your body, and
- Wear proper, adequate, correct-fitting PPE.
- Ensure that hands, fingers, other body parts, and others around you are out of the line of fire during tool usage.
- Do not use hand tools as pry bars.
- Do not throw tools from place to place or person to person.
- Do not drop tools from heights.
- Do not store tools on the ground.
- Do not force tools beyond their capacity or use cheater bars or other instruments to increase their capacity.

4.3 PORTABLE POWER TOOL USE

- While working with power tools, remove anything that could get caught in the tool, including loose clothing, long hair, loose jewelry, rings, and chains.
- Keep hands and body parts clear of all cutting, rotating, or moving parts of powered tools.
- Portable power tools shall be safety tested and certified by UL or an equivalent authority.
- Electric power tools must be either double-insulated or equipped with a 3-wire grounded wiring and plug. For additional electrical safety information, see **NAM-1561-PR1 – Electrical Safety Procedure**.
- Tools shall only be used with a GFCI or a GFCI adapter. Do not handle wet cords and power tools unless they have been deenergized.
- Non-GFCI adapters shall not be used, as these interrupt the continuity of the equipment grounding connection.
- Guards and safety devices provided by tool manufacturers shall not be removed or modified in any way which may interfere with their intended function.
- Portable equipment shall be handled in a manner which will not cause damage. Flexible electric cords shall not be used for raising or lowering the equipment and cords should not be fastened in any way that potentially damages the outer jacket or insulation.
- ERM typically rents portable power tools. Documentation of maintenance rests with the rental agency. If portable power tools are purchased by ERM, it will be the responsibility of the local office to keep maintenance records in accordance with **NAM-1302-PR1 – Equipment Maintenance and Calibration** and **ERM-1934-PR1 – Monitoring and Measurement**.

5. REFERENCES

Occupational Health and Safety Administration (OSHA) **29 Code of Federal Regulations (CFR) 1910 Subpart P – Hand and Portable Powered Tools and Other Hand-Held Equipment**

OSHA Regulation **29 CFR 1926 Subpart I – Tools – Hand and Power**

ERM Procedure **ERM-1934-PR1 – Monitoring and Measurement**

ERM Procedure **NAM-1302-PR1 – Equipment Maintenance and Calibration**

ERM Procedure **NAM-1310-PR1 – Personal Protective Equipment**

ERM Procedure **NAM-1324-PR1 – Safe Use of Cutting Tools**

ERM Guideline **NAM-1561-GU1 – Extension Cord Sets**

ERM Procedure **NAM-1561-PR1 – Electrical Safety Procedure**

ERM Procedure **NAM-1573-PR1 – Housekeeping**

DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
001	All	New document.	29 Jun 2015
002	All	Updated Document Number; updated titles (Section 2); updated paragraph alignment throughout; updated referenced document numbers (Section 4); updated References (Section 5).	10 Jan 2017
003	All	Minor language updates.	20 Aug 2020
004	4	Added information on ergonomic risk and retention of maintenance records.	4 Feb 2021
005	All	Minor language updates.	3 Aug 2023

APPROVAL SIGNATURE



Millard P. Griffin, Jr.

Regional Health & Safety Director

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Mobile Construction Equipment

DOCUMENT DETAILS

DOCUMENT TITLE	Mobile Construction Equipment
DOCUMENT NUMBER	NAM-1339-PR1
Approval Date	3 January 2024
Version	6
Applicability	North America

1. PURPOSE AND SCOPE

This document establishes safe work procedures designed to reduce/eliminate personal injury during the operation of mobile construction equipment (MCE) at project sites. This procedure is applicable to ERM field operations in which MCE is utilized.

2. ROLES AND RESPONSIBILITIES

Partner in Charge (PIC): Responsible for the following elements:

- Ensure this program is implemented, understood, and followed by employees under their charge, and
- Correct any deficiencies in the implementation of this procedure as identified by the Business Unit (BU) Health and Safety (H&S) Director.

Project Manager (PM)/Supervisor: Responsible for the following elements:

- Implement program during any project activities involving MCE,
- Perform observations of ERM work processes to assess whether employees are operating in accordance with this procedure, and
- Correct, in conjunction with the PIC and the BU H&S Director, any observed deficiencies in the implementation of this procedure.

BU H&S Director: Responsible for the following elements:

- Evaluate implementation of MCE procedures during health and safety plan reviews and project audits, and
- Communicate identified deficiencies to the PIC.

Subject Matter Expert (SME): Responsible for providing documented guidance to the PIC and PM in identifying, evaluating, and/or reviewing project risks, as well as recommending appropriate assessment tools and procedures.

High Risk Field Safety Officer (FSO): Responsible for the following elements:

- Serve as the primary point of contact for health and safety on projects requiring use of MCE,
- Communicate project health and safety specifics to the PM and PIC managing the project, including identified deficiencies and needs, and
- Where needed, request assistance from the BU or Regional H&S Director

Employee: Responsible for complying with the requirements stated within the procedure.

3. DEFINITIONS

Exclusion Zone: The area where MCE will or may be operating. Exclusion zones should include the swing radius and operating area of the MCE being used (including appropriate safety factors) and be marked by physical and visible barriers or other means of separation.

Mobile Construction Equipment (MCE): A diverse group of field machines which may have wheels or crawler treads. This may include, but not be limited to, bulldozers, backhoes, forklifts, bobcats, earth movers, cranes, boom/aerial lifts, etc. This includes support equipment such as forklifts and skid steers. This does not include motor vehicles (passenger cars and trucks, including dump and vacuum trucks) primarily used for over the road travel unless this equipment is engaged in project-specific activities such as towing or transportation of materials. At present, drill rigs are exempt from this procedure as their operation is covered in other ERM procedures.

Safety Factor: A margin of safety against known or potential risks. Regarding MCE, it may include increasing the size of work zones to ensure additional space between operating equipment and ground personnel.

Spotter: An employee who manages the space around heavy machinery, equipment, and vehicles, feeding information to the equipment operator.

Subject Matter Expert (SME): An employee who is a recognized expert in a particular area or topic.

4. PROCEDURE

4.1 SUBJECT MATTER EXPERTS

Prior to initiation of any project involving the use of MCE, the project requirements and the prepared risk assessment documents must be reviewed by a recognized ERM SME. Identified SMEs for MCE work can be found on ERM's **Project Liability Analysis (PLAN) SME page** on Minerva. The SME used, as well as their date of review, must be documented on the health and safety plan (HASP) for the project.

4.2 AUTHORIZED OPERATORS

Operators of mobile equipment shall be evaluated by their employer's prior to working for ERM through documentable experience and a practical evaluation of their skills. Only those operators who have been judged to be qualified will be authorized to operate mobile equipment on ERM projects. On-the-job training will not be allowed.

Project Managers/Supervisors will work with ERM subcontractors to maintain a list of the qualified operators present on their site as well as the specific equipment they are authorized to use. They will prohibit mobile equipment from being operated by any person who is not specifically authorized to do so.

Authorized operators are required to:

- Always use seat belts while in the mobile equipment they are assigned to operate. Seat belts must be fastened before the equipment is started.
- Use three points of contact whenever they enter or exit any piece of mobile equipment,
- Wear eye protection in accordance with **NAM-1310-PR1 – Personal Protective Equipment** if the equipment does not have an enclosed cab.
- Operate mobile equipment within the requirements of the manufacturer's owner's manual.
- Adhere to the exclusion zone established by the project team.
- Maintain control of the exclusion zone in which they are operating.
- When using a designated spotter, stop work and all equipment movement if operator loses sight of spotter.
- Stop work whenever unauthorized ground personnel or equipment enter the exclusion zone or when a designated spotter communicates to the operator to do so. Operators should only resume work when the area has been cleared.

Authorized operators are prohibited from:

- Allowing any personnel other than themselves from riding in or on the equipment unless additional seating with appropriate restraining devices (e.g., seat belts, shoulder harnesses) are provided by the manufacturer,
- Loading equipment beyond the limits established by the manufacturer,
- Using headphones, earbuds, or any other device which would distract from the ability to hear horns or emergency signals or limit communications with the spotter, and
- Traveling with loads which have not been secured for safe transport in accordance with manufacturer's requirements.

Note that ERM employees are expressly prohibited from operating MCE without the written approval of the Regional CEO. If approval is granted, the employee must retain the approval letter/email and make a copy available to the project team prior to usage of any approved form of MCE.

4.3 SPOTTERS

The use of a designated spotter is required for all MCE use whenever personnel, equipment, structures, or any other physical hazard could be encountered and contacted. This includes activities such as loading and unloading of MCE, backing up and navigating congested areas, and operating MCE near infrastructure and structures.

The designated spotter shall have no other responsibilities beyond spotting for one piece of MCE. Spotting for multiple pieces of equipment is not allowed. Spotters should always be in the equipment operator's line of sight yet remain out of the operating radius of the equipment. This includes the prohibition of spotters reaching under suspended loads or elevated components of active MCE.

A communication plan between the operator and spotter is to be established prior to any work being initiated, and radio communication between the two is highly suggested. Hand signals to be used are to be reviewed and agreed upon. The operator must stop work whenever they lose sight of the spotter.

Designated spotters are required to:

- Never walk behind the equipment and spot at the same time. When spotting, stand at the desired area where the equipment is going and flag the equipment back to you.
- Agree on hand signals with the operator prior to any spotting activities.
- Review the work area for any additional hazards, such as trip hazards that the spotter or other ground personnel could trip over.
- Evaluate the work area for fixed objects that the equipment can strike.
- Remove any people, objects, or equipment prior to spotting equipment in or out of an area to eliminate the possibility of a strike.
- Determine if there is a way to eliminate or minimize backing of the MCE, especially equipment with very limited visibility like a skid loader or skid-steer.

4.4 GROUND PERSONNEL

Ground personnel working in the vicinity of MCE shall receive site-specific briefings on the equipment activities to be performed, the defined exclusion zone, and the hazards of mobile equipment. At a minimum ground personnel must comply with the following rules:

- Wear high visibility (Class 2) work vests when working in any area where there is proximity to mobile equipment. Upgrade high visibility clothing to Class 3 if performing work in low light or night conditions.
- Stay outside of the established exclusion zone for the MCE (generally a 50-foot minimum distance). Enter the exclusion zone of mobile equipment only if:
 - The employee is authorized to do,
 - The employee can remain at least 50 feet from the reach of the active MCE,

- The employee has gotten the operator's attention and made eye contact,
- The operator has idled the equipment, grounded any extensions, and removed their hands from the controls, and
- The operator has given permission to approach the equipment.
- Never walk or position themselves between a fixed object and the operating equipment or between two or more pieces of operating mobile equipment.

4.5 MOBILE EQUIPMENT REQUIREMENTS

Mobile equipment used on ERM project sites must meet the following minimum requirements. Additional requirements may be necessary during certain operations (e.g., caging during concrete breaking or use of enclosed cabs for work creating flying debris).

- An operations manual for each piece of mobile equipment present on this site must be maintained and available for immediate review.
- Operators must be familiar with the manual requirements and must operate the equipment within the requirements of the manual.
- All mobile equipment must be equipped with roll-over protection systems or with a cab which provides protection from overhead hazards.
- All seatbelts must be present and functional.
- Back-up alarms must be installed and functional on all mobile equipment. Alarms must be loud enough to be heard over planned or existing background noise.
- Extensions such as buckets, blades, forks, and swing arms must be grounded when not in use.
- Brakes must be set, and wheels chocked (where applicable) when mobile equipment is not in use.

During fueling of mobile equipment, operators must shut off engines and must leave the vehicle unless the design of the vehicle requires the operator to remain in place. Fueling nozzles must maintain contact with the tank to eliminate the potential for static discharge. No smoking or open flames will be allowed in the immediate area during fueling. A spill kit and a fire extinguisher must be nearby (within 75 feet) during refueling operations.

4.6 INSPECTION AND MAINTENANCE

Mobile equipment used on ERM projects must be inspected daily prior to the start of the shift in which it will be used. Operators, or their designee, must complete the inspection using **NAM-1339-FM1 – Mobile Construction Equipment Inspection** or equivalent. Upon observation of any unsatisfactory condition (including malfunctioning air conditioners and/or heaters), the mobile equipment shall be suspended from operation and the unsatisfactory condition will be reported to the operator's supervisor immediately. The equipment will not be used until the condition is corrected to the supervisor's satisfaction.

During any maintenance or repair activity, ERM will require:



- Motors to be turned off,
- Extensions grounded or securely blocked,
- Controls set in a neutral position,
- Brakes to be set, and
- Any electrical systems to be disconnected and locked out, as needed.

5. REFERENCES

ERM Form **NAM-1339-FM1 – Mobile Construction Equipment Inspection**

ERM Procedure **NAM-1310-PR1 – Personal Protective Equipment**

DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
001	All	New document.	2 Aug 2016
002	All	Updated Document Number; updated titles (Section 2); updated paragraph alignment throughout; updated referenced document numbers (Section 4); updated References (Section 5).	11 Jan 2017
003	All	Added definitions of SME and Exclusion Zone. Added information on SMEs and ground personnel requirements.	20 Aug 2019
004	All	Minor language changes throughout; added/repared links.	13 Aug 2020
005	All	Minor language changes throughout.	24 Apr 2023
006	3, 4	Added spotter definition; updated language on spotter requirements. Minor editorial changes throughout.	3 Jan 2024

APPROVAL SIGNATURE



Millard P. Griffin, Jr.

Regional Health & Safety Director

Chemical Hazards

DOCUMENT DETAILS

DOCUMENT TITLE	Chemical Hazards
DOCUMENT NUMBER	NAM-1340-PR1
Approval Date	21 April 2023
Version	12
Applicability	North America

1. PURPOSE AND SCOPE

This document provides guidance in controlling potential employee exposure to toxic and hazardous substances. The procedure applies to all North American operations where these hazards have been identified. All reasonable measures will be taken to protect workers from exposure to a hazardous biological or chemical agent as a result of the storage, handling, processing, or use of such agent in the workplace.

2. ROLES AND RESPONSIBILITIES

Partner in Charge (PIC): Responsible for the following elements:

- Ensuring this procedure is implemented, understood, and followed by employees under their charge and working on their projects, and
- Correcting any deficiencies in the implementation of this procedure as identified by the Business Unit (BU) Health and Safety (H&S) Director.

Project Manager (PM)/Supervisor: Responsible for the following elements:

- Performing observations of ERM work processes to assess whether or not employees are operating in accordance with this procedure,
- Pausing or stopping work where deviations from this procedure are observed, and
- Correcting, in conjunction with the PIC and the BU H&S Director, any observed deficiencies in the implementation of this procedure.

BU H&S Director: Responsible for the following elements:

- Evaluating implementation of this procedure during health and safety plan reviews and project audits; and
- Communicating identified deficiencies to the PIC.

3. DEFINITIONS

Regulated substances: Chemical substances for which federal, provincial, state, or local regulations have been promulgated.

Certified Industrial Hygienist (CIH): An individual who has met the minimum requirements for education and experience and through examination has demonstrated a level of knowledge and skill in the field of industrial hygiene, as recognized by the American Board of Industrial Hygiene (ABIH).

Competent person: 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 corrective measures to eliminate these hazards.

Initial exposure assessment: An assessment conducted before or at the initiation of a task to determine expected exposures. The goal of the assessment is to identify task elements which are likely to cause employee exposures in excess of the regulatory limits for a substance and allow time for installation and implementation of the controls necessary to reduce exposures. The basis for an initial exposure assessment includes:

- Employee exposure monitoring, if feasible, and
- Observations, information, or calculations which indicate the potential for employee exposure. This may include previous monitoring within the workplace or evidence from historical operations which indicate the potential for exposure based on similar experiences.

4. PROCEDURE

4.1 IDENTIFICATION

Before performing any field work, the project management team should determine if any hazardous chemical substances, with particular emphasis on those materials identified as regulated substances in accordance with the regulations listed in Section 5 of this procedure, are present in the work area. If any hazardous chemical substances are identified, this should be noted on **NAM-1340-FM1 – Known or Suspected Chemicals of Concern** and an exposure assessment should be conducted by a competent person to determine if employees have the potential to be exposed above the action levels and specific time frames identified within substance-specific regulations and/or guidance developed by nationally and internationally recognized organizations (i.e., National Institute for Safety and Health [NIOSH], American Conference of Governmental Industrial Hygienists [ACGIH]). This assessment must be reviewed and approved by a CIH or Business Unit Health and Safety Director. The results of the initial exposure assessment must be included in the project-specific health and safety plan (HASP).

4.2 CONTROL

When the initial exposure assessment identifies the potential for employee exposures above a ceiling limit, action level, permissible exposure limit (PEL), recommended exposure limit (REL), threshold limit value (TLV) or other published exposure limit established by either governmental organizations (through regulation) or nationally and internationally recognized organizations

(through guidance), the project management team must develop a site-specific compliance program to address all required concerns for that substance. The project team will develop measures to use engineering controls, work practices, hygiene facilities and practices, and personal protective equipment (PPE) to mitigate exposure to chemical and biological hazards. Employees handling chemicals where potential for injury exists due to contact of noxious liquid with employee's skin shall wear PPE to protect the employee from injury.

Completed programs must be included in the project HASP. The compliance program must provide guidance on appropriate protective measures to ensure that no ERM employee is exposed to airborne chemical concentrations above the limits/levels indicated in the previous paragraph. Applicable records associated with the compliance program, including air sampling, medical surveillance records, management of change data, etc., must be maintained in the project file.

Written procedures related to chemical hazards, including any HASP, compliance program, and this procedure will be reviewed annually and, where significant changes are indicated, updated.

4.3 COMPLIANCE PROGRAM

When compliance programs are required by a specific standard, the following items shall be included unless otherwise directed by the standard:

- Description of the work activities that may expose employees to the substances of concern,
- Number of employees impacted by exposure,
- Tasks employees will be performing which may cause exposure,
- Appropriate PPE selection to ensure sufficient level of protection from chemical or biological exposure via inhalation or skin (or eye) contact,
- Medical surveillance which may be required by regulatory requirements or site-specific conditions,
- Maintenance practices to be followed for servicing or cleaning equipment used during site tasks, as well as procedures for disposing of any wastes generated,
- Instructions on setting up and using any identified engineering controls (e.g., ventilation, containment, etc.),
- Air monitoring data from initial exposure assessments,
- Additional air monitoring to be completed at the site,
- Action levels at which the compliance program must be implemented,
- Schedules for the completion of site activities,
- Emergency action plans in the event of a chemical release,
- A description of any arrangements made among subcontractors on multi-contractor sites to ensure all affected employees are informed of potential exposure,

- The name of the person who will serve as the competent person at the site (the competent person will be responsible for performing regular inspections of the work site, including all materials and equipment used during the job), and
- Where applicable, access to readily available emergency washing equipment such as eyewash fountain or quick-acting deluge shower.

4.4 TRAINING

All employees with potential exposures to the substances covered by this procedure must receive training on the precautions and procedures to be followed in handling, use, and storage prior to any activities that could result in exposure. Training should be performed initially, upon any substantial changes in operations or exposure potential, and annually as long as the employee is involved in operations involving exposure to the substance. Documentation of training will be recorded in ERM's Academy Learning Management System (LMS).

In general, training should cover the following topics, unless otherwise indicated by a specific regulation:

- Regulated areas, including authorizations and entrance restrictions,
- Signs and warnings,
- Container content identification,
- The nature of the specific hazard,
- Operations that could result in exposure,
- Personal protective equipment use and care, including respiratory protection requirements,
- Hygienic practices,
- Decontamination procedures,
- Emergency response procedures,
- Recognition and evaluation of potential hazardous situations, and
- Medical surveillance and first aid procedures.

4.5 EMPLOYEE ACCESS

Employees affected by this procedure, as well as their designated representatives, will have access to all written procedures associated with the potential for chemical exposure in the workplace.

5. REFERENCES

US Occupational Safety and Health Administration (OSHA) **29 Code of Federal Regulations (CFR) Subpart Z – Toxic and Hazardous Substances**

Alberta Regulation 393/88 (Chemical Hazards Regulations)

WorkSafeBC Regulations 5.48 (Chemical Agents and Biological Agents)

Ontario Regulation 833, R.R.O. 1990 (Control of Exposure to Biological or Chemical Agents)

Québec – Annexe I du Règlement sur la santé et la sécurité du travail

ERM Form **NAM-1340-FM1 - Known or Suspected Chemicals of Concern**

ERM Guideline **NAM-1341-WI1 – Exposure to Gas Hazards**

ERM Guideline **NAM-1342-GU1 – Asbestos Awareness**

ERM Work Instruction **NAM-1343-WI1 – Benzene Exposure Control**

ERM Guideline **NAM-1344-GU1 – Hydrogen Sulfide Awareness**

ERM Work Instruction **NAM-1345-WI1 – Lead Exposure Compliance**

ERM Guideline **NAM-1346-GU1 – Ammonia Awareness**

ERM Guideline **NAM-1347-GU1 – Crystalline Silica Awareness**

DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
001	All	New document.	18 Mar 2015
002	1, 4	Expanded document to include all chemical hazards. Added references to non-governmental organizations with recognized exposure limits.	9 Aug 2016
003	All	Updated Document Number; revised titles (Section 2); updated section numbering/spacing (all); updated References (Section 5).	1 Feb 2017
004	4, 5	Added reference to NAM-1340-FM1 (Known or Suspected Chemicals of Concern).	7 Aug 2017
005	All	Updated multiple sections to address issues related to compliance programs.	27 Oct 2017
006	1, 3, 4, 5	Updated Purpose statement (Section 1); removed definition of OSHA Regulated Substances (Section 3); added minor clarifying statements (Section 4); updated References (Section 5).	26 Jun 2018
007	App 1	Added Appendix 1.	16 Jul 2018
008	4.2, 4.3	Added information on PPE usage.	31 Jul 2018
009	App 1	Added medical surveillance triggers and hyperlinks to applicable standards.	1 Apr 2019
010	4.2	Added information on document retention in project file.	10 Apr 2019
011	All	Minor language changes; added to Reference section.	14 Aug 2020
012	All	Minor language changes.	21 Apr 2023

APPROVAL SIGNATURE


Millard P. Griffin, Jr.

Regional Health & Safety Director

APPENDIX A OSHA REGULATED CHEMICALS

- Asbestos (29 CFR 1910.1001) – Medical surveillance required for all employees who are or will be exposed to airborne concentrations of asbestos fibers at or above 0,1 fibers per cubic centimeter of air (f/cc) as an 8-hour time-weighted average (TWA), or 1.0 f/cc as a 30-minute TWA.
- 13 Carcinogens (29 CFR 1910.1003) – Medical examination is required prior to any work where an employee is required to enter a regulated area containing any of these 13 materials.
 - 1-Nitrobiphenyl
 - alpha-Naphthylamine
 - Methyl chloromethyl ether
 - 3,3'-Dichlorobenzidine (and its salts)
 - Bis-Chloromethyl ether
 - Beta-Naphthylamine
 - Benzidine
 - 4-Aminodiphenyl
 - Ethyleneimine
 - Beta-Propiolactone
 - 2-Acetylaminofluorene
 - 4-Dimethylaminoazo-benzene
 - N-Nitrododimethylamine
- Vinyl chloride (29 CFR 1910.1017) – Medical surveillance is required for each employee exposed, without regard to use of respirator, to airborne concentrations of vinyl chloride in excess of 0.5 parts per million parts of air (ppm) as an 8-hour TWA.
- Inorganic arsenic (29 CFR 1910.1018) – Medical surveillance is required for all employees who are or will be exposed to airborne concentrations of inorganic arsenic at or above 5 micrograms per cubic meters of air ($\mu\text{g}/\text{m}^3$) as an 8-hour TWA, without regard to the use of respirators, at least 30 days per year.
- Beryllium (29 CFR 1910.1024) – Medical surveillance is required for all employees who are or are reasonably expected to be exposed to airborne concentrations of beryllium at or above $0.1 \mu\text{g}/\text{m}^3$ as an 8-hour TWA for more than 30 days per year.
- Lead (29 CFR 1910.1025) – Medical surveillance is required for all employees who are or may be exposed to airborne concentrations of lead at or above $30 \mu\text{g}/\text{m}^3$ as an 8-hour TWA for more than 30 days per year.

- Chromium (VI) ([29 CFR 1910.1026](#)) – Medical surveillance is required for all employees who are or may be exposed to airborne concentrations of chromium (VI) at or above 2.5 µg/m³ as an 8-hour TWA for 30 or more days per year.
- Cadmium ([29 CFR 1910.1027](#)) – Medical surveillance is required for all employees who are or may be exposed to airborne concentrations of cadmium at or above 2.5 µg/m³ as an 8-hour TWA for 30 or more days per year.
- Benzene ([29 CFR 1910.1028](#)) – Medical surveillance is required for employees who are or may be exposed to airborne concentrations of benzene at or above 0.5 ppm as an 8-hour TWA for 30 or more days per year, or who are or may be exposed to airborne concentrations of benzene at or above 1.0 ppm as an 8-hour TWA for 10 days or more per year.
- Coke oven emissions ([29 CFR 1910.1029](#)) – Medical surveillance is required for employees who work in a coke oven regulated area for at least 30 days per year.
- 1,2-dibromo-3-chloropropane (DBCP; [29 CFR 1910.1044](#)) – Medical surveillance is required for employees who work in a DBCP regulated area or who are exposed to DBCP in emergency situations.
- Acrylonitrile ([29 CFR 1910.1045](#)) – Medical surveillance is required for employees who are or will be exposed to airborne concentrations of acrylonitrile at or above 1 ppm as an 8-hour TWA, without regard to the use of respirators.
- Ethylene oxide (EtO; [29 CFR 1910.1047](#)) – Medical surveillance is required for employees who are or will be exposed to airborne concentrations of EtO at or above 0.5 ppm as an 8-hour TWA, without regard to the use of respirators, for at least 30 days per year.
- Formaldehyde ([29 CFR 1910.1048](#)) – Medical surveillance is required for employees exposed to airborne concentrations of formaldehyde at or above 0.5 ppm as an 8-hour TWA, or 2 ppm as a 15-minute TWA.
- Methylenedianiline (MDA; [29 CFR 1910.1050](#)) – Medical surveillance is required for employees exposed to airborne MDA concentrations at or above 5 parts per billion parts of air (ppb), subject to dermal exposure for 15 days or more per year, or who have been exposed in an emergency situation.
- 1,3-Butadiene (BD; [29 CFR 1910.1051](#)) – Medical surveillance is required for employees who are or may be exposed to airborne concentrations of BD at or above 0.5 ppm as an 8-hour TWA for 30 or more days per year, or who are or may be exposed to airborne concentrations of benzene at or above 1.0 ppm as an 8-hour TWA, or 5 ppm as a 15-minute TWA, for 10 days or more per year.
- Methylene chloride (MC; [29 CFR 1910.1052](#)) – Medical surveillance is required for employees who are or may be exposed to airborne concentrations of MC at or above 12.5 ppm as an 8-hour TWA for 30 or more days per year, or who are or may be exposed to airborne concentrations of MC at or above 25 ppm as an 8-hour TWA, or 125 ppm as a 15-minute TWA, for 10 days or more per year.

- Respirable crystalline silica (29 CFR 1910.1053) – Medical surveillance is required for employees who are exposed to airborne concentrations of respirable crystalline silica at or above 25 µg/m³ as an 8-hour TWA for 30 days or more per year.

Site Safety Meeting Form

DOCUMENT DETAILS

DOCUMENT TITLE	Site Safety Meeting Form
DOCUMENT NUMBER	NAM-1501-FM1
Approval Date	26 January 2023
Version	6
Applicability	North America

DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
006	NA	Revision of fitness for duty question. Minor editorial changes.	26 Jan 2023

This Form Template has been Approved By:

APPROVAL SIGNATURE



Millard P. Griffin, Jr.

Regional Health & Safety Director

Project Name/Location:		Phone:
Project Number:	Date:	Time:
Meeting Leader:		
Today's Work Tasks:	Conducted By:	

1. Review relevant sections of the Health and Safety Plan (HASP), Job Hazard Analyses (JHAs) for planned tasks, and any other applicable procedures. Discuss potential hazards of planned work and control measures to be used to eliminate or reduce risks (including PPE). Pay specific attention to overlapping/ simultaneous operations.
2. Review emergency response procedures including emergency phone numbers, location of emergency equipment (fire extinguishers, first aid kit, AED, eyewashes, safety showers, etc.), exit routes, muster points, methods of conducting head count at muster point, and identity of first responders trained in first aid/CPR.
3. Does everyone fully understand the task(s)? Are there any changes that need to be assessed? Use SNAP cards to assess risks associated with changed or unplanned tasks.
4. Remind the team that everyone on the job site is empowered to stop work if something is unsafe or if there are any questions or concerns regarding safety.
5. Advise everyone to assess their fitness for duty today (i.e., are you in a physical, mental, and emotional state which allows you to perform your work assignment in a manner which does NOT threaten the safety or health of yourself, your co-workers, property, or the public at large?). Speak with the Field Team Leader privately if you are not fit for duty as described above.

What tools and equipment are required for today's tasks? Have they been inspected and are they in good condition?

What training/qualifications/experience is necessary for today's assigned tasks?

List any new or Short Service personnel on site today:

Discuss any recent incidents, near misses, field inspection findings, or other safety observations (or observations from similar tasks performed at other sites):

Additional Safety Meeting Topics (check those discussed)

- ☐ What client safety rules or procedures are applicable to today's activities?
- ☐ How will you communicate with others on site? How will you communicate with the PIC and PM?
- ☐ What are the potential impacts of planned activities to visitors, nearby workers, or the public?
- ☐ Whom do you contact if you have questions or before deviating from written procedures?
- ☐ What happens and whom do you contact if there is an injury or other emergency? If working at an active facility, how will you be alerted of an emergency and what will you do?
- ☐ Where is the nearest medical facility and how would we get an injured employee there? If medical help is more than five minutes away, is at least one person on site trained in first aid/CPR? How do you contact them?
- ☐ Do you have any medical condition or allergy that the project team needs to be aware of? Write this down and keep it in your pocket for reference in the event of an emergency.
- ☐ Are any work permits required?
- ☐ Has anything unexpected or out-of-the-ordinary occurred on this job recently to share?
- ☐ Is there anything different about today's operations as compared to yesterday or previous days?
- ☐ What is the worst that could happen if something goes wrong today?
- ☐ What activities occurring today could result in hand injuries? **Fixed open-blade knives are not permitted.**
- ☐ What natural hazards are present (including plants, animals, and insects)?
- ☐ What areas of the site have slip/trip/fall hazards? Can these be avoided? Are everyone's work boots in good shape?
- ☐ Other items:

Meeting Attendees (including employees, contractors, and visitors)

Name	Company	Sign-In*	Sign-Out**

* Signature/initials in this space verify that the employee is fit for performing work.

** Signature/initials in this space verify that the employee was uninjured during the workday.

Excavation and Trenching

DOCUMENT DETAILS

DOCUMENT TITLE	Excavation and Trenching
DOCUMENT NUMBER	NAM-1512-PR1
Approval Date	11 April 2024
Version	6
Applicability	North America

1. PURPOSE AND SCOPE

This document establishes procedures to protect personnel from the hazards associated with excavation and trenching activities. This document applies to all ERM field projects where ERM controls excavation and trenching activities and/or where ERM employees are exposed to hazards associated with excavation operations are conducted.

2. ROLES AND RESPONSIBILITIES

Partner in Charge: Responsible for the following elements:

- Ensuring this procedure is implemented, understood, and followed by employees under their charge and working on their projects, and
- Correcting any deficiencies in the implementation of this procedure as identified by the Business Unit (BU) Health and Safety (H&S) Director.

Project Manager (PM): Responsible for the following elements:

- Performing observations of ERM work processes to assess whether this procedure is applicable and if those employees impacted by this procedure are operating in accordance with noted requirements,
- Stopping work where deviations from this procedure are observed, and
- Correcting, in conjunction with the PIC and BU H&S Director, any observed deficiencies in the implementation of this procedure.

BU H&S Director: Responsible for the following elements:

- Evaluating implementation of this procedure during health and safety plan reviews and project audits, and
- Communicating identified deficiencies to the PIC.

Competent Person: Responsible for daily oversight of excavation operations, including identification and correction of identified deficiencies with follow-up reporting to the PM.

3. DEFINITIONS

Accepted engineering practices: Those requirements which are compatible with standards of practice required by a Registered Professional Engineer (RPE).

Benching: A method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

Cave-in: The separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise immobilize and/or injure a person.

Competent person: One who can identify 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 corrective measures to eliminate them.

Excavation: Any man-made cut, cavity, trench, or depression in an earth surface formed by earth removal.

Hazardous atmosphere: An atmosphere which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause death, illness, or injury.

Protective system: A method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

Shield: A structure that can withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses.

Shoring: A structure such as a metal hydraulic, mechanical, or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.

Sloping: A method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of loads.

Support system: A structure such as underpinning, bracing, or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

Trench: A narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet (4.6 m).

4. PROCEDURE

4.1 COMPETENT PERSON

When ERM controls excavation activities, an excavation competent person should be appointed by the PIC. Note that typically an ERM subcontractor will be performing excavation activities. In these situations, the competent person should be designated by the subcontractor and approved by the PIC. The competent person:

- Is responsible for conducting daily inspections of the excavations, adjacent areas, and protective systems prior to each shift,
- Is responsible for inspection of the excavation after every rainstorm or other event which may increase hazards to the employees,
- Must have knowledge of soils and soil classification,
- Understands the design and use of selected protective systems,
- Has the authority to stop work and take corrective actions when conditions change,
- Has the ability to recognize and test hazardous atmospheres,
- Has formal documentation of training as an excavation competent person, and
- Is physically located at the excavation while work is in progress.

4.2 SOIL CLASSIFICATION

Soil classification must be conducted in accordance with **NAM-1512-WI1 – Soils Classification**, if a sloping or benching protective system is used. For purposes of this procedure, all soils will be classified by a person meeting the definition of a competent person.

4.3 PROTECTIVE SYSTEMS

For excavations deeper than four feet (1.2 meters), employees will be protected by means of a properly designed protective system. This may include:

- Sloping and Benching: See **NAM-1512-WI2 – Slope Configurations** for more information.
- Timber Shoring: Timber shoring for trenches must be designed and stamped by an RPE and must comply with any applicable regulatory practices.
- Aluminum Hydraulic Shoring: Aluminum hydraulic shoring must be approved by an RPE and must comply with any applicable regulatory practices.
- Trench Shields/Boxes: Shields and boxes must either be pre-manufactured with listed load ratings or designed, stamped, and constructed under the direction of an RPE and must comply with any applicable regulatory practices.

Protective systems designed to protect employees in excavations deeper than 20 feet (6.1 meters) must be designed and stamped by an RPE. All excavations, regardless of depth, will be clearly identified and barricaded to keep unauthorized individuals out.

4.4 GENERAL REQUIREMENTS

4.4.1 SURFACE ENCUMBRANCES

All surface encumbrances that may create a hazard to employees shall be removed or supported.

4.4.2 SUBSURFACE CLEARANCE

Subsurface clearance activities shall be performed in accordance with **ERM-1511-PR1 – Subsurface Clearance** prior to any ground disturbance.

4.4.3 SPOILS

Spoils must be placed no closer than two feet (0.6 meters) from the surface edge of the excavation. Spoils should be placed so that they channel rainwater and other run-off away from the excavation and cannot accidentally run, slide, or fall back into the excavation.

4.4.4 SURFACE CROSSING OF TRENCHES

If trenches must be crossed, walkways or bridges must be provided for foot traffic. These structures must have:

- A safety factor of 4,
- A minimum clear width of 20 inches (0.5 meters),
- Be fitted with standard guardrails, and
- Extend a minimum of 24 inches (0.6 meters) past the surface edge of the trench.

4.4.5 ACCESS AND EGRESS

Access to and exit from excavations require the following conditions:

- Trenches four feet or more in depth should be provided with a fixed means of egress,
- Spacing between ladders, ramps, stairs, or other means of egress must be such that an employee will not have to travel more than 25 feet (7.6 meters) of lateral distance to the nearest means of egress, and
- Extension and job-built ladders, where used, must be secured, and extend a minimum of 36 inches (0.9 meters) above the landing.

4.4.6 EXPOSURE TO VEHICULAR TRAFFIC

Employees who may be exposed to vehicular traffic shall be provided with and required to wear Type 2 hi-visibility vests.

4.4.7 EXPOSURE TO FALLING LOADS

Employees shall be protected from loads or objects falling from lifting or digging equipment. Employees are not permitted to work under raised loads and shall stand away from equipment that is being loaded or unloaded, although equipment operators or truck drivers may stay in their

equipment during loading and unloading if their equipment is properly equipped with cab shields or adequate canopies.

4.4.8 WARNING SYSTEMS FOR MOBILE EQUIPMENT

When mobile equipment is operating adjacent to an excavation, a warning system shall be installed to prevent the equipment from falling into the trench. Warning systems may include installation of barricades, use of hand or mechanical signals, and installation of stop logs. Where possible, soils should be graded away from the excavation to aid in vehicle control.

4.4.9 HAZARDOUS ATMOSPHERES

Where oxygen deficiency or a hazardous atmosphere exists or could reasonably be expected to exist, such as in excavations in landfill areas or excavations in areas where hazardous substances are being removed or stored nearby, the atmospheres in the excavation shall be tested before employees enter excavations greater than 4 feet (1.22 m) in depth. This includes atmospheric testing for:

- Oxygen concentrations of less than 19.5% or more than 23.5%,
- Combustible gas concentration greater than 20% of the lower flammable limit (LFL), and
- Concentrations of any hazardous substances that exceed applicable regulatory limits.

When testing for atmospheric contaminants, the following should be considered:

- Testing should be conducted before employees enter the trench and should be done regularly to ensure the trench is safe,
- Atmospheric testing results should be documented on **NAM-1340-FM4 – Ambient Air Monitoring Form**,
- The frequency of testing should be increased if equipment is operating in the trench, and
- Testing frequency should be increased if welding, cutting, or burning is done in the trench.

4.4.10 EMERGENCY RESCUE EQUIPMENT

Emergency rescue equipment is required when a hazardous atmosphere exists or can reasonably be expected to exist within the trench or excavation. This should include, but not be limited to:

- Respirators suitable for the type of exposure anticipated: Respirators must be used in accordance with **NAM-1311-PR1 – Respiratory Protection**.
- Full-body harnesses and lifelines: Lifelines must be provided and always attended when employees enter deep confined spaces.

4.4.11 WATER ACCUMULATION

Methods for controlling standing water and water accumulation must be provided to prevent cave-ins. These methodologies will vary with each situation and must be planned carefully.

Surface water should be diverted away from the trench or excavation. Employees must be removed from any excavation during rainstorms. Employees are not allowed to work within any excavation where water accumulation exists unless:

- Support or shield systems are installed which are specifically designed to withstand water accumulations and are approved by an RPE,
- Water removal equipment is used and monitored by a competent person to prevent water accumulation, and
- Safety harnesses and lifelines are installed and used by all employees.

4.5 INSPECTIONS

Inspections of the trench or excavation will be made by a competent person using **NAM-1512-FM1 – Excavation/Trench Inspection** (or equivalent if subcontractors or third parties are serving as the excavation competent person). Inspections should be completed:

- Daily and before the start of each shift,
- As dictated by work being performed in the excavation,
- After every rainstorm,
- After any event which could increase excavation hazards (e.g., snowstorm, windstorm, thaw, earthquake, etc.),
- When fissures, tension cracks, sloughing, undercutting, water seepage, bulging at the bottom, or similar conditions occur,
- When there is a change in the size, location, or placement of the spoil pile, and
- When there is any indication of change or movement in adjacent structures.

5. REFERENCES

ERM Form **NAM-1340-FM4 – Ambient Air Monitoring Form**

ERM Procedure **NAM-1311-PR1 – Respiratory Protection**

ERM Procedure **ERM-1511-PR1 – Subsurface Clearance Procedure**

ERM Form **NAM-1512-FM1 – Excavation/Trench Inspection**

ERM Work Instruction **NAM-1512-WI1 – Soil Classification**

ERM Work Instruction **NAM-1512-WI2 – Slope Configurations**

Occupational Safety and Health Administration (OSHA) **29 Code of Federal Regulations (CFR) 1926, Subpart P – Excavations**

DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
001	All	New document.	26 Apr 2010
002	All	Updated format to comply with new Global document requirements; language changes throughout for clarity.	9 Mar 2016
003	All	Updated Document Number; updated titles (Section 2); updated paragraph alignment throughout; updated referenced document numbers (Section 4); updated References (Section 5).	5 Jan 2017
004	4	Updated information on hazardous atmospheres; fixed broken links.	20 Aug 2020
005	4.4.5	Revised to note 25 feet (7.8 m) of lateral travel to egress point.	26 May 2021
006	All	Three-year review. Minor grammatical changes.	11 Apr 2024

APPROVAL SIGNATURE



Millard P. Griffin, Jr.

Regional Health & Safety Director

Ladder Safety

DOCUMENT DETAILS

DOCUMENT TITLE	Ladder Safety
DOCUMENT NUMBER	NAM-1521-PR1
Approval Date	15 September 2023
Version	5
Applicability	North America

1. PURPOSE AND SCOPE

This document establishes the procedures necessary to ensure that ERM employees are using ladders and ladder systems safely. This procedure defines requirements for the inspection and use of ladders and ladder systems. This document applies to all North American ERM field and office locations.

2. ROLES AND RESPONSIBILITIES

Partner in Charge (PIC): Responsible for the following elements:

- Ensuring this procedure is implemented, understood, and followed by employees under their charge and working on their projects, and
- Correcting any deficiencies in the implementation of this procedure as identified by the Business Unit (BU) Health and Safety (H&S) Director.

Project Manager (PM)/Supervisor: Responsible for the following elements:

- Performing observations of ERM work processes to assess whether employees are operating in accordance with this procedure,
- Pausing or stopping work where deviations from this procedure are observed, and
- Correcting, in conjunction with the PIC and the BU H&S Director, any observed deficiencies in the implementation of this procedure.

BU H&S Director: Responsible for the following elements:

- Evaluating implementation of this procedure during health and safety plan reviews and project audits, and
- Communicating identified deficiencies to the PIC.



3. DEFINITIONS

Ladder: An appliance usually consisting of two side rails joined at regular intervals by crosspieces called steps, rungs, or cleats, on which a person may step in ascending or descending.

Extension ladder: A non-self-supporting portable ladder adjustable in length. It consists of two or more sections traveling in guides or brackets so arranged as to permit length adjustment. Its size is designated by the sum of the lengths of the sections measured along the side rails.

Fixed ladder: A ladder that is permanently attached to a structure, building or piece of equipment.

Single ladder: A non-self-supporting portable ladder, nonadjustable in length, consisting of only one section. Its size is designated by the overall length of the side rails.

Stepladder: A self-supporting portable ladder, nonadjustable in length, having flat steps and a hinged back. Its size is designated by the overall length of the ladder measured along the front edge of the side rails.

4. PROCEDURE

4.1 GENERAL REQUIREMENTS

- Ladders must only be used for the purpose for which they are designed. They must not be used as/or to create working platforms, runways, or scaffolds.
- Ladders must be provided for safe access to all work elevations where permanent or temporary stairways, ramps, or runways are not provided.
- Ladders must only be used if it is not possible to undertake the task using other control measures that would allow the task to be done in a safer manner.
- Ladders must be visually inspected for defects prior to use and after any occurrence that could affect safe use. Ladders with oil, grease, or other slipping hazards on the rungs or rails; broken or missing rungs or steps; broken or split side rails; damage to hardware guides, pawls, spreaders, and guide ropes; or other faulty or defective construction must not be used. When ladders with such defects are discovered, they must immediately be tagged and removed from service.
- Ladder feet must be placed on stable and level footing. The area around the top and bottom of the ladder must be kept clear.
- Ladder rungs must be uniformly spaced.
- Ladders must not be placed in passageways, doorways, driveways, or any location where they may be displaced by other work activities, unless protected by barricades or guards.
- Ladders must not be used on slippery surfaces unless secured and/or provided with slip-resistant feet to prevent accidental movement. The use of a ladder with slip-resistant feet is not a substitute for exercising care when placing, lashing, or holding a ladder upon slippery surfaces.

- Employees must face ladders at all times while ascending, descending, or working from the ladder.
- Only one person at a time is allowed to ascend, descend, or work from a ladder.
- Ladders must not be moved, shifted, or extended while in use.
- Three points of contact (i.e., two hands and one foot or two feet and one hand) must be maintained at all times when ascending or descending a ladder.
- Employees must grasp the ladder rungs, not the side rails, when ascending or descending a ladder. Employees must not carry any load or object that could cause loss of balance.
- Hand lines must be used to raise or lower materials that cannot safely be carried in a tool belt or pouch. Tools used while working from a ladder must be secured at all times when not in use. Tools must never be placed on the ladder top or rungs at any time.
- When working from a ladder, one hand must maintain a firm grip on the ladder at all times. The only exception is when both hands are working through the rungs of a ladder.
- Metal ladders must never be used near electrical equipment or for electrical work.
- The ladder duty rating shall not be exceeded. The total weight of the user, including clothing, tools and materials must not exceed the maximum manufacturer's load capacity.
- When not in use, ladders must be stored under suitable cover and secured against movement. If stored horizontally, both ends and the middle supported to prevent sagging and warping of rails.
- Ladders must not be painted in a manner that hides the warning labels, grain structure (for wood ladders), deterioration, or defects.

4.2 SINGLE AND EXTENSION LADDERS

- Employees must seek assistance when raising or lowering a ladder. One person must walk the ladder up or down while the second person foots the base of the ladder.
- Straight and extension ladders must be positioned at such a pitch that the horizontal distance from the top support to the foot of the ladder is about $\frac{1}{4}$ of the working length of the ladder (i.e., one foot (30 cm) out for every four feet (1.2 meters) up).
- When the ladder is being used to access an elevated working surface, the side rails of a single or extension ladder must extend at least 36 inches (0.9 meters) above the landing, except in those instances where such an extension would in itself produce a hazard. When this is not practical, install grab rails at the landing elevation to provide a secure grip.
- Straight ladders must be tied off, blocked, or otherwise secured while in use to prevent their movement.
- Employees are not permitted to stand on the top three rungs of any straight or extension ladder.
- Sections of an extension ladder must not be taken apart and used separately.

- Lashing ladders together to increase the length of a ladder is prohibited.

4.3 STEPLADDERS

- When using a stepladder, fully open and lock the side braces. Stepladders must not be used as straight ladders.
- Stepladders must not be used as a means of accessing elevated working surfaces. Stepladders may only be used as temporary elevated working platforms.
- All four feet of the stepladder must be placed on an even, solid footing.
- Employees are not permitted to stand on the top two steps of a stepladder.
- Employees must not climb the rear side of a stepladder unless the manufacturer specifically designs the ladder for such purpose.

5. REFERENCES

Occupational Safety and Health Administration (OSHA) **29 Code of Federal Regulations (CFR) 1910, Subpart D – Walking-Working Surfaces**

OSHA **29 CFR 1926, Subpart X – Stairways and Ladders**

DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
001	All	New document.	2 Jul 2015
002	4.1	Added information on rung spacing.	2 Aug 2016
003	All	Updated Document Number; updated titles (Section 2); updated paragraph alignment throughout; updated referenced document numbers (Section 4); updated References (Section 5).	6 Jan 2017
004	All	Minor language changes throughout for clarification.	2 Sep 2020
005	5	Revised and updated links.	15 Sep 2023

APPROVAL SIGNATURE



Millard P. Griffin, Jr.

Regional Health & Safety Director

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Electrical Safety

DOCUMENT DETAILS

DOCUMENT TITLE	Electrical Safety
DOCUMENT NUMBER	NAM-1561-PR1
Approval Date	6 January 2022
Version	7
Applicability	North America

1. PURPOSE AND SCOPE

This procedure describes the requirements for working on or around electrical circuits with voltages of 50 volts or greater. This document applies to all ERM field and office locations.

2. ROLES AND RESPONSIBILITIES

Partner in charge (PIC): Responsible for the following elements:

- Ensuring this procedure is implemented, understood, and followed by employees under their charge and working on their projects, and
- Correcting any deficiencies in the implementation of this procedure as identified by the Business Unit (BU) Health and Safety (H&S) Director.

Project Manager (PM)/Supervisor/Area Manager: Responsible for the following elements:

- Performing observations of ERM work processes to assess whether employees are operating in accordance with this procedure,
- Pausing or stopping work where deviations from this procedure are observed, and
- Correcting, in conjunction with the PIC and the BU H&S Director, any observed deficiencies in the implementation of this procedure.

Regional H&S Director: Responsible for approving any work on energized systems beyond that stated in Section 4.7 of this procedure.

BU H&S Director: Responsible for the following elements:

- Evaluating implementation of this procedure during health and safety plan reviews and project audits, and
- Communicating identified deficiencies to the PIC.

3. DEFINITIONS

Qualified Persons: One who has demonstrated skills and knowledge related to the construction and operation of electrical equipment and installations and has received safety training to identify and avoid the hazards involved.

Unqualified Persons: A person who is not a qualified person. Note that a person may be considered qualified with respect to certain operations and equipment and not qualified for others.

4. PROCEDURE

4.1 TRAINING

ERM personnel are not typically expected to work with or near exposed energized parts and, as such, will not typically be considered qualified persons. However, if the job duties of ERM employees require them to be exposed to electrical hazards, they will be trained in and familiar with safety-related work practices that pertain to their job assignments. This may include, but not be limited to:

- Methods of safe release of victims from contact with exposed energized electrical conductors or circuit parts,
- First aid and emergency procedures, including cardiopulmonary resuscitation (CPR) and the use of an automated external defibrillator (AED), if the HASP includes the use of this device,
- The proper use of special precautionary techniques, applicable electrical policies and procedures, personal protective equipment (PPE), insulating and shielding materials, and insulated tools and test equipment,
- Techniques to distinguish exposed live electrical parts from other parts of electric equipment,
- Techniques necessary to determine the voltage of exposed live parts,
- Appropriate clearance/approach distances based on the voltage of exposed live parts; and
 - Decision-making process necessary to be able to perform the following:
 - Conduct job safety planning,
 - Identify electrical hazards,
 - Assess the associated risk, and
 - Select the appropriate risk control methods including PPE.

Unqualified persons will be trained in, and be familiar with, any electrical safety-related practices necessary for their safety. Where required, ERM shall maintain training documentation and competency assessment as required by applicable regulatory agencies and National Fire Protection Agency (NFPA) Standard 70E (Standard for Electrical Safety in the Workplace).

4.2 SAFE WORK PRACTICES

When work is required to be performed on or near electrical circuits which are or may potentially be energized, ERM will:

- Assume that all electrical equipment is energized and will treat it as such and
- Develop safe work practices designed to prevent direct or indirect contact and the potential for associated injuries.

Where feasible, live circuits will be de-energized and locked out prior to any work on or near electrical circuits, unless de-energizing the circuit creates additional or increased hazards or is infeasible. If exposed electrical circuits cannot be de-energized, alternate work practices will be developed which will protect the employee from both direct and indirect contact with the energized circuits. Any barriers or panels removed as a result of accessing energized circuits will be replaced immediately upon completion.

All work locations shall be safely accessible whenever work is to be performed. Sufficient access and working space shall be provided and maintained about all electric equipment to permit ready and safe operation and maintenance of such equipment. Illumination shall be provided as needed to perform the work safely.

Insulating equipment designed for the voltage levels to be encountered shall be provided and employees shall be instructed to use the equipment. Employees and subcontractors will not perform any work unless and until danger from accidental contact with high-voltage lines has been effectively guarded against. Insulated gloves, sleeves and blankets must be visually inspected and electrically re-tested periodically at prescribed intervals or when found to be damaged or defective. Gloves, sleeves, and blankets shall be marked to indicate compliance with the re-test schedule and shall be marked with either the date tested, or the date the next test is due.

4.3 RISK ASSESSMENT

A risk assessment must be performed for all work where there is a risk of employee exposure to electrical hazards. The risk assessment must identify the process to be used by the employee before work is started to carry out the following:

- Identify hazards,
- Assess risks, and
- Implement risk control according to a hierarchy of methods.

All risk assessments must be reviewed by the BU H&S Director and a qualified electrical safety subject matter expert (SME) prior to performing the task assessed.

4.4 ARC FLASH RISK ASSESSMENT AND LABELING

Wherever equipment operating at 50 volts or more must be opened for inspection, troubleshooting, or repair by ERM employees (or contractors under an ERM contract), an arc flash

risk assessment must be performed to determine if an arc flash hazard exists. If an arc flash hazard exists, the risk assessment shall determine:

- Appropriate safety-related work practices,
- Equipment labeling requirements,
- The arc flash boundary, and
- The PPE to be used within the arc flash boundary.

If the arc flash risk assessment determines that there is a risk of arc flash, blast or electric shock, the electrical safety SME will be consulted to determine PPE training needs and requirements.

4.5 NORMAL OPERATION OF EQUIPMENT

Normal operation of electric equipment is permitted where all of the following conditions are satisfied:

- The equipment is properly installed,
- The equipment is properly maintained,
- The equipment doors are closed and secured,
- All equipment covers are in place and secured, and
- There is no evidence of impending failure.

If any of these conditions are not met, the appropriate arc rated PPE must be worn.

4.6 DE-ENERGIZED EQUIPMENT

Where electrical equipment will be de-energized to prevent employee contact with live circuits, the equipment shall be locked out, tagged out, or both. Employees will follow requirements outlined in **NAM-1562-PR1 – Hazardous Energy Control**.

An electrically safe work condition is not achieved until it has been verified using an adequately rated test instrument to test each phase conductor or circuit part to verify it is deenergized. Before and after each test, the test instrument must be tested to ensure that it is operating satisfactorily through verification on a known voltage source.

Until an electrically safe working condition is verified, all circuits are considered energized, and the appropriate arc rated PPE must be worn.

4.7 ENERGIZED EQUIPMENT

Work on exposed live equipment may occur through direct or indirect (contact through tools or materials) contact. Only qualified persons are allowed to work on electrical equipment that has not been de-energized. Qualified persons must have appropriate training as indicated in Section 4.1 and should be familiar with proper use of arc rated PPE, insulation, shielding, insulated tools, and work techniques designed to limit the potential for contact.

Energized work is only permitted where the project manager can demonstrate that the task to be performed is infeasible in a de-energized state due to equipment design or operational limitations.

The following energized work may be accomplished by a qualified electrical employee with the authorization of the PM:

- Verification of an electrically safe work condition during lockout,
- Testing, troubleshooting, and voltage measuring, and
- Thermography and visual inspections if the restricted approach boundary is not crossed.

No other energized work may be performed without authorization of the Regional H&S Director and a qualified electrical SME and completion of a live electrical work permit.

4.8 JOB BRIEF

Before starting each job that has the risk of employee exposure to electrical hazards, the Project Manager or his designee must conduct a job briefing with the employees involved. The briefing shall cover such subjects as hazards associated with the job, work procedures involved, special precautions, energy source controls, PPE requirements, and the information on the energized electrical work permit, if required. Additional job briefings shall be held if changes that might affect the safety of employees occur during the course of the work.

4.9 TEST INSTRUMENTS AND EQUIPMENT

Only qualified persons may perform tasks such as testing, troubleshooting, and voltage measuring within the limited approach boundary of energized electrical conductors or circuit parts operating at 50 volts or more or where an electrical hazard exists.

Test instruments, equipment, and their accessories must be rated for circuits and equipment where they are utilized and must be designed for the environment to which they will be exposed and for the manner in which they will be utilized. Test instruments and equipment and all associated test leads, cables, power cords, probes, and connectors will be visually inspected for external defects and damage before each use.

4.10 PORTABLE PLUG AND CORD HADN TOOLS AND EXTENSION CORD SETS

Before each use, portable cord- and plug-connected equipment will be visually inspected for external defects (such as loose parts or deformed and missing pins) and for evidence of possible internal damage (such as a pinched or crushed outer jacket). If there is a defect or evidence of damage that might expose an employee to injury, the defective or damaged item must be removed from service.

Note that cord- and plug-connected equipment and flexible cord sets (extension cords) that remain connected once they are put in place and are not exposed to damage are not required to be visually inspected until they are relocated.

4.11 GROUND FAULT CIRCUIT INTERRUPTER (GFCI) PROTECTION

GFCI protection will be provided where an employee is operating or using cord- and plug-connected tools related to maintenance and construction activity or wherever there are wet conditions. GFCI protection devices must be tested in accordance with the manufacturer's instructions.

4.12 OVERHEAD LINES

When work is being performed near overhead lines, the lines shall be de-energized and grounded by the organization that owns, operates, and/or controls the lines. If de-energizing or grounding of lines is not feasible, employees shall maintain an appropriate distance from the lines to limit the potential for contact or arcing.

For unqualified persons, neither the employee nor the longest conductive object they are in contact with shall be closer to the energized line than:

- 10 feet (3 meters) for voltages of 50 kilovolts (kV) or less, or
- 10 feet (3 meters) plus 4 inches (0.1 meters) for every 10kV over 50 kV.

Additionally, no vehicle or mechanical equipment will be operated so that any part of its structure may approach an overhead line closer than the distances provided in the previous paragraph. Signs shall be posted at, near, or on overhead lines and equipment to alert equipment operators to maintain an appropriate distance as indicated by this procedure.

For qualified persons, neither the employee nor the longest conductive object they are in contact with shall be closer to the energized line:

- 1 foot (30 cm) for voltages of over 300 volts (v), but not over 750 v
- 1.5 feet (46 cm) for voltages of over 750 v, but not over 2 kV
- 2 feet (61 cm) for voltages of over 2 kV, but not over 15 kV
- 3 feet (91 cm) for voltages of over 15 kV, but not over 37 kV
- 3.5 (107 cm) feet for voltages of over 37 kV, but not over 87.5 kV
- 4 (122 cm) feet for voltages of over 87.5 kV, but not over 121 kV
- 4.5 feet (137 cm) for voltages of over 121 kV, but not over 140 kV

4.13 ILLUMINATION

No employee is allowed to enter a space containing exposed energized parts unless sufficient lighting is provided to allow the employee to safely observe the area in question. Additionally, employees are not allowed to reach into blind areas or around obstructions to areas where energized equipment may exist.

4.14 CONFINED SPACE

When working in confined or enclosed spaces which contain or may contain exposed energized circuits, ERM will provide shields, barriers, or insulating materials for employee use to avoid

inadvertent contact with these parts. Openings into confined or enclosed spaces shall be secured to prevent the potential for swinging into an employee and causing inadvertent contact.

4.15 CONDUCTIVE MATERIALS

Employees will handle conductive materials in such a manner as to prevent contact with energized parts. Where longer materials such as pipes or conduit are handled, additional safeguards will be implemented, including use of guards, insulation, or revised material handling techniques.

Aluminum ladders are prohibited from use in areas where energized parts are present. Only ladders with non-conductive side rails shall be used in these areas.

The wearing of jewelry when working on or near energized parts is prohibited. The wearing of clothing with conductive properties (e.g., metallic parts, conductive threads) is also prohibited when working on or near energized parts.

5. REFERENCES

ERM Guideline **NAM-1561-GU1 – Cord Sets and Temporary Wiring**

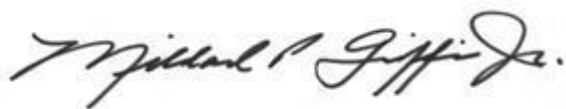
ERM Procedure **NAM-1562-PR1 – Hazardous Energy Control**

National Fire Protection Agency (NFPA) Standard 70E – Standard for Electrical Safety in the Workplace

DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
001	All	New document.	20 Mar 2014
002	All	Revised to meet new Global format; language changes for clarity.	15 Feb 2016
003	3; 4	Added additional definitions and procedural elements.	7 Mar 2016
004	4.12; 4.14	Updated Section 4.12; added Section 4.14.	3 Aug 2016
005	All	Updated Document Number; updated titles (Section 2); updated paragraph alignment throughout; updated referenced document numbers (Section 4); updated References (Section 5).	10 Jan 2017
006	All	Corrected link issues.	2 Sep 2021
007	All	Minor editorial changes.	6 Jan 2022

APPROVAL SIGNATURE



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Regional Health & Safety Director

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Hazardous Energy Control

DOCUMENT DETAILS

DOCUMENT TITLE	Hazardous Energy Control
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Version	8
Applicability	North America

1. PURPOSE AND SCOPE

This procedure defines the minimum requirements for the safe control of hazardous energy when performing maintenance or servicing work on machinery, equipment, or processes from which the unexpected startup or release of stored energy could cause harm to people. The requirements of this procedure do not apply to work on cord and plug-connected electrical machinery, equipment, or processes while under the exclusive control of the person performing the work.

2. ROLES AND RESPONSIBILITIES

Partner in Charge (PIC): Responsible for the following elements:

- Ensure this program is implemented, understood, and followed by employees under their charge,
- Verify the development of all machine, equipment, or process-specific procedures that would apply to ERM project sites where this procedure is applicable, and
- Correct any deficiencies in the implementation of this procedure as identified by the Business Unit (BU) Health and Safety (H&S) Director.

Project Manager (PM)/Supervisor: Responsible for the following elements:

- Implement this procedure during any project activities involving control of hazardous energy during maintenance or servicing of machines, equipment, or processes,
- Ensure all employees under their responsibility have attended and completed required training,
- Develop and maintain a list of authorized employees,
- Verify that an adequate supply of energy isolating devices are available,
- Perform observations/audits of ERM and subcontractor work processes to assess compliance with this procedure, and

- Correct, in conjunction with the PIC and the BU H&S Director, any observed deficiencies in the implementation of this procedure.

BU H&S Director: Responsible for the following elements:

- Provide support to the PIC, PM/Supervisor, employees, and subcontractors as needed to support implementation of this procedure,
- Evaluate implementation of hazardous energy isolation procedures during health and safety plan reviews and project audits,
- Assess compliance with this procedure's requirements and applicable regulations, and
- Communicate identified deficiencies to the PIC and PM/Supervisor.

Employee: Responsible for complying with the requirements stated within this procedure.

Subcontractors: Responsible for the following elements:

- Comply with all elements of this procedure while working on ERM projects requiring hazardous energy control, and
- Provide proof of training prior to initiation of any work related to hazardous energy control.

3. DEFINITIONS

Affected Employee: Any employee whose job requires them to operate or use a machine, equipment, or process on which servicing or maintenance is being performed under lockout or tagout or whose job requires them to work in an area in which such servicing or maintenance is being performed. An affected employee becomes an authorized employee when that employee's duties include performing servicing or maintenance covered under this procedure.

Authorized Employee: Any employee who applies locks or tags to machines or equipment to perform servicing or maintenance on that machine or equipment.

Energy source: Any chemical, electrical, gravity, hydraulic, mechanical, pneumatic, radiation, thermal or other source of energy that can cause harm to people. Primary energy sources supply the power that is used to perform work. Secondary energy sources include energy remaining in the system that is not being used, but when released can cause work to be done.

Energy isolating device: A mechanical device that physically blocks or isolates energy, such as an electrical circuit breaker, disconnect switch, blind, valve, or other device. This does not refer to push buttons, selector switches, interlocks, or other devices similar to a control circuit that cannot be 'locked' in position.

Group Lockout: An energy control procedure that provides authorized and affected employees with the same level of protection as a personal lockout or tagout device when servicing and/or maintenance is performed by a group of employees or subcontractors.

Individual Lockout: A lockout process in which each authorized employee places his lock and tag on each energy isolation device.

Lockout: The act of placement, in accordance with an established procedure, of a lockout device on an energy-isolating device, verifying that the energy-isolating device and the machinery, equipment, or process being controlled cannot be operated until the lockout device is removed.

Lockout Device: A device, such as a combination or key lock, a blank flange, or a bolted slip blind, which employs a secure means of holding an energy isolating device in a safe position and preventing the energizing of equipment, machinery, or a system. A lockout device shall be accompanied by a tag in all cases.

Lockout/Tagout Procedures: Task-specific instructions developed for machine, equipment, and process-specific hazardous energy control.

Tag: Warning labels affixed to energy isolating devices that do not provide the physical restraint on those devices that can be provided by a lock. Tags and their means of attachment should be made of materials that will withstand the environmental conditions of the workplace. Tag attachment devices shall be non-reusable, attachable by hand, self-locking and non-releasable with a minimum unlocking strength of no less than 50 pounds (22.7 kg). The tag shall have the general design and basic characteristics of, or at least be equivalent to, a one-piece, all environment-tolerant, nylon cable tie. The person performing the work shall date and sign the work tag.

Tagout: The placement of a tag on an energy-isolating device, in accordance with an established procedure, to indicate that the energy isolating device and the machine, equipment, or process being controlled cannot be operated until the tag is removed.

Try: The physical act of attempting to start the machine, equipment, or process on which work is to be performed before the work actually begins, therefore verifying that the LOTO is effective, and the machine, equipment, or process will not operate.

4. PROCEDURE

4.1 HAZARDOUS ENERGY CONTROL

Hazardous energy control includes:

- The identification of all energy sources for the machine, equipment, or process as it relates to the task being performed,
- A sequenced lockout and/or tagout, and
- Returning the equipment to service in the reverse sequence.

These steps need to be followed when developing written task-specific based procedures or when undertaking hazardous energy control in situations where a procedure has not been identified (e.g., emergency response).

4.1.1 SEQUENCE OF LOCKOUT

- Notify all affected employees that servicing or maintenance is required on a machine, piece of equipment, or process.

- Notify all affected employees that the machine, equipment, or process must be shut down and locked and/or tagged out to perform the servicing or maintenance.
- The authorized employee shall refer to the task-specific written procedure for the machine, equipment, or process involved to:
 - Identify the type and magnitude of the energy that the machine, equipment, or process utilizes;
 - Understand the hazards of the energy; and
 - Know the methods to control the energy.
- Notify the PM/Supervisor if a written procedure does not exist. A task-specific procedure must be written prior to beginning any work.
- If the machine, equipment, or process is operating, shut it down via normal stopping procedures (stop buttons, value closures, switches, etc.).
- Disconnect the machine, equipment, or process from all primary energy sources.
- Lockout the primary energy sources with individually assigned locks. Apply tags to the energy source identifying who placed the lock, the task(s) being performed, and when the lock was attached.
- Identify any secondary energy sources within the machine, equipment, or process, such as capacitors, springs, hydraulics, remaining gases, liquids, etc.
- Dissipate or restrain any secondary energy sources by appropriate methods, including grounding, blocking, bleeding, repositioning, etc.
- Ensure the equipment is properly disconnected from all energy sources by:
 - Ensuring that no personnel are exposed, and
 - Placing the operating controls into an "on" position to verify the isolation of the equipment by testing to make sure the equipment will not operate.

This is referred to as the "Lock, Tag, Try" method.

- Return operating controls to a neutral or "off" position. The machine, equipment or process is now locked out.

4.1.2 RESTORING EQUIPMENT TO SERVICE

When the servicing or maintenance is completed and the machine, equipment, or process is ready to return to normal operating condition, the following steps should be followed:

- Check the machine, equipment, or process and the immediate area nearby to ensure that nonessential items have been removed and that operating components of the machine, equipment, or process are operationally intact.
- Ensure that all individuals have been safely positioned or removed from the area.
- Verify that the operating controls are in a neutral or "off" position.

- Remove the lockout and/or tagout devices and re-energize the machine, equipment, or process. Note that the removal of some forms of blocking may require re-energization of the machine before safe removal.
- Notify affected employees that the servicing or maintenance is completed, and the machine, equipment, or process is ready for use.

4.1.3 GROUP HAZARDOUS ENERGY CONTROL

If more than one individual is required to lockout or tagout equipment, each shall place his/her own assigned lockout device and/or tag on the primary energy source(s). When an energy source cannot accept multiple locks or tags, a multiple lockout/tagout device such as a hasp may be used.

Alternatively, a single lock may be placed on energy source(s) with the key(s) being placed in a lockout box or cabinet that allows the use of multiple locks to secure it. Each individual will then use his/her own assigned lock and tag to secure the box or cabinet. Each person will remove his/her lock and tag from the box or cabinet when they are done with the job.

Under no conditions may any individual (employee, subcontractor, or visitor) be working in an area with hazardous energy under control without utilizing their own assigned lockout device.

4.1.4 NON-ROUTINE LOCK AND TAG REMOVAL

Individuals are responsible for removing any lockout and/or tagout devices that they place on energy sources. In instances where the authorized employee who affixed a lockout and/or tagout device is not present to remove them when needed, the Project Manager or Supervisor shall confirm that:

- The authorized employee who applied the device is absent and unavailable to remove the device, and
- The maintenance or servicing work has been completed and no personnel remain in the affected area.

After these steps have been completed, the device can be removed. When returning to work, the authorized employee shall be informed of the work that required his or her lockout and/or tagout device to be removed during his or her absence. The removal of a personal lockout and/or tagout device by anyone other than the person who installed it shall be documented via an entry in ERM's Event Communication System (ECS).

4.2 TRAINING

Training shall be provided to ensure that the purpose of the hazardous energy control program is understood. Training also ensures that the knowledge and skills required for the safe application, usage, and removal of energy control devices is acquired.

Each authorized individual shall be trained in:

- The recognition of applicable hazardous energy sources, and

- The methods and means necessary for energy isolation and control.

Each affected individual shall be instructed in the purpose and use of the hazardous energy control procedures. All other individuals whose work is in or near an area where hazardous energy control procedures may be utilized shall be instructed about the procedure and about the prohibition relating to attempts to restart machines, equipment, or processes that are locked or tagged out.

Retraining will be provided for all authorized and affected individuals whenever there is a change in their job assignments; a change in the machine, equipment, or process that presents a new hazard; or when there is a change in the hazardous energy control procedure. Additional retraining shall also be conducted whenever an inspection or audit reveals that there are inadequacies in the individual's knowledge or use of the hazardous energy control procedures.

4.3 OUTSIDE EMPLOYERS

Whenever clients or third-party servicing personnel are to be engaged in activities requiring hazardous energy isolation that may affect ERM operations, ERM and the other employer shall inform each other of their respective hazardous energy isolation procedures. Impacted ERM personnel shall understand and comply with the restrictions and prohibitions of the outside employer's hazardous isolation program.

4.4 PROGRAM REVIEW

This procedure document will be reviewed at least annually by the North America Regional H&S Director or his designee. PICs and or PMs in charge of field level efforts shall conduct a periodic inspection of the task-specific energy isolation procedures to ensure the procedure and its requirements are being followed. For those field projects in excess of one year in duration, inspections will occur at least annually.

5. REFERENCES

None.

DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
001	All	New document.	28 Jan 2015
002	All	Updated format. Minor language changes for clarity.	3 Sep 2015
003	Header	Document title change.	5 Jan 2016
004	4.4.2, 4.4.3, 4.4.7	Added additional information on affixing isolating devices; added Section 4.4.7 to discuss temporary re-energization of the system for positioning or testing.	13 Jul 2016
005	All	Updated Document Number; updated titles (Section 2); updated paragraph alignment throughout; updated referenced document numbers (Section 4); updated References (Section 5).	14 Jan 2017
006	4.4.7, 4.4.8, 4.5	Added Section 4.4.7 (Outside Employers) and Section 4.4.8 (Group Lockout/Tagout). Revised program review information in Section 4.5.	15 Feb 2019
007	All	Significant reorganization of entire procedure.	19 Oct 2020
008	NA	Three-year review. No changes.	27 Dec 2023

APPROVAL SIGNATURE


Millard P. Griffin, Jr.

Regional Health & Safety Director

Medical Surveillance

DOCUMENT DETAILS

DOCUMENT TITLE	Medical Surveillance
DOCUMENT NUMBER	NAM-1810-PR1
Approval Date	29 Jul 2024
Version	08
Applicability	North America

1. PURPOSE AND SCOPE

This document provides guidance on qualifying personnel for hazardous work, monitoring personnel for evidence of adverse health effects due to job site hazard exposure and determining suitability for future work assignments. This document applies to all ERM field and office locations.

2. ROLES AND RESPONSIBILITIES

Partner in Charge (PIC): Responsible for the following elements:

- Ensuring this procedure is implemented, understood, and followed by employees under their charge and working on their projects, and
- Correcting any deficiencies in the implementation of this procedure as identified by the Business Unit (BU) Health and Safety (H&S) Director.

Project Manager (PM)/Supervisor/Area Manager: Responsible for the following elements:

- Performing observations of ERM work processes to assess whether employees are operating in accordance with this procedure,
- Pausing or stopping work where deviations from this procedure are observed, and
- Correcting, in conjunction with the PIC and the BU H&S Director, any observed deficiencies in the implementation of this procedure.

BU H&S Director: Responsible for the following elements:

- Evaluating implementation of this procedure during health and safety plan reviews and project audits, and
- Communicating identified deficiencies to the PIC.

3. DEFINITIONS

Field Safety Officers (FSO): Employees who are responsible for the day-to-day implementation of ERM's health and safety processes on project sites.

4. PROCEDURE

4.1 APPLICABILITY

ERM employees who perform specific activities defined in Table 1 (Medical Surveillance Evaluation) must undergo periodic medical evaluation by a medical doctor specializing in occupational medicine before participating in field work. Medical evaluations will be provided to employees at no cost, without loss of pay, and at a reasonable time and place. Medical evaluations required for subcontractors will be provided at the expense of the subcontractor.

Table 1 will assist in determining the need for routine medical screening exams for employees who work outside of an ERM office. In addition, project risk assessments and the development of project-specific health and safety plans (HASPs) may indicate the potential for additional medical surveillance based on the presence of physical hazards or regulated substances.

The questions in Table 1 assess medical screenings and surveillance requirements mandated either by ERM or regulation. If you can answer "Yes" to the question, the indicated medical screening/surveillance applies. WorkCare can be contacted for scheduling of medical screening/surveillance by phone at 800-455-6155 (in the US) or 877-514-0546 (in Canada) or by email at delta.team@workcare.com.

NOTE: Canadian employees should contact their Business Unit H&S Director or Human Resources Director for guidance on completing a baseline medical exam.

TABLE 1 MEDICAL SURVEILLANCE EVALUATION

Category	Discussion
HAZWOPER	Will you perform work at active HAZWOPER sites or at sites where treatment, storage, or disposal of hazardous wastes is occurring?
Respirator	Will your work activities require you to wear a respirator? Refer to NAM-1311-PR1 – Respiratory Protection for additional information.
Asbestos	Will your work activities require you to perform any intrusive work with asbestos (e.g., sampling, demolition, etc.) or potentially expose you to airborne asbestos fibers in excess of published exposure limits?
Regulated Chemicals	Will your work include exposure to any regulated chemicals, as defined in Section 3 and Appendix 1 of NAM-1340-PR1 – Chemical Hazards , which have specified medical monitoring requirements within the applicable regulations?
Noise	Will your work require you to wear hearing protection because you will work in an environment where noise levels equal or exceed an 8-hour time-weighted average (TWA) of 85 decibels? Refer to

	NAM-1312-PR1 – Hearing Conservation for additional information.
Biohazards	Will your work require exposure to bloodborne pathogens? This will include Field Safety Officers (FSOs). Refer to NAM-1325-PR1 – Bloodborne Pathogens for additional information.
DOT Driver	Will you drive a truck or truck-trailer combination with a gross vehicle weight rating (GVWR) of 10,001 pounds or more during company business? Refer to NAM-1435-PR1 – Commercial Motor Vehicles for additional information.
Offshore Platform	Will you travel to and work on offshore vessels or structures? Refer to ERM-1532-PR3 – Offshore/Overnight Deployment (Vessel or Structure) for additional information.
Other	Are there any site or client-specific biological monitoring or toxicological screening requirements?

4.2 BASIC PHYSICAL EXAMINATION REQUIREMENTS

All employees and subcontractor personnel participating in site work as defined in Table 1 are required to have baseline and periodic physical examinations by an occupational physician. The physical examination will determine whether the employee will experience an increased health risk due to exposure to and operation of site equipment, use of safety equipment including respirators, or working in a potentially contaminated environment. An occupational physician must make this determination for each affected employee prior to field work.

The physician will determine the content of the medical examination based on the known or potential exposures identified by ERM and the employee. Annual and biennial refresher physicals may include, but not be limited to, the following:

- Complete medical histories,
- Physical examinations,
- Pulmonary function tests,
- EKG,
- Eye examinations and visual acuity,
- Audiograms,
- Urinalysis, and
- Blood chemistry, including hematology and serum.

The determination of whether an employee requires an annual or biennial update to their physical is dependent on several factors. ERM has provided WorkCare, our medical services provider, with details on the types of work performed by ERM employees. WorkCare assists in making the determination on the appropriate timetable for refresher physicals.

In addition to the required medical evaluations and tests, any additional medical testing will be completed as required by a site-specific health and safety plan (HASP).

4.3 ADDITIONAL PHYSICAL EXAM REQUIREMENTS

If a Project FSO determines that a site worker has potentially been exposed to hazardous materials, a follow-up exam will be offered to the exposed individual as soon as possible. An exit exam will be given to employees upon termination of employment or upon transfer to a group not engaged in hazardous waste work.

ERM follows drug and alcohol testing policies as set forth in the North American Substance Abuse Program (NASAP) managed by the Houston Area Safety Council. Where client or host facility requirements for pre-employment, post-accident, or random drug and alcohol testing exceed current ERM protocols, ERM will establish appropriate testing criteria to meet the expectations of the client or host facility.

4.4 DOCUMENTATION

Employee medical examination results shall be retained by the occupational physician and sent only to the employee. This information packet will include:

- Exam results and conditions requiring further evaluation or treatment,
- Conditions detected which would place the employee at risk while working at sites containing hazardous substances, and
- Any work limitations in hazardous site work.

A medical clearance letter shall be sent to ERM. This letter does not reveal any medical test results to ERM, rather it only states whether the employee is medically cleared to perform assigned work. The letter will also list any work restrictions applicable to the employee. The ERM H&S team, in concert with ERM Human Resources, will follow up on all medical clearance issues or work restrictions. At a minimum, the letter will contain the following:

- Employee name and office location,
- Date of physical exam and date of required follow-up exam,
- Physician's recommended work limitations, and
- Any employee medical complaints relating to exposure to hazardous substances.

The Project Manager or FSO must confirm project-specific medical surveillance is completed before site entry. Subcontractor personnel must provide proof of medical evaluations to the Project Manager or FSO before site entry. If any worker has not satisfactorily met medical requirements, such individuals will not be allowed to work on the site.

5. REFERENCES

Houston Area Safety Council NASAP Site (**Substance Abuse Testing & Background Screening**)

ERM Procedure **NAM-1311-PR1 – Respiratory Protection**

ERM Procedure **NAM-1340-PR1 – Chemical Hazards**

ERM Procedure **NAM-1312-PR1 – Hearing Conservation**

ERM Procedure **NAM-1325-PR1 – Bloodborne Pathogens**

ERM Procedure **NAM-1435-PR1 – Commercial Motor Vehicles**

ERM Procedure **ERM-1532-PR3 – Offshore/Overnight Deployment (Vessel or Structure)**

DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
001	All	New document.	21 Jan 2015
002	All	Reformatted to meet new Global documentation requirements. Minor language changes for clarity.	23 Jul 2015
003	All	Updated Document Number; updated titles (Section 2); updated paragraph alignment throughout; updated References (Section 5).	06 Jan 2017
004	4	Added Section 4.3 on additional physical exam requirements.	03 Oct 2017
005	4; 5	Expanded definitions of medical surveillance needs, added/updated References.	01 Apr 2019
006	4	Added hyperlinks; minor language revisions.	20 May 2020
007	4.1; 5	Incorporated former NAM-1810-WI1 as Table 1; revised links.	07 Mar 2023
008	4.1	Updated WorkCare email address. Added call-in number specifically for Canada.	29 Jul 2024

APPROVAL SIGNATURE



Millard P. Griffin, Jr.

Regional Health & Safety Director

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Medical Services

DOCUMENT DETAILS

DOCUMENT TITLE	Medical Services
DOCUMENT NUMBER	NAM-1840-PR1
Approval Date	01 February 2023
Version	14
Applicability	North America

1. PURPOSE AND SCOPE

This document establishes the procedures to ensure that ERM employees are provided with appropriate medical services as needed. This document applies to all ERM field and office locations in North America.

2. ROLES AND RESPONSIBILITIES

Partner in Charge (PIC): Responsible for the following elements:

- Ensuring this procedure is implemented, understood, and followed by employees under their charge and working on their projects, and
- Correcting any deficiencies in the implementation of this procedure as identified by the Business Unit (BU) Health and Safety (H&S) Director.

Project Manager (PM)/Supervisor/Area Manager: Responsible for the following elements:

- Performing observations of ERM work processes to assess whether employees are operating in accordance with this procedure,
- Pausing or stopping work where deviations from this procedure are observed, and
- Correcting, in conjunction with the PIC and the BU H&S Director, any observed deficiencies in the implementation of this procedure

BU H&S Director: Responsible for the following elements:

- Evaluating implementation of this procedure during health and safety plan reviews and project audits; and
- Communicating identified deficiencies to the PIC.

3. DEFINITIONS

Field Safety Officers (FSO): Employees who are responsible for the day-to-day implementation of ERM's health and safety processes on project sites.

4. PROCEDURE

4.1 FIRST AID SERVICES

4.1.1 FIRST AID RESPONDERS

It is the expectation of ERM that our personnel who are qualified as FSOs or designated as first aiders, where required, be trained and certified to render appropriate first aid and cardiopulmonary resuscitation (CPR). Evidence of current certification must be documented by the employee in the ERM Academy Learning Management System via the CPR and First Aid – US or CPR and First Aid – Canada certifications. If a client requires personnel working on their site to be first aid/CPR trained, ERM will ensure that appropriately trained personnel are assigned to such projects and have the applicable documentation in the ERM Academy as described above.

These trained individuals will be readily available to assist injured workers and will serve as first responders in the event of an emergency. They will be available at all times during business operations requiring their presence. Trained individuals who are unwilling or uncomfortable in aiding injured employees will not be assigned to these roles.

Acceptable training courses for ERM first aid responders will include in person or hybrid courses only, certified by the American Red Cross, the American Heart Association, Canadian Red Cross, Ambulance St-John, or an equivalent certificate through authorized training providers. Wilderness First Aid training may be an acceptable alternative; however, the course must include hands-on CPR training. Wilderness First Aid course content must be reviewed and approved by a member of the North America Health and Safety Team before it will be accepted as an alternative to courses listed above.

4.1.2 FIRST AID KITS

First aid supplies must be maintained and easily accessible at ERM project and office sites. At a minimum, first aid kits should comply with American National Standards Institute/International Safety Equipment Association (ANSI/ISEA) Standard Z308.1-2021, or as stipulated in Canadian provincial regulation.

On project sites, the contents of the kit must be inspected by the FSO prior to the start of the project and at least weekly during the job to ensure that items being used are replaced. Office first aid kits should be inspected at least quarterly as part of regularly scheduled office inspections.

Typically, those first aid kits maintained on short duration project sites or as personal kits in vehicles in the US should be Class A kits as defined in **NAM-1840-WI1 – First Aid Kit Contents**. Kits maintained in US offices and long-term office trailers should be Class B kits as defined in **NAM-1840-WI1 – First Aid Kit Contents**. Kits used in personal vehicles and offices in Canada should conform to Canadian provincial regulations, where applicable.

4.1.3 EMERGENCY RESPONSE PLANNING

On project sites, the PM will identify the mode in which medical services and first aid will be administered in the health and safety plan (HASP). It is recommended that the FSO drive to the

hospital from the project site to ensure the route is accurate. On complicated or long-term project sites, an emergency medical services drill may be advised.

In offices, the Area Manager will identify the mode in which medical services and first aid will be administered in the local Emergency Action Plan (**NAM-1212-PR1 – Emergency Action Plans**).

These documents shall include directions and a map to the nearest medical facility, along with emergency telephone numbers.

4.1.4 EYEWASH/DRENCH FACILITIES

At any project site where the eyes or body of any employee may be exposed to corrosive or otherwise hazardous chemicals, eyewash and body drench facilities must be available.

4.1.5 EMERGENCY COMMUNICATIONS

At any project site or office, a reliable means of emergency communication will be made available (e.g., cell phone, landline, radio, etc.) to communicate with emergency response personnel.

4.2 AVAILABILITY OF MEDICAL SERVICES

In the US, ERM has retained the services of WorkCare, Inc., a firm specializing in occupational medicine, to provide advice on medical issues and to administer physical and medical examinations as required for our medical surveillance program. Medical surveillance programs will be established with input from WorkCare to properly track the health status of ERM staff based upon their exposure risks. The Regional Health and Safety Director shall be involved in establishing the examination criteria.

WorkCare additionally provides incident intervention services to our employees in North America (and, under limited and pre-negotiated circumstances, to our subcontractors) 24 hours per day, 7 days per week, each day of the year. Whenever first aid is administered by one of our employees, it is expected that WorkCare's Incident Intervention services will also be contacted for guidance.

Please note WorkCare's Incident Intervention services are only available in your home country. When traveling outside your home country, employees are expected to contact International SOS for assistance with work-related injuries or illnesses.

Automatic external defibrillators (AED) are available in all offices of ERM. Contact your Business Unit Health and Safety Director for more information regarding AED use.

ERM safety staff should be informed of the need to render first aid or seek additional medical treatment. ERM employees requiring medical attention, in a non-emergency situation, should be provided transportation by another ERM employee and not be allowed to drive themselves to a medical facility.

5. REFERENCES

ERM Procedure **NAM-1212- PR1 – Emergency Action Plans**

ERM Work Instruction **NAM-1840-WI1 – First Aid Kit Contents**

Occupational Safety and Health Administration (OSHA) **29 Code of Federal Regulations (CFR) 1910.151** (*Medical Services and First Aid*)

American National Standards Institute (ANSI)/International Safety Equipment Association (ISEA) **Z308.1-2021** (*Minimum Requirements for Workplace First Aid Kits and Supplies*)

WorkSafeBC Part 3 Occupational Health and Safety Regulations - **Schedule 3-A** (*Minimum Levels of First Aid*)

Ontario Workplace Safety and Insurance Board (WSIB) **Regulation 1101** (*First Aid Requirements*)

DOCUMENT HISTORY

VERSION	SECTION	REASON FOR REVISION	DATE
001	NA	New document.	12 Feb 2014
002	All	Reformatted to meet new Global documentation requirements.	28 May 2014
002	All	Updated first aid kit content lists and references; minor language changes for clarity.	20 Jul 2015
004	4	Updated first aid kit references; deleted Section 4.3.	15 Feb 2016
005	4.1.1; 4.1.5	Clarified role of first responders; added information on emergency communications.	14 Jul 2016
006	4.1.1	Added information on acceptable training organizations.	02 Aug 2016
007	All	Updated document Number; updated titles (Section 2); updated paragraph alignment throughout; updated referenced document numbers (Section 4); updated References (Section 5).	06 Jan 2017
008	4; 5	Added reference to approved Canadian training agencies and removed list of ANSI first aid kit requirements (Section 4); updated References (Section 5).	27 Jun 2018
009	4.2	Added requirement regarding transport in non-emergency situations.	07 May 2019
010	5	Fixed header issue.	25 Nov 2019
011	4	Minor language changes/updates.	20 May 2020
012	All	Removed references to Floor Wardens and AEDs.	06 Oct 2021
013	4.1.2	Added paragraph clarifying where various classes of first aid kit should be used.	01 Aug 2022
014	All	Revised language throughout; added Wilderness First Aid; updated links.	01 Feb 2023

APPROVAL SIGNATURE



Millard P. Griffin, Jr.
Regional Health & Safety Director

Job Hazard Analyses

ERM-1115-FM1 - JHA Template
Version: 3.1
Revision Date: 17 October 2023

ERM-1115-FM1 - JHA Template
Version: 3.1
Revision Date: 17 October 2023

Task Steps ¹		Potential Hazards & Consequences ² <small>select</small>			Probability	Severity	RISK	Controls to Eliminate or Reduce Risks ³	

ONE JHA PER TASK. SUBCONTRACTORS MUST PROVIDE THEIR OWN JHAS. JHAS SHOULD BE WRITTEN IN PLAIN LANGUAGE AND SHOULD BE NO MORE THAN 2-3 PAGES IN LENGTH.
INSERT ADDITIONAL ROWS AS NEEDED ABOVE (MUST MANUALLY COPY AND PASTE FORMULA IN COLUMN H). ROW HEIGHTS MAY NEED TO BE MANUALLY EXPANDED TO VIEW ALL TEXT.
LEAVE SEVERAL BLANK OVERSIZED ROWS TO ALLOW HANDWRITTEN FIELD ADDITIONS. CAN ALSO DELETE UNNEEDED ROWS TO FIT PAGE(S).

1. Each task consists of a set of steps. List and number all the steps in the sequence they are performed. Specify the equipment or other details.
2. List potential health & safety hazards and consequences - ONE PER ROW - and select "H&S" from the drop-down list. Then list any potential security, environmental, and/or property loss impacts - ONE PER ROW - and select the corresponding code(s) from the drop-down list. Use numbers and letters for each hazard/impact listed (1a, 1b, etc). Use the DEVELOPMENT CHECKLIST and HAZARDOUS ENERGY WHEEL tabs in this spreadsheet to ensure all potential hazards have been identified. Hazards should be described in terms of their specific origin and negative consequences (e.g., instead of "moving equipment", write "injury from getting struck by forklift").
3. Describe the specific actions or procedures that will be implemented to eliminate or reduce each hazard. Be clear, concise, and specific. Use objective, observable, and quantified terms (e.g., instead of "use good body positioning," write "don't bend at waist or reach above head"). Use numbers and letters corresponding to listed hazards. Prioritize controls that are not vulnerable to human error.
4. Select the probability of occurrence and severity of each hazard, AFTER implementation of the planned control measures (use the Risk Matrix as a guide). The corresponding risk rating will then be automatically calculated [RISK = Likelihood x Severity].
A risk rating shaded red indicates that work cannot continue without additional control measures and approval of Partner-in-Charge.

WAYS TO ELIMINATE OR REDUCE RISKS (IN ORDER OF PREFERENCE):

ELIMINATE / AVOID --> SUBSTITUTE / MODIFY --> ISOLATE --> ENGINEER / SAFEGUARD --> TRAINING AND PROCEDURES --> WARNING AND ALERT MECHANISMS --> PPE



JHA Job Hazard Analysis

ERM-1115-FM1 - JHA Template
Version: 3.1
Revision Date: 17 October 2023

Project Number:	TBD	Project / Client Name:	Rowan
Partner-in-Charge / Project Manager:	TBD	Date and Revision Number:	9/17/2024

SPECIFIC TASK:	Digging to install wooden poles
----------------	---------------------------------

Minimum Required PPE for Entire Task:	<input checked="" type="checkbox"/> Hard Hat	<input checked="" type="checkbox"/> Safety-Toe Shoes	<input type="checkbox"/> Hearing Protection	<input type="checkbox"/> Goggles	<input type="checkbox"/> Face Shield	<input type="checkbox"/> Respirator	<input type="text" value="<enter type and cartridge type>"/>	<input type="checkbox"/> Other (specify):
	<input checked="" type="checkbox"/> Safety Glasses	<input checked="" type="checkbox"/> Reflective Vest	<input checked="" type="checkbox"/> Gloves	<input type="text" value="<enter type here>"/>	<input type="checkbox"/> PPE clothing	<input type="text" value="<enter type here (eg, Tyvek, FRC, long sleeves)>"/>	<input type="text" value="<enter additional PPE here>"/>	
Additional Task-Step Specific PPE: (as indicated below under Controls)	NA		Equipment / Tools Required:	Auger drill rig or similar, hand tools				
Training Required for this Task:	Contractor health and safety program		Permits Required for this Task:	Contractor to list out permits here				
Forms / SMS Procedures Associated with This Task:	Tailgate Form, mobile construction equipment checklists (if needed)							

JHA Developed / Reviewed By: (include name and job title)			JHA Review In Field	
			Field supervisor has ensured all personnel performing this task have reviewed JHA and agree to it. Site-specific changes to this JHA have been made as warranted based on this review. <u>Signature/Date:</u>	

Task Steps ¹		Potential Hazards & Consequences ²		select	Probability	Severity	RISK	Controls to Eliminate or Reduce Risks ³	
1	Exposure to site contaminants during drilling activities	1a	Exposure to contaminated soil and or groundwater during drilling activities	H&S	Heard of	Moderate	9	1a	Determine areas of the site prior to digging where potential chemicals of concern (COCs) are present.
		1b	Contact with soil	H&S	Possible	Moderate	12	1b	All crew are to wear long sleeves and nitrile gloves when handling soil. Crew is to pause work if they identify any abnormalities in the soil such as smell, unknown substance in the matrix of the soil, or non-natural looking color changes. Personnel are to wear Level D PPE at all times when working around soil. Wash hands after handling soil
		1c	Contact with groundwater	H&S	Heard of	Moderate	9	1c	Although the chances are low, the potential for contact with groundwater exists. Similar to soil, wear nitrile gloves at all times if handling groundwater. Level D PPE applies, if sampling is needed, use team support to assist in collecting the sample, wear goggles if needed, but safety glasses are acceptable. Wash hands after handling groundwater. Pause work if a sheen or foul odor is identified when handling water and contact the construction manager for further instruction.
2	Drilling Operations	2a	Pinch points and moving parts could cause bodily injury or death. Rotating components can catch person or clothing causing serious injury or death.	H&S	Possible	Severe	28	2a	<ul style="list-style-type: none">Inspect equipment prior to use including hydraulics and cables.Do not work on moving equipment.Remove/secure loose clothing, hair and jewelry.Identify emergency shut-off and make sure all personnel are aware of where it is and how to use it.De-energize hand-held and mobile equipment when not in use.Chock casing, rods, and tooling with potential to roll.Keep hands at least 6 inches away from any pinch point.Use "Show Your Hands" Procedure.Decon all downhole tooling, disengage drill rig by placing it in neutral.Never place hands near pull down rams or in pinch areas.Do not shovel within 2 feet of rotating drill string, maintain minimum 2 foot clearance around rotating drill string.
		2b	Drill rig equipment could break/snap causing equipment damage, bodily injury, or death.	H&S	Rare	Severe	7	2b	<ul style="list-style-type: none">Identify and do not position your hand or body in the potential line-of-fire in the event of unexpected start-up of equipment or release of energy.Ensure protective guards/barricades are in place.Stay out of the immediate area where rods are being advanced or pulled out to minimize injury.
		2c	Exposure to site contaminants could cause					2c	Wear Level D PPE at all times.



JHA Job Hazard Analysis

ERM-1115-FM1 - JHA Template
Version: 3.1
Revision Date: 17 October 2023

Project Number:	TBD	Project / Client Name:	Rowan
Partner-in-Charge / Project Manager:	TBD	Date and Revision Number:	9/17/2024

SPECIFIC TASK:	Soil and GW Management
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Minimum Required PPE for Entire Task:	<input checked="" type="checkbox"/> Hard Hat <input checked="" type="checkbox"/> Safety-Toe Shoes <input type="checkbox"/> Hearing Protection <input type="checkbox"/> Goggles <input type="checkbox"/> Face Shield <input type="checkbox"/> Respirator <input type="text" value="<enter type and cartridge type>"/> <input type="checkbox"/> Other (specify): <input checked="" type="checkbox"/> Safety Glasses <input checked="" type="checkbox"/> Reflective Vest <input checked="" type="checkbox"/> Gloves <input type="text" value="<enter type here>"/> <input type="checkbox"/> PPE clothing <input type="text" value="<enter type here (eg, Tyvek, FRC, long sleeves)>"/> <input type="text" value="<enter additional PPE here>"/>		
Additional Task-Step Specific PPE: (as indicated below under Controls)	NA	Equipment / Tools Required:	Mobile construction equipment, hand tools
Training Required for this Task:	Contractor health and safety program	Permits Required for this Task:	Contractor to list out permits here
Forms / SMS Procedures Associated with This Task:	Tailgate Form, mobile construction equipment checklists (if needed)		

JHA Developed / Reviewed By: (include name and job title)		JHA Review In Field
Alex Martinez / Managing Consultant		Field supervisor has ensured all personnel performing this task have reviewed JHA and agree to it. Site-specific changes to this JHA have been made as warranted based on this review. <u>Signature/Date:</u>

Task Steps ¹		Potential Hazards & Consequences ²		select	Probability	Severity	RISK	Controls to Eliminate or Reduce Risks ³
1	Exposure to site contaminants during waste management activities	1a	Exposure to contaminated soil and or groundwater while loading into trucks or place at area around the site	H&S	Heard of	Moderate	9	1a Determine areas of the site prior to digging where potential chemicals of concern (COCs) are present.
		1b	Contact with soil	H&S	Heard of	Moderate	9	1b Wear level D PPE at all times when handling soil. Wear nitrile gloves when handling soil. It is up to the personnel to identify any changes in soil characteristics such as foul odor or change in color or a sheen present in the soil within the matrix. Should any of the above characteristics be identified, notify the construction manager immediately and segregate the soil into its own pile. If no soil data is available, obtain sample containers and collect a sample and submit to the lab for analysis. Dedicated staff will be in charge of soil segregation to ensure waste streams are not mixed with others. Each area will have its own dedicated stockpile. However, if soil had been previously characterized and its waste stream known, then containerize in soil bin or drums. If stockpiled, cover with visqueen or similar material.
		1c	Contact with groundwater	H&S	Heard of	Moderate	9	1c Although the chances are low, the potential for contact with groundwater exists. Similar to soil, wear nitrile gloves at all times if handling groundwater. Level D PPE applies, if sampling is needed, use team support to assist in collecting the sample, wear goggles if needed, but safety glasses are acceptable. Wash hands after handling groundwater. Pause work if a sheen or foul odor is identified when handling water and contact the construction manager for further instruction. If groundwater is to be removed from the site, follow the same procedure as soil. However, groundwater is to be containerized in 55 gallon DOT approved steel drums or similar. Have the necessary bottleware for sample collection and submit to the lab after collected. The waste shall be stored on a pallet within a secondary containment catch basin. Notify construction manager immediately if drum is identified to have a leak or defects, such as damage to the drum or corrosive leaking.
	Contractor to fill in additional tasks and hazards associated with duct bank efforts							

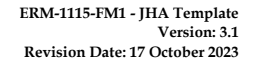
Task Steps ¹		Potential Hazards & Consequences ² <small>select</small>			Probability	Severity	RISK	Controls to Eliminate or Reduce Risks ³		

ONE JHA PER TASK. SUBCONTRACTORS MUST PROVIDE THEIR OWN JHAS. JHAS SHOULD BE WRITTEN IN PLAIN LANGUAGE AND SHOULD BE NO MORE THAN 2-3 PAGES IN LENGTH. INSERT ADDITIONAL ROWS AS NEEDED ABOVE (MUST MANUALLY COPY AND PASTE FORMULA IN COLUMN H). ROW HEIGHTS MAY NEED TO BE MANUALLY EXPANDED TO VIEW ALL TEXT. LEAVE SEVERAL BLANK OVERSIZED ROWS TO ALLOW HANDWRITTEN FIELD ADDITIONS. CAN ALSO DELETE UNNEEDED ROWS TO FIT PAGE(S).

1. Each task consists of a set of steps. List and number all the steps in the sequence they are performed. Specify the equipment or other details.
2. List potential health & safety hazards and consequences - ONE PER ROW - and select "H&S" from the drop-down list. Then list any potential security, environmental, and/or property loss impacts - ONE PER ROW - and select the corresponding code(s) from the drop-down list. Use numbers and letters for each hazard/impact listed (1a, 1b, etc). Use the DEVELOPMENT CHECKLIST and HAZARDOUS ENERGY WHEEL tabs in this spreadsheet to ensure all potential hazards have been identified. Hazards should be described in terms of their specific origin and negative consequences (e.g., instead of "moving equipment", write "injury from getting struck by forklift").
3. Describe the specific actions or procedures that will be implemented to eliminate or reduce each hazard. Be clear, concise, and specific. Use objective, observable, and quantified terms (e.g., instead of "use good body positioning," write "don't bend at waist or reach above head"). Use numbers and letters corresponding to listed hazards. Prioritize controls that are not vulnerable to human error.
4. Select the probability of occurrence and severity of each hazard, AFTER implementation of the planned control measures (use the Risk Matrix as a guide). The corresponding risk rating will then be automatically calculated [RISK = Likelihood x Severity].
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ERM-1115-FM1 - JHA Template
Print Date: 9/17/2024

Task Steps ¹	Potential Hazards & Consequences ²	select ↓	Probability	Severity	RISK	Controls to Eliminate or Reduce Risks ³

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Task Steps ¹		Potential Hazards & Consequences ² <small>select</small>			Probability	Severity	RISK	Controls to Eliminate or Reduce Risks ³	

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Safety Data Sheets

Known or Suspected Chemicals of Concern							
The following form must be filled out for all confirmed or suspected chemicals present on the site to which the ERM team may reasonably be exposed. Information on each chemical must be provided to all team members. Add additional sheets as necessary to address all chemical concerns.							
Chemical Name:		Arsenic (inorganic)		CAS Number:		7440-38-2	
Target Organs:		Routes of Exposure:		Exposure Symptoms:			
Liver, kidneys, skin, lungs, lymphatic system		Inhalation, skin absorption, skin and/or eye contact, ingestion		Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, resp irritation, hyperpigmentation of skin			
OSHA		NIOSH		ACGIH		Additional	
PEL:	0.005 mg/m3	REL	NA	TLV	0.01 mg/m3	IDLH Level:	5 mg/m3
STEL:	NA	STEL	NA	STEL	NA	Ionization Potential:	NA
Ceiling:	NA	Ceiling:	0.002 mg/m3 (15 min)	Ceiling:	NA	Known/Pot. Carcinogen	Yes
Peak:	NA	Sampling Methods: NIOSH 7300, 7301, 7303, 7900, 9102; OSHA ID105					
Chemical Name:		Chromium metal		CAS Number:		7440-47-3	
Target Organs:		Routes of Exposure:		Exposure Symptoms:			
Eyes, skin, respiratory system		Inhalation, ingestion, skin and/or eye contact		Irritation eyes, skin; lung fibrosis (histologic)			
OSHA		NIOSH		ACGIH		Additional	
PEL:	1 mg/m3	REL	0.5 mg/m3	TLV	0.5 mg/m3	IDLH Level:	250 mg/m3
STEL:	NA	STEL	NA	STEL	NA	Ionization Potential:	NA
Ceiling:	NA	Ceiling:	NA	Ceiling:	NA	Known/Pot. Carcinogen	No
Peak:	NA	Sampling Methods: NIOSH 7024, 7300, 7301, 7303, 9102; OSHA ID121, ID125G					
Chemical Name:		Naphthalene		CAS Number:		91-20-3	
Target Organs:		Routes of Exposure:		Exposure Symptoms:			
Eyes, skin, blood, liver, kidneys, central nervous system		Inhalation, skin absorption, ingestion, skin and/or eye contact		Irritation eyes; headache, confusion, excitement, malaise; nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria, renal shutdown; dermatitis, optical neuritis, corneal damage			
OSHA		NIOSH		ACGIH		Additional	
PEL:	10 ppm	REL	10 ppm	TLV	10 ppm	IDLH Level:	250 ppm
STEL:	NA	STEL	15 ppm	STEL	15 ppm	Ionization Potential:	8.12 eV
Ceiling:	NA	Ceiling:	NA	Ceiling:	NA	Known/Pot. Carcinogen	No
Peak:	NA	Sampling Methods: NIOSH 1501; OSHA 35					
Chemical Name:				CAS Number:		#N/A	
Target Organs:		Routes of Exposure:		Exposure Symptoms:			
#N/A		#N/A		#N/A			
OSHA		NIOSH		ACGIH		Additional	
PEL:	#N/A	REL	#N/A	TLV	#N/A	IDLH Level:	#N/A
STEL:	#N/A	STEL	#N/A	STEL	#N/A	Ionization Potential:	#N/A
Ceiling:	#N/A	Ceiling:	#N/A	Ceiling:	#N/A	Known/Pot. Carcinogen	#N/A
Peak:	#N/A	Sampling Methods: #N/A					
Chemical Name:				CAS Number:		#N/A	
Target Organs:		Routes of Exposure:		Exposure Symptoms:			
#N/A		#N/A		#N/A			
OSHA		NIOSH		ACGIH		Additional	
PEL:	#N/A	REL	#N/A	TLV	#N/A	IDLH Level:	#N/A
STEL:	#N/A	STEL	#N/A	STEL	#N/A	Ionization Potential:	#N/A
Ceiling:	#N/A	Ceiling:	#N/A	Ceiling:	#N/A	Known/Pot. Carcinogen	#N/A
Peak:	#N/A	Sampling Methods: #N/A					

Known or Suspected Chemicals of Concern

The following form must be filled out for all confirmed or suspected chemicals present on the site to which the ERM team may reasonably be exposed. Information on each chemical must be provided to all team members. Add additional sheets as necessary to address all chemical concerns.

Chemical Name: Fluoride		CAS Number:					
Target Organs:		Routes of Exposure:		Exposure Symptoms:			
OSHA		NIOSH		ACGIH		Additional	
PEL:		REL		TLV		IDLH Level:	
STEL:		STEL		STEL		Ionization Potential:	
Ceiling:		Ceiling:		Ceiling:		Known/Pot. Carcinogen?	
Peak:		Sampling Methods:					

Chemical Name:		CAS Number:					
Target Organs:		Routes of Exposure:		Exposure Symptoms:			
OSHA		NIOSH		ACGIH		Additional	
PEL:		REL		TLV		IDLH Level:	
STEL:		STEL		STEL		Ionization Potential:	
Ceiling:		Ceiling:		Ceiling:		Known/Pot. Carcinogen?	
Peak:		Sampling Methods:					

Chemical Name:		CAS Number:					
Target Organs:		Routes of Exposure:		Exposure Symptoms:			
OSHA		NIOSH		ACGIH		Additional	
PEL:		REL		TLV		IDLH Level:	
STEL:		STEL		STEL		Ionization Potential:	
Ceiling:		Ceiling:		Ceiling:		Known/Pot. Carcinogen?	
Peak:		Sampling Methods:					

Chemical Name:		CAS Number:					
Target Organs:		Routes of Exposure:		Exposure Symptoms:			
OSHA		NIOSH		ACGIH		Additional	
PEL:		REL		TLV		IDLH Level:	
STEL:		STEL		STEL		Ionization Potential:	
Ceiling:		Ceiling:		Ceiling:		Known/Pot. Carcinogen?	
Peak:		Sampling Methods:					

Chemical Name:		CAS Number:					
Target Organs:		Routes of Exposure:		Exposure Symptoms:			
OSHA		NIOSH		ACGIH		Additional	
PEL:		REL		TLV		IDLH Level:	
STEL:		STEL		STEL		Ionization Potential:	
Ceiling:		Ceiling:		Ceiling:		Known/Pot. Carcinogen?	
Peak:		Sampling Methods:					

Section 1. Identification

GHS product identifier : Fluorine
Chemical name : fluorine
Other means of identification :
Product use : Synthetic/Analytical chemistry.
Synonym :
SDS # : 001061
Supplier's details : Airgas USA, LLC and its affiliates
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

Emergency telephone number (with hours of operation) : 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 : OXIDIZING GASES - Category 1
GASES UNDER PRESSURE - Compressed gas
ACUTE TOXICITY (inhalation) - Category 1
SKIN CORROSION/IRRITATION - Category 1
SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 1
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (respiratory tract) - Category 1

GHS label elements

Hazard pictograms :



Signal word : Danger

Hazard statements : May cause or intensify fire; oxidizer.
Contains gas under pressure; may explode if heated.
Extremely Reactive.
Fatal if inhaled.
Causes severe skin burns and eye damage.
Causes serious eye damage.
Corrosive to the respiratory tract.

Precautionary statements

Section 2. Hazards identification

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. Open valve slowly. Use only with equipment cleaned for Oxygen service. Use only with equipment passivated before use. Use behind barricades with remote extensions on valves and regulators.
Prevention	: Wear protective gloves. Wear eye or face protection. Wear respiratory protection. Keep away from clothing, incompatible materials and combustible materials. Keep reduction valves free from grease and oil. Use only outdoors or in a well-ventilated area. Do not breathe gas. Do not eat, drink or smoke when using this product. Wash hands thoroughly after handling. Use and store only outdoors or in a well ventilated place.
Response	: In case of fire: Stop leak if safe to do so. IF exposed: Call a POISON CENTER or physician. IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISON CENTER or physician. IF SWALLOWED: Immediately call a POISON CENTER or physician. Rinse mouth. Do NOT induce vomiting. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower. Wash contaminated clothing before reuse. Immediately call a POISON CENTER or physician. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or physician.
Storage	: Store locked up. Protect from sunlight. Protect from sunlight when ambient temperature exceeds 52°C/125°F. Store in a well-ventilated place.
Disposal	: Dispose of contents and container in accordance with all local, regional, national and international regulations.
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	: fluorine
Other means of identification	:

CAS number/other identifiers

CAS number	: 7782-41-4
Product code	: 001061

Ingredient name	%	CAS number
fluorine	100	7782-41-4

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** : Get medical attention immediately. Call a poison center or physician. 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. Chemical burns must be treated promptly by a physician.
- Inhalation** : Get medical attention immediately. Call a poison center or physician. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. 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. 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** : Get medical attention immediately. Call a poison center or physician. Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Chemical burns must be treated promptly by a physician. 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** : Causes serious eye damage. Contact with rapidly expanding gas may cause burns or frostbite.
- Inhalation** : Fatal if inhaled. May give off gas, vapor or dust that is very irritating or corrosive to the respiratory system.
- Skin contact** : Causes severe burns. Contact with rapidly expanding gas may cause burns or frostbite.
- Frostbite** : Try to warm up the frozen tissues and seek medical attention.
- Ingestion** : May cause burns to mouth, throat and stomach. As this product is a gas, refer to the inhalation section.

Over-exposure signs/symptoms

- Eye contact** : Adverse symptoms may include the following:
pain
watering
redness
- Inhalation** : No specific data.
- Skin contact** : Adverse symptoms may include the following:
pain or irritation
redness
blistering may occur
- Ingestion** : Adverse symptoms may include the following:
stomach pains

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. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

Section 4. First aid measures

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. Oxidizing material. This material increases the risk of fire and may aid combustion. Contact with combustible material may cause fire. In a fire or if heated, a pressure increase will occur and the container may burst or explode.

Hazardous thermal decomposition products : Decomposition products may include the following materials: halogenated compounds

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.

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 : 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. Do not breathe gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised 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. Do not get in eyes or on skin or clothing. Do not breathe gas. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep away from clothing, incompatible materials and combustible materials. Keep reduction valves free from grease and oil. Empty containers retain product residue and can be hazardous. 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.

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). Store locked up. Separate from acids, alkalies, reducing agents and combustibles. Keep container tightly closed and sealed until ready for use. 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).

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
fluorine	<p>ACGIH TLV (United States, 3/2012). STEL: 3.1 mg/m³ 15 minutes. STEL: 2 ppm 15 minutes. TWA: 1.6 mg/m³ 8 hours. TWA: 1 ppm 8 hours.</p> <p>NIOSH REL (United States, 1/2013). TWA: 0.2 mg/m³ 10 hours. TWA: 0.1 ppm 10 hours.</p> <p>OSHA PEL (United States, 6/2010). TWA: 0.2 mg/m³ 8 hours. TWA: 0.1 ppm 8 hours.</p> <p>OSHA PEL 1989 (United States, 3/1989). TWA: 0.2 mg/m³ 8 hours. TWA: 0.1 ppm 8 hours.</p>

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.

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

Date of issue/Date of revision : 4/25/2015. **Date of previous issue** : 10/16/2014. **Version** : 0.04 5/14

Section 8. Exposure controls/personal protection

- 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: chemical splash goggles and/or face shield. If inhalation hazards exist, a full-face respirator may be required instead.
- 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.
- 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** : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. 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. [This gas is a pale-yellow to greenish, corrosive, toxic, liquefied gas which is an extremely powerful oxidizer with a pungent odor.]
- Color** : Yellowish. Yellow.
- Molecular weight** : 38 g/mole
- Molecular formula** : F₂
- Boiling/condensation point** : -188°C (-306.4°F)
- Melting/freezing point** : -219.61°C (-363.3°F)
- Critical temperature** : -128.55°C (-199.4°F)
- Odor** : Pungent.
- Odor threshold** : Not available.
- pH** : Not available.
- Flash point** : [Product does not sustain combustion.]
- Burning time** : Not applicable.
- Burning rate** : Not applicable.
- Evaporation rate** : Not available.
- Flammability (solid, gas)** : Extremely flammable in the presence of the following materials or conditions: reducing materials, combustible materials and organic materials.
- Lower and upper explosive (flammable) limits** : Not available.
- Vapor pressure** : Not available.

Section 9. Physical and chemical properties

Vapor density	: 1.312 (Air = 1)
Specific Volume (ft³/lb)	: 10.2041
Gas Density (lb/ft³)	: 0.098
Relative density	: Not applicable.
Solubility	: Not available.
Solubility in water	: Not available.
Partition coefficient: n-octanol/water	: Not available.
Auto-ignition temperature	: Not available.
Decomposition temperature	: Not available.
SADT	: Not available.
Viscosity	: Not applicable.

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	: Hazardous reactions or instability may occur under certain conditions of storage or use. Conditions may include the following: contact with combustible materials Reactions may include the following: risk of causing fire
Conditions to avoid	: No specific data.
Incompatibility with various substances	: Extremely reactive or incompatible with the following materials: reducing materials, combustible materials, organic materials, metals, alkalis and moisture.
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
fluorine	LC50 Inhalation Gas.	Rat	185 ppm	1 hours

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Exposure	Observation
fluorine	Eyes - Mild irritant	Human	-	5 minutes 25 parts per million	-

Sensitization

Section 11. Toxicological information

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Name	Category	Route of exposure	Target organs
fluorine	Category 1	Not determined	respiratory tract

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** : Causes serious eye damage. Contact with rapidly expanding gas may cause burns or frostbite.
- Inhalation** : Fatal if inhaled. May give off gas, vapor or dust that is very irritating or corrosive to the respiratory system.
- Skin contact** : Causes severe burns. Contact with rapidly expanding gas may cause burns or frostbite.
- Ingestion** : May cause burns to mouth, throat and stomach. As this product is a gas, refer to the inhalation section.

Symptoms related to the physical, chemical and toxicological characteristics

- Eye contact** : Adverse symptoms may include the following:
pain
watering
redness
- Inhalation** : No specific data.
- Skin contact** : Adverse symptoms may include the following:
pain or irritation
redness
blistering may occur
- Ingestion** : Adverse symptoms may include the following:
stomach pains

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

Short term exposure

Potential immediate effects : Not available.

Section 11. Toxicological information

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.

Bioaccumulative potential

Not available.

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

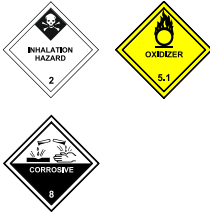
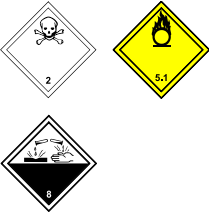
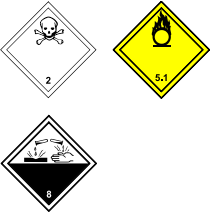

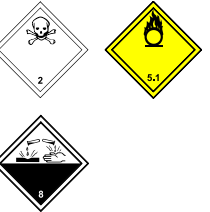
Section 13. Disposal considerations

container.

United States - RCRA Acute hazardous waste "P" List

Ingredient	CAS #	Status	Reference number
Fluorine	7782-41-4	Listed	P056

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1045	UN1045	UN1045	UN1045	UN1045
UN proper shipping name	FLUORINE, COMPRESSED	FLUORINE, COMPRESSED	COMPRESSED, FLUORINE	FLUORINE, COMPRESSED	FLUORINE, COMPRESSED
Transport hazard class(es)	2.3 (5.1, 8) 	2.3 (5.1, 8) 	2.3 (5.1, 8) 	2.3 (5.1, 8) 	2.3 (5.1, 8) 
Packing group	-	-	-	-	-
Environment	No.	No.	No.	No.	No.
Additional information	<p>Inhalation hazard zone A</p> <p>Reportable quantity 10 lbs / 4.54 kg Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements.</p> <p>Limited quantity Yes.</p> <p>Packaging instruction Passenger aircraft Quantity limitation: Forbidden.</p> <p>Cargo aircraft Quantity limitation: Forbidden.</p> <p>Special provisions 1</p>	<p>Explosive Limit and Limited Quantity Index 0</p> <p>ERAP Index 25</p> <p>Passenger Carrying Ship Index Forbidden</p> <p>Passenger Carrying Road or Rail Index Forbidden</p> <p>Special provisions 38</p>	-	-	<p>Passenger and Cargo Aircraft Quantity limitation: 0 Forbidden Cargo Aircraft Only Quantity limitation: 0 Forbidden</p>

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

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.

Section 14. Transport information

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption:** Not determined
United States inventory (TSCA 8b): This material is listed or exempted.

Clean Air Act (CAA) 112 regulated toxic substances: fluorine

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

Name	%	EHS	SARA 302 TPQ		SARA 304 RQ	
			(lbs)	(gallons)	(lbs)	(gallons)
fluorine	100	Yes.	-	-	-	-

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Sudden release of pressure
Immediate (acute) health hazard

Composition/information on ingredients

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
fluorine	100	No.	Yes.	No.	Yes.	No.

SARA 313

	Product name	CAS number	%
Form R - Reporting requirements	fluorine	7782-41-4	100
Supplier notification	fluorine	7782-41-4	100

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations

Massachusetts : This material is listed.

New York : This material is listed.

Section 15. Regulatory information

New Jersey	: This material is listed.
Pennsylvania	: This material is listed.
Canada inventory	: This material is listed or exempted.
<u>International regulations</u>	
International lists	Australia inventory (AICS): This material is listed or exempted. China inventory (IECSC): This material is listed or exempted. Japan inventory: Not determined. Korea inventory: This material is listed or exempted. Malaysia Inventory (EHS Register): Not determined. New Zealand Inventory of Chemicals (NZIoC): This material is listed or exempted. Philippines inventory (PICCS): This material is listed or exempted. Taiwan inventory (CSNN): Not determined.
Chemical Weapons Convention List Schedule I Chemicals	: Not listed
Chemical Weapons Convention List Schedule II Chemicals	: Not listed
Chemical Weapons Convention List Schedule III Chemicals	: Not listed

Canada

WHMIS (Canada)	: Class A: Compressed gas. Class D-1A: Material causing immediate and serious toxic effects (Very toxic). Class E: Corrosive material Class F: Dangerously reactive material. CEPA Toxic substances: This material is not listed. Canadian ARET: This material is not listed. Canadian NPRI: This material is listed. Alberta Designated Substances: This material is not listed. Ontario Designated Substances: This material is not listed. Quebec Designated Substances: This material is not listed.
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Section 16. Other information

Canada Label requirements	: Class A: Compressed gas. Class D-1A: Material causing immediate and serious toxic effects (Very toxic). Class E: Corrosive material Class F: Dangerously reactive material.
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Hazardous Material Information System (U.S.A.)

Health	3
Flammability	0
Physical hazards	3

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 are not required on SDSs 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 mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

Section 16. Other information

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.

History

Date of printing	: 4/25/2015.
Date of issue/Date of revision	: 4/25/2015.
Date of previous issue	: 10/16/2014.
Version	: 0.04
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 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution) UN = United Nations ACGIH – American Conference of Governmental Industrial Hygienists AIHA – American Industrial Hygiene Association CAS – Chemical Abstract Services CEPA – Canadian Environmental Protection Act CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act (EPA) CFR – United States Code of Federal Regulations CPR – Controlled Products Regulations DSL – Domestic Substances List GWP – Global Warming Potential IARC – International Agency for Research on Cancer ICAO – International Civil Aviation Organisation Inh – Inhalation LC – Lethal concentration LD – Lethal dosage NDSL – Non-Domestic Substances List NIOSH – National Institute for Occupational Safety and Health TDG – Canadian Transportation of Dangerous Goods Act and Regulations TLV – Threshold Limit Value TSCA – Toxic Substances Control Act WEEL – Workplace Environmental Exposure Level WHMIS – Canadian Workplace Hazardous Material Information System
References	: Not available.

Section 16. Other information

Indicates information that has changed from previously issued version.

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.

SAFETY DATA SHEET

Version 6.12
Revision Date 09/07/2024
Print Date 09/08/2024

SECTION 1: Identification of the substance/mixture and of the company/undertaking**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, Synthesis of substances

Uses advised against : The product is being supplied under the TSCA R&D Exemption (40 CFR Section 720.36). It is the recipient's responsibility to comply with the requirements of the R&D exemption. The product may not be used for a non-exempt commercial purpose under TSCA unless appropriate consent is granted in writing by MilliporeSigma.

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification**2.1 Classification of the substance or mixture****GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)**

Flammable solids (Category 2), H228
Carcinogenicity (Category 2), H351
Short-term (acute) aquatic hazard (Category 1), H400

Aldrich - 147141

Page 1 of 13

Long-term (chronic) aquatic hazard (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal Word

Warning

Hazard Statements

H228

Flammable solid.

H351

Suspected of causing cancer.

H410

Very toxic to aquatic life with long lasting effects.

Precautionary Statements

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.

P273

Avoid release to the environment.

P280

Wear protective gloves/ protective clothing/ eye protection/ face protection.

P308 + P313

IF exposed or concerned: Get medical advice/ attention.

P370 + P378

In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.

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

SECTION 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

Component	Classification	Concentration
Naphthalene		
	Flam. Sol. 2; Carc. 2; Aquatic Acute 1; Aquatic Chronic 1; H228, H351, H400, H410	<= 100 %

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice

Show this material safety data sheet to the doctor in attendance.

If inhaled

After inhalation: fresh air. Call in physician.

In case of skin contact

In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Consult a physician.

In case of eye contact

After eye contact: rinse out with plenty of water. Call in ophthalmologist. Remove contact lenses.

If swallowed

After swallowing: immediately make victim drink water (two glasses at most). 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

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media

Water Foam Carbon dioxide (CO₂) Dry powder

Unsuitable extinguishing media

For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture

Carbon oxides

Combustible.

Vapors are heavier than air and may spread along floors.

Forms explosive mixtures with air on intense heating.

Development of hazardous combustion gases or vapours possible in the event of fire.

5.3 Advice for firefighters

Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information

Remove container from danger zone and cool with water. Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Advice for non-emergency personnel: Avoid inhalation of dusts. Avoid substance contact. Ensure adequate ventilation. Keep away from heat and sources of ignition. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions

Do not let product enter drains. Risk of explosion.

6.3 Methods and materials for containment and cleaning up

Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up dry. Dispose of properly. Clean up affected area. Avoid generation of dusts.

6.4 Reference to other sections

For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling

Work under hood. Do not inhale substance/mixture.

Advice on protection against fire and explosion

Keep away from open flames, hot surfaces and sources of ignition. Take precautionary measures against static discharge.

Hygiene measures

Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions

Tightly closed. Keep away from heat and sources of ignition.

Storage class

Storage class (TRGS 510): 4.1B: Flammable solid hazardous materials

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients 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	Confirmed animal carcinogen with unknown relevance to humans Danger of cutaneous absorption		
		TWA	10 ppm 50 mg/m ³	USA. NIOSH Recommended Exposure Limits
		ST	15 ppm 75 mg/m ³	USA. NIOSH Recommended Exposure Limits
		TWA	10 ppm 50 mg/m ³	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		PEL	0.1 ppm 0.5 mg/m ³	California permissible exposure limits for chemical contaminants (Title 8, Article 107)
		Skin		

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Naphthalene	91-20-3	1-Naphthol + 2-Naphthol			ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift (As soon as possible after exposure ceases)			

8.2 Exposure controls

Appropriate engineering controls

Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

Personal protective equipment

Eye/face protection

Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

Skin protection

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Full contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested: KCL 741 Dermatril® L

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Splash contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested: KCL 741 Dermatril® L

Body Protection

Flame retardant antistatic protective clothing.

Respiratory protection

Recommended Filter type: Filter A-(P3)

The entrepreneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are carried out according to the instructions of the producer.

These measures have to be properly documented.

required when dusts are generated. Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure

Do not let product enter drains. Risk of explosion.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

- | | |
|--|--|
| a) Appearance | Form: flakes, granules
Color: white |
| b) Odor | aromatic |
| c) Odor 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 | 78.5 °C (173.3 °F) - closed cup - ISO 2719 |
| h) Evaporation rate | No data available |
| i) Flammability (solid, gas) | The substance or mixture is a flammable solid with the category 2. - Flammability (solids) |
| j) Upper/lower flammability or | Upper explosion limit: 5.9 %(V)
Lower explosion limit: 0.9 %(V) |

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explosive limits

- | | | |
|----|--|--|
| k) | Vapor pressure | 0.072 hPa at 20 °C (68 °F) - OECD Test Guideline 104 |
| l) | Vapor density | No data available |
| m) | Density | 1.08 g/cm ³ at 24.7 °C (76.5 °F) - OECD Test Guideline 109 |
| | Relative density | No data available |
| n) | Water solubility | 0.0308 g/l at 25 °C (77 °F) - OECD Test Guideline 105 - slightly soluble |
| o) | Partition coefficient: n-octanol/water | log Pow: 3.4 at 25 °C (77 °F) - OECD Test Guideline 107 - Bioaccumulation is not expected. |
| p) | Autoignition temperature | 526 - 587 °C (979 - 1089 °F) at 1,013 hPa - DIN 51794 |
| q) | Decomposition temperature | No data available |
| r) | Viscosity | No data available |
| s) | Explosive properties | No data available |
| t) | Oxidizing properties | none |

9.2 Other safety information

Surface tension	31.8 mN/m at 100.0 °C (212.0 °F)
-----------------	----------------------------------

SECTION 10: Stability and reactivity

10.1 Reactivity

Forms explosive mixtures with air on intense heating.

A range from approx. 15 Kelvin below the flash point is to be rated as critical.

The following applies in general to flammable organic substances and mixtures: in correspondingly fine distribution, when whirled up a dust explosion potential may generally be assumed.

10.2 Chemical stability

The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions

Violent reactions possible with:

Oxidizing agents

chromium(VI) oxide

benzoyl chloride

aluminium chloride

Risk of explosion with:

nitrogen oxides

10.4 Conditions to avoid

Heat, flames and sparks.

Strong heating.

10.5 Incompatible materials

No data available

10.6 Hazardous decomposition products

In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Oral: No data available

LC50 Inhalation - Rat - male and female - 4 h - > 0.4 mg/l - vapor

(OECD Test Guideline 403)

LD50 Dermal - Rabbit - 20,000 mg/kg

Remarks: (RTECS)

Skin corrosion/irritation

Skin - Rabbit

Result: No skin irritation - 24 h

Remarks: (ECHA)

Serious eye damage/eye irritation

Eyes - Rabbit

Result: No eye irritation - 24 h

Remarks: (ECHA)

Respiratory or skin sensitization

Maximization Test - Guinea pig

Result: negative

(OECD Test Guideline 406)

Germ cell mutagenicity

Test Type: Mutagenicity (mammal cell test): chromosome aberration.

Test system: Chinese hamster ovary cells

Metabolic activation: Metabolic activation

Method: OECD Test Guideline 473

Result: positive

Test Type: Ames test

Test system: Salmonella typhimurium

Metabolic activation: with and without metabolic activation

Method: OECD Test Guideline 471

Result: negative

Test Type: unscheduled DNA synthesis assay

Species: Rat

Cell type: Liver cells

Application Route: Oral

Method: OECD Test Guideline 486

Result: negative

Test Type: Micronucleus test
Species: Mouse
Cell type: Bone marrow
Application Route: Intraperitoneal
Method: US-EPA
Result: negative
Remarks: (ECHA)

Carcinogenicity

Suspected of causing cancer.

IARC: 2B - Group 2B: Possibly carcinogenic to humans (Naphthalene)

No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC. (Naphthalene)

NTP: RAHC - Reasonably anticipated to be a human carcinogen (Naphthalene)

No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP. (Naphthalene)

OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity

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

11.2 Additional Information

Repeated dose toxicity - Rat - male and female - Oral - 91 Days - NOAEL (No observed adverse effect level) - 200 mg/kg - LOAEL (Lowest observed adverse effect level) - 400 mg/kg

Repeated dose toxicity - Mouse - male and female - Oral - 90 Days - NOAEL (No observed adverse effect level) - 100 mg/kg

Repeated dose toxicity - Rat - male and female - Dermal - 90 Days - NOAEL (No observed adverse effect level) - 1,000 mg/kg

Repeated dose toxicity - Rat - male and female - inhalation (vapor) - 90 Days - NOAEL (No observed adverse effect level) - 300 mg/kg

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.

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

After absorption:

Headache
Stomach/intestinal disorders
Tremors
Convulsions
Changes in the blood count

Other dangerous properties can not be excluded.

This substance should be handled with particular care.

Heart -

SECTION 12: Ecological information

12.1 Toxicity

Toxicity to fish	flow-through test LC50 - Oncorhynchus mykiss (rainbow trout) - 1.6 mg/l - 96 h (OECD Test Guideline 203)
Toxicity to daphnia and other aquatic invertebrates	static test EC50 - Daphnia magna (Water flea) - 2.16 mg/l - 48 h (OECD Test Guideline 202)
Toxicity to algae	static test EC50 - Pseudokirchneriella subcapitata (green algae) - 2.96 mg/l - 4 h (US-EPA) Remarks: (ECHA)
Toxicity to fish(Chronic toxicity)	flow-through test LC50 - Oncorhynchus kisutch (coho salmon) - 2.1 mg/l - 96 h Remarks: (ECHA) flow-through test NOEC - Oncorhynchus kisutch (coho salmon) - 0.37 mg/l - 40 Days Remarks: (ECHA)
Toxicity to daphnia and other aquatic invertebrates(Chronic toxicity)	static test NOEC - Daphnia pulex (Water flea) - 0.59 mg/l - 125 d Remarks: (ECHA)

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12.2 Persistence and degradability

Biodegradability aerobic - Exposure time 28 d
Result: 2 % - Not readily biodegradable.
(OECD Test Guideline 302C)

12.3 Bioaccumulative potential

Bioaccumulation Cyprinus carpio (Carp) - 56 d
at 25 °C(Naphthalene)

Bioconcentration factor (BCF): 36.5 - 168
(OECD Test Guideline 305)

Remarks: Bioaccumulation is unlikely.

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 Endocrine disrupting properties

No data available

12.7 Other adverse effects

No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product

Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.

SECTION 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: yes 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

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Marine pollutant : yes

IATA

UN number: 1334 Class: 4.1 Packing group: III
Proper shipping name: Naphthalene, refined

SECTION 15: Regulatory information

CERCLA Reportable Quantity

Components	CAS-No.	Component RQ (lbs)	Calculated product RQ (lbs)
Naphthalene	91-20-3	100	100

SARA 304 Extremely Hazardous Substances Reportable Quantity

This material does not contain any components with a section 304 EHS RQ.

SARA 302 Extremely Hazardous Substances Threshold Planning Quantity

This material does not contain any components with a section 302 EHS TPQ.

SARA 311/312 Hazards : Fire Hazard
Acute Health Hazard
Chronic Health Hazard

SARA 313 : This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

US State Regulations

Massachusetts Right To Know

Naphthalene 91-20-3

Maine Chemicals of High Concern

Product does not contain any listed chemicals

Vermont Chemicals of High Concern

Product does not contain any listed chemicals

Washington Chemicals of High Concern

Product does not contain any listed chemicals

The ingredients of this product are reported in the following inventories:

TSCA : All substances listed as active on the TSCA inventory

TSCA list

No substances are subject to a Significant New Use Rule.

No substances are subject to TSCA 12(b) export notification requirements.

SECTION 16: Other information

Further information

The information is believed to be correct but is not exhaustive and will be used solely as a guideline, which is based on current knowledge of the chemical substance or mixture and is applicable to appropriate safety precautions for the product. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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Version: 6.12

Revision Date: 09/07/2024

Print Date: 09/08/2024

SAFETY DATA SHEET

Version 6.5
Revision Date 10/27/2023
Print Date 04/06/2024

SECTION 1: Identification of the substance/mixture and of the company/undertaking**1.1 Product identifiers**

Product name : PCB No 28

Product Number : 35601
Brand : Sigma-Aldrich
Index-No. : 602-039-00-4
CAS-No. : 7012-37-5

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-
527-3887 CHEMTREC (International) 24
Hours/day; 7 Days/week

SECTION 2: Hazards identification**2.1 Classification of the substance or mixture****GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)**

Specific target organ toxicity - repeated exposure (Category 2), H373
Short-term (acute) aquatic hazard (Category 1), H400
Long-term (chronic) aquatic hazard (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal Word	Warning
Hazard statement(s)	
H373	May cause damage to organs through prolonged or repeated exposure.
H410	Very toxic to aquatic life with long lasting effects.
Precautionary statement(s)	
P260	Do not breathe dust.
P273	Avoid release to the environment.
P314	Get medical advice/ attention if you feel unwell.
P391	Collect spillage.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Synonyms : 2,4,4'-Trichlorobiphenyl
2,4,4'-PCB

Formula : $C_{12}H_7Cl_3$
Molecular weight : 257.54 g/mol
CAS-No. : 7012-37-5
EC-No. : 230-293-2
Index-No. : 602-039-00-4

Component	Classification	Concentration
2,4,4'-Trichlorobiphenyl		
	STOT RE 2; Aquatic Acute 1; Aquatic Chronic 1; H373, H400, H410 Concentration limits: ≥ 0.005 %: STOT RE 2, H373; ≥ 0.005 %: STOT RE 2, H373; M-Factor - Aquatic Acute: 10 - Aquatic Chronic: 10	≤ 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice

Show this material safety data sheet to the doctor in attendance.

If inhaled

After inhalation: fresh air. Call in physician.

In case of skin contact

In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Consult a physician.

In case of eye contact

After eye contact: rinse out with plenty of water. Call in ophthalmologist. Remove contact lenses.

If swallowed

After swallowing: immediately make victim drink water (two glasses at most). 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

SECTION 5: Firefighting measures**5.1 Extinguishing media****Suitable extinguishing media**

Water Foam Carbon dioxide (CO₂) Dry powder

Unsuitable extinguishing media

For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture

Carbon oxides

Hydrogen chloride gas

Combustible.

Development of hazardous combustion gases or vapours possible in the event of fire.

5.3 Advice for firefighters

Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information

Suppress (knock down) gases/vapors/mists with a water spray jet. Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures**6.1 Personal precautions, protective equipment and emergency procedures**

Advice for non-emergency personnel: Avoid inhalation of dusts. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.

For personal protection see section 8.

6.2 Environmental precautions

Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up dry. Dispose of properly. Clean up affected area. Avoid generation of dusts.

6.4 Reference to other sections

For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling

Work under hood. Do not inhale substance/mixture.

Hygiene measures

Change contaminated clothing. Preventive skin protection recommended. Wash hands after working with substance.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions

Tightly closed. Dry.

Storage class

Storage class (TRGS 510): 11: Combustible Solids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
2,4,4'-Trichlorobiphenyl	7012-37-5	TWA	0.001 mg/m ³	USA. NIOSH Recommended Exposure Limits
	Remarks	Potential Occupational Carcinogen		

8.2 Exposure controls

Appropriate engineering controls

Change contaminated clothing. Preventive skin protection recommended. Wash hands after working with substance.

Personal protective equipment

Eye/face protection

Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

Skin protection

Handle with impervious gloves.

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Full contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested: KCL 741 Dermatril® L

Splash contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested: KCL 741 Dermatril® L

Body Protection

protective clothing

Respiratory protection

Recommended Filter type: Filter type P2

The entrepreneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are carried out according to the instructions of the producer.

These measures have to be properly documented.
required when dusts are generated.

Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure

Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

- | | |
|-------------------|-------------------------------------|
| a) Appearance | Form: solid |
| b) Odor | No data available |
| c) Odor Threshold | No data available |
| d) pH | No data available |
| e) Melting | Melting point/range: 56 °C (133 °F) |

	point/freezing point	
f)	Initial boiling point and boiling range	No data available
g)	Flash point	> 100.00 °C (> 212.00 °F)
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapor pressure	No data available
l)	Vapor density	No data available
m)	Density	No data available
	Relative density	No data available
n)	Water solubility	insoluble
o)	Partition coefficient: n-octanol/water	No data available
p)	Autoignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	none

9.2 Other safety information

No data available

SECTION 10: Stability and reactivity

10.1 Reactivity

The following applies in general to flammable organic substances and mixtures: in correspondingly fine distribution, when whirled up a dust explosion potential may generally be assumed.

10.2 Chemical stability

The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions

Violent reactions possible with:
strong oxidising agents

10.4 Conditions to avoid

no information available

10.5 Incompatible materials

No data available

10.6 Hazardous decomposition products

In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Oral: No data available

Inhalation: No data available

Dermal: No data available

Skin corrosion/irritation

No data available

Serious eye damage/eye irritation

No data available

Respiratory or skin sensitization

No data available

Germ cell mutagenicity

No data available

Carcinogenicity

IARC: 1 - Group 1: Carcinogenic to humans (2,4,4'-Trichlorobiphenyl)

NTP: No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity

No data available

Specific target organ toxicity - single exposure

No data available

Specific target organ toxicity - repeated exposure

May cause damage to organs through prolonged or repeated exposure.

Aspiration hazard

No data available

11.2 Additional Information

RTECS: DV8840000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

SECTION 12: Ecological information

12.1 Toxicity

Toxicity to fish LC50 - Pimephales promelas (fathead minnow) - > 0.16 mg/l - 96.0 h

Toxicity to daphnia and other aquatic invertebrates EC50 - Daphnia magna (Water flea) - > 0.16 mg/l - 48 h

12.2 Persistence and degradability

No data available

12.3 Bioaccumulative potential

No data available

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties

No data available

12.7 Other adverse effects

No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product

Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.

SECTION 14: Transport information

DOT (US)

UN number: 3432 Class: 9 Packing group: II
Proper shipping name: Polychlorinated biphenyls, solid
Reportable Quantity (RQ):
Marine pollutant: yes Poison Inhalation Hazard: No

IMDG

Sigma-Aldrich - 35601

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UN number: 3432 Class: 9 Packing group: II EMS-No: F-A, S-A
Proper shipping name: POLYCHLORINATED BIPHENYLS, SOLID
Marine pollutant : yes
Marine pollutant : yes

IATA

UN number: 3432 Class: 9 Packing group: II
Proper shipping name: Polychlorinated biphenyls, solid

SECTION 15: Regulatory information

SARA 302 Components

This material does not contain any components with a section 302 EHS TPQ.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

No SARA Hazards

Massachusetts Right To Know Components

No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

2,4,4'-Trichlorobiphenyl	CAS-No. 7012-37-5	Revision Date 1989-08-11
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California Prop. 65 Components

, which is/are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov .	2,4,4'-Trichlorobiphenyl	CAS-No. 7012-37-5	Revision Date 2008-08-01
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SECTION 16: Other information

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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SAFETY DATA SHEET

Version 6.10
Revision Date 09/06/2024
Print Date 09/07/2024

SECTION 1: Identification of the substance/mixture and of the company/undertaking**1.1 Product identifiers**

Product name : Arsenic

Product Number : 202657

Brand : Aldrich

Index-No. : 033-001-00-X

CAS-No. : 7440-38-2

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

Uses advised against : The product is being supplied under the TSCA R&D Exemption (40 CFR Section 720.36). It is the recipient's responsibility to comply with the requirements of the R&D exemption. The product may not be used for a non-exempt commercial purpose under TSCA unless appropriate consent is granted in writing by MilliporeSigma.

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765

Fax : +1 800 325-5052

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification**2.1 Classification of the substance or mixture****GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)**

Acute toxicity, Oral (Category 3), H301

Acute toxicity, Inhalation (Category 3), H331

Skin irritation (Category 2), H315

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Serious eye damage (Category 1), H318
Carcinogenicity (Category 1A), H350
Short-term (acute) aquatic hazard (Category 1), H400
Long-term (chronic) aquatic hazard (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 Statements

H301 + H331

Toxic if swallowed or if inhaled.

H315

Causes skin irritation.

H318

Causes serious eye damage.

H350

May cause cancer.

H410

Very toxic to aquatic life with long lasting effects.

Precautionary Statements

P201

Obtain special instructions before use.

P202

Do not handle until all safety precautions have been read and understood.

P261

Avoid breathing dust.

P264

Wash skin thoroughly after handling.

P270

Do not eat, drink or smoke when using this product.

P271

Use only outdoors or in a well-ventilated area.

P273

Avoid release to the environment.

P280

Wear protective gloves/ protective clothing/ eye protection/ face protection.

P301 + P310 + P330

IF SWALLOWED: Immediately call a POISON CENTER/ doctor. Rinse mouth.

P302 + P352

IF ON SKIN: Wash with plenty of soap and water.

P304 + P340 + P311

IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/ doctor.

P305 + P351 + P338 + P310

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER/ doctor.

P308 + P313

IF exposed or concerned: Get medical advice/ attention.

P332 + P313

If skin irritation occurs: Get medical advice/ attention.

P362

Take off contaminated clothing and wash before reuse.

P391

Collect spillage.

P403 + P233

Store in a well-ventilated place. Keep container tightly closed.

P405

Store locked up.

P501

Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Formula : As
Molecular weight : 74.92 g/mol
CAS-No. : 7440-38-2
EC-No. : 231-148-6
Index-No. : 033-001-00-X

Component	Classification	Concentration
arsenic	Acute Tox. 3; Skin Irrit. 2; Eye Dam. 1; Carc. 1A; Aquatic Acute 1; Aquatic Chronic 1; H301, H331, H315, H318, H350, H400, H410 M-Factor - Aquatic Acute: 10 M-Factor - Aquatic Chronic: 1	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice

First aiders need to protect themselves. Show this material safety data sheet to the doctor in attendance.

If inhaled

After inhalation: fresh air. Immediately call in physician. If breathing stops: immediately apply artificial respiration, if necessary also oxygen.

In case of skin contact

In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Consult a physician.

In case of eye contact

After eye contact: rinse out with plenty of water. Immediately call in ophthalmologist. Remove contact lenses.

If swallowed

If swallowed: give water to drink (two glasses at most). Seek medical advice immediately. In exceptional cases only, if medical care is not available within one hour, induce vomiting (only in persons who are wide awake and fully conscious), administer activated charcoal (20 - 40 g in a 10% slurry) and consult a doctor as quickly as possible.

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

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media

For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture

Nature of decomposition products not known.

Not combustible.

Ambient fire may liberate hazardous vapours.

5.3 Advice for firefighters

Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information

Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Advice for non-emergency personnel: Avoid generation and inhalation of dusts in all circumstances. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.

For personal protection see section 8.

6.2 Environmental precautions

Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up carefully. Dispose of properly. Clean up affected area. Avoid generation of dusts.

6.4 Reference to other sections

For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling

Work under hood. Do not inhale substance/mixture.

Hygiene measures

Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions

Tightly closed. Dry. Keep in a well-ventilated place. Keep locked up or in an area accessible only to qualified or authorized persons.

Storage class

Storage class (TRGS 510): 6.1A: Combustible, acute toxic Cat. 1 and 2 / very toxic hazardous materials

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
arsenic	7440-38-2	TWA	0.01 mg/m ³	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Lung cancer Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Confirmed human carcinogen		
		C	0.0020 mg/m ³	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen See Appendix A 15 minute ceiling value		

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
arsenic	7440-38-2	inorganic arsenic plus methylated metabolites	15µg/g creatinine	Urine	ACGIH - Biological Exposure Indices (BEI)

	Remarks	End of shift			
		inorganic arsenic plus methylated metabolites	15µg/g creatinine	Urine	ACGIH - Biological Exposure Indices (BEI)
		End of the workweek (After four or five consecutive working days with exposure)			

8.2 Exposure controls

Appropriate engineering controls

Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

Personal protective equipment

Eye/face protection

Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Tightly fitting safety goggles

Skin protection

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Full contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested: KCL 741 Dermatrill® L

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Splash contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested: KCL 741 Dermatrill® L

Body Protection

protective clothing

Respiratory protection

Recommended Filter type: Filter type P3

The entrepreneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are carried out according to the instructions of the producer.

These measures have to be properly documented.

required when dusts are generated.

Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure

Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a) Appearance	Form: powder Color: gray
b) Odor	No data available
c) Odor Threshold	No data available
d) pH	No data available
e) Melting point/freezing point	Melting point/ range: 817 °C (1503 °F) - lit.
f) Initial boiling point and boiling range	613 °C 1135 °F - lit.
g) Flash point	()Not applicable
h) Evaporation rate	No data available
i) Flammability (solid, gas)	No data available
j) Upper/lower flammability or explosive limits	No data available
k) Vapor pressure	No data available
l) Vapor density	No data available
m) Density	5.727 g/mL at 25 °C (77 °F) - lit.
Relative density	5.622.4 °C - OECD Test Guideline 109
n) Water solubility	ca.0.0106 g/l at 20 °C (68 °F) - OECD Test Guideline 105 - slightly soluble
o) Partition coefficient: n-octanol/water	Not applicable for inorganic substances
p) Autoignition temperature	> 430 °C (> 806 °F)does not ignite
q) Decomposition temperature	No data available
r) Viscosity	No data available
s) Explosive properties	No data available
t) Oxidizing properties	none

9.2 Other safety information

No data available

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SECTION 10: Stability and reactivity

10.1 Reactivity

No data available

10.2 Chemical stability

The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions

Exothermic reaction with:

Aluminum

Bromine

bromates

chlorates

iodates

Nitric acid

Risk of ignition or formation of inflammable gases or vapours with:

nitrates

Alkali metals

Zinc

Reducing agents

Strong oxidizing agents

Risk of explosion with:

potassium permanganate

azides

halogen-halogen compounds

Peroxides

nitrogen trichloride

10.4 Conditions to avoid

Heat. Exposure to air may affect product quality.

no information available

10.5 Incompatible materials

No data available

10.6 Hazardous decomposition products

In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Mouse - 145 mg/kg

Remarks: Behavioral:Ataxia.

Diarrhea

(RTECS)

Classified according to Regulation (EU) 1272/2008, Annex VI (Table 3.1/3.2)

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Inhalation: No data available
Dermal: No data available
No data available

Skin corrosion/irritation

Skin - In vitro study
Result: Irritating to skin. - 15 min
Remarks: (ECHA)

Serious eye damage/eye irritation

Eyes - Rabbit
Result: Causes serious eye damage. - 24 h
(OECD Test Guideline 405)

Respiratory or skin sensitization

Maximization Test - Guinea pig
Result: negative
(OECD Test Guideline 406)

Germ cell mutagenicity

Test Type: Ames test
Test system: Escherichia coli
Result: negative
Remarks: (ECHA)

Carcinogenicity

May cause cancer. Positive evidence from human epidemiological studies.

IARC: 1 - Group 1: Carcinogenic to humans (arsenic)
NTP: Known - Known to be human carcinogen (arsenic)
OSHA: OSHA specifically regulated carcinogen (arsenic)

Reproductive toxicity

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

11.2 Additional Information

RTECS: CG0525000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

The following applies to arsenic and its compounds in general: they take effect as capillary and enzyme toxins. Symptoms of arsenic poisoning: acute: after inhalation, mucosal irritations with coughing, dyspnoea, pain in the thorax. Perforations within the respiratory tract are possible. After oral uptake, gastrointestinal disorders with vomiting, diarrhoea, and spasms, CNS disorders with headache, confusion, shaking fits and disturbed consciousness, cardiovascular disorders all the way to circulatory collapse. Chronic: exanthema, dermal lesions in the form of hyperkeratosis and hypermelanosis, loss of hair,

conjunctivitis and polyneuropathy, impaired hepatic function, and renal damage. After accumulation in the liver, kidneys, and skin, arsenic is eliminated from the organism only slowly. Experience has shown arsenic compounds to be carcinogenic in man.

Other dangerous properties can not be excluded.

This substance should be handled with particular care.

Stomach - Irregularities - Based on Human Evidence

Stomach - Irregularities - Based on Human Evidence

SECTION 12: Ecological information

12.1 Toxicity

Toxicity to fish	static test LC50 - <i>Oreochromis mossambicus</i> (Mozambique tilapia) - 28.68 mg/l - 96 h Remarks: (ECHA)
Toxicity to daphnia and other aquatic invertebrates	static test EC50 - <i>Bosmina longirostris</i> (water flea) - 0.85 mg/l - 48 h Remarks: (ECHA)
Toxicity to algae	static test NOEC - <i>Macrocystis pyrifera</i> (brown algae) - 0.04 mg/l - 42 h Remarks: (ECHA)
Toxicity to bacteria	static test EC50 - activated sludge - 10.6 mg/l - 10 Days Remarks: (ECHA)
Toxicity to fish(Chronic toxicity)	flow-through test NOEC - <i>Pimephales promelas</i> (fathead minnow) - 2.13 mg/l - 35 d Remarks: (ECHA)
Toxicity to daphnia and other aquatic invertebrates(Chronic toxicity)	flow-through test NOEC - Shrimp - 0.631 mg/l - 51 d Remarks: (ECHA)

12.2 Persistence and degradability

The methods for determining biodegradability are not applicable to inorganic substances.

12.3 Bioaccumulative potential

No data available

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties

No data available

12.7 Other adverse effects

No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product

Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.

SECTION 14: Transport information

DOT (US)

UN number: 1558 Class: 6.1 Packing group: II
Proper shipping name: Arsenic
Reportable Quantity (RQ): 1 lbs
Reportable Quantity (RQ): 1 lbs
Poison Inhalation Hazard: No

IMDG

UN number: 1558 Class: 6.1 Packing group: II EMS-No: F-A, S-A
Proper shipping name: ARSENIC
Marine pollutant : yes

IATA

UN number: 1558 Class: 6.1 Packing group: II
Proper shipping name: Arsenic

SECTION 15: Regulatory information

CERCLA Reportable Quantity

Components	CAS-No.	Component RQ (lbs)	Calculated product RQ (lbs)
arsenic	7440-38-2	1	1
arsenic	7440-38-2	1	1 (D004)

SARA 304 Extremely Hazardous Substances Reportable Quantity

This material does not contain any components with a section 304 EHS RQ.

SARA 302 Extremely Hazardous Substances Threshold Planning Quantity

This material does not contain any components with a section 302 EHS TPQ.

SARA 311/312 Hazards : Acute Health Hazard
Chronic Health Hazard

SARA 313 : The following components are subject to reporting levels established by SARA Title III, Section 313:

arsenic	7440-38-2	>= 90 - <= 100 %
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US State Regulations

Massachusetts Right To Know

arsenic	7440-38-2
---------	-----------

Pennsylvania Right To Know

arsenic	7440-38-2
---------	-----------

Maine Chemicals of High Concern

Product does not contain any listed chemicals

Vermont Chemicals of High Concern

arsenic	7440-38-2
---------	-----------

Washington Chemicals of High Concern

arsenic	7440-38-2
---------	-----------

California Prop. 65

WARNING: This product can expose you to chemicals including arsenic, which is/are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

The ingredients of this product are reported in the following inventories:

TSCA : All substances listed as active on the TSCA inventory

TSCA list

No substances are subject to a Significant New Use Rule.

No substances are subject to TSCA 12(b) export notification requirements.

SECTION 16: Other information

Further information

The information is believed to be correct but is not exhaustive and will be used solely as a guideline, which is based on current knowledge of the chemical substance or mixture and is applicable to appropriate safety precautions for the product. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact

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Version: 6.10

Revision Date: 09/06/2024

Print Date: 09/07/2024

SAFETY DATA SHEET

Version 6.8
Revision Date 09/07/2024
Print Date 09/08/2024

SECTION 1: Identification of the substance/mixture and of the company/undertaking**1.1 Product identifiers**

Product name : Chromium

Product Number : 266299
Brand : Aldrich
CAS-No. : 7440-47-3

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

Uses advised against : The product is being supplied under the TSCA R&D Exemption (40 CFR Section 720.36). It is the recipient's responsibility to comply with the requirements of the R&D exemption. The product may not be used for a non-exempt commercial purpose under TSCA unless appropriate consent is granted in writing by MilliporeSigma.

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification**2.1 Classification of the substance or mixture**

Not a hazardous substance or mixture.

2.2 GHS Label elements, including precautionary statements

Not a hazardous substance or mixture.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

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SECTION 3: Composition/information on ingredients

3.1 Substances

Formula : Cr
Molecular weight : 52.00 g/mol
CAS-No. : 7440-47-3
EC-No. : 231-157-5

Component	Classification	Concentration
chromium		
		<= 100 %

SECTION 4: First aid measures

4.1 Description of first-aid measures

If inhaled

After inhalation: fresh air.

In case of skin contact

In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower.

In case of eye contact

After eye contact: rinse out with plenty of water. Remove contact lenses.

If swallowed

After swallowing: make victim drink water (two glasses at most). Consult doctor if feeling unwell.

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

SECTION 5: Firefighting measures

5.1 Extinguishing media

Unsuitable extinguishing media

For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture

Chromium oxides

5.3 Advice for firefighters

In the event of fire, wear self-contained breathing apparatus.

5.4 Further information

none

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Advice for non-emergency personnel: Avoid inhalation of dusts. Evacuate the danger area, observe emergency procedures, consult an expert.

For personal protection see section 8.

6.2 Environmental precautions

No special precautionary measures necessary.

6.3 Methods and materials for containment and cleaning up

Observe possible material restrictions (see sections 7 and 10). Take up dry. Dispose of properly. Clean up affected area. Avoid generation of dusts.

6.4 Reference to other sections

For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions

Tightly closed. Dry.

Air sensitive.

Storage class

Storage class (TRGS 510): 11: Combustible Solids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
chromium	7440-47-3	TWA	0.5 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		PEL	0.5 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)
		TWA	1 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
chromium	7440-47-3	Total chromium	0.7 µg/l	Urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift at end of workweek			

8.2 Exposure controls

Appropriate engineering controls

Change contaminated clothing. Wash hands after working with substance.

Personal protective equipment

Eye/face protection

Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested: Dermatrill® (KCL 740 / Aldrich Z677272, Size M)

Splash contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested: Dermatrill® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the EC 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.

Respiratory protection

Recommended Filter type: Filter type P1

The entrepreneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are carried out according to the instructions of the producer.

These measures have to be properly documented.

required when dusts are generated.

Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure

No special precautionary measures necessary.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a) Appearance	Form: powder Color: light gray
b) Odor	odorless
c) Odor Threshold	No data available
d) pH	No data available
e) Melting point/freezing point	Melting point/ range: 1,857 °C (3,375 °F) - lit.
f) Initial boiling point and boiling range	2,672 °C 4,842 °F - lit.
g) Flash point	()Not applicable
h) Evaporation rate	No data available
i) Flammability (solid, gas)	No data available
j) Upper/lower flammability or explosive limits	No data available
k) Vapor pressure	No data available
l) Vapor density	No data available
m) Density	7.14 g/mL at 25 °C (77 °F) - lit.
Relative density	No data available
n) Water solubility	insoluble
o) Partition coefficient: n-octanol/water	Not applicable for inorganic substances

- | | |
|------------------------------|-------------------|
| p) Autoignition temperature | No data available |
| q) Decomposition temperature | No data available |
| r) Viscosity | No data available |
| s) Explosive properties | No data available |
| t) Oxidizing properties | none |

9.2 Other safety information

No data available

SECTION 10: Stability and reactivity

10.1 Reactivity

No data available

10.2 Chemical stability

The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions

No data available

10.4 Conditions to avoid

no information available

10.5 Incompatible materials

Strong acids, Strong oxidizing agents

10.6 Hazardous decomposition products

In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Oral: No data available

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation

Remarks: No data available

Serious eye damage/eye irritation

Remarks: No data available

Respiratory or skin sensitization

No data available

Germ cell mutagenicity

No data available

Carcinogenicity

IARC: No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity

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

11.2 Additional Information

RTECS: GB4200000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Stomach - Irregularities - Based on Human Evidence

Stomach - Irregularities - Based on Human Evidence

SECTION 12: Ecological information

12.1 Toxicity

Toxicity to fish LC50 - Cyprinus carpio (Carp) - 14.3 mg/l - 96 h

Toxicity to daphnia and other aquatic invertebrates EC50 - Daphnia magna (Water flea) - 0.07 mg/l - 48 h

12.2 Persistence and degradability

The methods for determining biodegradability are not applicable to inorganic substances.

12.3 Bioaccumulative potential

Bioaccumulation Oncorhynchus mykiss (rainbow trout) - 30 d
- 50 µg/l(chromium)

Bioconcentration factor (BCF): 1.03 - 1.22

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 Endocrine disrupting properties

No data available

12.7 Other adverse effects

No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product

Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.

SECTION 14: Transport information

DOT (US)

UN number: 3077 Class: 9

Packing group: III

Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (chromium)

Reportable Quantity (RQ): 5000 lbs

Reportable Quantity (RQ): 10 lbs

Poison Inhalation Hazard: No

IMDG

Not dangerous goods

IATA

Not dangerous goods

Further information

Not classified as dangerous in the meaning of transport regulations.

SECTION 15: Regulatory information

CERCLA Reportable Quantity

Components	CAS-No.	Component RQ (lbs)	Calculated product RQ (lbs)
chromium	7440-47-3	5000	5000

This material does not contain any components with a section 304 EHS RQ.

This material does not contain any components with a section 302 EHS TPQ.

SARA 313 : The following components are subject to reporting levels established by SARA Title III, Section 313:

chromium	7440-47-3	>= 90 - <= 100 %
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chromium 7440-47-3

chromium 7440-47-3

Product does not contain any listed chemicals

Product does not contain any listed chemicals

Product does not contain any listed chemicals

TSCA : All substances listed as active on the TSCA inventory

No substances are subject to a Significant New Use Rule.

No substances are subject to TSCA 12(b) export notification requirements.

Further information

The information is believed to be correct but is not exhaustive and will be used solely as a guideline, which is based on current knowledge of the chemical substance or mixture and is applicable to appropriate safety precautions for the product. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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Version: 6.8

Revision Date: 09/07/2024

Print Date: 09/08/2024



APPENDIX D

CAP INSPECTION FORM

CAP INSPECTION FORM

Location		Date/Time	
Inspector		Weather	

Landscaped Areas	
Vegetation	<input type="checkbox"/> Healthy <input type="checkbox"/> Sparse <input type="checkbox"/> Bare Spot
Trees	<input type="checkbox"/> Healthy <input type="checkbox"/> Poor Health <input type="checkbox"/> Dead
Shrubs	<input type="checkbox"/> Healthy <input type="checkbox"/> Poor Health <input type="checkbox"/> Dead
Vent Risers and Piping at Utility Poles	<input type="checkbox"/> Good Condition <input type="checkbox"/> Cracked <input type="checkbox"/> Broken/Damaged
Cover Condition	<input type="checkbox"/> Healthy <input type="checkbox"/> Erosion <input type="checkbox"/> Burrowing
Overall Condition & Notes	
Hardscaped Areas	
Condition of Drainage Features	<input type="checkbox"/> Good Condition <input type="checkbox"/> Blocked <input type="checkbox"/> Broken/Damaged
Cracks or Deterioration in Pavement	<input type="checkbox"/> Good Condition <input type="checkbox"/> Cracked <input type="checkbox"/> Broken/Damaged
Evidence or Knowledge of Recent Breaches of Pavement	
Overall Condition of Pavement	



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Brazil	Poland
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China	Romania
Colombia	Senegal
France	Singapore
Germany	South Africa
Ghana	South Korea
Guyana	Spain
Hong Kong	Switzerland
India	Taiwan
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