Pilot Study Work Plan

G.W. Lisk Company, Inc.

G.W. Lisk Facility—2 South Street

Village of Clifton Springs
Ontario County, New York

NYSDEC BCP Site Number: C835026

April 2023

Project Number: 0516919

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April 2023

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G.W. Lisk Facility—2 South Street
Village of Clifton Springs, Ontario County, New York

NYSDEC BCP Site Number C835026

Prepared for:

G.W. Lisk Company, Inc.

Prepared by:

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PILOT STUDY WORK PLAN
April 2023
G.W. LISK FACILITY—2 SOUTH STREET
VILLAGE OF CLIFTON SPRINGS, ONTARIO COUNTY,
NEW YORK
NYSDEC BCP SITE NUMBER C835026

I, Stephen A. Mirabello, certify that I am currently a NYS registered professional engineer and that this Pilot Study Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

Stephen A. Mirabello, P.E.

ERM Consulting & Engineering, Inc.

Date: 4/14/23

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Acronyms and Abbreviations

CAMP	Community Air Monitoring Plan
CPP	Citizen Participation Plan
CSHC	Clifton Springs Hospital and Clinic
CVOC	Chlorinated Volatile Organic Compound
DER-10	Division of Environmental Remediation's Final Technical Guidance for Site Investigation and Remediation
DUSR	Data Usability Summary Report
ERM	ERM Consulting & Engineering, Inc.
G.W. Lisk	G.W. Lisk Company, Inc.
HASP	Health and Safety Plan
IRM	Interim Remedial Measure
MGP	Manufactured Gas Plant
MNA	Monitored Natural Attenuation
MW	Monitoring Well
NYCRR	New York Codes, Rules, and Regulations
NYSDEC	New York State Department of Environmental Conservation
ORP	Oxidation-Reduction Potential
PARCC	Precision, Accuracy, Reproducibility, Completeness, and Comparability
P.E.	Professional Engineer
P.G.	Professional Geologist
QA/QC	Quality Assurance / Quality Control
QAPP	Quality Assurance Project Plan
RI	Remedial Investigation
SC	Site Characterization
Site	The G.W. Lisk Facility located at 2 South Street in the Village of Clifton Springs, Ontario County, New York
SRI	Supplemental Remedial Investigation
SVI	Soil Vapor Intrusion
SVOC	Semivolatile Organic Compound
TCA	Trichloroethane
TCE	Trichloroethene
TOGS	Technical Operations Guidance Series
VOC	Volatile Organic Compound

1. INTRODUCTION

At the request of the New York State Department of Environmental Conservation (NYSDEC), G.W. Lisk Company, Inc. (G.W. Lisk) entered into an Order on Consent and Administrative Settlement with the NYSDEC dated 27 May 2015 (Index Number R8-0852-15-04) to perform Site Characterization (SC) of environmental media at the G.W. Lisk Facility located at 2 South Street in the Village of Clifton Springs, Ontario County, New York (the Site). The location of the Site is shown in Figure 1, and the layout of the facility shown in Figure 2. The Site was initially classified as a “P” (potential) site by the NYSDEC and identified as Site Number 835026. G.W. Lisk submitted an application to the NYSDEC for entry into the Brownfield Cleanup Program (BCP) as a Participant and the application was accepted by the NYSDEC after public notice and review. Brownfield Site Cleanup Agreement Index Number C835026-12-18 was executed by the NYSDEC on 23 January 2019. The Site is identified as NYSDEC BCP Site Number C835026.

1.1 Purpose and Objectives

Based on the results of the Remedial Investigation (RI) and Supplemental Remedial Investigation (SRI), ERM developed the scope of work for this Pilot Study (PS)consistent with NYSDEC technical requirements contained in the Division of Environmental Remediation’s Final Technical Guidance for Site Investigation and Remediation (DER-10; NYSDEC, 2010a), to meet the following goals:

- Introduce enriched emulsified vegetable oil (EOS Pro) and bioaugmentation culture (BAC-9) to the overburden groundwater in two distinct areas around G-B-12 and G-B-11(Figure 3)
- Delineate radius of influence of EOS Pro and BAC-9 in soil and groundwater at injection sites near G-B-12 and G-B-11
- Analyze degradation of trichloroethene (TCE) and daughter products in groundwater down-gradient of injection locations for further support of augmented Monitored Natural Attenuation (MNA); and
- Produce data of sufficient quantity and quality to inform the development of a final remedy.

Results from previous environmental investigation and sampling activities conducted at the Site have been incorporated into this PS Work Plan. Additional monitoring wells and groundwater sampling events are proposed within this PS to collect data for use in developing a remedial strategy for the Site.

1.1.1 Project Organization

The Site is currently owned by Raer Corporation and operated by G.W. Lisk. Primary contacts for G.W. Lisk are provided below.

Operator		
G.W. Lisk	Allen Hawker	315-462-4271
Operator’s Consultant		
ERM Consulting & Engineering, Inc.	Ernie Rossano, P.G.	631-756-8917
	Tim Daniluk, P.G.	315-233-3043
	Stephen Mirabello, P.E.	609-403-7564
Operator’s Counsel		
Harter Secrest & Emery	Tom Tuori, Esq.	585-231-1449

1.1.2 Citizen Participation

As required in the Brownfield Cleanup Agreement, G.W. Lisk prepared and submitted a Citizen Participation Plan (CPP) to the NYSDEC for review (ERM, 2019). The CPP was approved by the NYSDEC on 17 May 2019. The CPP describes procedures that will be used to keep the public informed of the current status of environmental activities at the Site.

1.2 Site Location and Layout

The Site is located in the south-central portion of the Village of Clifton Springs in Ontario County, New York. Figure 1 shows the location of the Site and adjacent areas. Figure 2 show the layout and land use of the Site including the parcel boundary (red line), the official BCP Site boundary (yellow line), and surrounding areas. The parcel currently contains approximately 26.654 acres and the BCP Site boundary contains approximately 8.828 acres. The Site is located within a mixed industrial, commercial, and residential use area.

1.3 General Description and History

The Site was originally developed in the mid-1800s for agricultural use. The G.W. Lisk facility is privately owned and has been operating since the early-1900s. The facility originally operated as a manufacturer of tin cake pans, pails, and spraying devices from 1910 until the late-1940s. The facility began solenoid manufacturing operations in 1948 and continues to operate as a manufacturer of solenoids and valves for industrial and commercial markets.

After originally consisting of a single chicken coop in 1910, the facility currently occupies approximately 225,000 square feet of building space. There are two main clusters of attached buildings where facility operations occur (Figure 2). Paved parking areas are located on the central, southern, and eastern portions of the Site. Paved driveways and shipping areas are also located throughout the Site. The western and southern portions of the Site are primarily wooded.

The Site and other properties in the area obtain potable water from the Village of Clifton Springs Water Department. There are three reported water wells within a 0.5-mile radius of the Site dating as far back as, at least, 1929; however, it is not known whether these wells still exist and/or if they supply water for potable purposes. Information on these wells was provided to the NYSDEC in correspondence dated 31 October 2019. Two non-potable water supply wells are present at the Site (Figure 2). Water from these two wells is reportedly used to supply a water fountain located at the Clifton Springs Hospital and Clinic (CSHC) property immediately north of the Site.

1.4 Previous Groundwater Investigations

1.4.1 Clifton Springs Hospital and Clinic

Several VOCs, SVOCs, and inorganic (metal) compounds were detected in one or more groundwater samples previously collected at the CSHC property located immediately north of the Site. The investigations were performed in 2014 and 2015 in association with a proposed acquisition of the CSHC property by others (H&A, 2015).

Chlorinated VOCs (CVOCs) were detected in some groundwater samples at concentrations above the ambient water quality standards and guidance values. At least one onsite source of VOCs, SVOCs, and metals detected in soil and/or groundwater at the CSHC property was identified during the 2014 and 2015 investigations (H&A, 2015), which resulted in the identification of a former manufactured gas plant (MGP) at the CSHC property. The NYSDEC has assigned Spill Number 1402630 to the CSHC property.

Groundwater analytical data contained in Haley & Aldrich (2015) are summarized in the RI Work Plan (ERM, 2020).

1.4.2 G.W. Lisk Site Characterization

The Order required the performance of an SC at the Site. The SC Report (ERM, 2018) describes the field efforts and associated analytical results for environmental media samples. Compounds of potential concern including several CVOCs, SVOCs, and metals were detected in soil and groundwater at the Site at concentrations above potentially-applicable standards, criteria, and guidance.

1.4.3 2021 Remedial Investigation

Based on the results of the SC presented in the NYSDEC-approved SC Report (ERM, 2018), an RI was requested and completed. The RI further characterized the Site and refined the Conceptual Site Model for the Site and adjacent CSHC property.

The RI results indicated that VOC impacts beneath the Main Building have descended into shallow bedrock, where hydrogeologic conditions can result in rapid transport downgradient. VOC composition in groundwater at the Main Building is similar to that observed at the “springs” north of the CSHC. Surface water, sediment, and deep bedrock (greater than 25 feet below the bedrock surface) did not show evidence of impact from Site operations. SVOCs and VOCs of apparent limited extent were identified south (upgradient) of the facility both near the surface and at the bedrock interface. Detections occurred only beneath and immediately adjacent to the Main Building.

1.4.4 2022 Supplemental Remedial Investigation

Based on the results of RI presented in the draft RI report (ERM, 2022), an SRI was requested and completed. The SRI further characterized the Site and refined the Conceptual Site Model for the Site and adjacent CSHC property. The SRI investigated soil vapor, indoor air, surface water, sediment, soil, and groundwater.

The SRI results indicate that:

- Two primary source areas exist surrounding wells G-MW-02 and G-MW-01
- Lateral extent of VOCs in soil and groundwater near G-B-12 and GB-14 is greater than previously known;
- SVOCs encountered in surface soil at G-B-14 are limited in extent; Confirmed degradation of trichloroethene (TCE) to cis-dichloroethene (cDCE) in groundwater for further support of Monitored Natural Attenuation (MNA), however full dechlorination not evident under in situ conditions; and
- Produce data of sufficient quantity and quality to support the development of a final remedy.

The draft RI report report is in development and has an expected delivery date of June 2023.

1.5 Site Geology

The Site is located within the Erie-Ontario Lowlands physiographic province (Bloom, 1978). The Site is positioned directly on the Onondaga Escarpment where it intersects the Sulphur Creek outwash valley. Topography generally slopes towards the northeast (towards Sulphur Creek) on the western part of the Site and generally towards the northwest (towards Sulphur Creek) on the eastern part of the Site. Topographic relief across the Site is approximately 90 feet with the highest elevations in the southwestern portion of the Site and the lowest elevations along Sulphur Creek in the north-central portion of the Site.

Native soil at the Site was previously mapped by United States Department of Agriculture Soil Conservation Service as Palmyra gravelly loam (USDA, 2017). Native soil is predominantly derived from glacial outwash deposits or bedrock (Caldwell, 1988). The glacial outwash deposits consist predominantly of gravel with sand and are generally thin or not present in upland portions of the Site and increase in thickness towards the north and west. Diamictons encountered are interpreted as glacial till (Caldwell, 1988). Overburden deposits underlying the facility generally consist of clean fill, including fine sand and gravel. Based on available data, total overburden thickness in the area ranges from less than 3 feet to over 51 feet. Figure 4 summarizes typical geological units encountered near the Main Building.

Bedrock consists of medium gray limestone of the Middle Devonian Onondaga Limestone. The top of bedrock was encountered at depths ranging from 0.2 to 49.5 feet below ground (or floor) surface. Generally, the bedrock surface slopes towards the west-northwest at the Site. The primary groundwater-bearing zones in the Onondaga Limestone are typically horizontal bedding-plane separations that are often connected with solution-widened vertical joints. A typical stratigraphic section at the Site is shown in Figure 4.

Groundwater was encountered in the overburden units on top of the bedrock at depths ranging from 8.1 to 25.94 feet below ground (or floor) surface. Greater depths to water exist in the southwestern portion of the Site where elevation is higher and overburden thickness is much greater. Mapped groundwater flow direction in the overburden across the Site is generally towards the west-northwest, towards and along Sulphur Creek. Estimated groundwater flow direction in shallow bedrock across the Site (Figure 5) is generally also towards the west-northwest.

Sulphur Creek flows generally from the south towards the north and northwest through the Site and has been designated a Class D surface waterbody by the NYSDEC. The stream channel has been influenced by development and construction activities over the years and the channel morphology is variable. Bedrock locally crops out in the stream channel. Stream depth was less than 1.2 feet at all measured locations during the RI and the calculated stream discharge was approximately 7 cubic feet per second at all stream gauge stations, consistently. Stream discharge can vary significantly as a function of precipitation received in the area.

1.6 Conceptual Site Model

Overburden at the Site is of variable thickness, thickest to the south and thinning to the north and east. Overburden consists primarily of fine medium and coarse sand with silt and gravel in discontinuous pockets. There was some till observed in the southern portion of the Site, but this is largely absent on the majority of both the G.W. Lisk property and the CSHC property. The top of bedrock was encountered at depths ranging from 0.6 feet to greater than 51 feet below ground surface in soil borings on the G.W. Lisk Site and the neighboring CSHC property. The saturated portion of the overburden was thin when compared to the overall thickness of the overburden. Exceedances of soil criteria and guidance values are presented in Figure 6 and consist of shallow SVOC impacts in the southwest portion of the Site and VOC impacts near the bedrock interface southwest of a Main Building. A summary of historical soil sample data is provided in Table 1.

Bedrock beneath the Site is characterized as argillaceous limestone of the Onondaga Formation. Intervals of weathered bedrock or saprolite, characterized as chemically weathered and oxidized limestone exhibiting solution-widened cavities along bedding planes and fractures, varied in thickness from 4 feet or more at G-MW-08D to absent at H-MW-10D. The bedrock surface contours indicate a trough in the bedrock surface, which is generally followed by the now channelized Sulphur Creek. Bedrock potentiometric contours suggest groundwater movement in bedrock follows this feature northwest onto CSHC property.

Comparison of overburden and bedrock groundwater levels from all monitoring well couplets and triplets indicate that the vertical hydraulic gradient is generally downward (from overburden into bedrock) in monitoring well clusters on G.W. Lisk property. On the CSHC property, vertical gradients are less consistent with many clusters exhibiting an upward flow component.

The composition of VOCs detected in groundwater in overburden and bedrock is a mix of CVOCs consisting primarily of tetrachloroethene, TCE, 111-Trichloroethane (TCA), and their daughter products with the highest observed concentrations existing beneath the Main Building. Analytical results from the RI indicate advective movement of CVOCs, primarily in bedrock. Groundwater and CVOCs follow bedrock surface and potentiometric contours first northwest and then north once on CSHC property. Once in the bedrock aquifer, contaminant transport is rapid. This conclusion is supported by the fracture features observed, measured hydraulic conductivities, and by concentrations observed in H-Spring-02 where the majority of the CVOCs present is the parent TCE, indicating that it has not had sufficient residence time to break down into daughter products. Degradation of TCE to cDCE is occurring and confirmed by Compound Specific Isotope Analysis along the primary flow path from the Main Building ultimately ending at Spring 2 where enrichment of carbon-12 in the cDCE relative to TCE in the source area indicates anaerobic degradation is occurring (additional detail to be provided in the Supplemental Remedial Investigation Report, expected June 2023). Exceedances in overburden groundwater are shown in Figure 7. A summary of historical groundwater data is provided in Table 2. Transport is primarily by advection through bedding plane solution-widened joints and fractures in the limestone. High angle fractures in the upper 20 feet of bedrock further increase secondary porosity and are a secondary advection pathway for contaminants to the aquifer. Deeper bedrock (i.e., greater than 25 feet below the top of bedrock) is more competent, exhibiting fewer fractures and karst features.

A second plume was identified and confirmed with the supplemental RI work west of the Main Building in the parking lot area near the G-MW-01 well cluster, likely associated with AOPC 4 and AOPC 5 identified in the SC Report (ERM 2018). This plume is similar to the one originating beneath the Main Building but did not match the degradation signature observed in the primary plume (less enrichment of carbon-12 in cDCE). The fingerprint is similar because the source material is the same as that beneath the Main Building, but it was likely discharged through historical outfalls 011 and 012 and fill material associated with the septic systems comprising those outfall systems transported to this area, thereby creating a plume with an identical speciation but a different degradation timeline. This secondary plume also descends into the epikarst and is advected northward toward H-MW-12D, which appears to contain a mixture of both plumes, which ultimately combine and extend north to Spring-2.

Overburden, though generally of coarse textured materials such as sand, is thin except for the southern end of the study area. During the RI, the water table was generally close to the bedrock surface or absent in overburden at several proposed overburden well locations. The intermittent saturation of the overburden leaves bedrock as the primary medium through which contaminant transport is occurring. The Onondaga Limestone has very low primary porosity and areas devoid of fractures are unlikely to have absorbed VOCs into the matrix by diffusion. Hydraulic conductivities on the order of hundreds to thousands of feet per day in bedrock support the likelihood of rapid transport through the karst environment. The presence of TCE at the far downgradient end of the Site compared to the relatively short distance to deep bedrock (D2 wells) and much lower concentrations of TCE and other CVOCs in deeper bedrock indicates that further downward migration is retarded by increasing rock competency further from the epikarst zone.

The notable absence of impacts to the surface water or sediment in Sulphur Creek indicates that onsite discharges to the creek do not contain significant levels of contaminants and/or that the concrete lining of the channel serves as an effective barrier between surface water and impacted groundwater.

An unrelated plume exists on the CSHC property, comprised of compounds unrelated to G.W. Lisk operations. These results are consistent with the work of Haley & Aldrich (2015), assessing the presence of legacy impacts from the former MGP on the current CSHC property. A similar VOC signature exists in AOC-06 soil on G.W. Lisk property. Anecdotal evidence describes material from the former MGP having been deposited in AOC-06 as fill material. This is supported by analytical results presented in this RI.

Soil and groundwater impacts are the likely source of soil vapor impacts beneath the Main Building. Concentrations of CVOC in these media are at levels with the potential to result in vapor intrusion. This issue has been addressed through the SVI IRM for the Main Building and subsequent Interim Site Management Plan. Groundwater flow from AOC-06 and G B 14 passing beneath the Hundreds Building, though much lesser in magnitude than beneath the Main Building, has the potential to cause vapor intrusion. This has been investigated and is being addressed under the Hundreds Building SVI IRM.

1.7 Standards, Criteria, and Guidance

The following standards and criteria apply to this project.

- 6 New York Codes, Rules, and Regulations (NYCRR) Part 375—Environmental Remediation Programs
- 6 NYCRR Part 608—Use and Protection of Waters
- 6 NYCRR Parts 700-706—Water Quality Standards
- 29 Code of Federal Regulations Part 1910.120—Hazardous Waste Operations and Emergency Response

The following guidance applies to this project.

- DER-10 (NYSDEC, 2010a)
- NYSDEC Division of Spills Management—Sampling Guidelines and Protocols: Technologies Background and Quality Control/Quality Assurance for the NYSDEC Spill Response Program (NYSDEC, 1992)
- Technical Operations Guidance Series (TOGS) 1.1.1—Ambient Water Quality Standards & Guidance Values and Groundwater Effluent Limitations (NYSDEC, 1998)

Sample results will be compared to applicable NYSDEC standards, criteria, and guidance by environmental media as summarized below.

Groundwater

Groundwater results are compared to the NYSDEC's ambient water quality standards and guidance values (TOGS 1.1.1; NYSDEC, 1998) for groundwater (Class GA).

Soil

Soil results are compared to 6 NYCRR Part 375 Soil Cleanup Objectives (NYSDEC, 2006) for the current and anticipated future land use (industrial) and for the protection of groundwater as applicable. As required in DER-10, soil results will also be compared to unrestricted soil cleanup objectives to facilitate performance of a remedial alternatives analysis based on collected data.

2. SCOPE OF THE PILOT STUDY

At the request of the NYSDEC, ERM Consulting & Engineering, Inc. (ERM) has developed the following scope of work to satisfy remaining site concerns and inform possible remedial decisions.

2.1 Subsurface Clearance

UDig New York will be notified prior to the initiation of intrusive activities at the Site and will be requested to identify, locate, and mark public utilities. G.W. Lisk and CSHC personnel will be requested to identify underground utilities associated with plant operations. Additionally, an independent underground utility locating service will be contracted to evaluate and clear proposed drilling locations prior to commencement of intrusive activities. The private utility location contractor will scan, identify, locate, and mark potential subsurface utilities at the proposed sample locations. To the extent practicable, samples will be located in areas that are at least 10 feet away from underground utilities and in areas not subject to drafts from over-head heating, ventilation, or air conditioning equipment.

Proposed sampling locations may be adjusted in the field if necessary to facilitate the protection of health and safety based on the results of subsurface clearance efforts.

2.2 Well Installations

Soil borings will be installed at 13 discrete locations with an arrangement based on two distinct study areas highlighted in Figure 8. Part 1 is located on the eastern side of the BCP Boundary at the southeastern edge of the main facility building, and Part 2 is located directly west in the parking lot of the facility. Each soil boring will be advanced to the top of bedrock or diamict as determined in the field by an ERM geologist. Soil will be continuously sampled via direct push or split spoon for logging in the field by an ERM geologist.

Five of the 13 soil borings will become injection wells, and the remaining eight will become monitoring wells with locations shown in Figure 8. These wells will be completed by hollow stem auger drilling to the bedrock where a two-inch diameter polyvinyl chloride (PVC) well will be installed at each location with a 10-slot screen and #2 sand. Sand will extend two feet above the top of the screen, with a minimum two-foot hydrated bentonite seal above the sand, and pressure grouted with bentonite-cement grout using a tremie pipe to within one foot of the ground surface. The proposed installation schematic and rationale based on geology is presented in cross section in Figures 9 and 10. Each well will be finished with a flush steel protective cover. Each new well will be surveyed by a licensed surveyor.

2.3 Well Injections

Subsurface conditions within all injection well locations will be prepped using approximately 99 gallons of emulsified vegetable oil (EOS Pro) per well as a carbon substrate for a total of 495 gallons of EOS Pro. EOS Pro is an enriched, emulsified vegetable oil (59.8% soybean oil) designed to stimulate and support biodegradation of chlorinated solvents. EOS Pro is food grade and USDA certified, engineered to stimulate microbial activity, and support long-term bioremediation efforts. Specific product information for EOS Pro is provided in Appendix G. The EOS Pro will be diluted with potable water using a 10:1 dilution ratio (water:EOS Pro) and will be introduced to the aquifer's target zone via gravity flow or a transfer pump through a closed manifold system to the well head, depending on field conditions at the time of injection. The recommended dilution ratio specified by the EOS manufacturer is between 4:1 to 20:1 (water:EOS Pro). By selecting a dilution ratio of 10:1, this ratio is able to be adjusted in either direction as needed depending on site conditions observed at the time of the injection.

Immediately following the EOS Pro injection, the greater of three well volumes, or approximately 55 gallons of potable water sourced from the Site will be used to flush each well to remove residual product from the well screen and to promote distribution into the soil. The EOS Pro will stimulate anaerobic conditions within the groundwater in and immediately surrounding the injection location and is designed to establish anaerobic conditions after approximately 30 days. This will be achieved through the consumption of dissolved oxygen by groundwater bacteria as EOS Pro vegetable oil is metabolized. Anaerobic conditions are required to promote optimal growth for the later injected enriched bioaugmentation culture (BAC-9), which will perform reductive dichlorination on the groundwater impacted by TCE. BAC-9 has been proven to degrade chlorinated ethenes including TCE, cDCE, VC, and Freon 113. Specific product information for BAC-9 is included in Appendix H. Pressure transducers will be deployed in nearby wells proximal to the injection location prior to the injection to monitor water level changes during the injection. The water level monitoring will be used as an additional line of evidence to determine radii of influence from the injection wells. The radius of influence from the injection is critical to design if this pilot study supports scaling up this injection to a remedial technology for the Site.

At the time of EOS Pro injections, flush water will be prepared on Site that will later be used for the BAC-9 injection. In an effort to establish anaerobic conditions and decrease concentrations of residual chlorine disinfectant commonly found in municipal water supplies, residual EOS Pro will be mixed with potable water sourced from the Site and distributed in five 55-gallon drums previously used to transport EOS Pro to the Site. The drums will be sealed and stored on Site inside an access controlled storage building. Over the same 30-day time period, the EOS Pro and water mixture within the drums will become deoxygenated and dechlorinated to support BAC-9's growth, and to reduce potential competition for reductive dichlorination once in the subsurface from the flush following the BAC-9 injection.

Approximately 30 days after the injection of EOS Pro, dissolved oxygen (DO) will be measured in each injection well and 55-gallon drum using a water quality sampling meter to confirm anaerobic conditions. In accordance with the manufacturer, conditions will be considered sufficiently anaerobic if stabilized DO readings are below 1.0 mg/L. If DO measurements exceed 1.0 mg/L after stabilization in either the well or within the 55-gallon drums, the EOS Pro manufacturer will be contacted, and an order will be placed for additional EOS Pro. The additional supply of EOS Pro will be added or injected in accordance with the manufacturer's instruction, and an additional 7 days will pass before retesting the DO concentrations.

Once anaerobic conditions are confirmed within the all wells and drums, approximately 1.8 L of BAC-9 will be delivered to the target zone of each injection well for a total of 9 L of BAC-9.The BAC-9 is a non-toxic, naturally occurring microbial consortium including *Dehlococcoides mccartyi* capable of degrading chlorinated solvents to innocuous compounds through the replacement of chlorine by dissolved hydrogen, also known as halorespiration. The BAC-9 will be directly injected into the aquifer with tubing that will extend into the submerged well screen and will be delivered to the target depth using compressed nitrogen or argon. The injection well will then be immediately flushed using the greater of three well volumes, or approximately 55 gallons of the deoxygenated and dechlorinated water stored on Site. Throughout the radius of influence of each injection well, the BAC-9 will work to reductively dechlorinate any present TCE through its usual pathway of cDCE to vinyl chloride, and ultimately to non-toxic ethene.

Due to the hydrophobic nature and density of both the EOS Pro and BAC-9, the injection is expected to be contained within a radius of influence that will be determined as a result of this pilot study. Passive treatment is expected to occur as impacted overburden groundwater flows downgradient and through the treatment zones created by the injections. Groundwater at the site or in the immediate area is not used as drinking water, and the injections are proposed away from the nearest surface water body, Sulphur Creek. Therefore, negative impacts to the quality of surface water or drinking water are not anticipated.

2.4 Groundwater Sampling

All wells will be developed using an inertial lifting technique after installation and at least two weeks prior to sampling. Development will be considered achieved when geochemical parameters achieve stabilization, a minimum of three well volumes have been removed from the well if stabilization is not achieved, or if the well is purged dry during multiple attempts to properly develop the well. Typical low flow purging and sampling guidance will be used to determine geochemical stabilization (USEPA 2010).

Well sampling will occur following the attached sampling plan (Table 3) for VOCs by EPA Method 8260 and total organic carbon (TOC) by EPA Method 9060. The sampling plan includes a total of six sampling events occurring over the course of one year. Due to the layout of the monitoring wells downgradient of the injection points and the groundwater flow calculated using historical groundwater data collected by ERM, not all wells are predicted to see an immediate impact from the injections. Therefore, the sampling plan incrementally adds wells that are a further distance from the injection points over the course of a year (Figure 8). Two wells (G-MW-07S and G-MW-07D) will not be included in sampling due to their position upgradient of the injection locations as indicated on Figure 5.

The first sampling event will occur after injection wells are installed and developed consistent with other overburden wells as specified in the Remedial Investigation Work Plan (ERM 2020). Prior to the EOS-Pro injection to serve as a baseline, and the following sampling events will occur at 30, 90, 180, 270, and 365 days post injection. Prior to the groundwater sampling effort, ERM will conduct a round of comprehensive well-gauging across the Site. Results will be used to develop groundwater contour maps to be submitted with the final report. Groundwater samples will be collected using low-flow/minimal drawdown purging and sampling techniques (USEPA 2010).

Field parameters including dissolved oxygen, pH, Oxidation-Reduction Potential, conductivity, turbidity, and temperature will be measured and recorded during sampling activities. Samples for laboratory analysis will be placed into a pre-chilled cooler for transport under proper chain-of-custody procedures to the project laboratory for analysis of the parameters indicated in the sampling plan.

2.5 Sample Analyses

The laboratory analysis of samples collected during the SRI will be performed by a New York State Department of Health approved environmental laboratory using analytical methods consistent with the NYSDEC's Analytical Services Protocol (NYSDEC, 2010b). The project laboratory will be requested to achieve detection and reporting limits that are below applicable cleanup levels whenever feasible. Laboratory analytical reports will contain Analytical Services Protocol Category B deliverables and electronic data deliverables to facilitate data usability review as required by the NYSDEC. Samples collected during the SRI will be analyzed for the parameters indicated in Table 3.

2.6 Data Usability

A Data Usability Summary Report (DUSR) will be prepared for all samples collected during the Pilot Study. The DUSR will be prepared consistent with the NYSDEC guidance contained in DER-10 Appendix 2B. The results of the data usability evaluation will be presented in an Electronic Data Summary consistent with the requirements of DER 10 Section 3.14(b).

Data Quality Objectives are qualitative and quantitative criteria required to support the decision-making process. Data Quality Objectives define the uncertainty in an analytical data set and are expressed in terms of precision, accuracy, representatives, completeness, and comparability (PARCC)—outlined below:

- Precision is a measure of mutual agreement among measurement of the same property usually under prescribed similar conditions. Precision is best expressed in terms of the standard deviation.

- Accuracy is the degree of agreement of a measurement (or an average of measurements) with an accepted reference of “true value”. Accuracy is an estimate of potential numerical bias (i.e., low or high) in analytical data.
- Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point a process condition, or an environmental condition.
- Completeness is a measure of the amount of valid data obtained compared to the amount that was expected to be obtained under correct normal conditions.
- Comparability expresses the confidence with which one data set can be compared with another. Comparability is a qualitative measurement. Comparability is assessed by reviewing results or procedures for analytical data that do not agree with expected results.

The Quality Assurance Project Plan (QAPP; see Section 3.3) describes sampling and analysis procedures to be used during implementation of the SRI along with quality assurance / quality control (QA/QC) criteria. The field team will collect representative and complete samples. The chemist at the laboratory will analyze samples using accepted protocols resulting in data that meet PARCC standards.

2.7 Investigation-Derived Waste

Management of investigation-derived waste will comply with DER-10 Section 3.3(e). Investigation-derived wastes will be disposed within the borehole of origin in reverse order of removal to the extent practicable unless non-aqueous phase liquids, sheen, unusual odor, discoloration, or other evidence of gross contamination is observed. Any soil cuttings, exhibiting visual, olfactory, or field screening evidence of potential contamination will be containerized into steel 55-gallon drums or other appropriate containers for waste characterization and disposal. All water, inclusive of decontamination, well development, or purge water will also be containerized into steel 55-gallon drums or other appropriate containers for waste characterization and disposal.

The containers will be labeled and moved to a designated onsite staging area until characterized and disposed. Existing waste profiles will be used if acceptable by the receiving facility. If waste characterization samples are required, they will be analyzed for the following parameters:

- Toxicity Characteristic Leaching Procedure VOCs;
- Toxicity Characteristic Leaching Procedure SVOCs;
- Polychlorinated biphenyls;
- Resource Conservation and Recovery Act Metals;
- Ignitability (solids) or flammability (liquids);
- Reactivity; and
- pH.

2.8 Pilot Study Report

A Draft Pilot Study Report will be prepared in a manner consistent with NYSDEC requirements contained in DER-10 Section 3.14. The Draft PS Report will build upon the results presented in the SRI Report and will seek to complete the following:

- Determine the radius of influence of a well injection;

- Describe the change in VOC concentration over time at and down-gradient from the injection locations; and
- Evaluate the viability of EOS Pro with bioaugmentation dechlorinating Consortium BAC-9 as a long-term remediation solution.

Conclusions and recommendations will be provided and if appropriate based on the results of the Pilot Study, recommendations for future remedial amendments as necessary such as additional investigations or proceeding to remedial Alternatives Analysis consistent with DER-10 Section 4.4(c). A standalone electronic data submission consistent with DER-10 Section 1.15 will also be provided to the NYSDEC.

The PS Report will be finalized after receipt, discussion, and incorporation of NYSDEC comments, as appropriate. The Final Pilot Study Report will be certified in accordance with DER-10 Section 1.5.

2.9 Permitting

The following permit will be obtained as part of the PS remedy implementation activities (Example documents in Appendix F):

- USEPA Underground Injection Control for Class V Well permit (prior to implementation of remedial strategies).

3. ASSOCIATED DOCUMENTS

3.1 Health and Safety Plan

A Site-specific Health and Safety Plan (HASP) is presented in Appendix A. The procedures set forth in the HASP are designed to minimize the risk of exposure to chemical and physical hazards that may be present at the Site. These procedures generally conform to applicable federal, state, and local regulations—including Occupational Safety and Health Administration requirements governing activities at hazardous waste sites contained in 29 Code of Federal Regulations 1910.120 (Hazardous Waste Operations and Emergency Response). Specific practices and procedures, including the level of personal protective equipment, are based on a review of currently available information for the Site.

Every potential safety hazard associated with this IRM may not be predicted. The HASP does not attempt to establish rules to cover every contingency that may arise, but it does provide a basic framework for the safe completion of field activities and plans for reasonable contingencies.

3.2 Community Air Monitoring Plan

The Community Air Monitoring Plan (CAMP) for the Site is presented in Appendix B. The CAMP is consistent with the requirements of DER-10, Appendix 1A (NYSDEC, 2010a). The CAMP describes monitoring requirements and response action levels associated with the monitoring of VOCs and particulates (i.e., dust) downwind of intrusive PS activities. The action levels specified in the CAMP require increased monitoring, corrective actions to abate emissions, and/or work stoppage if necessary. The CAMP provides a measure of protection for the down-wind community from potential airborne contaminant releases as a result of Site work activities.

3.3 Quality Assurance Project Plan

The QAPP for the Site is presented in Appendix C. The QAPP is consistent with the requirements of DER-10, Section 2.4 (NYSDEC, 2010a). The QAPP describes sampling and analysis procedures to be used during implementation of the PS along with QA/QC criteria. The QAPP will facilitate generation of data of acceptable PARCC.

3.4 Investigation Personnel and Qualifications

The experience and qualifications of key ERM project personnel that will be involved in implementing the PS are presented in Appendix D.

4. PROJECT SCHEDULE

An estimated project schedule for implementation of the PS is presented in Table 4.

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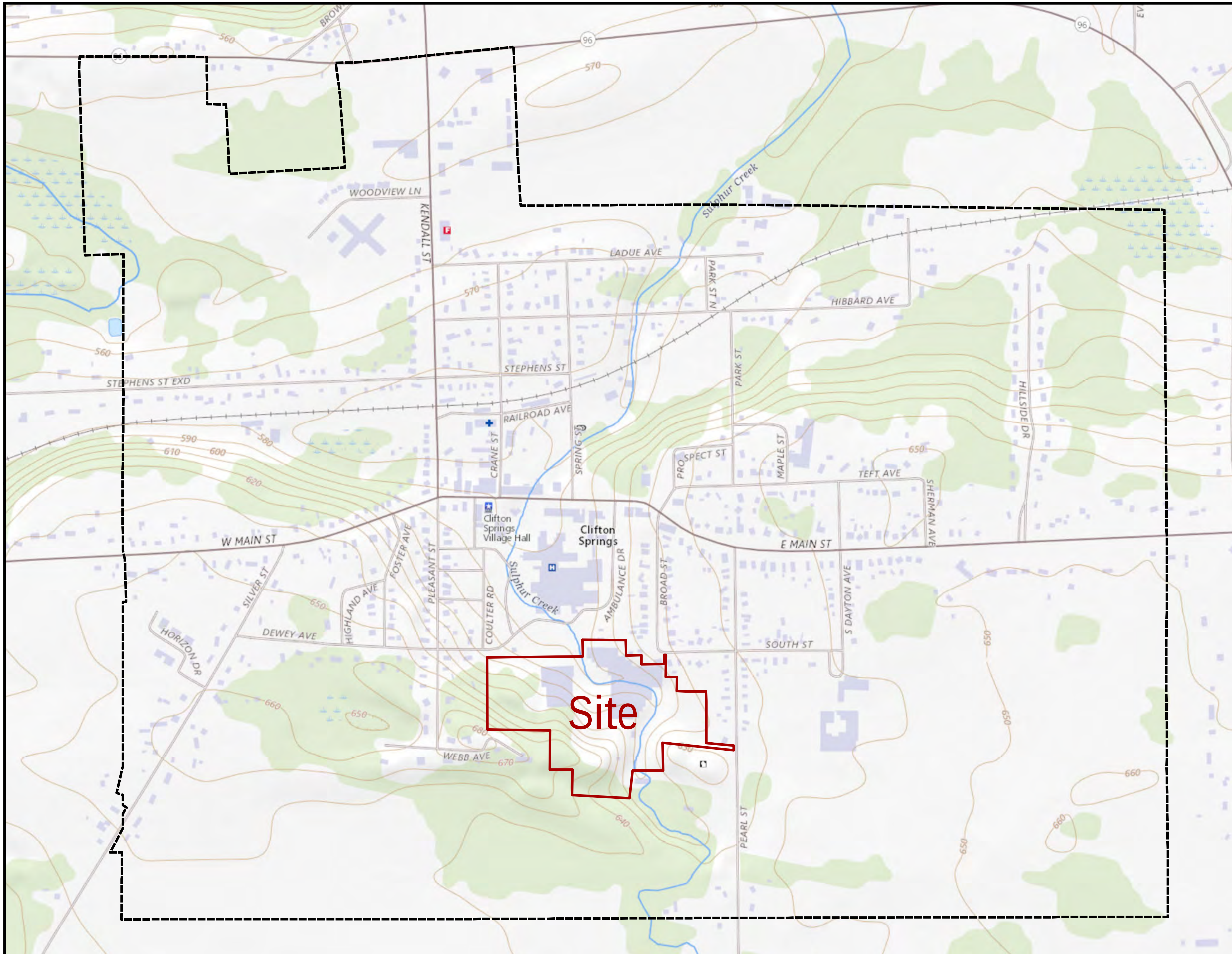
FIGURES



Legend

Property Parcel Boundary

Village of Clifton Springs

NOTES:
- Basemap provided by ESRI World Topography.

N

0 350 700 1,050 1,400

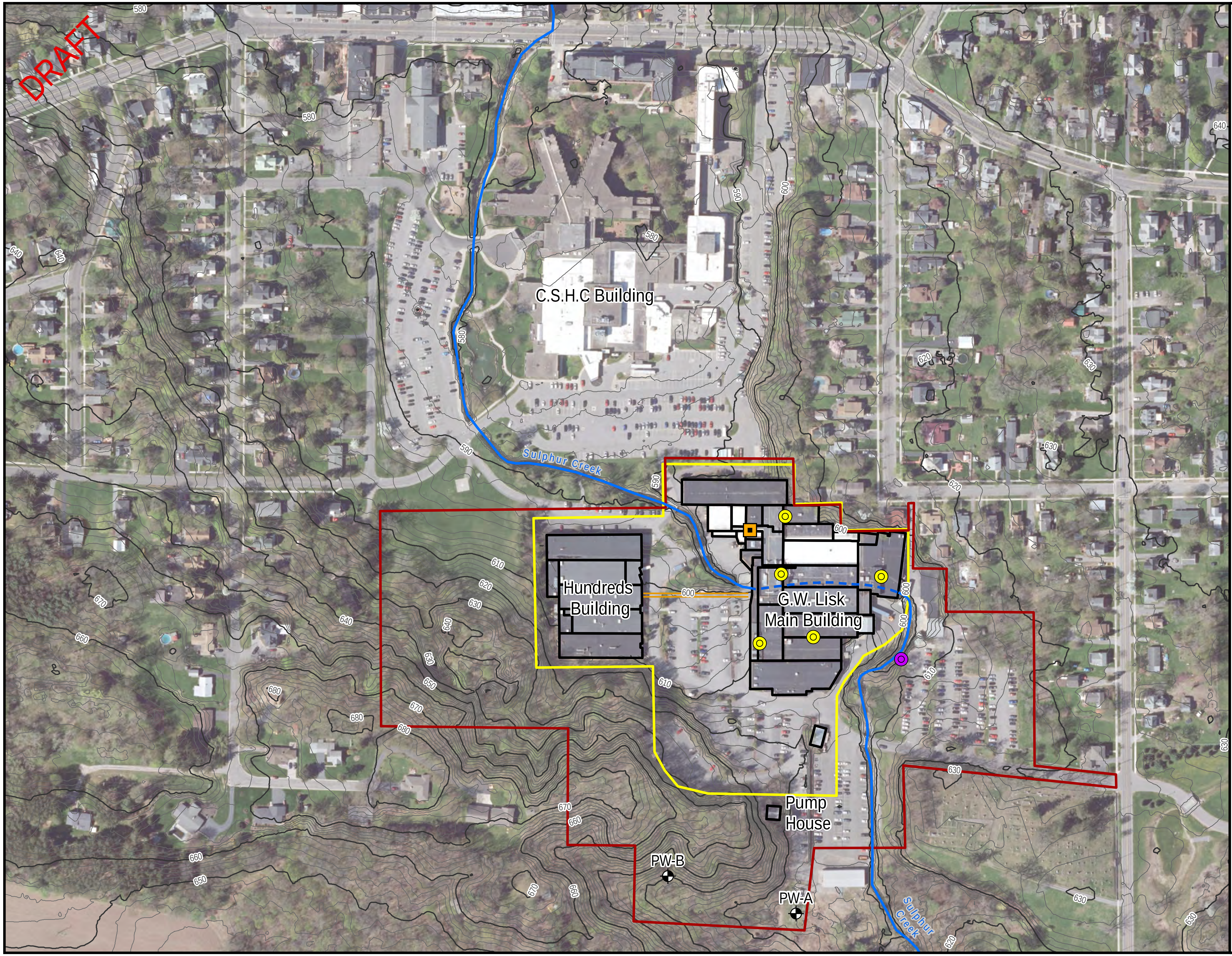
Feet

Figure 1: Site Location Map

G.W. Lisk Company, Inc.

2 South Street, Clifton Springs, NY

ERM



Legend

- Water Supply Wells
- Former Degreaser Sump
- Former Outfall Location
- Stormwater Outfall Location
- Former Trench (Approximate)
- Surface Stream
- Inferred Stream Path
- 2 ft. Elevation Contour
- 10 ft. Elevation Contour
- Property Parcel Boundary
- BCP Boundary
- Facility Outline

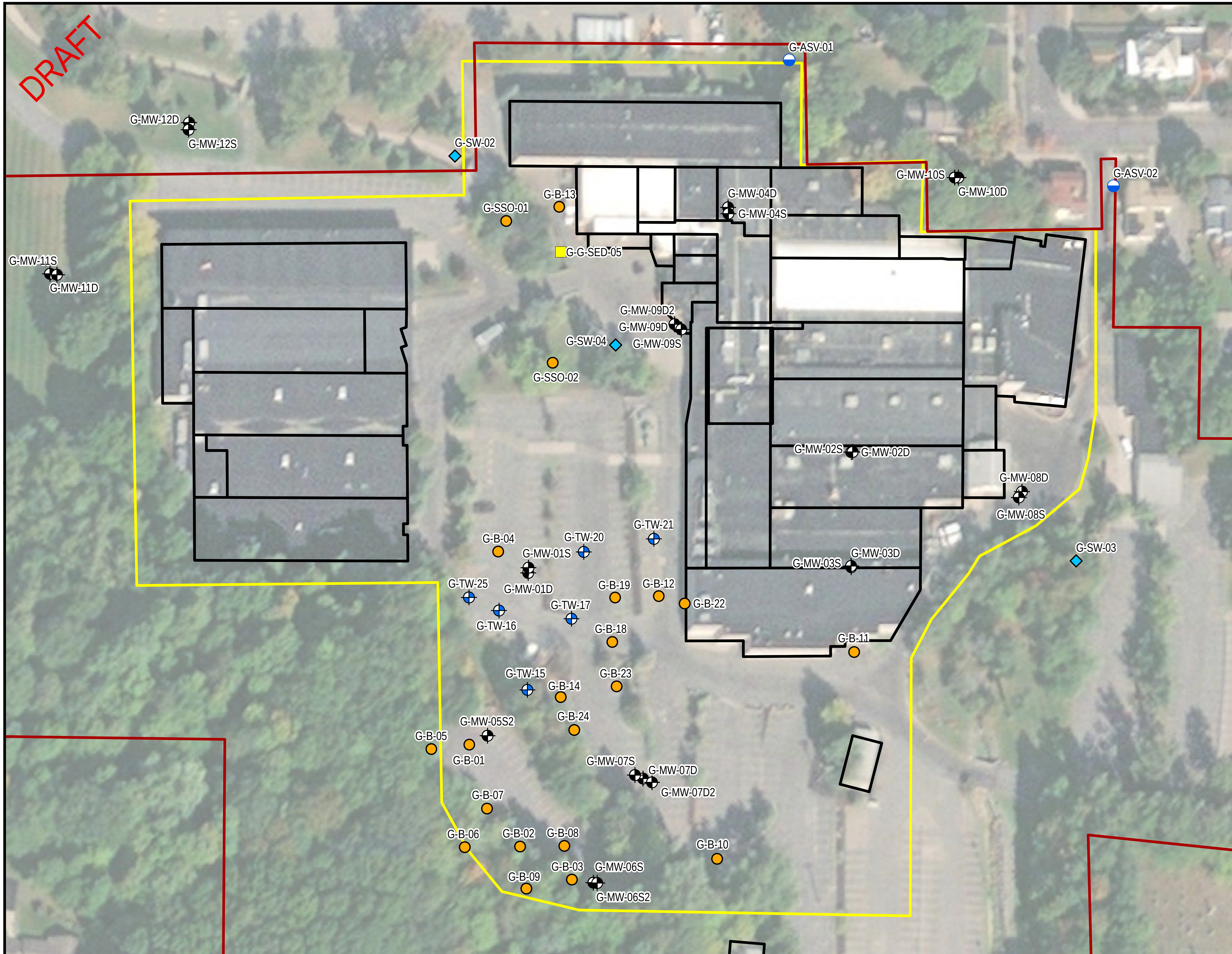
NOTES:
- Facility room outlines are approximate in location and converted from AutoCAD models.
- Surface elevation contours are modified from Ontario County, 2017.
- Elevation is reported as feet above Mean Sea Level (MSL).
- Aerial imagery provided by Esri World Imagery.

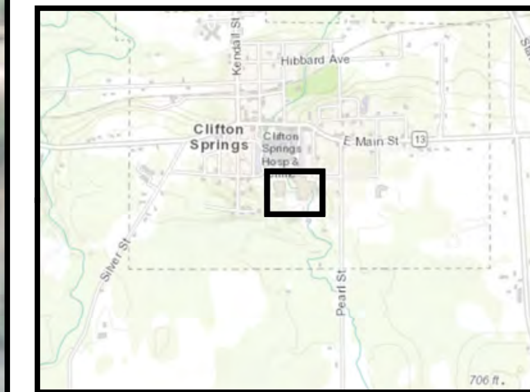
0 37.5 75 150 225 300
Feet

Figure 2: Site Topography and Facility Layout

G.W. Lisk Company, Inc.
2 South Street, Clifton Springs, NY

ERM





Legend

- Monitoring Well Location
- Temporary Well Location
- Soil Boring Location
- Active Soil Vapor Location
- Co-located Surface Water and Sediment Sample Location
- Sediment Sample Location
- Property Parcel Boundary
- BCP Boundary
- Facility Outline

NOTES:
- Locations shown are from the Remedial Investigation (RI) and Supplemenlal RI.
- Facility room outlines are approximate in location and converted from AutoCAD models.
- Aerial imagery provided by Esri World Imagery.

N

0 25 50 100 150 200
Feet

Figure 3: Remedial Investigation Onsite Locations

G.W. Lisk Company, Inc.
2 South Street, Clifton Springs, NY

ERM

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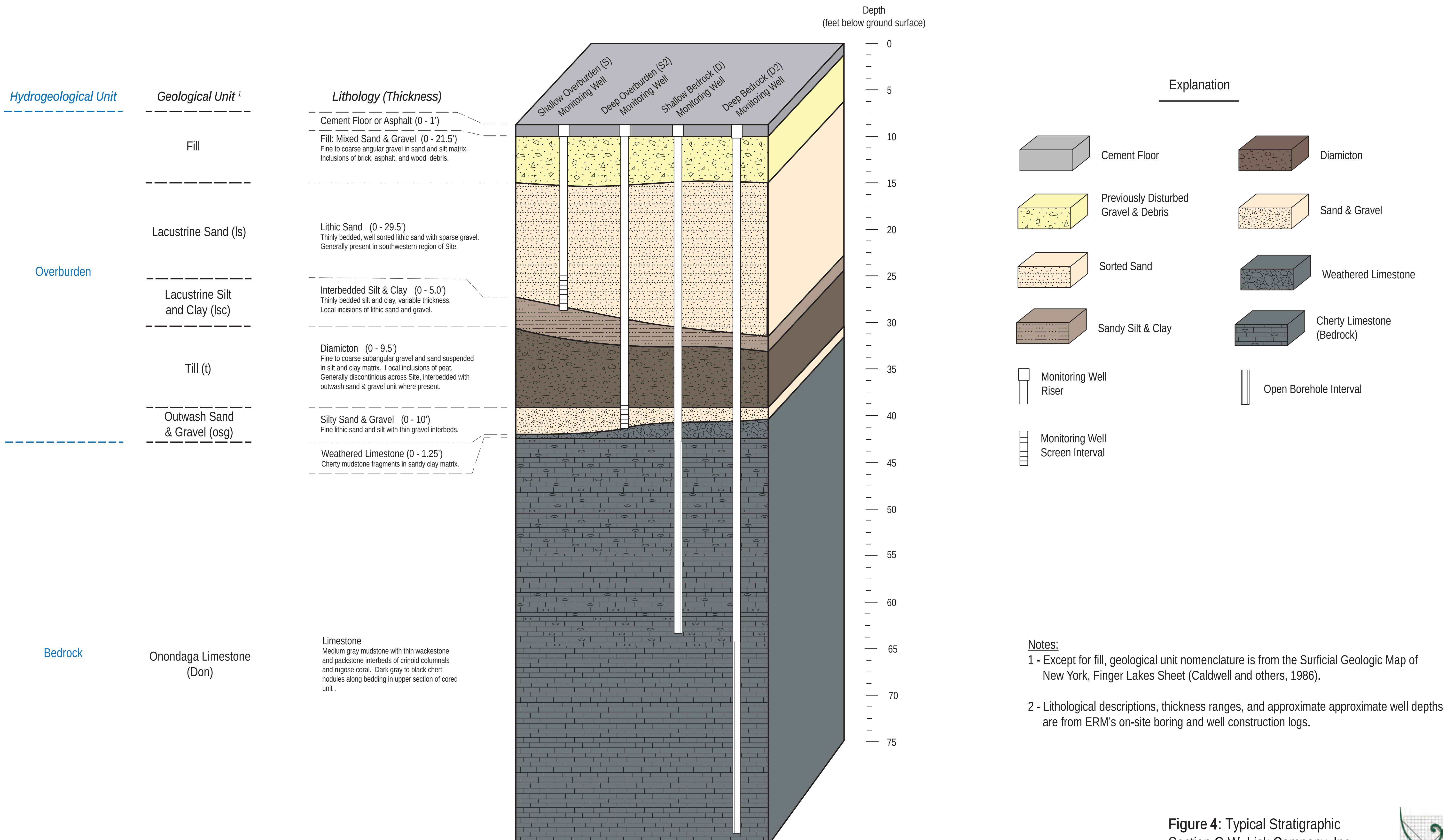


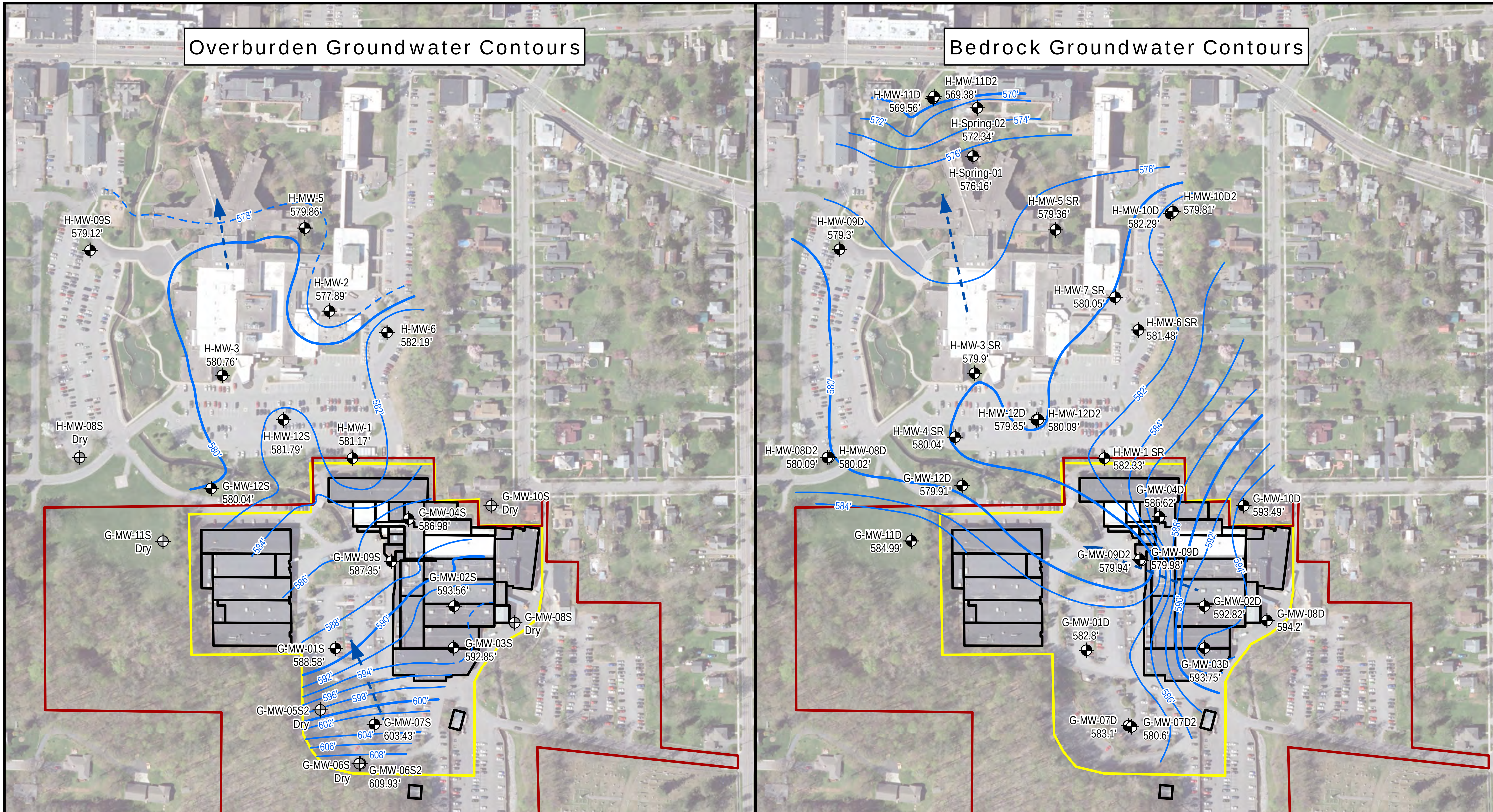
Notes:

1 - Except for fill, geological unit nomenclature is from the Surficial Geologic Map of New York, Finger Lakes Sheet (Caldwell and others, 1986).

2 - Lithological descriptions, thickness ranges, and approximate approximate well depths are from ERM's on-site boring and well construction logs.

Figure 4: Typical Stratigraphic Section G.W. Lisk Company, Inc. 2 South Street, Clifton Springs, NY

ERM



Legend

Monitoring Well

Dry Monitoring Well

380.21' Groundwater Elevation (ft.)

Groundwater Contour - 2 ft. (Observed)

Groundwater Contour - 2 ft. (Inferred)

Inferred Groundwater Flow Direction

Legend (cont.)

Property Parcel Boundary

BCP Boundary

Facility Outline

N

0 75 150 300 450 600

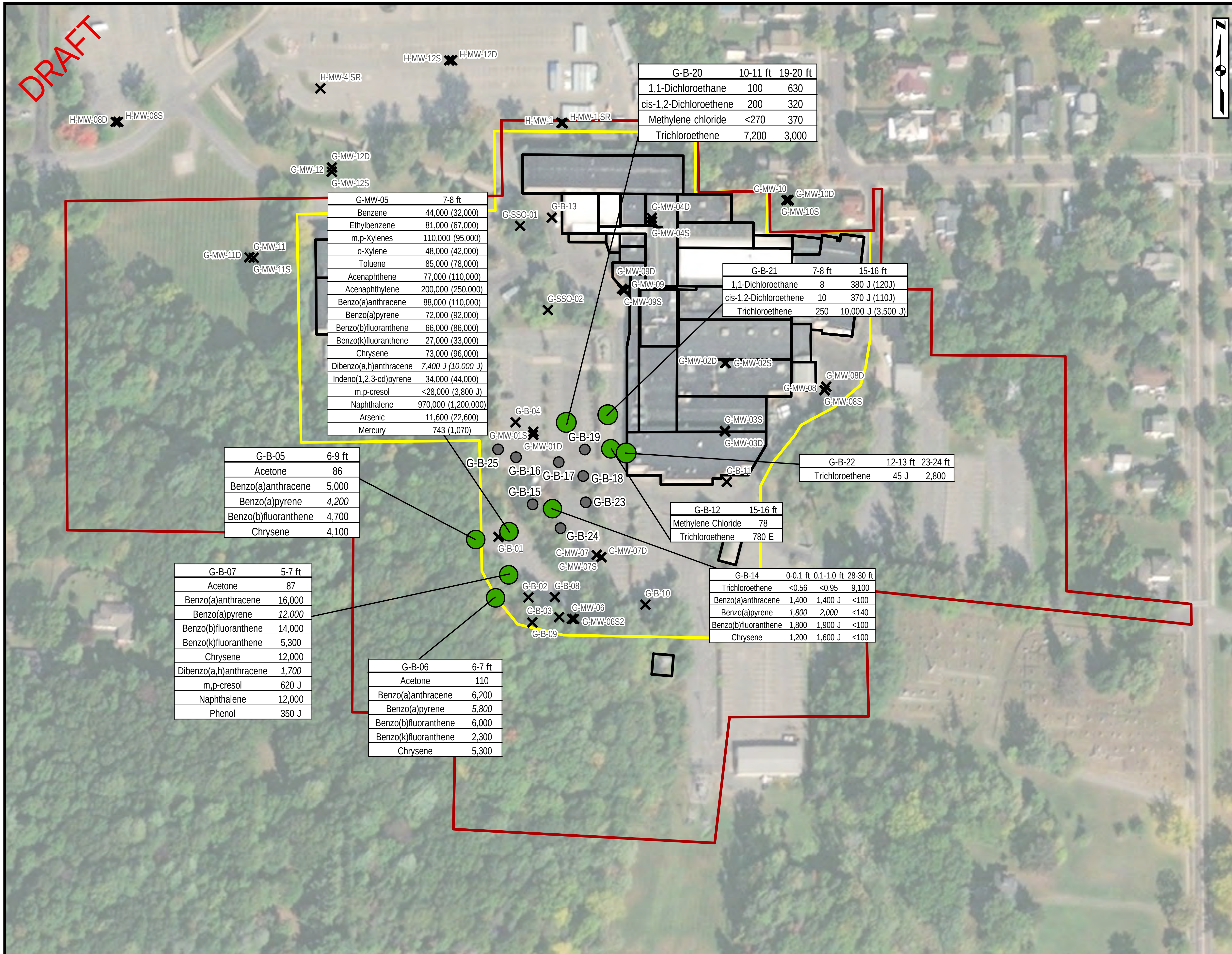
Feet

NOTES:

- Groundwater elevations recorded 1 June 2021.
- Bedrock groundwater contours were made using shallow bedrock groundwater elevations. Deep bedrock groundwater elevations are shown but were not used in groundwater contour interpolation.
- Facility room outlines are approximate in location and converted from AutoCAD models.
- Aerial imagery provided by Esri World Imagery.

Figure 5:
Two-Panel Groundwater Contour Map
G.W. Lisk Company, Inc.
2 South Street, Clifton Springs, NY

ERM



G-B-20	10-11 ft	19-20 ft
1,1-Dichloroethane	100	630
cis-1,2-Dichloroethene	200	320
Methylene chloride	<270	370
Trichloroethene	7,200	3,000

G-MW-05	7-8 ft
Benzene	44,000 (32,000)
Ethylbenzene	81,000 (67,000)
m,p-Xylenes	110,000 (95,000)
o-Xylene	48,000 (42,000)
Toluene	85,000 (78,000)
Acenaphthene	77,000 (110,000)
Acenaphthylene	200,000 (250,000)
Benzo(a)anthracene	88,000 (110,000)
Benzo(a)pyrene	72,000 (92,000)
Benzo(b)fluoranthene	66,000 (86,000)
Benzo(k)fluoranthene	27,000 (33,000)
Chrysene	73,000 (96,000)
Dibenzo(a,h)anthracene	*7,400 J (10,000 J)*
Indeno(1,2,3-cd)pyrene	34,000 (44,000)
m,p-cresol	<28,000 (3,800 J)
Naphthalene	970,000 (1,200,000)
Arsenic	11,600 (22,600)
Mercury	743 (1,070)

G-B-21	7-8 ft	15-16 ft
1,1-Dichloroethane	8	380 J (120J)
cis-1,2-Dichloroethene	10	370 J (110J)
Trichloroethene	250	10,000 J (3,500 J)

G-B-05	6-9 ft
Acetone	86
Benzo(a)anthracene	5,000
Benzo(a)pyrene	*4,200*
Benzo(b)fluoranthene	4,700
Chrysene	4,100

G-B-22	12-13 ft	23-24 ft
Trichloroethene	45 J	2,800

G-B-12	15-16 ft
Methylene Chloride	78
Trichloroethene	780 E

G-B-07	5-7 ft
Acetone	87
Benzo(a)anthracene	16,000
Benzo(a)pyrene	*12,000*
Benzo(b)fluoranthene	14,000
Benzo(k)fluoranthene	5,300
Chrysene	12,000
Dibenzo(a,h)anthracene	*1,700*
m,p-cresol	620 J
Naphthalene	12,000
Phenol	350 J

G-B-14	0-0.1 ft	0.1-1.0 ft	28-30 ft
Trichloroethene	<0.56	<0.95	9,100
Benzo(a)anthracene	1,400	1,400 J	<100
Benzo(a)pyrene	*1,800*	*2,000*	<140
Benzo(b)fluoranthene	1,800	1,900 J	<100
Chrysene	1,200	1,600 J	<100

G-B-06	6-7 ft
Acetone	110
Benzo(a)anthracene	6,200
Benzo(a)pyrene	*5,800*
Benzo(b)fluoranthene	6,000
Benzo(k)fluoranthene	2,300
Chrysene	5,300

Legend

- Soil Boring that Exceeds the 6 NYCRR Part 375 SCOs - Protection of Groundwater
- Soil Boring Does Not Exceed the 6 NYCRR Part 375 SCOs - Protection of Groundwater
- Soil Boring Not Sampled During the Supplemental RI
- Property Parcel Boundary
- BCP Boundary
- Facility Outline

NOTES:
- Results are in micrograms per kilogram (µg/kg)
- ft = feet
- J = estimated value
- E = concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.
- SCOs = Soil Cleanup Objectives
- NYCRR = New York Codes, Rules and Regulations
- Soil samples collected during the Remedial Investigation (RI) in 2021 or the Supplemental RI in 2022.
- 1,200 = result that exceeds the Protection of Groundwater SCO.
- *1,200* = result that exceeds the Restricted Industrial SCO.
- 1,200 = result that exceeds both the Protection of Groundwater and Restricted Industrial SCOs.
- Field duplicates shown in parentheses.
- Facility room outlines are approximate in location and converted from AutoCAD models.
- Aerial imagery provided by Esri World Imagery.

0 25 50 100 150 200
Feet

Figure 6: RI Soil Exceedances

G.W. Lisk Company, Inc.
2 South Street, Clifton Springs, NY

ERM

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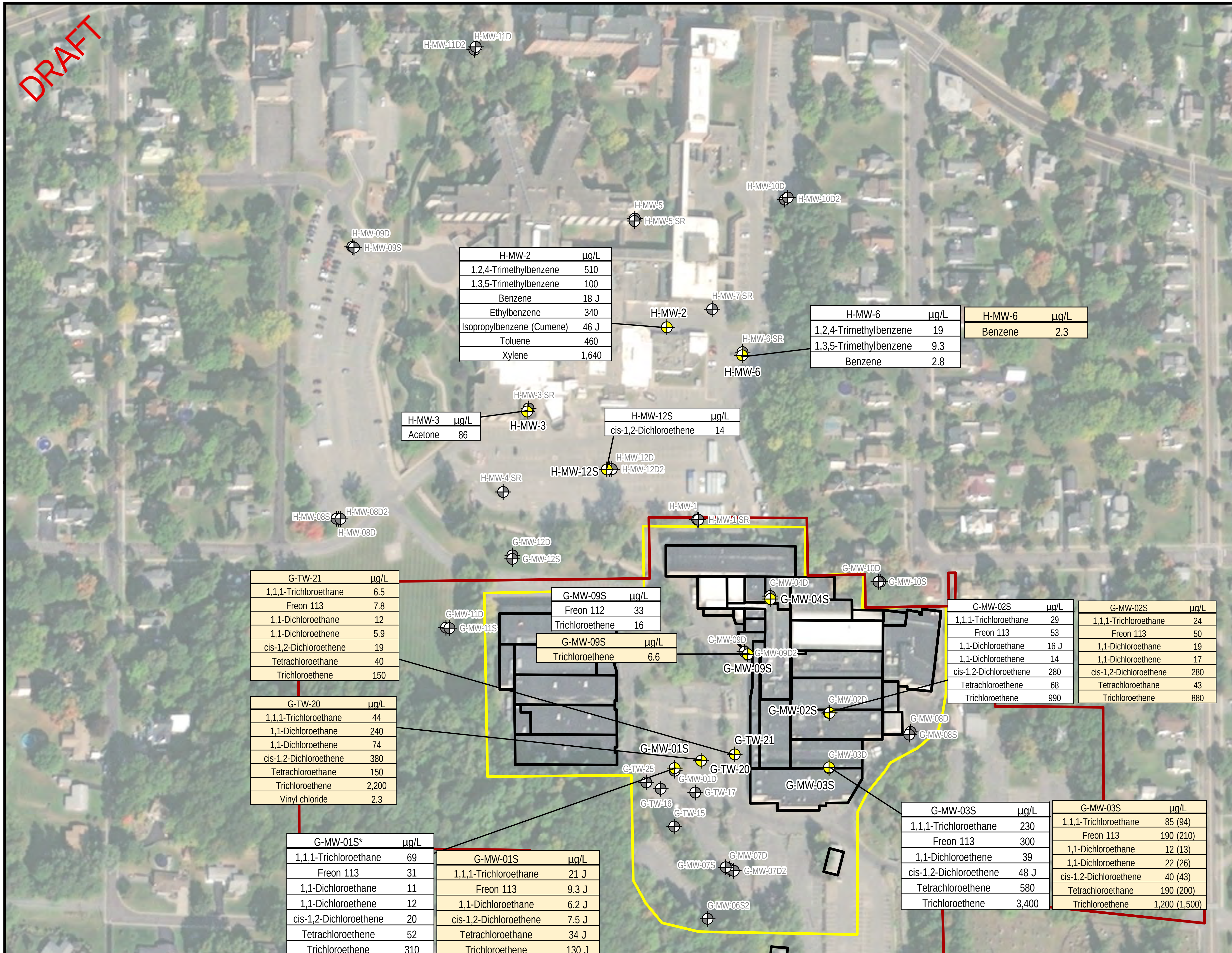


H-MW-2	µg/L
1,2,4-Trimethylbenzene	510
1,3,5-Trimethylbenzene	100
Benzene	18 J
Ethylbenzene	340
Isopropylbenzene (Cumene)	46 J
Toluene	460
Xylene	1,640

H-MW-6	µg/L
1,2,4-Trimethylbenzene	19
1,3,5-Trimethylbenzene	9.3
Benzene	2.8

H-MW-6	µg/L
Benzene	2.3

H-MW-3	µg/L
Acetone	86

H-MW-12S	µg/L
cis-1,2-Dichloroethene	14

G-TW-21	µg/L
1,1,1-Trichloroethane	6.5
Freon 113	7.8
1,1-Dichloroethane	12
1,1-Dichloroethene	5.9
cis-1,2-Dichloroethene	19
Tetrachloroethane	40
Trichloroethene	150

G-MW-09S	µg/L
Freon 112	33
Trichloroethene	16

G-MW-09S	µg/L
Trichloroethene	6.6

G-TW-20	µg/L
1,1,1-Trichloroethane	44
1,1-Dichloroethane	240
1,1-Dichloroethene	74
cis-1,2-Dichloroethene	380
Tetrachloroethane	150
Trichloroethene	2,200
Vinyl chloride	2.3

G-MW-02S	µg/L
1,1,1-Trichloroethane	29
Freon 113	53
1,1-Dichloroethane	16 J
1,1-Dichloroethene	14
cis-1,2-Dichloroethene	280
Tetrachloroethene	68
Trichloroethene	990

G-MW-02S	µg/L
1,1,1-Trichloroethane	24
Freon 113	50
1,1-Dichloroethane	19
1,1-Dichloroethene	17
cis-1,2-Dichloroethene	280
Tetrachloroethane	43
Trichloroethene	880

G-MW-01S*	µg/L
1,1,1-Trichloroethane	69
Freon 113	31
1,1-Dichloroethane	11
1,1-Dichloroethene	12
cis-1,2-Dichloroethene	20
Tetrachloroethene	52
Trichloroethene	310

G-MW-01S	µg/L
1,1,1-Trichloroethane	21 J
Freon 113	9.3 J
1,1-Dichloroethane	6.2 J
cis-1,2-Dichloroethene	7.5 J
Tetrachloroethane	34 J
Trichloroethene	130 J

G-MW-03S	µg/L
1,1,1-Trichloroethane	230
Freon 113	300
1,1-Dichloroethene	39
cis-1,2-Dichloroethene	48 J
Tetrachloroethene	580
Trichloroethene	3,400

G-MW-03S	µg/L
1,1,1-Trichloroethane	85 (94)
Freon 113	190 (210)
1,1-Dichloroethane	12 (13)
1,1-Dichloroethene	22 (26)
cis-1,2-Dichloroethene	40 (43)
Tetrachloroethane	190 (200)
Trichloroethene	1,200 (1,500)

Legend

- Overburden Monitoring Well Location that Exceeds NYS TOGS 1.1.1 Class GA Standard
- Overburden Monitoring Well Location that does not Exceed NYS TOGS 1.1.1 Class GA Standard
- Property Parcel Boundary
- BCP Boundary
- Facility Outline

NOTES:
- µg/L = micrograms per liter
- J = Estimated value
- * = G-MW-01S results are from November 2017.
- White data box = June 2021 results
- Yellow data box = August 2022 results
- Groundwater sampled during the Remedial Investigation (RI) in June 2021 and the Supplemental RI in August 2022.
- Facility room outlines are approximate in location and converted from AutoCAD models.
- Aerial imagery provided by Esri World Imagery.

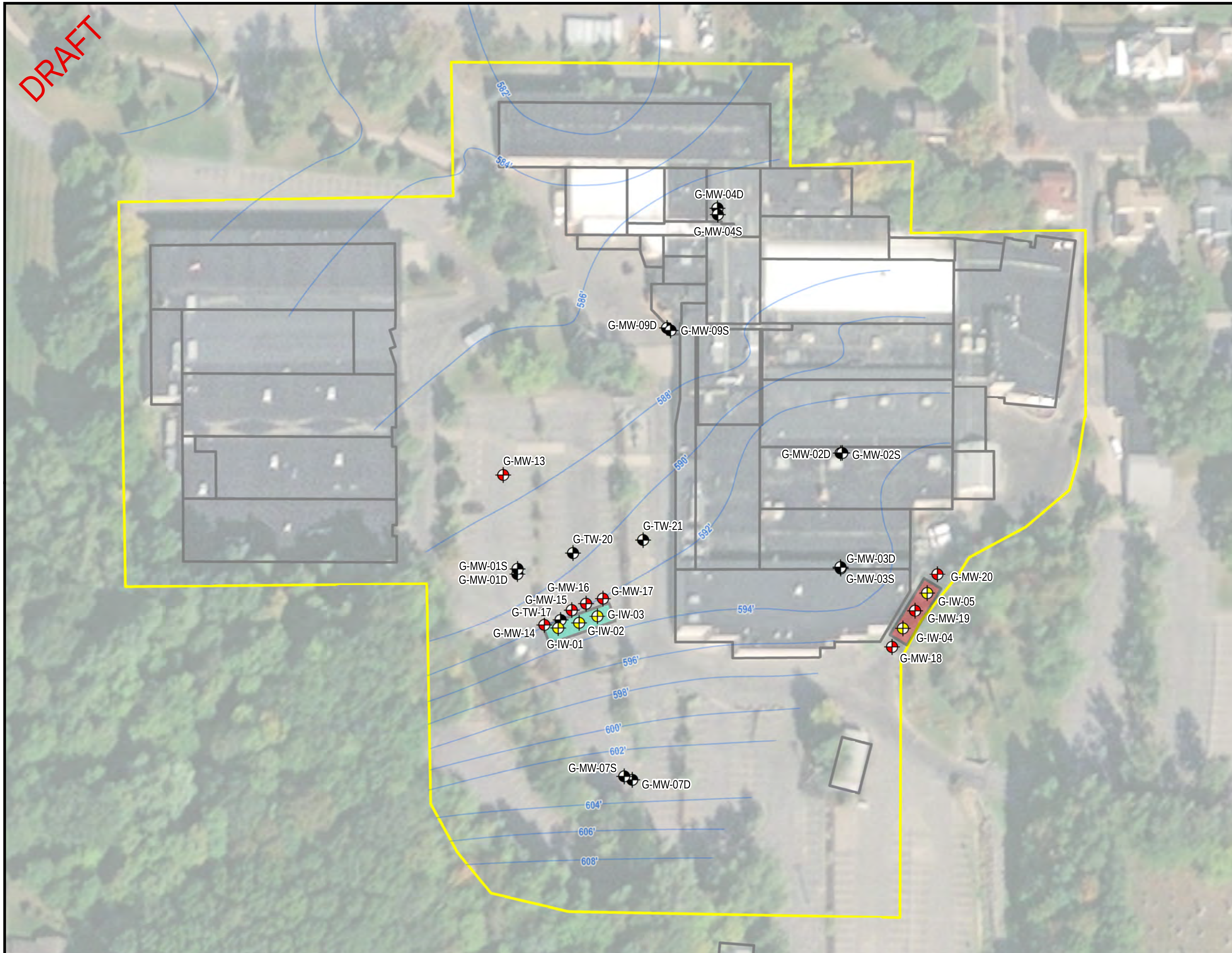
N

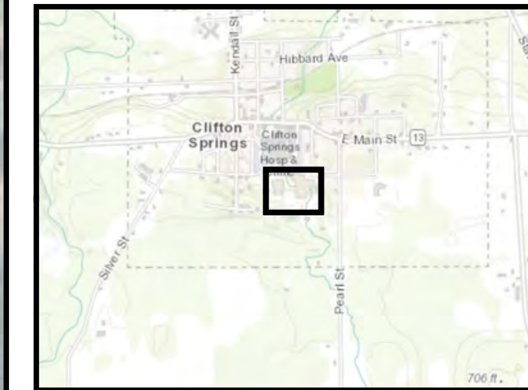
0 50 100 200 300 400
Feet

Figure 7: RI Groundwater Exceedances

G.W. Lisk Company, Inc.
2 South Street, Clifton Springs, NY

ERM





Legend

- Proposed Injection Monitoring Well Location
- Proposed Observation Monitoring Well Location
- Existing Monitoring Well Location
- Groundwater Contour - 2 ft. (Dashed where Inferred)

Proposed Study Areas

- Part 1
- Part 2
- BCP Boundary
- Facility Outline

NOTES:
- Facility room outlines are approximate in location and converted from AutoCAD models.
- Aerial imagery provided by Esri World Imagery.

N

0 25 50 100 150 200
Feet

Figure 8: Proposed Injection Plan
G.W. Lisk Company, Inc.
2 South Street, Clifton Springs, NY

ERM

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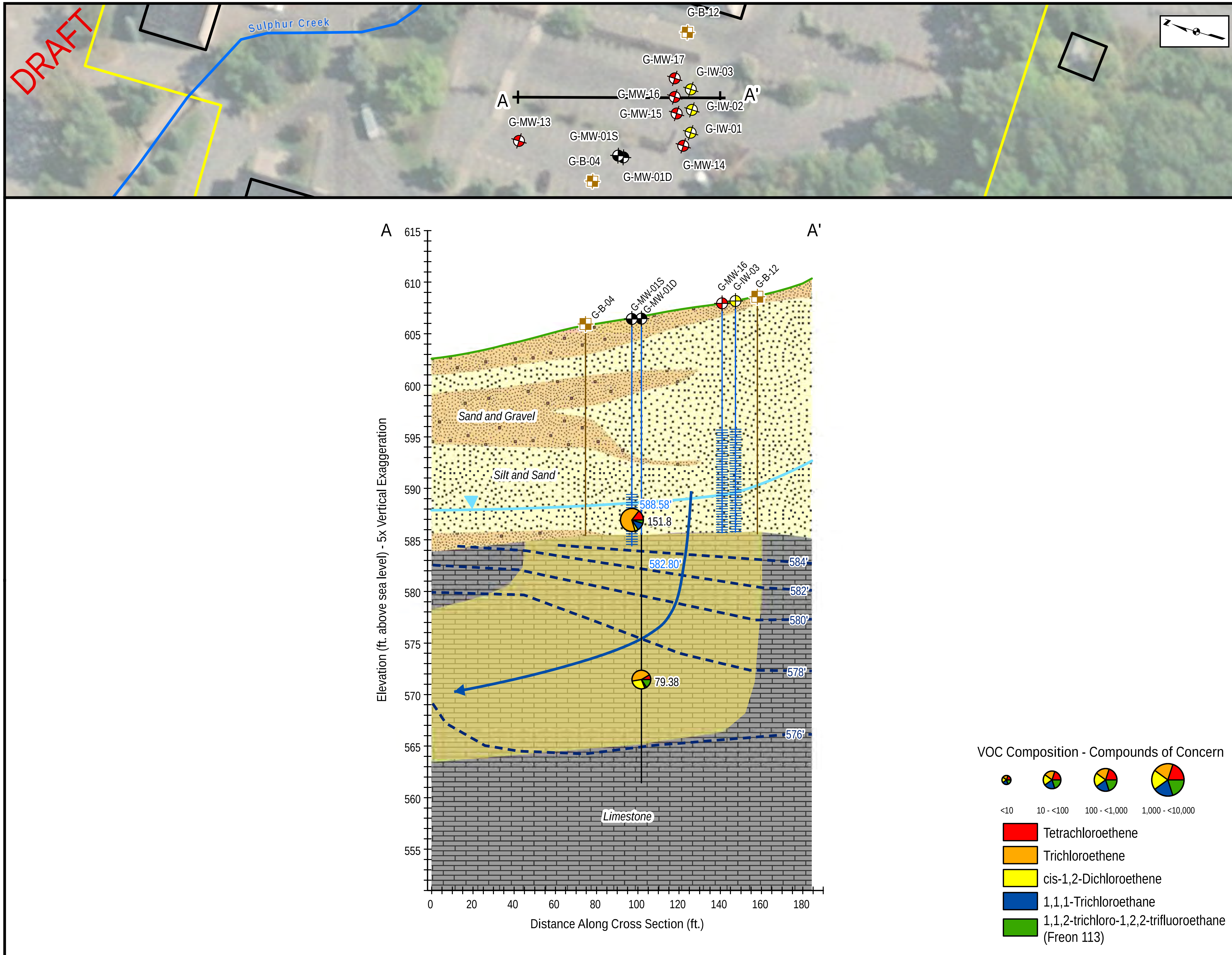

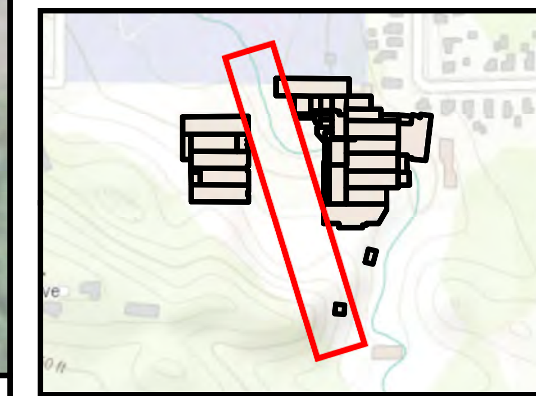

Legend

- Monitoring Well Location
- Soil Boring Location
- Proposed Injection Well
- Proposed Observation Well
- Surface Profile
- Well Trace
- Well Screen
- Open Borehole
- Soil Boring Trace
- Surface Stream
- Water Table
- Equipotential Line
- Groundwater Flow Direction
- CVOC Plume
- BCP Boundary
- Facility Outline

Lithology

- Silt and Sand
- Sand and Gravel
- Limestone

NOTES:
- ft. = feet
- VOC = Volatile Organic Compound
- CVOC = Chlorinated Volatile Organic Compound
- 9.56 = Total VOCs displayed in micrograms per liter (µg/L)
- 590' = Groundwater elevation in feet
- Groundwater gauged and collected June 2021.
- Geologic units estimated based on interpolation of borelog information.
- Facility room outlines are approximate in location and converted from AutoCAD models.
- Aerial imagery provided by Esri World Imagery.

Figure 9: Cross Section A-A'
G.W. Lisk Company, Inc.
2 South Street, Clifton Springs, NY

ERM

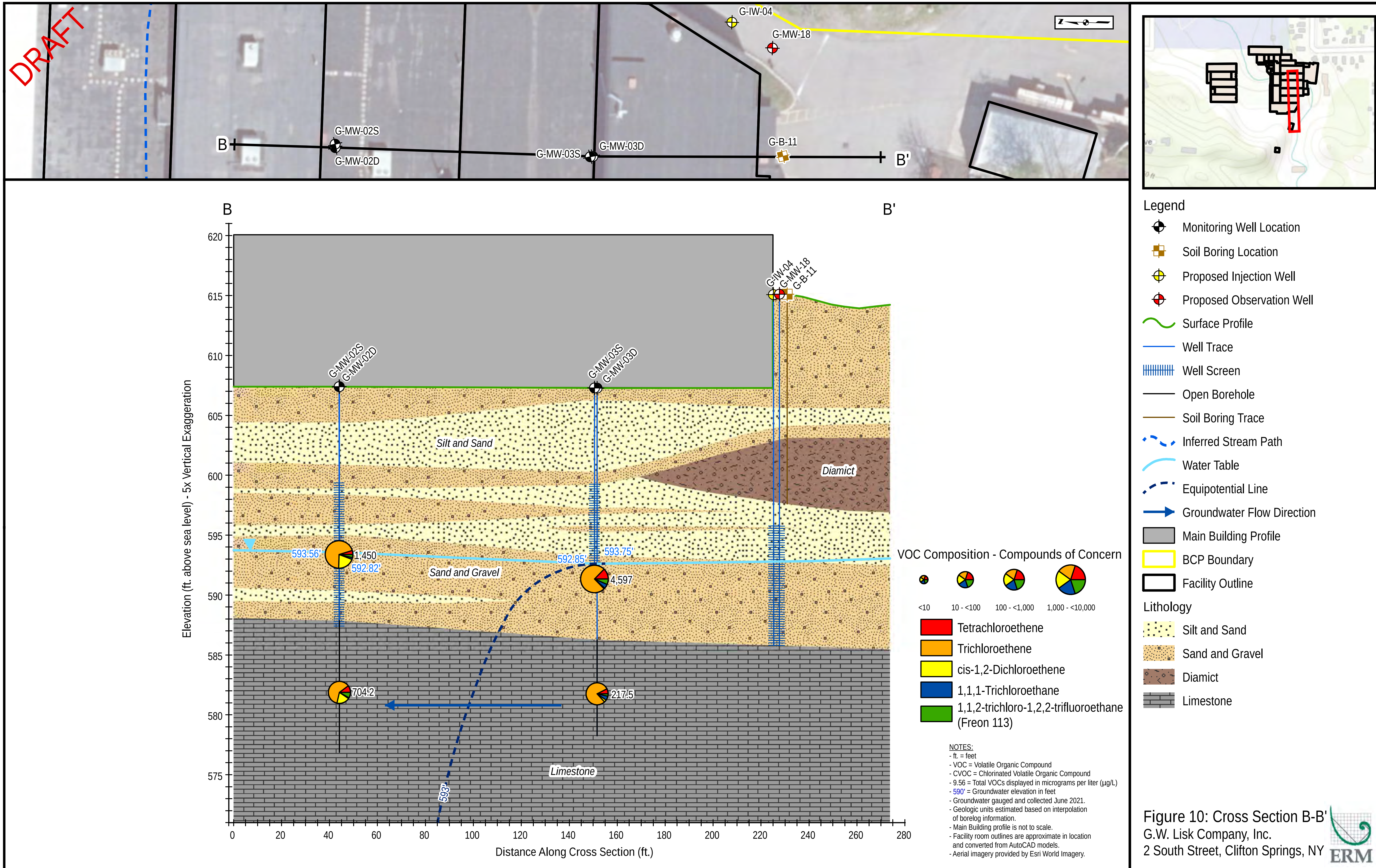

Figure 10: Cross Section B-B'
G.W. Lisk Company, Inc.
2 South Street, Clifton Springs, NY

TABLES

Table 1
Soil Data Exceedance Summary Table
G.W. Lisk Clifton Springs Facility
Clifton Springs, New York

	Analyte	6 NYCRR PART 375 RESTRICTED INDUSTRIAL	6 NYCRR PART 375 PROTECTION OF GROUND WATER	Location ID	G-B-15	G-B-15	G-B-16	G-B-16	G-B-16	G-B-17	G-B-17	G-B-17	G-B-18	G-B-18	G-B-19	G-B-19
				Sample Date	8/9/2022	8/10/2022	8/10/2022	8/10/2022	8/10/2022	8/11/2022	8/11/2022	8/11/2022	8/10/2022	8/10/2022	8/10/2022	8/10/2022
				Sample Type	N	N	N	N	N	N	N	FD	N	N	N	N
				Depth	0 - 0.5 ft	23 - 24 ft	8 - 9 ft	21 - 22 ft	27 - 28 ft	11 - 12 ft	19 - 20 ft	19 - 20 ft	6 - 7 ft	19 - 20 ft	17 - 18 ft	23 - 24 ft
				Unit												
	1,1,1-Trichloroethane	1,000,000	680	μg/kg	< 0.59	< 0.51	< 0.36	< 0.38	< 0.45	< 0.48	< 0.64	< 0.51	< 0.33	< 0.51	31	4.7 J
	1,1,2,2-Tetrachloroethane	NS	NS	μg/kg	< 0.59	< 0.51	< 0.36	< 0.38	< 0.45	< 0.48	< 0.64	< 0.51	< 0.33	< 0.51 J	< 0.42	< 0.52 J
	1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113)	NS	NS	μg/kg	< 4.7	< 4.1	< 2.9	< 3.1	< 3.6	< 3.8	< 5.2	< 4.0	< 2.6	< 4.1	30	1.2 J
	1,1,2-Trichloroethane	NS	NS	μg/kg	< 1.2	< 1.0	< 0.72	< 0.77	< 0.90	< 0.96	< 1.3	< 1.0	< 0.66	< 1.0	< 0.84	< 1.0 J
	1,1-Dichloroethane	480,000	**270**	μg/kg	< 1.2	< 1.0	< 0.72	< 0.77	< 0.90	< 0.96	< 1.3	< 1.0	< 0.66	< 1.0	1.6	0.32 J
	1,1-Dichloroethene	1,000,000	330	μg/kg	< 1.2 J	< 1.0	< 0.72	< 0.77	< 0.90	< 0.96	< 1.3	< 1.0	< 0.66	< 1.0	3.7	< 1.0 J
	1,2,3-Trichlorobenzene	NS	NS	μg/kg	< 2.3	< 2.0	< 1.4	< 1.5	< 1.8	< 1.9	< 2.6	< 2.0	< 1.3	< 2.0 J	< 1.7	< 2.1 J
	1,2,4-Trichlorobenzene	NS	NS	μg/kg	< 2.3	< 2.0	< 1.4	< 1.5	< 1.8	< 1.9	< 2.6	< 2.0	< 1.3	< 2.0 J	< 1.7	< 2.1 J
	1,2-Dibromo-3-chloropropane	NS	NS	μg/kg	< 3.5	< 3.1	< 2.2	< 2.3	< 2.7	< 2.9	< 3.9	< 3.0	< 2.0	< 3.1 J	< 2.5	< 3.1 J
	1,2-Dichlorobenzene	1,000,000	1,100	μg/kg	< 2.3	< 2.0	< 1.4	< 1.5	< 1.8	< 1.9	< 2.6	< 2.0	< 1.3	< 2.0 J	< 1.7	< 2.1 J
	1,2-Dichloroethane	60,000	20	μg/kg	< 1.2	< 1.0	< 0.72	< 0.77	< 0.90	< 0.96	< 1.3	< 1.0	< 0.66	< 1.0	< 0.84	< 1.0 J
	1,2-Dichloropropane	NS	NS	μg/kg	< 1.2	< 1.0	< 0.72	< 0.77	< 0.90	< 0.96	< 1.3	< 1.0	< 0.66	< 1.0	< 0.84	< 1.0 J
	1,3-Dichlorobenzene	560,000	2,400	μg/kg	< 2.3	< 2.0	< 1.4	< 1.5	< 1.8	< 1.9	< 2.6	< 2.0	< 1.3	< 2.0 J	< 1.7	< 2.1 J
	1,4-Dichlorobenzene	250,000	1,800	μg/kg	< 2.3	< 2.0	< 1.4	< 1.5	< 1.8	< 1.9	< 2.6	< 2.0	< 1.3	< 2.0 J	< 1.7	< 2.1 J
	1,4-Dioxane	250,000	100	μg/kg	< 94	< 82	< 57	< 62	< 72	< 77	< 100	< 81	< 53	< 82	< 68	< 83 J
	2-Butanone	1,000,000	120	μg/kg	< 12	< 10	< 7.2	< 7.7	< 9.0	< 9.6	< 13	< 10	< 6.6	< 10	< 8.4	< 10 J
	2-Hexanone	NS	NS	μg/kg	< 12	< 10	< 7.2	< 7.7	< 9.0	< 9.6	< 13	< 10	< 6.6	< 10	< 8.4	< 10 J
	4-Methyl-2-pentanone	NS	NS	μg/kg	< 12	< 10	< 7.2	< 7.7	< 9.0	< 9.6	< 13	< 10	< 6.6	< 10	< 8.4	< 10 J
	Acetone	1,000,000	50	μg/kg	< 12	< 10	< 7.2	< 7.7	< 9.0	< 9.6	< 13	< 10	< 6.6	5.2	< 8.4	< 10 J
	Benzene	89,000	60	μg/kg	< 0.59	< 0.51	< 0.36	0.28	0.28	< 0.48	< 0.64	< 0.51	< 0.33	< 0.51	< 0.42	< 0.52 J
	Bromodichloromethane	NS	NS	μg/kg	< 0.59	< 0.51	< 0.36	< 0.38	< 0.45	< 0.48	< 0.64	< 0.51	< 0.33	< 0.51	< 0.42	< 0.52 J
	Bromoform	NS	NS	μg/kg	< 4.7	< 4.1	< 2.9	< 3.1	< 3.6	< 3.8	< 5.2	< 4.0	< 2.6	< 4.1 J	< 3.4	< 4.2 J
	Bromomethane	NS	NS	μg/kg	< 2.3 J	< 2.0 J	< 1.4 J	< 1.5 J	< 1.8 J	< 1.9	< 2.6	< 2.0	< 1.3 J	< 2.0 J	< 1.7 J	< 2.1 J
	Carbon disulfide	NS	NS	μg/kg	< 12 J	< 10	< 7.2	< 7.7	< 9.0	< 9.6	< 13	< 10	< 6.6	< 10	< 8.4	< 10 J
	Carbon tetrachloride	44,000	760	μg/kg	< 1.2	< 1.0	< 0.72	< 0.77 J	< 0.90	< 0.96	< 1.3	< 1.0	< 0.66	< 1.0 J	< 0.84	< 1.0 J
VOCs	Chlorobenzene	1,000,000	1,100	μg/kg	< 0.59	< 0.51	< 0.36	< 0.38	< 0.45	< 0.48	< 0.64	< 0.51	< 0.33	< 0.51	< 0.42	< 0.52 J
	Chlorobromomethane	NS	NS	μg/kg	< 2.3 J	< 2.0 J	< 1.4 J	< 1.5 J	< 1.8 J	< 1.9	< 2.6	< 2.0	< 1.3 J	< 2.0 J	< 1.7 J	< 2.1 J
	Chloroethane	NS	NS	μg/kg	< 2.3 J	< 2.0 J	< 1.4 J	< 1.5 J	< 1.8 J	< 1.9 J	< 2.6 J	< 2.0 J	< 1.3 J	< 2.0 J	< 1.7 J	< 2.1 J
	Chloroform	700,000	370	μg/kg	< 1.8	< 1.5	< 1.1	< 1.2	< 1.4	< 1.4	< 1.9	< 1.5	< 0.99	< 1.5	< 1.3	< 1.6 J
	Chloromethane	NS	NS	μg/kg	< 4.7 J	< 4.1	< 2.9	< 3.1	< 3.6	< 3.8 J	< 5.2 J	< 4.0 J	< 2.6	< 4.1	< 3.4	< 4.2 J
	cis-1,2-Dichloroethene	1,000,000	**250**	μg/kg	< 1.2	< 1.0	< 0.72	< 0.77	< 0.90	< 0.96	< 1.3	< 1.0	< 0.66	< 1.0	2.6	3.1 J
	cis-1,3-Dichloropropene	NS	NS	μg/kg	< 0.59	< 0.51	< 0.36	< 0.38	< 0.45	< 0.48	< 0.64	< 0.51	< 0.33	< 0.51	< 0.42	< 0.52 J
	Cyclohexane	NS	NS	μg/kg	< 12	< 10	< 7.2	1.2	0.52	< 9.6	< 13	< 10	< 6.6	< 10	< 8.4	< 10 J
	Dibromochloromethane	NS	NS	μg/kg	< 1.2	< 1.0	< 0.72	< 0.77	< 0.90	< 0.96	< 1.3	< 1.0	< 0.66	< 1.0	< 0.84	< 1.0 J
	Dichlorodifluoromethane (Freon 12)	NS	NS	μg/kg	< 12 J	< 10	< 7.2	< 7.7	< 9.0	< 9.6 J	< 13 J	< 10 J	< 6.6	< 10	< 8.4	< 10 J
	Ethylbenzene	780,000	1,000	μg/kg	< 1.2	< 1.0	< 0.72	< 0.77	< 0.90	< 0.96	< 1.3	< 1.0	< 0.66	< 1.0	< 0.84	< 1.0 J
	Ethylene dibromide	NS	NS	μg/kg	< 1.2	< 1.0	< 0.72	< 0.77	< 0.90	< 0.96	< 1.3	< 1.0	< 0.66	< 1.0	< 0.84	< 1.0 J
	Isopropylbenzene (Cumene)	NS	NS	μg/kg	< 1.2	< 1.0	< 0.72	< 0.77	< 0.90	< 0.96	< 1.3	< 1.0	< 0.66	< 1.0 J	< 0.84	< 1.0 J
	m,p-Xylenes	1,000,000	1,600	μg/kg	< 2.3	< 2.0	< 1.4	0.69	0.61	< 1.9	< 2.6	< 2.0	< 1.3	< 2.0	< 1.7	< 2.1 J
	Methyl acetate	NS	NS	μg/kg	< 4.7	< 4.1	< 2.9	< 3.1	< 3.6	< 3.8	< 5.2	< 4.0	< 2.6	< 4.1	< 3.4	< 4.2 J
	Methyl tert-butyl ether	1,000,000	930	μg/kg	< 2.3	< 2.0	< 1.4	< 1.5	< 1.8	< 1.9	< 2.6	< 2.0	< 1.3	< 2.0	< 1.7	< 2.1 J
	Methylcyclohexane	NS	NS	μg/kg	< 4.7	< 4.1	< 2.9	1.2	0.81	< 3.8	< 5.2	< 4.0	< 2.6	< 4.1	< 3.4	< 4.2 J
	Methylene chloride	1,000,000	**50**	μg/kg	< 5.9	< 5.1	< 3.6	< 3.8	< 4.5	< 4.8	< 6.4	< 5.1	< 3.3	< 5.1	< 4.2	< 5.2 J
	o-Xylene	1,000,000	1,600	μg/kg	< 1.2	< 1.0	< 0.72	< 0.77	< 0.90	< 0.96	< 1.3	< 1.0	< 0.66	< 1.0	< 0.84	< 1.0 J
	Styrene	NS	NS	μg/kg	< 1.2	< 1.0 J	< 0.72 J	< 0.77 J	< 0.90 J	< 0.96	< 1.3	< 1.0	< 0.66 J	< 1.0 J	< 0.84 J	< 1.0 J
	Tetrachloroethene	300,000	1,300	μg/kg	< 0.59	< 0.51	< 0.36	0.31	< 0.45	0.63	< 0.64	< 0.51	0.29 J	< 0.51	88	22 J
	Toluene	1,000,000	700	μg/kg	< 1.2	< 1.0	< 0.72	1.2	0.78	< 0.96	< 1.3	< 1.0	< 0.66	< 1.0	< 0.84	< 1.0 J
	trans-1,2-Dichloroethene	1,000,000	190	μg/kg	< 1.8 J	< 1.5	< 1.1	< 1.2	< 1.4	< 1.4	< 1.9	< 1.5	< 0.99	< 1.5	< 1.3	< 1.6 J
	trans-1,3-Dichloropropene	NS	NS	μg/kg	< 1.2	< 1.0	< 0.72	< 0.77	< 0.90	< 0.96	< 1.3	< 1.0	< 0.66	< 1.0	< 0.84	< 1.0 J
	Trichloroethene	400,000	**470**	μg/kg	< 0.59	< 0.51	< 0.36	0.58 J	< 0.45	0.45	< 0.64	< 0.51	0.12 J	< 0.51 J	130	30 J
	Trichlorofluoromethane (Freon 11)	NS	NS	μg/kg	< 4.7 J	< 4.1	< 2.9	< 3.1 J	< 3.6	< 3.8	< 5.2	< 4.0	< 2.6	< 4.1 J	< 3.4	< 4.2 J
	Vinyl chloride	27,000	20	μg/kg	< 1.2 J	< 1.0	< 0.72	< 0.77 J	< 0.90	< 0.96 J	< 1.3 J	< 1.0 J	< 0.66	< 1.0 J	< 0.84	< 1.0 J
	1,2,4,5-Tetrachlorobenzene	NS	NS	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	2,2'-Oxybis(1-chloropropane)	NS	NS	μg/kg	< 1,200	< 200	< 200	< 210	< 220	< 220	< 230	< 240	< 210	< 230	< 220	< 220
	2,3,4,6-Tetrachlorophenol	NS	NS	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	2,4,5-Trichlorophenol	NS	NS	μg/kg	< 1,000	< 170 J	< 170 J	< 170	< 180 J	< 180	< 190	< 200	< 170	< 190	< 180 J	< 180
	2,4,6-Trichlorophenol	NS	NS	μg/kg	< 610	< 100	< 100	< 100	< 110	< 110	< 110	< 120	< 100	< 110	< 110	< 110
	2,4-Dichlorophenol	NS	NS	μg/kg	< 920	< 150	< 150	< 160	< 160	< 160	< 170	< 180	< 150	< 170	< 160	< 160
	2,4-Dimethylphenol	NS	NS	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	2,4-Dinitrophenol	NS	NS	μg/kg	< 4,900	< 820	< 820	< 830	< 860	< 880	< 910	< 950	< 830	< 910	< 870	R
	2,4-Dinitrotoluene	NS	NS	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	2,6-Dinitrotoluene	NS	NS	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	2-Chloronaphthalene	NS	NS	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	2-Chlorophenol	NS	NS	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	2-Methylnaphthalene	NS	NS	μg/kg	< 1,200	< 200	< 200	< 210	< 220	< 220	< 230	< 240	< 210	< 230	< 220	< 220
	2-Nitroaniline	NS	NS	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	2-Nitrophenol	NS	NS	μg/kg	< 2,200	< 370 J	< 370 J	< 380	< 390 J	< 390	< 410	< 430	< 370	< 410	< 390 J	< 390
	3,3'-Dichlorobenzidine	NS	NS	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	3-Nitroaniline	NS	NS	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	4-Bromophenyl phenyl ether	NS	NS	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	4-Chloro-3-methylphenol	NS	NS	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	4-Chlorophenyl phenyl ether	NS	NS	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	4-Nitrophenol	NS	NS	μg/kg	< 1,400	< 240	< 240	< 240	< 250	< 260	< 270	< 280	< 240	< 270	< 250	< 250
	Acenaphthene	1,000,000	98,000	μg/kg	< 820	< 140	< 140	< 140	< 140	< 150	< 150	< 160	< 140	< 150	< 140	< 140
	Acenaphthylene	1,000,000	107,000	μg/kg	< 820	< 140	< 140	< 140	< 140	< 150	< 150	< 160	< 140	< 150	< 140	< 140
	Acetophenone	NS	NS	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	Anthracene	1,000,000	1,000,000	μg/kg	< 610	< 100	< 100	< 100	< 110	< 110	< 110	< 120	< 100	< 110	< 110	< 110
	Atrazine	NS	NS	μg/kg	< 820	< 140	< 140	< 140	< 140	< 150	< 150	< 160	< 140	< 150	< 140	< 140
	Benzaldehyde	NS	NS	μg/kg	< 1,300	< 220	< 220	< 230	< 240	< 240	< 250	< 260	< 230	< 250	< 240	< 240
	Benzo(a)anthracene	11,000	1,000	μg/kg	200	< 100	< 100	< 100	< 110	< 110	< 110	< 120	< 100	< 110	< 110	< 110
	Benzo(a)pyrene	1,100	22,000	μg/kg	< 820	< 140	< 140	< 140	< 140	< 150	< 150	< 160	< 140	< 150	< 140	< 140
	Benzo(b)fluoranthene	11,000	1,700	μg/kg	260	< 100	< 100	< 100	< 110	< 110	< 110	< 120	< 100	< 110	< 110	< 110
	Benzo(g,h,i)perylene	1,000,000	1,000,000	μg/kg	160	< 140	< 140	< 140	< 140	< 150	< 150	< 160	< 140	< 150	< 140	< 140
	Benzo(k)fluoranthene	110,000	1,700	μg/kg	< 610	< 100	< 100	< 100	< 110	< 110	< 110	< 120	< 100	< 110	< 110	< 110
	Benzyl butyl phthalate	NS	NS	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
SVOCs	Biphenyl	NS	NS	μg/kg	< 2,300	< 390	< 390	< 400	< 410	< 420	< 430	< 450	< 390	< 430	< 420	< 420
	Bis(2-chloroethoxy)methane	NS	NS	μg/kg	< 1,100	< 180	< 180	< 190	< 190	< 200	< 200	< 210	< 180	< 200	< 200	< 200
	Bis(2-ethylhexyl)phthalate	NS	NS	μg/kg	< 1,000 J	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	Caprolactam	NS	NS	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	Carbazole	NS	NS	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	Chrysene	110,000	1,000	μg/kg	200	< 100	< 100	< 100	< 110	< 110	< 110	< 120	< 100	< 110	< 110	< 110
	Dibenzo(a,h)anthracene	1,100	1,000,000	μg/kg	< 610	< 100	< 100	< 100	< 110	< 110	< 110	< 120	< 100	< 110	< 110	< 110
	Dibenzofuran	1,000,000	210,000	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	Dibutyl phthalate	NS	NS	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	Dichloroethyl ether	NS	NS	μg/kg	< 920	< 150	< 150	< 160	< 160	< 160	< 170	< 180	< 150	< 170	< 160	< 160
	Diethyl phthalate	NS	NS	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	Dimethyl phthalate	NS	NS	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	Dinitro-o-cresol	NS	NS	μg/kg	< 2,600	< 440	< 440	< 450	< 470	< 480	< 500	< 510	< 450	< 490	< 470	< 470
	Di-n-octyl phthalate	NS	NS	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	Fluoranthene	1,000,000	1,000,000	μg/kg	320	< 100	< 100	< 100	< 110	< 110	< 110	< 120	< 100	< 110	< 110	< 110
	Fluorene	1,000,000	386,000	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	Hexachlorobenzene	12,000	3,200	μg/kg	< 610	< 100	< 100	< 100	< 110	< 110	< 110	< 120	< 100	< 110	< 110	< 110
	Hexachlorobutadiene	NS	NS	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	Hexachlorocyclopentadiene	NS	NS	μg/kg	< 2,900	< 490 J	< 490 J	< 500 J	< 520 J	< 520	< 540	< 560	< 490 J	< 540 J	< 520 J	< 520
	Hexachloroethane	NS	NS	μg/kg	< 820	< 140	< 140	< 140	< 140	< 150	< 150	< 160	< 140	< 150	< 140	< 140
	Indeno(1,2,3-cd)pyrene	11,000	8,200	μg/kg	150	< 140	< 140	< 140	< 140	< 150	< 150	< 160	< 140	< 150	< 140	< 140
	Isophorone	NS	NS	μg/kg	< 920	< 150	< 150	< 160	< 160	< 160	< 170	< 180	< 150	< 170	< 160	< 160
	m,p-cresol	1,000,000	330	μg/kg	< 1,500	< 240	< 240	< 250	< 260	< 260	< 270	< 280	< 250	< 270	< 260	< 260
	Naphthalene	1,000,000	12,000	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	Nitrobenzene	NS	NS	μg/kg	< 920	< 150	< 150	< 160	< 160	< 160	< 170	< 180	< 150	< 170	< 160	< 160
	n-Nitrosodi-n-propylamine	NS	NS	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	n-Nitrosodiphenylamine	NS	NS	μg/kg	< 820	< 140	< 140	< 140	< 140	< 150	< 150	< 160	< 140	< 150	< 140	< 140
	o-Cresol	1,000,000	330	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	p-Chloroaniline	NS	NS	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	Pentachlorophenol	55,000	800	μg/kg	< 820	< 140	< 140	< 140	< 140	< 150	< 150	< 160	< 140	< 150	< 140	< 140
	Phenanthrene	1,000,000	1,000,000	μg/kg	150	< 100	< 100	< 100	< 110	< 110	< 110	< 120	< 100	< 110	< 110	< 110
	Phenol	1,000,000	330	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	p-Nitroaniline	NS	NS	μg/kg	< 1,000	< 170	< 170	< 170	< 180	< 180	< 190	< 200	< 170	< 190	< 180	< 180
	Pyrene	1,000,000	1,000,000	μg/kg	300	< 100	< 100	< 100	< 110	< 110	< 110	< 120	< 100	< 110	< 110	< 110
Solids	Solids, Total	NS	NS	%	80.9	95.1	96.0	94.6	91.3	89.0	86.7	84.3	95.5	85.9	90.0	91.1

Notes:
< = Compound not detected at concentrationsabove the laboratory reporting detection limit.The laboratory reporting detection limit is shown.
J = Estimated value. The Target analyte concentration is below the quantitation limit (RL), but above the Method Detection Limit (MDL).
R = Rejected. Quality control indicates that the data are unusable (compound may or not be present).
N = Normal Environmental Sample
FD = Field Duplicate Sample
μg/kg = micrograms per kilogram
ft = feet

Table 1
Soil Data Exceedance Summary Table
G.W. Lisk Clifton Springs Facility
Clifton Springs, New York

	Analyte	6 NYCRR PART 375 RESTRICTED INDUSTRIAL	6 NYCRR PART 375 PROTECTION OF GROUND WATER	Location ID	G-B-20	G-B-20	G-B-21	G-B-21	G-B-21	G-B-22	G-B-22	G-B-23	G-B-23	G-B-24	G-B-24	G-B-25	G-B-25
				Sample Date	8/10/2022	8/10/2022	8/9/2022	8/9/2022	8/9/2022	8/9/2022	8/9/2022	8/9/2022	8/9/2022	8/10/2022	8/10/2022	8/11/2022	8/11/2022
				Sample Type	N	N	N	N	FD	N	N	N	N	N	N	N	N
				Depth	10 - 11 ft	19 - 20 ft	7 - 8 ft	15 - 16 ft	15 - 16 ft	12 - 13 ft	23 - 24 ft	8 - 9 ft	27 - 28 ft	12 - 13 ft	23 - 24 ft	12 - 13 ft	20 - 21 ft
				Unit													
VOCs	1,1,1-Trichloroethane	1,000,000	680	µg/kg	50	450	12	140 J	74 J	28 J	130	< 0.38	1.6	< 0.50	< 0.50	< 0.42	< 0.40
	1,1,2,2-Tetrachloroethane	NS	NS	µg/kg	< 27	< 30	< 0.53	< 47	< 30	< 27	< 25	< 0.38	< 0.55	< 0.50	< 0.50	< 0.42	< 0.40
	1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113)	NS	NS	µg/kg	130	66	18	99	66	< 220	130	< 3.0	5.3	< 4.0	< 4.0	< 3.4	< 3.2
	1,1,2-Trichloroethane	NS	NS	µg/kg	< 54	< 60	< 1.1	< 93	< 60	< 55	< 50	< 0.75	< 1.1	< 1.0	< 1.0	< 0.84	< 0.80
	1,1-Dichloroethane	480,000	**270**	µg/kg	100	**630**	8.0	**380 J**	120 J	< 55	36	< 0.75	< 1.1	< 1.0	< 1.0	< 0.84	< 0.80
	1,1-Dichloroethene	1,000,000	330	µg/kg	55	130	4.2 J	140 J	< 60 J	< 55 J	25 J	< 0.75 J	< 1.1 J	< 1.0	< 1.0	< 0.84	< 0.80
	1,2,3-Trichlorobenzene	NS	NS	µg/kg	< 110	< 120	< 2.1	< 190	< 120	< 110	< 99	< 1.5	< 2.2	< 2.0	< 2.0	< 1.7	< 1.6 J
	1,2,4-Trichlorobenzene	NS	NS	µg/kg	< 110	< 120	< 2.1	< 190	< 120	< 110	< 99	< 1.5	< 2.2	< 2.0	< 2.0	< 1.7	< 1.6 J
	1,2-Dibromo-3-chloropropane	NS	NS	µg/kg	< 160	< 180	< 3.2	< 280	< 180	< 160	< 150	< 2.3	< 3.3	< 3.0	< 3.0	< 2.5	< 2.4
	1,2-Dichlorobenzene	1,000,000	1,100	µg/kg	< 110	< 120	< 2.1	< 190	< 120	< 110	< 99	< 1.5	< 2.2	< 2.0	< 2.0	< 1.7	< 1.6
	1,2-Dichloroethane	60,000	20	µg/kg	< 54	< 60	< 1.1	< 93	< 60	< 55	< 50	< 0.75	< 1.1	< 1.0	< 1.0	< 0.84	< 0.80
	1,2-Dichloropropane	NS	NS	µg/kg	< 54	< 60	< 1.1	< 93	< 60	< 55	< 50	< 0.75	< 1.1	< 1.0	< 1.0	< 0.84	< 0.80
	1,3-Dichlorobenzene	560,000	2,400	µg/kg	< 110	< 120	< 2.1	< 190	< 120	< 110	< 99	< 1.5	< 2.2	< 2.0	< 2.0	< 1.7	< 1.6
	1,4-Dichlorobenzene	250,000	1,800	µg/kg	< 110	< 120	< 2.1	< 190	< 120	< 110	< 99	< 1.5	< 2.2	< 2.0	< 2.0	< 1.7	< 1.6
	1,4-Dioxane	250,000	100	µg/kg	< 4,400	< 4,800	< 85	< 7,500	< 4,800	< 4,400	< 4,000	< 60	< 88	< 81	< 80	< 67	< 64
	2-Butanone	1,000,000	120	µg/kg	< 540	< 600	< 11	< 930	< 600	< 550	< 500	< 7.5	< 11	< 10	< 10	< 8.4	< 8.0
	2-Hexanone	NS	NS	µg/kg	< 540	< 600	< 11	< 930	< 600	< 550	< 500	< 7.5	< 11	< 10	< 10	< 8.4	< 8.0
	4-Methyl-2-pentanone	NS	NS	µg/kg	< 540	< 600	< 11	< 930	< 600	< 550	< 500	< 7.5	< 11	< 10	< 10	< 8.4	< 8.0
	Acetone	1,000,000	50	µg/kg	< 540	< 600	< 11	< 930	< 600	< 550	< 500	< 7.5	< 11	< 10	< 10	< 8.4	< 8.0
	Benzene	89,000	60	µg/kg	< 27	< 30	0.23	< 47	< 30	< 27	< 25	< 0.38	< 0.55	< 0.50	< 0.50	< 0.42	< 0.40
	Bromodichloromethane	NS	NS	µg/kg	< 27	< 30	< 0.53	< 47	< 30	< 27	< 25	< 0.38	< 0.55	< 0.50	< 0.50	< 0.42	< 0.40
	Bromoform	NS	NS	µg/kg	< 220	< 240	< 4.2	< 370	< 240	< 220	< 200	< 3.0	< 4.4	< 4.0	< 4.0	< 3.4	< 3.2
	Bromomethane	NS	NS	µg/kg	< 110 J	< 120 J	< 2.1 J	< 190 J	< 120 J	< 110 J	< 99 J	< 1.5 J	< 2.2 J	< 2.0 J	< 2.0 J	< 1.7	< 1.6
	Carbon disulfide	NS	NS	µg/kg	< 540	< 600	< 11 J	< 930 J	< 600 J	< 550 J	< 500 J	< 7.5 J	< 11 J	< 10	< 10	< 8.4	< 8.0
	Carbon tetrachloride	44,000	760	µg/kg	< 54	< 60	< 1.1	< 93	< 60	< 55	< 50	< 0.75	< 1.1	< 1.0	< 1.0	< 0.84	< 0.80
	Chlorobenzene	1,000,000	1,100	µg/kg	< 27	< 30	< 0.53	< 47	< 30	< 27	< 25	< 0.38	< 0.55	< 0.50	< 0.50	< 0.42	< 0.40
	Chlorobromomethane	NS	NS	µg/kg	< 110 J	< 120 J	< 2.1 J	< 190 J	< 120 J	< 110 J	< 99 J	< 1.5 J	< 2.2 J	< 2.0 J	< 2.0 J	< 1.7	< 1.6
	Chloroethane	NS	NS	µg/kg	< 110 J	< 120 J	< 2.1 J	< 190 J	< 120 J	< 110 J	< 99 J	< 1.5 J	< 2.2 J	< 2.0 J	< 2.0 J	< 1.7 J	< 1.6 J
	Chloroform	700,000	370	µg/kg	< 82	< 90	< 1.6	< 140	< 90	< 82	< 75	< 1.1	< 1.6	< 1.5	< 1.5	< 1.3	< 1.2
	Chloromethane	NS	NS	µg/kg	< 220	< 240	< 4.2 J	< 370 J	< 240 J	< 220 J	< 200 J	< 3.0 J	< 4.4 J	< 4.0	< 4.0	< 3.4 J	< 3.2 J
	cis-1,2-Dichloroethene	1,000,000	**250**	µg/kg	200	**320**	10	**370 J**	110 J	< 55	180	< 0.75	0.42	< 1.0	< 1.0	< 0.84	< 0.80
	cis-1,3-Dichloropropene	NS	NS	µg/kg	< 27	< 30	< 0.53	< 47	< 30	< 27	< 25	< 0.38	< 0.55	< 0.50	< 0.50	< 0.42	< 0.40
	Cyclohexane	NS	NS	µg/kg	< 540	< 600	< 11	< 930	< 600	< 550	< 500	< 7.5	< 11	< 10	< 10	< 8.4	< 8.0
	Dibromochloromethane	NS	NS	µg/kg	< 54	< 60	< 1.1	< 93	< 60	< 55	< 50	< 0.75	< 1.1	< 1.0	< 1.0	< 0.84	< 0.80
	Dichlorodifluoromethane (Freon 12)	NS	NS	µg/kg	< 540	< 600	< 11 J	< 930 J	< 600 J	< 550 J	< 500 J	< 7.5 J	< 11 J	< 10	< 10	< 8.4 J	< 8.0 J
	Ethylbenzene	780,000	1,000	µg/kg	< 54	< 60	< 1.1	< 93	< 60	< 55	< 50	< 0.75	< 1.1	< 1.0	< 1.0	< 0.84	< 0.80
	Ethylene dibromide	NS	NS	µg/kg	< 54	< 60	< 1.1	< 93	< 60	< 55	< 50	< 0.75	< 1.1	< 1.0	< 1.0	< 0.84	< 0.80
	Isopropylbenzene (Cumene)	NS	NS	µg/kg	< 54	< 60	< 1.1	< 93	< 60	< 55	< 50	< 0.75	< 1.1	< 1.0	< 1.0	< 0.84	< 0.80
	m,p-Xylenes	1,000,000	1,600	µg/kg	< 110	< 120	< 2.1	< 190	< 120	< 110	< 99	< 1.5	< 2.2	< 2.0	< 2.0	< 1.7	< 1.6
	Methyl acetate	NS	NS	µg/kg	< 220	< 240	< 4.2	< 370	< 240	< 220	< 200	< 3.0	< 4.4	< 4.0	< 4.0	< 3.4	< 3.2
	Methyl tert-butyl ether	1,000,000	930	µg/kg	< 110	< 120	< 2.1	< 190	< 120	< 110	< 99	< 1.5	< 2.2	< 2.0	< 2.0	< 1.7	< 1.6
	Methylcyclohexane	NS	NS	µg/kg	< 220	< 240	< 4.2	< 370	< 240	< 220	< 200	< 3.0	< 4.4	< 4.0	< 4.0	< 3.4	< 3.2
	Methylene chloride	1,000,000	**50**	µg/kg	< 270	**370**	< 5.3	< 470	< 300	< 270	< 250	< 3.8	< 5.5	< 5.0	< 5.0	< 4.2	< 4.0
	o-Xylene	1,000,000	1,600	µg/kg	< 54	< 60	< 1.1	< 93	< 60	< 55	< 50	< 0.75	< 1.1	< 1.0	< 1.0	< 0.84	< 0.80
	Styrene	NS	NS	µg/kg	< 54 J	< 60 J	< 1.1	< 93	< 60	< 55	< 50	< 0.75	< 1.1	< 1.0 J	< 1.0 J	< 0.84	< 0.80
	Tetrachloroethene	300,000	1,300	µg/kg	1,100	470	63	910	560	240 J	710	< 0.38	4.8	< 0.50	< 0.50	0.45	0.18
	Toluene	1,000,000	700	µg/kg	< 54	< 60	< 1.1	< 93	< 60	< 55	< 50	< 0.75	< 1.1	< 1.0	< 1.0	< 0.84	< 0.80
	trans-1,2-Dichloroethene	1,000,000	190	µg/kg	< 82	< 90	0.19 J	< 140 J	< 90 J	< 82 J	< 75 J	< 1.1 J	< 1.6 J	< 1.5	< 1.5	< 1.3	< 1.2
	trans-1,3-Dichloropropene	NS	NS	µg/kg	< 54	< 60	< 1.1	< 93	< 60	< 55	< 50	< 0.75	< 1.1	< 1.0	< 1.0	< 0.84	< 0.80
	Trichloroethene	400,000	**470**	µg/kg	**7,200**	**3,000**	250	**10,000 J**	**3,500 J**	45 J	**2,800**	< 0.38	5.8	< 0.50	< 0.50	0.25	0.11
	Trichlorofluoromethane (Freon 11)	NS	NS	µg/kg	< 220	< 240	< 4.2 J	< 370 J	< 240 J	< 220 J	< 200 J	< 3.0 J	< 4.4 J	< 4.0	< 4.0	< 3.4	< 3.2
	Vinyl chloride	27,000	20	µg/kg	< 54	< 60	< 1.1 J	< 93 J	< 60 J	< 55 J	< 50 J	< 0.75 J	< 1.1 J	< 1.0	< 1.0	< 0.84 J	< 0.80 J
SVOCs	1,2,4,5-Tetrachlorobenzene	NS	NS	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	2,2'-Oxybis(1-chloropropane)	NS	NS	µg/kg	< 230	< 230	< 220	< 240	< 230	< 220	< 210	< 210	< 230	< 200	< 230	< 210	< 220
	2,3,4,6-Tetrachlorophenol	NS	NS	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	2,4,5-Trichlorophenol	NS	NS	µg/kg	< 190 J	< 190 J	< 180	< 200	< 190	< 180	< 170	< 180	< 190	< 170 J	< 190 J	< 180	< 180
	2,4,6-Trichlorophenol	NS	NS	µg/kg	< 120	< 120	< 110	< 120	< 110	< 110	< 100	< 110	< 120	< 100	< 120	< 100	< 110
	2,4-Dichlorophenol	NS	NS	µg/kg	< 170	< 170	< 170	< 180	< 170	< 170	< 160	< 160	< 170	< 150	< 170	< 160	< 160
	2,4-Dimethylphenol	NS	NS	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	2,4-Dinitrophenol	NS	NS	µg/kg	< 920	< 920	< 890	< 970	< 920	< 890	< 830	< 850	< 920	< 810	< 920	< 840	R
	2,4-Dinitrotoluene	NS	NS	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	2,6-Dinitrotoluene	NS	NS	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	2-Chloronaphthalene	NS	NS	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	2-Chlorophenol	NS	NS	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	2-Methylnaphthalene	NS	NS	µg/kg	< 230	< 230	< 220	< 240	< 230	65	< 210	< 210	< 230	< 200	< 230	< 210	< 220
	2-Nitroaniline	NS	NS	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	2-Nitrophenol	NS	NS	µg/kg	< 410 J	< 420 J	< 400	< 440	< 410	< 400	< 370	< 380	< 420	< 360 J	< 420 J	< 380	< 390
	3,3'-Dichlorobenzidine	NS	NS	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	3-Nitroaniline	NS	NS	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	4-Bromophenyl phenyl ether	NS	NS	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	4-Chloro-3-methylphenol	NS	NS	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	4-Chlorophenyl phenyl ether	NS	NS	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	4-Nitrophenol	NS	NS	µg/kg	< 270	< 270	< 260	< 280	< 270	< 260	< 240	< 250	< 270	< 240	< 270	< 250	< 250
	Acenaphthene	1,000,000	98,000	µg/kg	< 150	< 150	< 150	< 160	< 150	< 150	< 140	< 140	< 150	17	< 150	< 140	< 140
	Acenaphthylene	1,000,000	107,000	µg/kg	< 150	< 150	< 150	< 160	< 150	< 150	< 140	< 140	< 150	< 130	< 150	< 140	< 140
	Acetophenone	NS	NS	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	Anthracene	1,000,000	1,000,000	µg/kg	< 120	< 120	< 110	< 120	< 110	< 110	< 100	< 110	< 120	54	< 120	< 100	< 110
	Atrazine	NS	NS	µg/kg	< 150	< 150	< 150	< 160	< 150	< 150	< 140	< 140	< 150	< 130	< 150	< 140	< 140
	Benzaldehyde	NS	NS	µg/kg	< 250	< 250	< 240	< 270	< 250	< 240	< 230	< 230	< 250	< 220	< 250	< 230	< 240
	Benzo(a)anthracene	11,000	1,000	µg/kg	< 120	< 120	< 110	< 120	< 110	< 110	< 100	< 110	< 120	230	< 120	< 100	< 110
	Benzo(a)pyrene	1,100	22,000	µg/kg	< 150	< 150	< 150	< 160	< 150	< 150	< 140	< 140	< 150	230	< 150	< 140	< 140
	Benzo(b)fluoranthene	11,000	1,700	µg/kg	< 120	< 120	< 110	< 120	< 110	< 110	< 100	< 110	< 120	270	< 120	< 100	< 110
	Benzo(g,h,i)perylene	1,000,000	1,000,000	µg/kg	< 150	< 150	< 150	< 160	< 150	< 150	< 140	< 140	< 150	150	< 150	< 140	< 140
	Benzo(k)fluoranthene	110,000	1,700	µg/kg	< 120	< 120	< 110	< 120	< 110	< 110	< 100	< 110	< 120	94	< 120	< 100	< 110
	Benzyl butyl phthalate	NS	NS	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	Biphenyl	NS	NS	µg/kg	< 440	< 440	< 420	< 460	< 440	< 420	< 400	< 400	< 440	< 380	< 440	< 400	< 410
	Bis(2-chloroethoxy)methane	NS	NS	µg/kg	< 210	< 210	< 200	< 220	< 210	< 200	< 190	< 190	< 210	< 180	< 210	< 190	< 190
	Bis(2-ethylhexyl)phthalate	NS	NS	µg/kg	< 190	< 190	< 180	< 200	< 190	230	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	Caprolactam	NS	NS	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	Carbazole	NS	NS	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	36	< 190	< 180	< 180
	Chrysene	110,000	1,000	µg/kg	< 120	< 120	< 110	< 120	< 110	< 110	< 100	< 110	< 120	210	< 120	< 100	< 110
	Dibenzo(a,h)anthracene	1,100	1,000,000	µg/kg	< 120	< 120	< 110	< 120	< 110	< 110	< 100	< 110	< 120	33	< 120	< 100	< 110
	Dibenzofuran	1,000,000	210,000	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	16	< 190	< 180	< 180
	Dibutyl phthalate	NS	NS	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	Dichloroethyl ether	NS	NS	µg/kg	< 170	< 170	< 170	< 180	< 170	< 170	< 160	< 160	< 170	< 150	< 170	< 160	< 160
	Diethyl phthalate	NS	NS	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	Dimethyl phthalate	NS	NS	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	Dinitro-o-cresol	NS	NS	µg/kg	< 500	< 500	< 480	< 520	< 500	< 480	< 450	< 460	< 500	< 440	< 500	< 460	< 470
	Di-n-octyl phthalate	NS	NS	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	Fluoranthene	1,000,000	1,000,000	µg/kg	< 120	< 120	< 110	< 120	< 110	< 110	< 100	< 110	< 120	460	< 120	< 100	< 110
	Fluorene	1,000,000	386,000	µg/kg	< 190	< 190	< 180	< 200	< 190	20	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	Hexachlorobenzene	12,000	3,200	µg/kg	< 120	< 120	< 110	< 120	< 110	< 110	< 100	< 110	< 120	< 100	< 120	< 100	< 110
	Hexachlorobutadiene	NS	NS	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	Hexachlorocyclopentadiene	NS	NS	µg/kg	< 550 J	< 550 J	< 530 J	< 580 J	< 550 J	< 530 J	< 500 J	< 510 J	< 550 J	< 480 J	< 550 J	< 500	< 510 J
	Hexachloroethane	NS	NS	µg/kg	< 150	< 150	< 150	< 160	< 150	< 150	< 140	< 140	< 150	< 130	< 150	< 140	< 140
	Indeno(1,2,3-cd)pyrene	11,000	8,200	µg/kg	< 150	< 150	< 150	< 160	< 150	< 150	< 140	< 140	< 150	130	< 150	< 140	< 140
	Isophorone	NS	NS	µg/kg	< 170	< 170	< 170	< 180	< 170	< 170	< 160	< 160	< 170	< 150	< 170	< 160	< 160
	m,p-cresol	1,000,000	330	µg/kg	< 280	< 280	< 270	< 290	< 280	< 260	< 250	< 260	< 280	< 240	< 280	< 250	< 260
	Naphthalene	1,000,000	12,000	µg/kg	< 190	< 190	< 180	< 200	< 190	28	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	Nitrobenzene	NS	NS	µg/kg	< 170	< 170	< 170	< 180	< 170	< 170	< 160	< 160	< 170	< 150	< 170	< 160	< 160
	n-Nitrosodi-n-propylamine	NS	NS	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	n-Nitrosodiphenylamine	NS	NS	µg/kg	< 150	< 150	< 150	< 160	< 150	< 150	< 140	< 140	< 150	< 130	< 150	< 140	< 140
	o-Cresol	1,000,000	330	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	p-Chloroaniline	NS	NS	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	Pentachlorophenol	55,000	800	µg/kg	< 150	< 150	< 150	< 160	< 150	< 150	< 140	< 140	< 150	< 130	< 150	< 140	< 140
	Phenanthrene	1,000,000	1,000,000	µg/kg	< 120	< 120	< 110	< 120	< 110	40	< 100	< 110	< 120	290	< 120	< 100	< 110
	Phenol	1,000,000	330	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	p-Nitroaniline	NS	NS	µg/kg	< 190	< 190	< 180	< 200	< 190	< 180	< 170	< 180	< 190	< 170	< 190	< 180	< 180
	Pyrene	1,000,000	1,000,000	µg/kg	< 120	< 120	< 110	< 120	< 110	18	< 100	< 110	< 120	410	20	< 100	< 110
Solids	Solids, Total	NS	NS	%	84.8	84.7	88.6	81.9	84.4	89.1	93.2	92.6	85.6	96.9	85.1	92.3	92.2

Notes:
< = Compound not detected at concentrationsabove the laboratory reporting detection limit.The laboratory reporting detection limit is shown.
J = Estimated value. The Target analyte concentration is below the quantitation limit (RL), but above the Method Detection Limit (MDL).
R = Rejected. Quality control indicates that the data are unusable (compound may or not be present).
N = Normal Environmental Sample
FD = Field Duplicate Sample
µg/kg = micrograms per kilogram
ft = feet

Table 2
Groundwater Exceedance Data Summary Table
G.W. Lisk Clifton Springs Facility
Clifton Springs, New York

	Analyte	NY TOGS 1.1.1 DW CLASS GA	Location ID	G-MW-01D	G-MW-01S	G-MW-02D	G-MW-02S	G-MW-03D	G-MW-03S	G-MW-03S	G-MW-04D
			Sample Date	8/30/2022	8/31/2022	8/31/2022	8/31/2022	8/30/2022	8/31/2022	8/31/2022	8/30/2022
			Sample Type	N	N	N	N	N	N	FD	N
			Unit								
VOCs	1,1,1-Trichloroethane	**5**	µg/L	**7.0**	**21 J**	2.3	**24**	1.7	**85**	**94**	1.2
	1,1,2,2-Tetrachloroethane	5	µg/L	*< 0.50*	*< 0.50 J*	*< 1.0*	*< 5.0*	*< 0.50*	*< 5.0*	*< 5.0*	*< 0.50*
	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	**5**	µg/L	**59**	**9.3 J**	**42**	**50**	1.5	**190**	**210**	*< 2.5*
	1,1,2-Trichloroethane	1	µg/L	*< 1.5*	*< 1.5 J*	*< 3.0*	*< 15*	*< 1.5*	*< 15*	*< 15*	*< 1.5*
	1,1-Dichloroethane	**5**	µg/L	**5.9**	**6.2 J**	**13**	**19**	0.76	**12**	**13**	1.8
	1,1-Dichloroethene	**5**	µg/L	4.3	3.9 J	4.9	**17**	0.54	**22**	**26**	0.21
	1,2,3-Trichlorobenzene	5	µg/L	*< 2.5*	*< 2.5 J*	*< 5.0*	*< 25*	*< 2.5*	*< 25*	*< 25*	*< 2.5*
	1,2,4-Trichlorobenzene	5	µg/L	*< 2.5*	*< 2.5 J*	*< 5.0*	*< 25*	*< 2.5*	*< 25*	*< 25*	*< 2.5*
	1,2,4-Trimethylbenzene	5	µg/L	--	--	--	--	--	--	--	--
	1,2-Dibromo-3-chloropropane	0.04	µg/L	*< 2.5*	*< 2.5 J*	*< 5.0*	*< 25*	*< 2.5*	*< 25*	*< 25*	*< 2.5*
	1,2-Dichlorobenzene	3	µg/L	*< 2.5*	*< 2.5 J*	*< 5.0*	*< 25*	*< 2.5*	*< 25*	*< 25*	*< 2.5*
	1,2-Dichloroethane	0.6	µg/L	*< 0.50*	*< 0.50 J*	*< 1.0*	*< 5.0*	*< 0.50*	*< 5.0*	*< 5.0*	*< 0.50*
	1,2-Dichloroethene	NS	µg/L	--	--	--	--	--	--	--	--
	1,2-Dichloropropane	1	µg/L	*< 1.0*	*< 1.0 J*	*< 2.0*	*< 10*	*< 1.0*	*< 10*	*< 10*	*< 1.0*
	1,3,5-Trimethylbenzene	5	µg/L	--	--	--	--	--	--	--	--
	1,3-Dichlorobenzene	3	µg/L	*< 2.5*	*< 2.5 J*	*< 5.0*	*< 25*	*< 2.5*	*< 25*	*< 25*	*< 2.5*
	1,3-Dichloropropene	0.4	µg/L	--	--	--	--	--	--	--	--
	1,4-Dichlorobenzene	3	µg/L	*< 2.5*	*< 2.5 J*	*< 5.0*	*< 25*	*< 2.5*	*< 25*	*< 25*	*< 2.5*
	1,4-Dioxane	NS	µg/L	*< 250*	*< 250 J*	*< 500*	*< 2,500*	*< 250*	*< 2,500*	*< 2,500*	*< 250*
	2-Butanone (Methyl ethyl ketone)	50	µg/L	*< 5.0*	*< 5.0 J*	*< 10*	*< 50*	*< 5.0*	*< 50*	*< 50*	*< 5.0*
	2-Hexanone	50	µg/L	*< 5.0*	*< 5.0 J*	*< 10*	*< 50*	*< 5.0*	*< 50*	*< 50*	*< 5.0*
	4-Isopropyltoluene	5	µg/L	--	--	--	--	--	--	--	--
	4-Methyl-2-pentanone	NS	µg/L	*< 5.0 J*	*< 5.0 J*	*< 10*	*< 50*	*< 5.0*	*< 50*	*< 50*	*< 5.0 J*
	Acetone	50	µg/L	*< 5.0*	*< 5.0 J*	*< 10*	*< 50*	*< 5.0*	*< 50*	*< 50*	*< 5.0*
	Benzene	**1**	µg/L	*< 0.50*	*< 0.50 J*	*< 1.0*	*< 5.0*	*< 0.50*	*< 5.0*	*< 5.0*	*< 0.50*
	Bromodichloromethane	50	µg/L	*< 0.50*	*< 0.50 J*	*< 1.0*	*< 5.0*	*< 0.50*	*< 5.0*	*< 5.0*	*< 0.50*
	Bromoform	50	µg/L	*< 2.0*	*< 2.0 J*	*< 4.0*	*< 20*	*< 2.0*	*< 20*	*< 20*	*< 2.0*
	Bromomethane	5	µg/L	*< 2.5 J*	*< 2.5 J*	*< 5.0 J*	*< 25 J*	*< 2.5 J*	*< 25 J*	*< 25 J*	*< 2.5 J*
	Carbon disulfide	60	µg/L	*< 5.0*	*< 5.0 J*	*< 10*	*< 50*	*< 5.0*	*< 50*	*< 50*	*< 5.0*
	Carbon tetrachloride	5	µg/L	*< 0.50*	*< 0.50 J*	*< 1.0*	*< 5.0*	*< 0.50*	*< 5.0*	*< 5.0*	*< 0.50*
	Chlorobenzene	5	µg/L	*< 2.5*	*< 2.5 J*	*< 5.0*	*< 25*	*< 2.5*	*< 25*	*< 25*	*< 2.5*
	Chlorobromomethane	5	µg/L	*< 2.5*	*< 2.5 J*	*< 5.0*	*< 25*	*< 2.5*	*< 25*	*< 25*	*< 2.5*
	Chloroethane	5	µg/L	*< 2.5*	*< 2.5 J*	*< 5.0*	*< 25*	*< 2.5*	*< 25*	*< 25*	*< 2.5*
	Chloroform	**7**	µg/L	*< 2.5*	*< 2.5 J*	*< 5.0*	*< 25*	*< 2.5*	*< 25*	*< 25*	1.4
	Chloromethane	5	µg/L	*< 2.5*	*< 2.5 J*	*< 5.0*	*< 25*	*< 2.5*	*< 25*	*< 25*	*< 2.5*
	cis-1,2-Dichloroethene	**5**	µg/L	**100**	**7.5 J**	**55**	**280**	3.2	**40**	**43**	3.1
	cis-1,3-Dichloropropene	0.4	µg/L	*< 0.50*	*< 0.50 J*	*< 1.0*	*< 5.0*	*< 0.50*	*< 5.0*	*< 5.0*	*< 0.50*
	Cyclohexane	NS	µg/L	*< 10*	*< 10 J*	*< 20*	*< 100*	*< 10*	*< 100*	*< 100*	*< 10*
	Dibromochloromethane	50	µg/L	*< 0.50*	*< 0.50 J*	*< 1.0*	*< 5.0*	*< 0.50*	*< 5.0*	*< 5.0*	*< 0.50*
	Dichlorodifluoromethane (Freon 12)	**5**	µg/L	1.3	*< 5.0 J*	*< 10*	*< 50*	*< 5.0*	*< 50*	*< 50 J*	*< 5.0*
	Ethylbenzene	5	µg/L	*< 2.5*	*< 2.5 J*	*< 5.0*	*< 25*	*< 2.5*	*< 25*	*< 25*	*< 2.5*
	Ethylene dibromide	0.0006	µg/L	*< 2.0*	*< 2.0 J*	*< 4.0*	*< 20*	*< 2.0*	*< 20*	*< 20*	*< 2.0*
	Isopropylbenzene (Cumene)	5	µg/L	*< 2.5*	*< 2.5 J*	*< 5.0*	*< 25*	*< 2.5*	*< 25*	*< 25*	*< 2.5*
	m,p-Xylenes	5	µg/L	*< 2.5*	*< 2.5 J*	*< 5.0*	*< 25*	*< 2.5*	*< 25*	*< 25*	*< 2.5*
	Methyl acetate	NS	µg/L	*< 2.0*	*< 2.0 J*	*< 4.0*	*< 20*	*< 2.0*	*< 20*	*< 20*	*< 2.0*
	Methyl tert-butyl ether	10	µg/L	*< 2.5*	*< 2.5 J*	*< 5.0*	*< 25*	*< 2.5*	*< 25*	*< 25*	*< 2.5*
	Methylcyclohexane	NS	µg/L	*< 10*	*< 10 J*	*< 20*	*< 100*	*< 10*	*< 100*	*< 100*	*< 10*
	Methylene chloride	5	µg/L	*< 2.5*	*< 2.5 J*	*< 5.0*	*< 25*	*< 2.5*	*< 25*	*< 25*	*< 2.5*
	Naphthalene	NS	µg/L	--	--	--	--	--	--	--	--
	n-Butylbenzene	5	µg/L	--	--	--	--	--	--	--	--
	n-Propylbenzene	5	µg/L	--	--	--	--	--	--	--	--
	o-Xylene	5	µg/L	*< 2.5*	*< 2.5 J*	*< 5.0*	*< 25*	*< 2.5*	*< 25*	*< 25*	*< 2.5*
	sec-Butylbenzene	5	µg/L	--	--	--	--	--	--	--	--
	Styrene	5	µg/L	*< 2.5*	*< 2.5 J*	*< 5.0*	*< 25*	*< 2.5*	*< 25*	*< 25*	*< 2.5*
	tert-Butylbenzene	5	µg/L	--	--	--	--	--	--	--	--
	Tetrachloroethene	**5**	µg/L	**23**	**34 J**	**24**	**43**	**6.1**	**190**	**200**	1.5
	Toluene	5	µg/L	*< 2.5*	*< 2.5 J*	*< 5.0*	*< 25*	*< 2.5*	*< 25*	*< 25*	*< 2.5*
	trans-1,2-Dichloroethene	5	µg/L	*< 2.5*	*< 2.5 J*	*< 5.0*	*< 25*	*< 2.5*	*< 25*	*< 25*	*< 2.5*
	trans-1,3-Dichloropropene	0.4	µg/L	*< 0.50*	*< 0.50 J*	*< 1.0*	*< 5.0*	*< 0.50*	*< 5.0*	*< 5.0*	*< 0.50*
	Trichloroethene	**5**	µg/L	**140**	**130 J**	**230**	**880**	**62**	**1,200**	**1,500**	3.5
	Trichlorofluoromethane (Freon 11)	5	µg/L	*< 2.5 J*	*< 2.5 J*	*< 5.0*	*< 25*	*< 2.5*	*< 25*	*< 25*	*< 2.5 J*
	Vinyl chloride	**2**	µg/L	0.24 J	*< 1.0 J*	0.26	*< 10*	*< 1.0*	*< 10*	*< 10*	*< 1.0 J*
	Xylene, Total	5	µg/L	--	--	--	--	--	--	--	--
Dissolved Gases	Ethane	NS	µg/L	*< 0.500*	*< 0.500*	2.72	*< 0.500*	*< 0.500*	*< 0.500*	--	*< 0.500*
	Ethene	NS	µg/L	*< 0.500*	*< 0.500*	2.44	*< 0.500*	*< 0.500*	*< 0.500*	--	*< 0.500*
	Methane	NS	µg/L	*< 2.00*	*< 2.00*	5.28	2.46	*< 2.00*	*< 2.00*	--	*< 2.00*
Metals	Aluminum	NS	mg/L	0.00334	1.68	0.111	*< 0.0100*	0.360	*< 0.0141*	*< 0.0192*	0.0120
	Antimony	0.003	mg/L	*< 0.00400*	*< 0.08000*	*< 0.00400*	*< 0.00400*	0.00055	*< 0.00400*	*< 0.00400*	*< 0.00400*
	Arsenic	0.025	mg/L	0.00021	0.00620	0.00098	0.00325	0.00042	0.00035	0.00031	0.00023
	Barium	1	mg/L	0.08302	0.6938	0.2807	0.2666	0.08879	0.1321	0.1324	0.06578
	Beryllium	0.003	mg/L	*< 0.00050*	*< 0.01000*	*< 0.00050*	*< 0.00050*	*< 0.00050*	*< 0.00050*	*< 0.00050*	*< 0.00050*
	Cadmium	0.005	mg/L	*< 0.00020*	*< 0.00400*	*< 0.00020*	*< 0.00020*	*< 0.00020*	*< 0.00020*	*< 0.00020*	*< 0.00020*
	Calcium	NS	mg/L	126	743 J	141	140	115	131	131	84.3
	Chromium	0.05	mg/L	*< 0.00100*	0.01064	0.00524	0.00028	0.00079	0.00032	0.00026	*< 0.00100*
	Cobalt	NS	mg/L	*< 0.00050*	0.00883	0.00110	0.00086	0.00055	*< 0.00050*	*< 0.00050*	*< 0.00050*
	Copper	0.2	mg/L	0.00082	0.01957	0.00241	*< 0.00100*	0.00242	0.00070	0.00075	0.00110
	Iron	NS	mg/L	*< 0.0794*	6.44	12.5	2.23	9.39	*< 0.0500*	*< 0.0777*	*< 0.541*
	Lead	0.025	mg/L	*< 0.00100*	0.00903	0.00037	*< 0.00100*	*< 0.00100*	*< 0.00100*	*< 0.00100*	*< 0.00100*
	Magnesium	**35**	mg/L	25.8	**164**	**43.2**	**39.7**	21.8	**35.4**	**35.4**	18.2
	Manganese	NS	mg/L	*< 0.00100*	2.174	0.1906	0.07304	0.1633	0.02836	0.03100	*< 0.01048*
	Mercury	0.0007	mg/L	*< 0.00020*	0.00015	0.00014	0.00009	*< 0.00020*	0.00010	0.00010	*< 0.00020*
	Nickel	0.1	mg/L	*< 0.00200*	0.01671	0.00617	0.00101	0.00253	0.00172	0.00239	*< 0.00200*
	Potassium	NS	mg/L	2.53	12.3	7.15	6.30	3.81	4.67	4.71	5.40
	Selenium	0.01	mg/L	*< 0.00500*	*< 0.100*	*< 0.00500*	*< 0.00500*	*< 0.00500*	*< 0.00500*	*< 0.00500*	*< 0.00500*
	Silver	0.05	mg/L	*< 0.00040*	*< 0.00800*	*< 0.00040*	*< 0.00040*	*< 0.00040*	*< 0.00040*	*< 0.00040*	*< 0.00040*
	Sodium	**20**	mg/L	**156**	**4,130**	**381**	**476**	**278**	**372**	**374**	**122**
	Thallium	0.0005	mg/L	*< 0.00100*	*< 0.02000*	*< 0.00100*	*< 0.00100*	0.00014	*< 0.00100*	0.00019	*< 0.00100*
	Vanadium	NS	mg/L	*< 0.00500*	*< 0.1000*	*< 0.00500*	*< 0.00500*	*< 0.00500*	*< 0.00500*	*< 0.00500*	*< 0.00500*
	Zinc	2	mg/L	*< 0.01000*	*< 0.2000*	*< 0.01000*	*< 0.01000*	*< 0.01000*	*< 0.01000*	0.00406	*< 0.01000*
Cations	Calcium	NS	mg/L	127	363	133	139	103	133	--	94.7
	Magnesium	**35**	mg/L	25.3	**82.1**	**40.4**	**38.3**	18.6	34.1	--	19.8
	Potassium	NS	mg/L	2.46	10.9	6.52	6.05	3.62	4.42	--	5.54
	Sodium	**20**	mg/L	**171**	**3,990**	**396**	**462**	**300**	**396**	--	**145**
Anions	Alkalinity, Total as CaCO3	NS	mg/L	311	1,020	299	372	288	357	--	322
	Chloride	**250**	mg/L	**292**	**7,190**	**810**	**917**	**504**	**678**	--	150
	Sulfate	**250**	mg/L	31.1	173	37.7	63.5	35.0	49.9	--	32.0
	Nitrate (NO3)	**10**	mg/L	5.0	**16**	0.41	0.032 J	3.1	2.9	--	3.4
General Chemistry	Nitrogen oxide anion (NO2-)	1	mg/L	0.021 J	*< 0.050*	0.024 J	0.018 J	0.028 J	*< 0.050*	--	0.015 J
	Organic Carbon, Total	NS	mg/L	1.32	2.41	1.76	0.791	0.941	0.848	--	1.35

Notes:

< = Compound not detected at concentrations above the laboratory reporting detection limit.
The laboratory reporting detection limit is shown.
J = The Target analyte concentration is below the quantitation limit, but above the Method Detection Limit.
-- = Not analyzed
NS = No Standard
N = Normal Environmental Sample
FD = Field Duplicate Sample
µg/L = micrograms per liter
mg/L = milligrams per liter

Table 2
Groundwater Exceedance Data Summary Table
G.W. Lisk Clifton Springs Facility
Clifton Springs, New York

Analyte		NY TOGS 1.1.1 DW CLASS GA	Location ID	G-MW-06S2	G-MW-07D	G-MW-07S	G-MW-08D	G-MW-09D	G-MW-09D	G-MW-09S	G-MW-10D
			Sample Date	9/1/2022	9/1/2022	9/1/2022	9/1/2022	8/31/2022	8/31/2022	8/31/2022	9/1/2022
			Sample Type	N	N	N	N	N	FD	N	N
			Unit								
VOCs	1,1,1-Trichloroethane	**5**	µg/L	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
	1,1,2,2-Tetrachloroethane	5	µg/L	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	**5**	µg/L	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
	1,1,2-Trichloroethane	1	µg/L	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
	1,1-Dichloroethane	**5**	µg/L	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
	1,1-Dichloroethene	**5**	µg/L	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
	1,2,3-Trichlorobenzene	5	µg/L	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
	1,2,4-Trichlorobenzene	5	µg/L	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
	1,2,4-Trimethylbenzene	5	µg/L	--	--	--	--	--	--	--	--
	1,2-Dibromo-3-chloropropane	0.04	µg/L	< 2.5 J	< 2.5 J	< 2.5 J	< 2.5 J	< 2.5	< 2.5	< 2.5	< 2.5 J
	1,2-Dichlorobenzene	3	µg/L	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
	1,2-Dichloroethane	0.6	µg/L	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
	1,2-Dichloroethene	NS	µg/L	--	--	--	--	--	--	--	--
	1,2-Dichloropropane	1	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
	1,3,5-Trimethylbenzene	5	µg/L	--	--	--	--	--	--	--	--
	1,3-Dichlorobenzene	3	µg/L	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
	1,3-Dichloropropene	0.4	µg/L	--	--	--	--	--	--	--	--
	1,4-Dichlorobenzene	3	µg/L	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
	1,4-Dioxane	NS	µg/L	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250
	2-Butanone (Methyl ethyl ketone)	50	µg/L	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
	2-Hexanone	50	µg/L	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
	4-Isopropyltoluene	5	µg/L	--	--	--	--	--	--	--	--
	4-Methyl-2-pentanone	NS	µg/L	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
	Acetone	50	µg/L	< 5.0	< 5.0	1.8	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
	Benzene	**1**	µg/L	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
	Bromodichloromethane	50	µg/L	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	1.0
	Bromoform	50	µg/L	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
	Bromomethane	5	µg/L	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5 J	< 2.5 J	< 2.5 J	< 2.5
	Carbon disulfide	60	µg/L	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
	Carbon tetrachloride	5	µg/L	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
	Chlorobenzene	5	µg/L	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
	Chlorobromomethane	5	µg/L	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
	Chloroethane	5	µg/L	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
	Chloroform	**7**	µg/L	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	**9.9**
	Chloromethane	5	µg/L	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
	cis-1,2-Dichloroethene	**5**	µg/L	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
	cis-1,3-Dichloropropene	0.4	µg/L	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
	Cyclohexane	NS	µg/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
	Dibromochloromethane	50	µg/L	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
	Dichlorodifluoromethane (Freon 12)	**5**	µg/L	< 5.0	< 5.0	< 5.0	< 5.0	**17**	**18**	1.3	< 5.0
	Ethylbenzene	5	µg/L	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
	Ethylene dibromide	0.0006	µg/L	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
	Isopropylbenzene (Cumene)	5	µg/L	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
	m,p-Xylenes	5	µg/L	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
	Methyl acetate	NS	µg/L	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
	Methyl tert-butyl ether	10	µg/L	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
	Methylcyclohexane	NS	µg/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
	Methylene chloride	5	µg/L	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
	Naphthalene	NS	µg/L	--	--	--	--	--	--	--	--
	n-Butylbenzene	5	µg/L	--	--	--	--	--	--	--	--
	n-Propylbenzene	5	µg/L	--	--	--	--	--	--	--	--
	o-Xylene	5	µg/L	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
	sec-Butylbenzene	5	µg/L	--	--	--	--	--	--	--	--
	Styrene	5	µg/L	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
	tert-Butylbenzene	5	µg/L	--	--	--	--	--	--	--	--
	Tetrachloroethene	**5**	µg/L	< 0.50	< 0.50	< 0.50	< 0.50	0.78	0.85	0.36	< 0.50
	Toluene	5	µg/L	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
	trans-1,2-Dichloroethene	5	µg/L	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
	trans-1,3-Dichloropropene	0.4	µg/L	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
	Trichloroethene	**5**	µg/L	< 0.50	0.35	< 0.50	**18**	**11**	**11**	**6.6**	< 0.50
	Trichlorofluoromethane (Freon 11)	5	µg/L	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
	Vinyl chloride	**2**	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
	Xylene, Total	5	µg/L	--	--	--	--	--	--	--	--
Dissolved Gases	Ethane	NS	µg/L	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	--	< 0.500	< 0.500
	Ethene	NS	µg/L	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	--	< 0.500	< 0.500
	Methane	NS	µg/L	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00	--	< 2.00	< 2.00
Metals	Aluminum	NS	mg/L	< 0.0100	< 0.0250	< 0.200	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
	Antimony	0.003	mg/L	< 0.00400	< 0.00400	< 0.08000	< 0.00400	< 0.00400	< 0.00400	< 0.00400	< 0.00400
	Arsenic	0.025	mg/L	0.00027	0.00026	< 0.01000	0.00030	0.00050	0.00052	0.00048	0.00017
	Barium	1	mg/L	0.01434	0.06318	0.6205	0.1692	0.07389	0.07568	0.07932	0.02376
	Beryllium	0.003	mg/L	< 0.00050	< 0.00050	< 0.01000	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
	Cadmium	0.005	mg/L	< 0.00020	< 0.00020	< 0.00400	< 0.00020	0.00007	0.00007	0.00006	< 0.00020
	Calcium	NS	mg/L	111 J	126 J	448 J	146 J	106	106	105	76.3 J
	Chromium	0.05	mg/L	0.00172	0.00354	< 0.02000	0.00076	0.00036	0.00038	0.00064	0.00032
	Cobalt	NS	mg/L	< 0.00050	0.00022	< 0.01000	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
	Copper	0.2	mg/L	0.00078	0.00535	0.00797	0.00101	0.00198	0.00157	0.00162	0.00056
	Iron	NS	mg/L	< 0.0500	1.86	< 1.00	< 0.0519	< 0.0500	< 0.0535	< 0.0500	< 0.0500
	Lead	0.025	mg/L	< 0.00100	< 0.00100	< 0.02000	< 0.00100	< 0.00100	< 0.00100	< 0.00100	< 0.00100
	Magnesium	**35**	mg/L	21.7	19.4	**123**	29.0	22.5	22.5	22.6	16.8
	Manganese	NS	mg/L	< 0.00100	0.01948	< 0.02000	0.00082	0.00158	0.00160	0.01701	0.00113
	Mercury	0.0007	mg/L	0.00009	< 0.00020	< 0.00020	0.00009	0.00011	0.00010	0.00013	< 0.00020
	Nickel	0.1	mg/L	< 0.00200	0.00158	< 0.04000	0.00147	0.00179	0.00180	0.00292	0.00093
	Potassium	NS	mg/L	1.04	2.28	13.0	4.33	4.68	4.81	4.41	4.25
	Selenium	0.01	mg/L	< 0.00500	< 0.00500	< 0.100	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
	Silver	0.05	mg/L	< 0.00040	< 0.00040	< 0.00800	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040
	Sodium	**20**	mg/L	10.2	**73.0**	**3,880**	**534**	**250**	**250**	**252**	**91.6**
	Thallium	0.0005	mg/L	< 0.00100	< 0.00100	< 0.02000	< 0.00100	< 0.00100	< 0.00100	< 0.00100	< 0.00100
	Vanadium	NS	mg/L	< 0.00500	< 0.00500	< 0.1000	< 0.00500	< 0.00500	< 0.00500	< 0.00500	< 0.00500
	Zinc	2	mg/L	0.1084	< 0.01000	0.2464	< 0.01000	< 0.01000	< 0.01000	< 0.01000	< 0.01000
Cations	Calcium	NS	mg/L	107	123	414	133	105	--	103	72.5
	Magnesium	**35**	mg/L	21.6	19.2	**120**	28.4	21.6	--	22.0	16.2
	Potassium	NS	mg/L	1.03	2.13	13.2	4.31	4.52	--	4.02	3.97
	Sodium	**20**	mg/L	9.62	**70.3**	**3,700**	**550**	**270**	--	**268**	**86.7**
Anions	Alkalinity, Total as CaCO3	NS	mg/L	281	302	648	374	324	--	318	264
	Chloride	**250**	mg/L	22.9	144	**7,410**	**903**	**441**	--	**427**	110
	Sulfate	**250**	mg/L	24.1	22.7	207	45.7	28.8	--	28.5	25.7
	Nitrate (NO3)	**10**	mg/L	**11**	6.1	**11**	3.0	2.1	--	2.2	2.7
General Chemistry	Nitrogen oxide anion (NO2-)	1	mg/L	< 0.050	< 0.050	< 0.050	< 0.050	0.017 J	--	0.023 J	< 0.050
	Organic Carbon, Total	NS	mg/L	1.14	1.41	2.98	1.14	1.46	--	1.54	1.40

Notes:
< = Compound not detected at concentrations above the laboratory reporting detection limit.
The laboratory reporting detection limit is shown.
J = The Target analyte concentration is below the quantitation limit, but above the Method Detection Limit.
-- = Not analyzed
NS = No Standard
N = Normal Environmental Sample
FD = Field Duplicate Sample
µg/L = micrograms per liter
mg/L = milligrams per liter

Table 2
Groundwater Exceedance Data Summary Table
G.W. Lisk Clifton Springs Facility
Clifton Springs, New York

Analyte		NY TOGS 1.1.1 DW CLASS GA	Location ID	G-MW-11D	G-MW-12D	G-MW-12S	G-TW-17	G-TW-20	G-TW-21
			Sample Date	8/31/2022	8/31/2022	9/1/2022	9/1/2022	9/1/2022	8/31/2022
			Sample Type	N	N	N	N	N	N
			Unit						
VOCs	1,1,1-Trichloroethane	**5**	µg/L	< 2.5	< 2.5	< 2.5 J	< 2.5	**44**	**6.5**
VOCs	1,1,2,2-Tetrachloroethane	5	µg/L	< 0.50	< 0.50	< 0.50 J	< 0.50	< 12	< 0.50
VOCs	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	**5**	µg/L	< 2.5	< 2.5	< 2.5 J	< 2.5	< 62	**7.8**
VOCs	1,1,2-Trichloroethane	1	µg/L	< 1.5	< 1.5	< 1.5 J	< 1.5	< 38	< 1.5
VOCs	1,1-Dichloroethane	**5**	µg/L	< 2.5	< 2.5	< 2.5 J	< 2.5	**240**	**12**
VOCs	1,1-Dichloroethene	**5**	µg/L	< 0.50	< 0.50	< 0.50 J	< 0.50	**74**	**5.9**
VOCs	1,2,3-Trichlorobenzene	5	µg/L	< 2.5	< 2.5	< 2.5 J	< 2.5	< 62	< 2.5
VOCs	1,2,4-Trichlorobenzene	5	µg/L	< 2.5	< 2.5	< 2.5 J	< 2.5	< 62	< 2.5
VOCs	1,2,4-Trimethylbenzene	5	µg/L	--	--	--	--	--	--
VOCs	1,2-Dibromo-3-chloropropane	0.04	µg/L	< 2.5	< 2.5	< 2.5 J	< 2.5	< 62 J	< 2.5
VOCs	1,2-Dichlorobenzene	3	µg/L	< 2.5	< 2.5	< 2.5 J	< 2.5	< 62	< 2.5
VOCs	1,2-Dichloroethane	0.6	µg/L	< 0.50	< 0.50	< 0.50 J	< 0.50	< 12	< 0.50
VOCs	1,2-Dichloroethene	NS	µg/L	--	--	--	--	--	--
VOCs	1,2-Dichloropropane	1	µg/L	< 1.0	< 1.0	< 1.0 J	< 1.0	< 25	< 1.0
VOCs	1,3,5-Trimethylbenzene	5	µg/L	--	--	--	--	--	--
VOCs	1,3-Dichlorobenzene	3	µg/L	< 2.5	< 2.5	< 2.5 J	< 2.5	< 62	< 2.5
VOCs	1,3-Dichloropropene	0.4	µg/L	--	--	--	--	--	--
VOCs	1,4-Dichlorobenzene	3	µg/L	< 2.5	< 2.5	< 2.5 J	< 2.5	< 62	< 2.5
VOCs	1,4-Dioxane	NS	µg/L	< 250	< 250	< 250 J	< 250	< 6,200	< 250
VOCs	2-Butanone (Methyl ethyl ketone)	50	µg/L	< 5.0	< 5.0	< 5.0 J	< 5.0	< 120	< 5.0
VOCs	2-Hexanone	50	µg/L	< 5.0	< 5.0	< 5.0 J	< 5.0	< 120	< 5.0
VOCs	4-Isopropyltoluene	5	µg/L	--	--	--	--	--	--
VOCs	4-Methyl-2-pentanone	NS	µg/L	< 5.0	< 5.0	< 5.0 J	< 5.0	< 120	< 5.0
VOCs	Acetone	50	µg/L	< 5.0	< 5.0	2.1 J	3.9	< 120	1.6
VOCs	Benzene	**1**	µg/L	< 0.50	< 0.50	< 0.50 J	< 0.50	< 12	0.49
VOCs	Bromodichloromethane	50	µg/L	< 0.50	< 0.50	< 0.50 J	< 0.50	< 12	< 0.50
VOCs	Bromoform	50	µg/L	< 2.0	< 2.0	< 2.0 J	< 2.0	< 50	< 2.0
VOCs	Bromomethane	5	µg/L	< 2.5 J	< 2.5 J	< 2.5 J	< 2.5 J	< 62	< 2.5 J
VOCs	Carbon disulfide	60	µg/L	< 5.0	< 5.0	< 5.0 J	< 5.0	< 120	< 5.0
VOCs	Carbon tetrachloride	5	µg/L	< 0.50	< 0.50	< 0.50 J	< 0.50	< 12	< 0.50
VOCs	Chlorobenzene	5	µg/L	< 2.5	< 2.5	< 2.5 J	< 2.5	< 62	< 2.5
VOCs	Chlorobromomethane	5	µg/L	< 2.5	< 2.5	< 2.5 J	< 2.5	< 62	< 2.5
VOCs	Chloroethane	5	µg/L	< 2.5	< 2.5	< 2.5 J	< 2.5	< 62	< 2.5
VOCs	Chloroform	**7**	µg/L	< 2.5	< 2.5	< 2.5 J	< 2.5	< 62	0.73
VOCs	Chloromethane	5	µg/L	< 2.5	< 2.5	< 2.5 J	< 2.5	< 62	< 2.5
VOCs	cis-1,2-Dichloroethene	**5**	µg/L	< 2.5	< 2.5	< 2.5 J	< 2.5	**380**	**19**
VOCs	cis-1,3-Dichloropropene	0.4	µg/L	< 0.50	< 0.50	< 0.50 J	< 0.50	< 12	< 0.50
VOCs	Cyclohexane	NS	µg/L	< 10	< 10	< 10 J	< 10	< 250	< 10
VOCs	Dibromochloromethane	50	µg/L	< 0.50	< 0.50	< 0.50 J	< 0.50	< 12	< 0.50
VOCs	Dichlorodifluoromethane (Freon 12)	**5**	µg/L	< 5.0	< 5.0	< 5.0 J	< 5.0	< 120	< 5.0 J
VOCs	Ethylbenzene	5	µg/L	< 2.5	< 2.5	< 2.5 J	< 2.5	< 62	< 2.5
VOCs	Ethylene dibromide	0.0006	µg/L	< 2.0	< 2.0	< 2.0 J	< 2.0	< 50	< 2.0
VOCs	Isopropylbenzene (Cumene)	5	µg/L	< 2.5	< 2.5	< 2.5 J	< 2.5	< 62	< 2.5
VOCs	m,p-Xylenes	5	µg/L	< 2.5	< 2.5	< 2.5 J	< 2.5	< 62	< 2.5
VOCs	Methyl acetate	NS	µg/L	< 2.0	< 2.0	< 2.0 J	< 2.0	< 50	< 2.0
VOCs	Methyl tert-butyl ether	10	µg/L	< 2.5	< 2.5	< 2.5 J	< 2.5	< 62	1.0
VOCs	Methylcyclohexane	NS	µg/L	< 10	< 10	< 10 J	< 10	< 250	< 10
VOCs	Methylene chloride	5	µg/L	< 2.5	< 2.5	< 2.5 J	< 2.5	< 62	< 2.5
VOCs	Naphthalene	NS	µg/L	--	--	--	--	--	--
VOCs	n-Butylbenzene	5	µg/L	--	--	--	--	--	--
VOCs	n-Propylbenzene	5	µg/L	--	--	--	--	--	--
VOCs	o-Xylene	5	µg/L	< 2.5	< 2.5	< 2.5 J	< 2.5	< 62	< 2.5
VOCs	sec-Butylbenzene	5	µg/L	--	--	--	--	--	--
VOCs	Styrene	5	µg/L	< 2.5	< 2.5	< 2.5 J	< 2.5	< 62	< 2.5
VOCs	tert-Butylbenzene	5	µg/L	--	--	--	--	--	--
VOCs	Tetrachloroethene	**5**	µg/L	< 0.50	< 0.50	< 0.50 J	0.18	**150**	**40**
VOCs	Toluene	5	µg/L	< 2.5	< 2.5	< 2.5 J	< 2.5	< 62	< 2.5
VOCs	trans-1,2-Dichloroethene	5	µg/L	< 2.5	< 2.5	< 2.5 J	< 2.5	< 62	< 2.5
VOCs	trans-1,3-Dichloropropene	0.4	µg/L	< 0.50	< 0.50	< 0.50 J	< 0.50	< 12	< 0.50
VOCs	Trichloroethene	**5**	µg/L	< 0.50	< 0.50	< 0.50 J	0.54	**2,200**	**150**
VOCs	Trichlorofluoromethane (Freon 11)	5	µg/L	< 2.5	< 2.5	< 2.5 J	< 2.5	< 62	< 2.5
VOCs	Vinyl chloride	**2**	µg/L	< 1.0	< 1.0	< 1.0 J	< 1.0	**2.3**	0.28
VOCs	Xylene, Total	5	µg/L	--	--	--	--	--	--
Dissolved Gases	Ethane	NS	µg/L	< 0.500	< 0.500	--	--	--	--
Dissolved Gases	Ethene	NS	µg/L	< 0.500	< 0.500	--	--	--	--
Dissolved Gases	Methane	NS	µg/L	< 2.00	6.17	--	--	--	--
Metals	Aluminum	NS	mg/L	< 0.0100	< 0.0359	--	--	--	--
Metals	Antimony	0.003	mg/L	0.00049	0.00095	--	--	--	--
Metals	Arsenic	0.025	mg/L	0.00025	0.00031	--	--	--	--
Metals	Barium	1	mg/L	0.1084	0.07206	--	--	--	--
Metals	Beryllium	0.003	mg/L	< 0.00050	< 0.00050	--	--	--	--
Metals	Cadmium	0.005	mg/L	< 0.00020	< 0.00020	--	--	--	--
Metals	Calcium	NS	mg/L	138	148	--	--	--	--
Metals	Chromium	0.05	mg/L	0.00021	0.00034	--	--	--	--
Metals	Cobalt	NS	mg/L	0.00031	0.00318	--	--	--	--
Metals	Copper	0.2	mg/L	0.00068	0.00048	--	--	--	--
Metals	Iron	NS	mg/L	< 0.0500	0.548	--	--	--	--
Metals	Lead	0.025	mg/L	< 0.00100	0.00036	--	--	--	--
Metals	Magnesium	**35**	mg/L	**39.4**	**38.1**	--	--	--	--
Metals	Manganese	NS	mg/L	0.00489	0.03039	--	--	--	--
Metals	Mercury	0.0007	mg/L	0.00010	0.00009	--	--	--	--
Metals	Nickel	0.1	mg/L	0.00373	0.01634	--	--	--	--
Metals	Potassium	NS	mg/L	2.68	3.09	--	--	--	--
Metals	Selenium	0.01	mg/L	< 0.00500	< 0.00500	--	--	--	--
Metals	Silver	0.05	mg/L	< 0.00040	< 0.00040	--	--	--	--
Metals	Sodium	**20**	mg/L	**80.7**	**71.1**	--	--	--	--
Metals	Thallium	0.0005	mg/L	0.00026	0.00026	--	--	--	--
Metals	Vanadium	NS	mg/L	< 0.00500	< 0.00500	--	--	--	--
Metals	Zinc	2	mg/L	< 0.01000	< 0.01000	--	--	--	--
Cations	Calcium	NS	mg/L	141	137	--	--	--	--
Cations	Magnesium	**35**	mg/L	**40.7**	**37.1**	--	--	--	--
Cations	Potassium	NS	mg/L	2.75	3.05	--	--	--	--
Cations	Sodium	**20**	mg/L	**88.7**	**75.6**	--	--	--	--
Anions	Alkalinity, Total as CaCO3	NS	mg/L	393	338	--	--	--	--
Anions	Chloride	**250**	mg/L	200	163	--	--	--	--
Anions	Sulfate	**250**	mg/L	57.0	144	--	--	--	--
Anions	Nitrate (NO3)	**10**	mg/L	3.4	0.027 J	--	--	--	--
General Chemistry	Nitrogen oxide anion (NO2-)	1	mg/L	< 0.050	0.017 J	--	--	--	--
General Chemistry	Organic Carbon, Total	NS	mg/L	1.49	1.64	--	--	--	--

Notes:

< = Compound not detected at concentrations above the laboratory reporting detection limit.
The laboratory reporting detection limit is shown.
J = The Target analyte concentration is below the quantitation limit, but above the Method Detection Limit.
-- = Not analyzed
NS = No Standard
N = Normal Environmental Sample
FD = Field Duplicate Sample
µg/L = micrograms per liter
mg/L = milligrams per liter

Table 3
Pilot Study Groundwater Sampling Plan
GW Lisk Clifton Springs Facility
Clifton Springs, NY

ERM

Well ID*	Baseline**	30 days	90 days	180 days	270 days	365 days
G-IW-01	X	X	X	X	X	X
G-IW-02	X	X	X	X	X	X
G-IW-03	X	X	X	X	X	X
G-IW-04	X	X	X	X	X	X
G-IW-05	X	X	X	X	X	X
G-MW-13	X				X	X
G-MW-14	X	X	X	X	X	X
G-MW-15	X			X	X	X
G-MW-16	X	X	X	X	X	X
G-MW-17	X	X	X	X	X	X
G-MW-18	X	X	X	X	X	X
G-MW-19	X	X	X	X	X	X
G-MW-20	X	X	X	X	X	X
G-MW-01S	+		X	X	X	X
G-MW-01D	+		X	X	X	X
G-MW-02S	+			X	X	X
G-MW-02D	+			X	X	X
G-MW-03S	+		X	X	X	X
G-MW-03D	+		X	X	X	X
G-MW-04S	+					X
G-MW-04D	+					X
G-MW-07S	+					
G-MW-07D	+					
G-MW-09S	+				X	X
G-MW-09D	+				X	X
G-TW-17	+	X	X	X	X	X
G-TW-20	+	X	X	X	X	X
G-TW-21	+	X	X	X	X	X

Notes:

* All samples will be analyzed for volatile organic compounds (VOCs) by EPA Method 8260 and total organic cargon (TOC) by EPA Method 9060

** Sample taken at the time of injection

+ Well sampled during Supplemental RI sampling event in March, 2023

IW = Injection Well

MW = Monitoring Well

TW = Temporary Well

Table 4
Estimated Project Schedule for Pilot Injection Study
G.W. Lisk Facility - Clifton Springs, New York
NYSDEC BCP Site Number C835026

Milestone	**Date ***
Submit Draft Pilot Work Plan to DEC/DOH	23- February-2023
Submit Revised Draft Work Plan to DEC/DOH	30 March 2023
Submit Final Pilot Work Plan to DEC/DOH; initiate placement of the Final Pilot Work Plan in the Document Repository	28-April-2023
Initiate Pilot Site Work (well installation)	22-May-2023
Complete Baseline Sampling	21-June-2023
EOS Pro Injection	26-30-June-2023
30 Day Sampling	1-2-August 2023
BAC-9 Injection	3-August 2023
90 Day Sampling	28-29-September 2023
180 Day Sampling	1-2-January 2024
270 Day Sampling	26-28-March 2024
365 Day Sampling	25-28-June 2024
Submit Draft Pilot Study Report to DEC/DOH	23-September 2024

* The schedule for future dates is estimated and is subject to change based on review times, contractor availability, site conditions encountered, and other conditions that may be beyond the control of G.W. Lisk.

APPENDIX A HEALTH AND SAFETY PLAN

This Level 2 health and safety plan (HASP) provides health and safety guidelines for project work meeting one or more of the following criteria:

- Some likelihood of physical and/or chemical hazard exposure (e.g., sampling, use of equipment and tools);
- Number of job tasks is five or greater;
- Use of subcontractors;
- Project work covered by the Level 2 HASP includes, but is not limited to:
  - Activities that could have an adverse effect on the environment (e.g., use of bulk liquid storage tanks, generators, etc.);
  - Use of mobile construction equipment
  - Confined space entry;
  - Construction, including operation of construction-related equipment (aerial lifts, forklifts, scaffolds, rigging/lifting equipment, etc.);
  - Decommissioning, decontamination, and demolition (DDD) operations;
  - Excavations, trenching, drilling, or other ground disturbance activities (i.e., activities requiring subsurface clearance [SSC] operations);
  - Exposure to hazardous energy (energy control operations, overhead power line exposure);
  - Hot work (e.g., welding, flame cutting, or other spark-producing activities);
  - Work at heights in excess of 4 feet (1.2 meters);
  - Work on, near (within 1m [3ft.] of water and > 15cm [6 inches] deep), over, or under water, including any boating operations, diving, or off-shore platform work; and
  - Work on an active or inactive mining site, outside of administration buildings.

All project work that requires a Level 2 HASP is required to have a Field Safety Officer (FSO) assigned and on site.

The HASP should be developed with input from the project team (including our subcontractors) and reviewed with all ERM project team members. A signed copy of the HASP must be maintained at the project site during work and must be archived in the project files.

H&S Team review is required for the Level 2 HASP. You can e-mail completed plans requiring review to the **ERM North America HASP Review Team** (Canada project reviews can be sent to the **ERM Canada HASP Review Team**). This HASP must be reviewed by the Project Manager and reviewed/approved by the Partner in Charge (PIC) and updated as warranted to address changes in scope, hazards present, project personnel, etc. At a minimum, HASPs must be reviewed annually or if the scope of work changes. Updated HASPs should also be sent to the H&S Team for review and PIC for approval.

Administrative Information ***This document is valid for a maximum time period of one year after completion. The document must be reviewed if the scope of work or nature of site hazards changes and must be updated as warranted.***	
Project Name: G.W. Lisk	Site Name & Location: G.W. Lisk Facility, 2 South Street, Clifton Springs, New York
Client Contact and Phone: Allen Hawker (315) 462-4271	Client: G.W. Lisk
Health & Safety Plan Date: 6/2/2022	GMS Project #: 0516919
Partner in Charge: Ernest Rossano	Revision Number and Date: Rev. 0, 6/2/2022
Project Manager: Tim Daniluk	Field Work Start Date: 7/1/2022
Field Team Leader: Tim Daniluk, Katherine Popyack, Kevin Warner, Olivia Botting	Anticipated Field Work End Date: 8/1/2022
Field Safety Officer: ☒ Standard ☒ High Risk Tim Daniluk, Katherine Popyack, Kevin Warner, Olivia Botting	Short Service Employees (SSE): Alexis Harford
Experienced Person: ☐ N/A ☒ SSC ☐ Aquatic ☐ Mining Tim Daniluk, Katherine Popyack, Kevin Warner	SSE Mentor(s): Tim Daniluk, Katherine Popyack, Kevin Warner, Olivia Botting
Additional ERM personnel on site: Cal Payne, Jason Reynolds, Jonathan Mills, Dikshya Khanal, Alexis Harford	
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) or using mobile construction equipment (excluding drilling equipment).***	
SME Review Required: ☐ Yes ☒ No SME Type: Click here to enter text. SME Name: Click here to enter text. Date of SME Review: Click here to enter a date.	Signature File:
H&S Team Review	
Reynolds Reviewer Name: Millard Griffin Review Date: 6/3/2022	Signature File: Millard P Griffin Jr.
Field Safety Officer Waiver	
☐ Waiver of Standard FSO is being requested in accordance with Section 4.10 of NAM-1110-PR1 (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: Click here to enter text.	
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:

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 G.W. Lisk Company, Inc. (GWL) Facility is located at 2 South Street in the Village of Clifton Springs, New York. Previous site characterization work at the Site identified VOCs, including trichloroethene (TCE), 1,1-Dichloroethene (DCE), 1,1,1-Trichloroethane (TCA), and Tetrachloroethene (PCE) in soil vapor in one of more locations; TCE was also detected in indoor air. This HASP has been prepared to assist in protecting on-site personnel from potential exposure to contaminated media. Facility access is controlled by obtaining access badged at reception.

Project Background and Scope of Work

Include list of tasks to be completed by ERM personnel during this project, and a separate list of tasks to be completed by any subcontractors at the site. A site-specific Job Hazard Analysis (JHA; ERM-1115-FM1) must be completed for each task to be performed.

A JHA template and reference/example JHAs for more common tasks can be found at: North America H&S Page - JHAs.

Based on the results of the Remedial Investigation (RI), a Pre Design Investigation (PDI) scope of work has been developed to delineate volatile organic compounds (VOCs) in soil and groundwater at select locations, delineate semi-volatile organic compounds (SVOCs) in surface soil at select locations, analyze degradation of trichloroethylene (TCE) and daughter products in groundwater for further support of Monitored Natural Attenuation (MNA), and produce data of sufficient quantity and quality to support the development of a final remedy. Soil borings, installation of temporary wells, well abandonment, and groundwater sampling will happen for this work.

ERM Task 1: Oversight sub-surface clearance for proposed soil boring locations.	☒ JHA Attached?
ERM Task 2: Oversight of ten soil borings and soil sampling.	☒ JHA Attached?
ERM Task 3: Oversight of five temporary well installations.	☒ JHA Attached?
ERM Task 4: Oversight of well abandonment	☒ JHA Attached?
ERM Task 5: Groundwater sampling event.	☒ JHA Attached?
ERM Task 6: Click here to enter text.	☐ JHA Attached?
Add Subcontractor Scope of Work here.	
Subcontractor Task 1: Sub-surface clearance activities.	☒ JHA Reviewed?
Subcontractor Task 2: Installation of soil borings and temporary wells.	☒ JHA Reviewed?
Subcontractor Task 3: Well abandonment.	☒ JHA Reviewed?
Subcontractor Task 4: Click here to enter text.	☐ JHA Reviewed?

Subcontractor(s) to be used:	Prescreened under **Subcontractor Use Basic Standards** Policy?
1. Alpha Analytical	☒ Yes ☐ No ☐ Waiver requested/approved?
2. GPRS	☒ Yes ☐ No ☐ Waiver requested/approved?
3. Parratt Wolff	☒ Yes ☐ No ☐ Waiver requested/approved?

Is a Bridging Document (***NAM-1117-FM1***), as defined in **NAM-1110-PR1**, needed for this project?	☐ Yes ☒ No
If a Bridging Document is required, has it been attached to this HASP?	☐ Yes ☒ No

Site/Project General Information

Site Type (check all applicable boxes)

☒ Industrial	☒ Hazardous waste release (Hazwoper)
☐ Residential	☐ Remote site or inactive facility*
☐ Unsecured	☐ Other (specify): Click here to enter text.
☐ Aquatic (on, near, over or under water)	☐ Other (specify): Click here to enter text.

* ERM Form **NAM-1501-FM2** (*Undeveloped, Remote, or Inactive Sites*) must be completed and attached to this document.

Management of Change

The following process will be followed in the event that any changes are identified with respect to schedule, equipment type, equipment installation/configuration, personnel and/or site conditions. The process, as stated below, can be accepted as written below 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 and ERM Field Team Leader (FTL), after reaching agreement with any impacted subcontractor(s), will discuss options with the PIC.
4. The PIC will determine an appropriate course of action (may need to discuss options with Subject Matter Experts).
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 and ERM FTL.
7. The ERM FSO and ERM FTL 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 below or revised depending on project needs.

1. The ERM FSO and ERM FTL 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 and ERM FTL, 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 FTL can authorize work to commence.
4. Once work commences, the ERM FSO and FTL shall 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 and FTL will document any opportunities for improvement or other lessons learned within the ERM CAPA system.

Societal/Social Concerns

Consider challenges for project team members associated with the societal biases relevant to where the project is being performed (e.g., gender, racial, sexual orientation, religious, etc.). When such biases are identified, describe mitigation steps that have been discussed with and agreed to by all project team members. Describe mitigations, if applicable, below.

Field team members should be aware of societal biases and make everyone feel welcomed and part of the team. Support team members and report any incidents to PM/PIC.

Accessibility Concerns

Consider any barriers members of the project team may face that impact their ability to participate fully (e.g. physical, technological, cultural, etc.); remember, these barriers may not always be visible to you. Note: do not record information specific to individuals, rather, describe mitigation steps that have been discussed with and agreed to by all project team members.

Field team member should be understanding of each person's needs and realize that everyone is different.

Main Project Hazards (check all applicable boxes)

High Risk Work Hazards

Use of a High Risk FSO is required for any work involving one or more of the following except as noted in Section 4.10.2 of NAM-1110-PR1. Additional control measures may be required beyond the use of a JHA.

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

Other Hazards

Use of a Standard FSO is required for any work involving one or more of the following except as noted in Section 4.10.2 of NAM-1110-PR1.

- ☒ Biological hazards
- ☒ Chemical exposure potential (including asbestos)
- ☒ Compressed gas
- ☐ Extended (>14 hours) or nonstandard work shifts (e.g., night work)
- ☒ Extreme weather
- ☐ Hand/power tool use
- ☒ High noise (>85 dBA)
- ☐ Long distance or duration driving**
- ☐ Material handling
- ☒ Slips/trips
- ☒ Natural hazards (e.g., plants, animals, insects)
- ☐ Portable or fixed ladders
- ☐ Radiation (ionizing or non-ionizing)
- ☒ Subsurface clearance work/drilling rigs
- ☐ Working on/near*/over/under water (including transport
- ☐ Work at an active or inactive mine site
- ☐ Helicopter use
- ☐ Hot Work
- ☐ Other (specify): Click here to enter text.
- ☐ Other (specify): Click here to enter text.
- ☐ Other (specify): Click here to enter text.

* Near water is defined as within 1m (3 ft.) and greater than 15cm (6 inches) deep

** 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, a Journey Management Plan (***ERM-1430-FM1***) is required and should be appended to this HASP.

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.

☒	Alconox or Liquinox	☐	Isopropyl alcohol
☒	Hydrocholoric acid (HCl)	☐	Household bleach (NaOCl)
☒	Nitric acid (HNO_3)	☒	Calibration gas
☒	Sulfuric acid (H_2SO_4)	☐	Other (specify): Click here to enter text.
☐	Sodium hydroxide (NaOH)	☐	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 BU H&S Director for additional information or assistance.

Are chemicals being transported to or from the site that are 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 the site to which the ERM team 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 ERM Procedure **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 Business Unit H&S 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.

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-1302-FM3 (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
Steel-toed Boots	☒	☐	Inner Chemical Gloves	☒	☐
Outer Disposable Boots	☐	☒	Outer Chemical Gloves	☐	☒
Long Sleeve Shirt/Pants	☒	☐	Leather or Kevlar Gloves	☐	☒
Tyvek Suit	☐	☒	Safety Glasses/Goggles	☒	☐
Poly-Coated Tyvek Suit	☐	☒	Face Shield	☐	☒
Fully Encapsulated Chemical Suit	☐	☒	Hearing Protection	☒	☐
Flame Resistant Clothing/Coveralls	☐	☒	Half-face Respirator	☐	☒
High Visibility Traffic Vest	☒	☐	Full-face Respirator	☐	☒
Hard Hat/Approved Helmet	☐	☒	Personal Floatation Device	☐	☒
Wet Suit/Dry Suit	☐	☒	If either half or full-face respirator checked: • Define cartridge type: Click here to enter text. • Define cartridge change frequency: Click here to enter text.		
Other (specify): Click here to enter text.	☐	☐			

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 Business Unit H&S 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	☒	☐	Toilets	☐	☒
Emergency Eyewash Solution	☒	☐	Other (specify): Click here to enter text.	☐	☐
Air Horn	☐	☒	Other (specify): Click here to enter text.	☐	☐
Decontamination Supplies	☒	☐	Other (specify): Click here to enter text.	☐	☐
Fire Extinguisher	☒	☐	Other (specify): Click here to enter text.	☐	☐
Potable Water	☒	☐	Other (specify): Click here to enter text.	☐	☐

Training/Certification and Medical Surveillance

If training is required for an employee, 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	**Tim Daniluk**	**Katherine Popyack**	**Kevin Warner**	**Olivia Botting**	**Cal Payne**	**Jason Reynolds**	**Jonathan Mills**
40-Hour/8-Hour HAZWOPER	☒	☒	☒	☒	☒	☒	☒
8-Hour HAZWOPER Supervisor*	☐	☐	☐	☐	☐	☐	☐
40-Hour/8-Hour MSHA New Miner	☐	☐	☐	☐	☐	☐	☐
ERM FSO – Standard/High Risk	ST☐ HR☒	ST☐ HR☒	ST☒ HR☐	ST☒ HR☐	ST☒ HR☐	ST☒ HR☐	ST☒ HR☐
DDD Practice FSO/DM	☐	☐	☐	☐	☐	☐	☐
First Aid/CPR Certification	☒	☒	☒	☒	☒	☒	☒
Subsurface Clearance (SSC) EP/GE	EP☒ GE☐	EP☒ GE☐	EP☒ GE☐	EP☐ GE☒	EP☒ GE☐	EP☒ GE☐	EP☐ GE☒
Aquatic EP/GE	EP☐ GE ☒	EP☐ GE☒	EP☐ GE☒	EP☐ GE☒	EP☐ GE☒	EP☐ GE☒	EP☐ GE☒
Mining EP/GE	EP☐ GE☐	EP☐ GE☐	EP☐ GE☐	EP☐ GE☐	EP☐ GE☐	EP☐ GE☐	EP☐ GE☐
EPA Hazardous Waste	☐	☐	☐	☐	☐	☐	☐
Hazmat/Dangerous Goods Shipping**	☐	☐	☐	☐	☐	☐	☐
International Traveler	☐	☐	☐	☐	☐	☐	☐
Respirator Wearer Certification	☐	☐	☐	☐	☐	☐	☐
Off Road Driving	☐	☐	☐	☐	☐	☐	☐
Towing	☐	☐	☐	☐	☐	☐	☐
ATV/UTV Usage	☐	☐	☐	☐	☐	☐	☐
Other (specify): Click here to enter text.	☐	☐	☐	☐	☐	☐	☐
Other (specify): Click here to enter text.	☐	☐	☐	☐	☐	☐	☐
Other (specify): Click here to enter text.	☐	☐	☐	☐	☐	☐	☐
Other (specify): Click here to enter text.	☐	☐	☐	☐	☐	☐	☐
Medical Surveillance* **							
Medical Clearance	☒	☒	☒	☒	☒	☒	☒
Respirator Clearance and Fit Test	☐	☐	☐	☐	☐	☐	☐
Blood Lead and ZPP	☐	☐	☐	☐	☐	☐	☐
Other: Click here to enter text.	☐	☐	☐	☐	☐	☐	☐

* Provides specialized training to serve as an on-site manager supervising employees engaged in work covered by 29 CFR 1910.120.

** 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.

Define Exclusion Zone Requirements, if any, here. Immediate drilling area. Height of drill mast if applicable, access granted only when driller working inside exclusion zone indicates it is safe to enter.

Define Contamination Reduction Zone requirements, if any, here. Immediately outside of exclusion zone, where ERM personnel are typically located for sampling and logging of cores.

Define Support Zone requirements, if any, here. None

Site Access/Control

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

Define Site Access/Control procedures, if any, here. Facility access is controlled by obtaining access badged at reception.

Decontamination Procedures

Describe procedures for the decontamination of personnel and equipment.

Define personnel decontamination procedures, if any, here. None

Define equipment decontamination procedures, if any, here. Alconox and water. In-between drilling each proposed location, subcontractors should decontaminate drilling equipment. ERM should decontaminate in between each sample.

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 here. Backfilling boring holes.

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.

Describe any contributing factor potentially initiating emergency response (e.g., process, material, or weather) here. Extreme weather, other emergency, rally at designated assembly point.

Describe any lights and/or sounds associated with evacuation here. Fire alarm (if applicable), otherwise spoken notification.

Describe any emergency drill requirements for subcontractors on-site here. None.
Describe any primary and alternative muster points here. Muster points designated outdoors by signage on location, with map signage in buildings.
Describe any site-specific evacuation procedures here. None.
Describe the methodology to be used for accounting for site visitors here. Headcount. Subcontractors responsible for their employees and subs (ERM responsible for ERM subs), use list on tailgate safety meeting form.
Describe any PPE and spill kit requirements here. None beyond PPE listed above.
Is a map associated with evacuation attached? ☐ Yes ☒ No

Emergency Contacts

All ERM employees are empowered to pause or stop work to address any unsafe acts/conditions, questions, concerns or changed conditions.

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 H&S Team.*
- *At direction of PM, PIC, or H&S Team, call WorkCare Incident Intervention at (888) 449-7787 (available 24 hours/7 days per week in US only).*
- *Clients may have their own procedures that we need to follow.*

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.

Contact	Name	Location	Phone Numbers
Hospital (attach map)	Clifton Springs Hospital and Clinic	2 Coutler Rd, Clifton Springs, NY 14432	911 or (315) 462-9561
Police	Clifton Springs Police Department	1 W Main St, Clifton Springs, NY 14432	911 or (315) 462-2422
Fire	Clifton Springs Fire Department	39 Kendall St, Clifton Springs, NY 14432	911 or (315) 462-7501
Poison Control*	Click here to enter text.	Click here to enter text.	Click here to enter text.
Incident Intervention	WorkCare	NA	888-449-7787
Partner-in-Charge	Ernest Rossano	Melville, NY	(631) 756-8917
Project Manager	Tim Daniluk	Syracuse, NY	(315) 317-2044
Field Manager (if not PM)	Click here to enter text.	Click here to enter text.	Click here to enter text.
Field Safety Officer (if not PM)	Olivia Botting	Syracuse, NY	(315) 552-8484
SSC Experienced Person	Click here to enter text.	Click here to enter text.	Click here to enter text.
Aquatic Experienced Person	Click here to enter text.	Click here to enter text.	Click here to enter text.
Mining Experienced Person	Click here to enter text.	Click here to enter text.	Click here to enter text.
Business Unit H&S Director	Dave Nickel	Minneapolis, MN	561-270-1131
Regional H&S Director	Millard Griffin	Atlanta, GA	678-294-8658

Subcontractor Contact	Click here to enter text.	Click here to enter text.	Click here to enter text.
Site Contact	Allen Hawker	Clifton Springs, NY	(315) 462-4271
Additional Contact			
Additional Contact	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**.			

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.

ERM has prepared this plan solely for the purpose of protecting the health and safety of ERM employees. Subcontractors, visitors, and others at the site are required to follow provisions in this document at a minimum, but must refer to the organization's health and safety program for their protection.

Printed Name	Signature	Organization	Date

Approval Signatures

Signatures in this section indicate the signing employee will comply with and enforce this HASP, as well as procedures and guidelines established in ERM's DCS. Signatures also indicate that any subcontractors performing work under contract to ERM have met the minimum safety standards in NAM-1130-PR2 (Subcontractor Use Basic Standards).

Project Manager	Date
Typed Name: Tim Daniluk Signature File:	6/8/2022
Partner-in-Charge	**Date**
Typed Name: Ernie Rossano Signature File: Ernest Rossano	6/8/2022

<table>
<tr><td rowspan="8">Approval of Unified Safety Planning Documents
In accordance with ERM's Global Safety Planning Procedure (<u>ERM-1110-PR1</u>), when more than one entity (subcontractor, etc.) is involved in delivering the ERM scope of work, a designated representative from each entity must approve the HASP. This must be an individual with the authority to direct the activities of individuals in the field. If entities will be working under their own safety planning documents, a <u>Bridging Document</u> must be completed.</td><td>Entity: Click here to enter text.</td><td>Date</td></tr>
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Click here to enter text.
Signature File:</td><td>Click here to enter a date.</td></tr>
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Attachments ***Check all appropriate documents to be attached to this HASP.***	
☒ Site-specific JHAs for all tasks (including subcontractors)	☒ Map of route to hospital with turn-by-turn instructions
☒ Subsurface Clearance (SSC) Project Plan (ERM-1511-FM1)	☒ SNAP Cards (ERM-1140-FM1)
☒ Site Safety Meeting Form (NAM-1501-FM1)	☐ Field Audit Form (ERM-1941-FM4)
☒ Vehicle Inspection Forms (ERM-1430-FM2)	☐ Industrial Hygiene Sample Data (NAM-1302-FM1)
☐ Journey Management Plans (ERM-1430-FM1)	☒ Ambient Air Monitoring Form (NAM-1302-FM2)
☒ Safety Data Sheets (SDS) for chemicals brought to site	☐ Site-specific requirements
☐ PLAN Risk Assessment	☐ Subcontractor training/certification documentation
☐ Facility site map(s)	☐ 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	
☒ Travel Risk Assessment (ERM-1410-ST1)	☒ Subsurface Clearance Standard (ERM-1511-PR1)
☒ Driver and Vehicle Safety (ERM-1430-PR1)	☐ Aquatic Work Management (ERM-1530-PR1)
☐ Fixed Wing Aircraft/Helicopter Standard (ERM-1440-ST1)	☒ Short Service Employees (ERM-1611-PR1)
Regional Standards/Procedures	
☐ Fire Prevention (NAM-1213-PR1)	☐ Mobile Construction Equipment (NAM-1339-PR1)
☐ Confined Space Entry (NAM-1572-PR1)	☐ Excavation and Trenching (NAM-1512-PR1)
☐ Fall Protection (NAM-1313-PR1)	☒ Hazard Communication (NAM-1301-PR1)
☐ Ladder Safety (NAM-1521-PR1)	☐ Cold Stress (NAM-1323-PR1)
☒ Hearing Conservation (NAM-1312-PR1)	☒ Heat Stress (NAM-1323-PR2)
☐ Incident Reporting and Investigation (NAM-1220-PR1)	☐ Medical Services (NAM-1840-PR1)
☐ Medical Surveillance (NAM-1810-PR1)	☒ Personal Protective Equipment (NAM-1310-PR1)
☐ Hot Work (NAM-1542-PR1)	☐ Respiratory Protection (NAM-1311-PR1)
☒ Bloodborne Pathogens (NAM-1325-PR1)	☒ Insect Bite Prevention Standard (NAM-1361-ST1)
☒ Hand Tools/Portable Power Equipment (NAM-1329-PR1)	☒ Incident/Illness Management (NAM-1210-PR1)
☐ Electrical Safety (NAM-1561-PR1)	☐ Energy Isolation (NAM-1562-PR1)
☒ Waste Management Planning (NAM-1122-PR1)	☒ Spill Prevention and Response (NAM-1123-PR1)
☐ Fatigue Management (NAM-1328-PR1)	☐ Safe Use of Cutting Tools (NAM-1324-PR1)
☐ Lone Workers (NAM-1326-PR1)	☒ Compressed Gas Cylinders (NAM-1341-PR1)

See It; Own It; Share It	Stop Work Authority
It means that: • **We know that we have a responsibility to look out for each other, to intervene when necessary, to be proactive and to help keep safety issues from becoming problems.** • **We also look out for ourselves. If we recognize that a situation is unsafe, we are expected to stop what we are doing, reassess the situation and consult with others if necessary before proceeding safely.** • **We assign no blame to anyone who raises safety issues.** • **We strive to learn lessons from the large and small events that are part of our daily experience.**	**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 not being in compliance 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.**

ERM

JHA
Job Hazard Analysis

Project Number:	516919	Project / Client Name:	Pre Design Investigation/ G.W. Lisk
Project Manager:	Tim Daniluk	Location:	2 South Street, Clifton Springs, New York 14432
Partner-in-Charge:	Ernest Rossano	Date and Revision Number:	6/3/2022, Rev. 0

SPECIFIC TASK:	**COVID-19 Specific Hazard Assement for Site Visits and General Field Work**

Minimum Required PPE for Entire Task:	☑ Hard Hat ☑ Safety-Toe Shoes ☐ Hearing Protection ☐ Goggles ☐ Face Shield ☐ Respirator N/A ☐ Other (specify): ☑ Safety Glasses ☑ Reflective Vest ☑ Gloves chemical resistant ☑ PPE clothing Long sleeves, pants N/A		
Additional Task-Step Specific PPE: (as indicated below under Controls)	Face coverings (as needed)	Equipment / Tools Required:	Face coverings, nitrile gloves, biocidal or antibacterial solutions/ soap, hand sanitizer.
Training Required for this Task:	Field work shall be conducted by those with ERM-specific trainings. Company updates to COVID-19 field work shall be followed	Permits Required for this Task:	N/A
Forms Associated with This Task:	Refer to this JHA, Travel Position, ERM Control NAM-1363-GU1, Face Coverings Guidance, and COVID-19 Field Recommendations.		

JHA Developed / Reviewed By:			JHA Review In Field
Name / Job Title:	Name / Job Title:	Name / Job Title:	Field supervisor to ensure all personnel performing this task have reviewed JHA and agree to follow it. Site-specific changes to this JHA have been made as warranted based on this review. **Signature/Date:**
Alexis Harford/ Consultant I			

Task Steps[1]		Potential Hazards & Consequences[2]		select	Probability	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
1	Pre-plan for work activity	1a	Not having the current standards and procedures, including, but not limited to COVID-19	H&S	Heard of	Medium	6	1a	• Refer to the Centers for Disease Control (CDC) site for guidance. • Refer to ERM COVID-19 Site and FAQs site for guidance. • Contact client for any client or site specific requirements/restrictions.
				H&S	Heard of	Medium	6	1b	Conduct Pre-field work review with Local H&S, PM, and/or PIC to verify work can be performed safely with the following standards.
	Evaluate fitness for duty	2a	Exposing others to infectious disease, including, but not limited to COVID-19	H&S	Possible	Major	20	2a	Please coordinate with the project team to verify and report your fitness for duty: 1) On a the day prior to the initiation of work*; 2) Prior to beginning work each day*; 3) Each day upon the completion of work activities; and, 4) Upon any perceived change to your fitness for duty. *Determine and report prior to travel to the work site. **Under any of the following circumstances, exercise your Stop Work Authority**: If you are sick, have a fever, cough, and/or shortness of breath or have been in close contact with ANYONE (friend, family, etc.) – stay home. If you have traveled to a high-risk area and/or have been in contact with someone who has or may have been infected with COVID-19 – stay home. If you become sick while working in the field or at a client site, you should remove yourself from the site as soon as it is safe to do so and contact your personal health care physician (PHCP) for advice. In all cases where an employee is sick, has symptoms of COVID-19, or has an elevated exposure potential due to travel or contact with others as outlined above, please contact your supervisor, PM, and PIC immediately.

Task Steps[1]		Potential Hazards & Consequences[2]		select	Probability	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
2		2b	Anxiety stemming from the potential for exposure illness including COVID-19.	H&S	Possible	Medium	8	2b	The most important thing for our employees to remember is that they have ultimate Stop Work authority. If you do not feel comfortable performing the indicated work, you should let your line manager, the PM, the PIC, BUMP, or BU H&S Director know as quickly as possible so alternate arrangements can be made.
	Evaluate Work Activities	3a	Unable to perform work activities in compliance with the controls listed herein; increased exposure potential to COVID-19	H&S	Heard of	Medium	6	3a	Review the scope of work to be performed prior to mobilization to evaluate if the proposed tasks can be performed in accordance with these controls. Please review your scope of work accordingly and identify any activities that would require a change in methodology or equipment. Coordinate with the project team to identify an acceptable alternative and develop a hazard assessment prior to mobilization. Examples: Okay to perform without further coordination after review of the associated activity JHA - Buddy system required to avoid lone worker - Under normal circumstances this can be completed while maintaining a physical buffer (6ft). Requires additional coordination and a change in methodology or equipment to complete - Team lift required to move compact piece of equipment - To perform a team lift, personnel would violate the requirement to maintain a physical buffer (6ft).
	Practice good personal hygiene	4a	Exposing others or yourself to infectious disease, including, but not limited to COVID-19	H&S	Possible	Medium	8	4a	Good hygiene must be practiced universally. If you think that you must sacrifice good personal hygiene to perform any of your work duties, please STOP WORK and contact the project team for guidance. - Cover your nose and mouth with a flexed elbow or paper tissue when coughing or sneezing and dispose immediately of the tissue. - Wash your hands often with soap and water for at least 20 seconds, especially after going to the bathroom; before eating; and after blowing your nose, coughing, or sneezing. - If soap and water are not readily available, use an alcohol-based hand sanitizer with at least 60% alcohol. - Avoid close contact with people, particularly any who are sick. - Avoid touching your eyes, nose, and mouth. - Clean and disinfect frequently touched objects and surfaces using a regular household cleaning spray or wipe. - CDC, at this time, does not recommend that people who are well wear a respirator/N-95 to protect themselves from respiratory diseases, including COVID-19, as there is no evidence that wearing a mask – of any type – protects non-sick persons. But wearing a face cover does prevent the spread of the virus from contagious persons who may not even know they are infected. ERM staff are able to voluntarily wear a face cover if they so desire. Also, some local governments may start requiring the use of a face cover by everyone when in public - check your local requirements.
	Travel to the project Site	5a	Exposure illness including COVID-19	H&S	Likely	Significant	20	5a	Do not carpool. Utilize a company vehicle or your personal vehicle for transportation to the project site. If necessary, utilize a rental vehicle. When using a company vehicle or rental, disinfect the vehicle including door handles, steering wheel and other surfaces before and after use. However, please practice the personal hygiene recommendations and try yo avoid travel by public transportation. This includes, but is not limited to: - Buses - Trains - Light Rail - Taxis - Rideshares (e.g., Uber and Lift) - Shared Rideables (e.g., Jump Bike and Lime Scooter)

	Task Steps[1]		Potential Hazards & Consequences[2]	select	Probability	Severity	RISK		Controls to Eliminate or Reduce Risks[3]
	Tailboard meeting, sign-in, JHA review, and activity associated documentation.	6a	Exposure illness including COVID-19 - Subcontractors or vendors	H&S	Possible	Medium	8	6a	Verbally discuss fitness for duty with any subcontractors, vendors, or other parties onsite. Review the signs and symptoms of COVID-19 (see below) and verify that they have not experienced these themselves and have not knowingly been in contact with someone who has exhibited or reported these symptoms. - Fever - Cough - Shortness of breath
		6b	Exposure illness including COVID-19 - Inhalation	H&S	Possible	Serious	12	6b	Conduct tailboard meetings outside in well ventilated areas. Avoid closed conditions such as job trailers. **Utilize physical distancing (referenced commonly as social distancing):** - Maintain a buffer of at least 6 feet (2 m) from other people. - Avoid crowds
3		6c	Exposure illness including COVID-19 - Personal Contact	H&S	Possible	Serious	12	6c	As above, utilize physical distancing and avoid small enclosed areas. Abstain from normal social greetings (i.e., handshakes)
		6d	Exposure illness including COVID-19 - Surface Transmission	H&S	Possible	Serious	12	6d	Implement the following controls to limit potential exposure while maintaining required documentation: - Do not share or pass around writing implements, clipboards, or other supplies, bring your own pen; - Don disposable gloves (e.g., nitrile) while signing; - Take turns when signing to maintain physical distancing (6ft from others); - Utilize magnets to hold signature pages on vehicles and limit handling; - If possible have one person complete all required documentation; and, - Change gloves before touching personal items. **- Do not physically collect individual documentation (e.g., field notes) physically from the group. Instead convert to electronic on an individual basis and combine electronically. If dcouments must be touched then wear nitrile gloves while handling them and do not touch any part of your body or clothing while doing so. When finished, remove gloves and wash hands with soap.**
		6e	Exposure illness including COVID-19	H&S	Possible	Serious	12	6e	Review scope of work and determine if work can be divided to maximize the controls specified above.
	Perform work activities	7a	Performance of work activities may lead to increased exposure potential to COVID-19	H&S	Possible	Serious	12	7a	If in the performace of the work activities you observe conditions that contradict the controls described herein, STOP WORK and contact the project team before proceeding. Plan work so that at least 6 feet (2m) is maintained. Example one person touches equipment and collects samples and the second person is scribe and prepares labels/COC.
		7b	Exposure from Field office trailers	H&S	Possible	Serious	12	7b	Project team should don proper gloves and wipe down work surface upon arrival at the trailer including but not limits to inside and out door handles, light switches, table/desks, and electronic devices. - Do not maintain any trash cans inside the trailer. All trash including food waste should be removed. - If an eating area is established in the trailer it should be wiped down before and after eating including tables, mocrowaves, coffee makers, and refrigerator handles. - Limit time and the number of people in thr trailer. Maintian 6ft seperation. Keep heat/AC off if possible and maintin windows or doors open for fresh air - Project team should perform cleaning of the trailer as in bullet one prior to depature for the day.
	Demobilization	8a	Exposing others to potential contact via surface tansmission	H&S	Possible	Significant	16	8a	Don clean PPE and disinfect all rental and ERM equipment, coolers, sample container exteriors, and supplies prior to returning it to the vehicle. Properly dispose of all disposable PPE onsite prior to leaing. Do not transport back to the office.
		8b	Exposure illness including COVID-19 - Surface Transmission	H&S	Heard of	Serious	9	8b	Remove and place field clothes in a bag prior to leaving the site. Wash all field clothes in warm to hot water to disinfect (virus can live for a couple of days on surfaces and clothing).

	Task Steps[1]		Potential Hazards & Consequences[2]	select	Probability	Severity	RISK		Controls to Eliminate or Reduce Risks[3]
				E					

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). 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.

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 Development Checklist

This checklist provides common hazards and some hazard control measures for consideration, and can be used to help develop site-specific JHAs

Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Fatigue and Stress	Specifically define acceptable work hours, work duration, work weeks, consecutive days, etc. Define rest frequency and duration. Take weather, PPE, activity level into consideration. Identify activities with increased mental stress / strain, and determine if controls are warranted: multiple employees, work rotation, etc. Identify activities with limited mental stress (e.g., 'boring or dull activities' where inattention can occur), and determine if controls are warranted: multiple employees, work rotation, etc. Consider activities that may occur immediately before or after the task (e.g., driving), and determine whether controls are required (e.g., limitations on driving after 10 hr days of field activities). Remember that stress and fatigue ARE NOT LIMITED to field / construction activities.
Sharp Edges (designate in JHA the specific cut or puncture hazard associated with the task step)	Wear ____ gloves (designate type, e.g. heavy leather, cut-resistant, puncture-resistant). Wear ___ footwear (designate type, e.g. puncture-resistant insoles). Wear ___ clothing (designate type, e.g. long sleeves, heavy coveralls). Have gloves on your person at all times. Employees performing significant amounts of cutting tool use should wear high-visibility gloves to encourage awareness of where hands are being placed. Do not attempt to catch falling tools/equipment. Ensure guards are in place. Use ___ cutting tool (designate type, e.g. scissors, shears, snips). Do not use dull blades. Do not use open-bladed knives. Inspect tools/equipment in area prior to start of task to identify sharp edges and, if possible, remove/protect or position body to ensure no contact during task. Always cut away from hand, body and face. Ensure others are not in line-of-fire when cutting. Place object to be cut in a vise or on a flat surface or use another tool to hold object while cutting. Do not place fingers in ends of piping or other tubular material.
Pinch Points (designate in JHA the specific pinch hazard associated with the task step)	Wear ___ gloves (designate type, e.g. heavy leather, puncture-resistant). Have gloves on your person at all times. Inspect work area prior to start of task to identify pinch points and remove/protect to ensure do not contact during task. Consider body positioning prior to start of task to identify potential pinch points and change position to ensure do not contact during task. Identify pinch points by warning label and/or paint color. Do not position your hand or body so it can be caught between a lifted load and adjacent objects. Do not place fingers/hands between sections of multi-component/moveable items (e.g. fencing sections, sheet piling, hinged panels).
Slips / Trips / Falls from Surface Conditions (designate in JHA the specific slip, trip, fall hazard associated with the task step)	Wear ___ footwear (designate type, e.g. shoes with rubber soles or low heels, crampons). Identify and use only safe pathways and stairs when entering/exiting/working in area. Obtain additional lighting and use clear safety glasses in areas with low/unclear visibility. Inspect work area for potential slip/trip/fall obstructions prior to start of work and remove or, if not possible, mark with highly visible tape/flags, etc. Keep work area organized and free of surface obstructions during task. Immediately dry wet areas or restrict access (e.g. with warning tape, signs, cones). Remove snow/ice prior to start of work. Reassess surface conditions if weather changes and address any new hazards (e.g. slick surface developing as a result of wet/freezing conditions). Do not carry loads that restrict visibility. Do not stack objects higher than ___ (designate height). Ensure steps, walkways and shoes are not slippery or loose prior to use. Keep work area surfaces clear of debris (e.g. mud, leaves) and store tools/equipment to eliminate trip hazards when not in use. Keep eyes on path and nearby surroundings when walking. Take small steps and shuffle feet in potentially slippery areas. Walk slowly around corners and when entering/exiting doors. Use slip-resistant mats. Use handrails when going up/down stairs. Fill in/flatten uneven ground. Use steps/stepladders for access in and out of shallow trenches/excavation.
Fall from Elevated Position (designate in JHA the specific elevated hazard associated with the task step)	Use carts with high sides to contain load. Ensure load is secure and balanced prior to moving. Maintain 3-points of contact when mounting/dismounting vehicle/equipment. Maintain 3-points of contact when climbing/descending ladders. Use equipment/mechanical means (e.g. tool belt, rope) to transport tools/materials. Ensure steps, ladder rungs and shoes are not slippery or loose. Do not stand or work off top of ladder (e.g. top 2 steps of stepladder). Extend ladder at least 3-feet beyond top bearing point. Have another person hold bottom of ladder at all times while working or until top is secured; if ladder is not equipped with grip pads, hold bottom at all times. Position extension ladder at 1 foot distance for every 4 feet of working height. Do not overreach; keep body between ladder rails and both feet on same rung. Wear fall protection when working at a height of 6 feet (1.8 meters) or greater. Wear full body harness with double-locking snap hooks and shock absorbing lanyard. Inspect fall protection prior to use and do not use if: worn or frayed lanyard or webbing/stitching; locking devices, snap hooks, etc. are not working properly; metal components are worn, damaged, or have burrs, etc.; annual inspection tag is not in place and current. Connect to secure anchor point meeting fall protection specifications (capable of supporting 5,000# per person attached, above shoulder height, no sharp edges, etc.). Ensure scaffolding has secured boards, is adequately braced, has a handrail, is free of debris and holes and is in good working condition. Stand only on secured and inspected flooring and uprights. Work only within the scaffolding structure.

JHA Development Checklist

This checklist provides common hazards and some hazard control measures for consideration, and can be used to help develop site-specific JHAs

Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Back Sprain/Strain (designate in JHA the specific back sprain/strain hazard associated with the task step)	Use ___ mechanical lifting/carrying device (designate type, e.g. cart, dolly, forklift). Obtain assistance when lifting ____ (designate what, e.g. awkwardly shaped objects) or objects weighing greater than ___ (designate limit). Bend and lift with legs/arms, not back. Keep objects close to body and do not twist while lifting (turn with feet). Position work equipment to avoid over-reaching while working. Do not overload waste containers, fill ___ full (designate volume). When objects are lifted/carried by two persons, take positions on opposite ends. Store heavy/bulky items with safe access in mind. Take regular breaks every ___ (designate frequency).
Suspended Loads/Low-Hanging Objects (designate in JHA the specific suspended load, low-hanging hazard associated with the task step)	Wear hard hat. Wear ___ gloves (designate type, e.g. rubber dot for grip). Wear ___ footwear (designate type, e.g. steel-toe boots; footwear with metatarsal-protection). Do not attempt to catch falling objects. Stay ___ (designate distance) away from raised objects. Restrict access with warning tape and/or posted signs. Secure loose objects prior to lifting or moving by ___ (designate how, e.g. with straps, sideboards, use of panel cart with high sides). Remove low-hanging objects or identify (e.g. mark with highly visible paint, tape, flags) and/or communicate location to site personnel. Visually inspect equipment before beginning task. Verify latest equipment inspection/tag is current before beginning task. Inspect lifting rigging (chains/slings/cables) to ensure in good condition and do not use if defects, signs of excessive wear are identified. Verify lifting equipment is certified and rated for handling the reach and load limits for required work. Use trained spotter(s) to alert others of hazards. Use tag lines held by trained personnel to guide load and do not wrap lines around body parts. Pre-inspect travel route to ensure clearance. Keep load low to ground to ensure clear visibility when transporting. Move load using low, slow, controlled movements.
Rotating / Automated / Energized Equipment (designate in JHA the specific rotating hazard associated with the task step)	Do not work on moving equipment. De-energize all energy sources (e.g. compressed, pressurized) equipment prior to working on. Lock out/tag out equipment per LOTO procedure and verify energy isolation prior to start of task. Employees who perform LOTO must receive authorized employee training. 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. Remove/secure loose clothing, hair and jewelry. Keep hands/body/tools ___ (designate distance) away from equipment. Identify automatic-start equipment with signs/labels. Locate emergency stop/shutdown switch prior to start of task. Ensure all associated personnel are notified of work activities. De-energize hand-held and mobile equipment when not in use. Plan work lay-out/processes to avoid and/or minimize line-of-fire risks. Define and barricade personnel exclusion zones based on machine swing areas, area below crane operation, etc.
Vapors, Airborne Debris (designate in JHA the specific vapor, debris or liquid hazard associated with the task step)	Keep area ventilated by ___ (designate how, e.g. with forced draft fans, outside use only). Perform ___ monitoring (designate method and frequency) and stop work if monitoring result ___ (designate limits). Position body upwind. Keep work area wet to limit dust. Set-up work zone to restrict non-essential access and minimize off-site impacts. Wear ___ eye/face protection (designate type, e.g. safety glasses, face shield, splash goggles or combinations). Wear ___ clothing (designate type, e.g. long sleeves, paper suit). Wear ___ breathing protection (designate type, e.g. dust mask, full/half-face respirator with ___ (designate type) cartridges). Establish cartridge change-out schedule. (designate in JHA the specific ignition risks associated with the task step)
Ignition (designate in JHA the specific ignition risks associated with the task step)	Undertake work under Hot Work Permit. Monitor VOCs and LEL by ___ (designate method and frequency) and stop work if monitoring result ___ (designate limits). Seal all pipe/openings (e.g. tank holes, storm drains) in work zone that may emit vapors. Ensure all equipment in work area is intrinsically safe. Define/barricade work areas to exclude unauthorized access/external ignition sources (e.g. vehicular traffic). Keep area ventilated by ___ (designate method, e.g. with fans). Ensure lines are clear prior to disconnect and/or use dry couplings. Assess and control static risks for all work equipment and processes. Have ___ (designate number, type and size) fire extinguisher(s) on site and immediately available for use. (designate in JHA the specific high noise hazard associated with the task step)
	Determine whether noise monitoring has been necessary on other projects of similar scope. Measure noise levels with a noise dosimeter if project will last over 30 days, or for shorter work use the rule or thumb that you should be able to hear a

JHA Development Checklist

This checklist provides common hazards and some hazard control measures for consideration, and can be used to help develop site-specific JHAs

Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
High Noise Level (designate in JHA the specific high noise hazard associated with the task step)	Measure noise levels with a noise dosimeter if project will last over 30 days, or for shorter work use the rule of thumb that you should be able to hear a person talking to you in a normal voice at 1m/3 ft. If you cannot hear them without them raising their voice the hearing protection is necessary, and noise monitorting is advisable. For any employee working on the site who has not attended hearing conservation training within the past year, review this JHA with them and document their training. Wear ___ hearing protection (designate type, e.g. ear plugs, ear muffs, double hearing protection) based on known or potential noise levels. Post warning signs at ___ (designate distance) from work area stating entry restrictions and/or type of hearing protection required. Ensure mufflers are installed in equipment. Minimize potential external/third party/community impacts by ___ (designate how). Share noise dosimetry results with your Divisional Safety Advisor so we can build up a bank of knowledge about the types of equipment at projects where hearing protection should be considered.
Heat Stress and Burns (designate in JHA the specific heat hazard associated with the task step)	**Hot Equipment:** Allow equipment/material to cool prior to working with. Use designated handles to open/move equipment. Turn off equipment and allow to cool prior to refueling. Identify hot surfaces prior to start of task and avoid direct contact with.Drink cool fluids and take rest breaks every ___ (designate frequency). Wear ___ gloves (designate type, e.g. oven mitts, thermal, etc...). Use ___ (designate type, e.g. tongs, insulated handles) tool to move equipment or materials. **Hot Weather:** Check the weather forecast in advance & be prepared for those conditions Wear ___ clothing (designate type, e.g. light-weight fabrics with long sleeves & trousers, cool vest, etc...). Schedule regular breaks, watch your colleagues using the buddy system. Use sun block for skin protection, drink cool drinks regularly (i.e.: before you become thirsty), take breaks in the shade (advice on the regularity and duration of these can be found in the SWP linked to below) Stop work if fatigue or physical stress situations develop in your or those around you High humidity, working in direct sunlight, work in contact with hot surfaces influence the severity of hot working conditions. Seek specific guidance and training if work in these conditions is necessary. (Advice is available on the SWP for heat stress available on Minerva Americas H&S pages at the following link: http://minerva.erm.com/Support/HS/AmericasHS/Safe%20Work%20Practices%20SWP/04%20-%20Heat%20Stress%20-%20updated%208-11.doc)
Cold Stress (designate in JHA the specific cold hazard associated with the task step)	Drink hot/warm fluids and take rest breaks every ____ (designate frequency) Wear ___ clothing (designate type, e.g. insulating layers, down jacket, chef coat). Wear ___ gloves (designate type, e.g. thermal, freeze-protection). In temperatures below freezing do not touch bare metal surfaces with the naked skin without adequate PPE, such as gloves. At or below 4°C/40°F adequate dry insulating clothing must be available to keep worker's core temperature at or above 36°C/96.8°F Dampness/condensation, work in contact with cold water or surfaces, and wind speed all influence the severity of cold working conditions. Seek specific guidance and training if work in these conditions is necessary. (Training is available on ERM North American Minerva page at the following link: http://minerva/erm/globalsupport/healthandsafety/NA/HS%20Training%20Materials/Home.aspx)
High Voltage/Electrical Contact (designate in JHA the specific high voltage / electrical hazard associated with the task step)	Use wooden or fiberglass ladder. Stand on non-conductive surface. Remove metal jewelry. Footwear worn around electrical circuits should be non-conductive. Ensure power cords are free of defects and exposed wires. Do not work in ___ (designate condition, e.g. thunderstorm) weather. Use___ gloves (designate type in JHA, e.g. electrical-insulted). Use ground fault circuit interrupter (GFCI). Use low voltage lighting. Ground equipment by ___ (designate how or refer to separate procedure). Pre-inspect travel route to ensure clearance. Inspect above and below ground areas prior to start of work to identify electrical lines and communicate locations to site personnel. **SSC:** Ensure completion of subsurface clearance procedure requirements. Ensure line locator service identification of underground lines. Use non-destructive drilling techniques (e.g. air-knife). When excavating, assign spotter to stop work at sign of subsurface conduits/wires. Keep ___ distance from overhead power lines (designate distance in JHA based on voltage, regulations, etc.). Lock-Out/Tag-Out (LOTO): LOTO equipment must be available as per the LOTO procedure and verify isolation of energy source prior to start of task. Tags must read “DANGER – DO NOT OPERATE” and be resistant to wear and tear by the environment they are being used in. Employees who perform LOTO must receive authorized employee training, subcontractors must provide evidence that they have (e.g.: a certficate) Wear a cotton t-shirt, Class II Electrical Arc Protection suit, Class O (low voltage) gloves, and non-conductive footwear. Only the person who placed the LOTO device is authorized to remove it, so after-hours contact information for LOTO employees must be in the HASP. Ensure all associated/potentially impacted personnel are notified of work activities. Before working on live equipment, it should be brought to a “zero-energy state” by turning off the equipment’s power (at source, such as by switching off specific circuit breakers. (“Zero-energy” is not attained until the individual working on the machinery attempts to turn the machine on and is unsuccessful.) In certain situations, where machinery must stay live to do work, and Lock-Out is not possible, the Project Manager and Field Safety Officer must be directly involved when Tag-Out is taking place. For all sites where work extends beyond 1 year, a LOTO a documented process inspection must occur to check that LOTO procedures in-place are still valid.

JHA Development Checklist

This checklist provides common hazards and some hazard control measures for consideration, and can be used to help develop site-specific JHAs

Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Chemical/Liquids Contact or Release (designate in JHA the specific chemical/liquid hazard associated with the task step)	Wear ___ eye/face protection (designate type, e.g. safety glasses, face shield, chemical splash goggles or combination) Wear ___ clothing (designate type, e.g. long sleeves, paper suit, protective apron, polyethylene coated suit). Wear ___ gloves (designate type, e.g. butyl, nitrile, rubber, resistant to specific chemical/duration). Ensure that gloves and boots are taped to the suit to prevent liquid splash. Double-layering nitrile or latex protective gloves is a good idea for added protection. If acidic or caustic chemicals are present, wear outer neoprene or rubber gloves. Restrict access to work area by ___ (designate how). Use funnel when pouring liquid. Ensure bleed valves are open and lines are clear prior to disconnect and/or use dry couplings. Have ___ (designate type/amount, e.g. pads, boom) absorbent material on hand. Place container and/or absorbent/plastic sheeting under connection prior to disconnect. Store hazardous materials in dedicated container/area (e.. shed, box). Wash hands frequently. Inspect pressurized lines and all fittings/couplings to ensure integrity/closure. Assess rating and compatibility of materials used vs purpose. Ensure storage compatibility of multiple products. **Hazard Communication:** For each chemical product used by ERM employees or subcontractors, a SDS sheet must be obtained and kept on-file. Chemical containers must be labeled in accordance with OSHA regulations. Review SDS and container label prior to start of task/handling and follow associated requirements. Ensure all employees on the jobsite have been told about the chemical in-use and are protected. Confirm SDS is relevant when working with legacy material (e.g. historic releases). A chemical inventory list must be prepared and updated as new or different chemicals are procured. If chemical exposure occurs, even if medical symptoms are not present, inform the Field Safety Office or Office H&S Contact.
Biological Contact (designate in JHA the specific biological hazard associated with the task step)	Wear ___ clothing (designate type, e.g. long sleeves, hood, paper suit). Wear ___ gloves (designate type, e.g. fabric, nitrile). Use insect repellant. Inspect area prior to start of task and remove/avoid animal (e.g. dogs), insect (e.g. bees, wasps), plant (e.g. poison ivy) hazards if possible; otherwise reschedule work and/or contact professional service for removal. Report allergies and ensure treatment is available on site. Avoid loud noises/brightly colored clothing if bees are known to be in area.
Repetitive Motion (designate in JHA the specific repetitive motion hazard associated with the task step)	Use ___ tool and/or ___ technique (designate, e.g. ratchet wrench) to minimize repetitive stress risk. Change position frequently during job (e.g. vary grip, hand motion). Keep wrists in a neutral (straight) position as you work. When possible, rotate tasks to give body parts a rest. Take breaks every ___ (designate frequency) and do simple stretches/exercises. Ensure gloves fit hands properly to decrease stress on hand/joints.

JHA Development Checklist

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Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Traffic (designate in JHA the specific pedestrian / motorized traffic hazard associated with the task step)	Wear ___ clothing (designate type, e.g. reflective vest, neon orange/green shirt). High-visibility safety vests: class I may be used when traffic is below 25 mph, Class II for 25-50 mph, and Class 3 for >50 mph. Set up work zone to restrict non-essential access by ___ (designate how, e.g. with cones/barricades/fencing, placed specified distance apart/from work area, etc.). Avoid risks posed by detour (e.g. pedestrians forced into other traffic). Use parked vehicle with hazard lights facing oncoming traffic to protect work zone. Use buddy system to establish traffic watch. Use trained spotters when backing and when visibility is restricted. Inspect surrounding area prior to backing. Adjust mirrors and check equipment back-up alarm to confirm operational prior to start of task. Use horn to alert others prior to backing. Use traffic management consultant. Stay ___ (designate distance) from operating equipment/extended arm, etc. Make eye contact with equipment operator and receive approval prior to approaching. Ensure spotters and equipment operators maintain eye contact. Establish parking/staging/loading/unloading areas (consider equipment turning circles, swing zones etc.). Ensure trailers / trucks are rated and balanced. Chock truck/trailer wheels when not moving. Ensure load is distributed during load/unload to avoid tip/roll-over. Ensure all personnel remain outside of tip-over radius when dumping.
Improper Waste Transport / Disposal (designate in JHA the specific waste disposal hazard associated with the task step)	Designate safe waste storage area/container prior to start of task. Ensure waste materials meet container specifications prior to use. Label waste containers. Separate hazardous and non-hazardous wastes. Place waste containers in designated storage area and secure prior to leaving site. Confirm waste transport truck/container integrity prior to loading. Confirm shipping document description/approved destination with waste container label prior to off-site shipment. For unsealed/partially exposed loads, perform ___ monitoring (designate method and frequency) and stop work if monitoring result ___ (designate limits).
H&S Risks and Increase in ERM Liability caused by Subcontractors Working on the Jobsite	Select only subcontractors that have been prequalified and approved for use. Ensure a signed, executed subcontract agreement is in-place prior to subcontractors performing work on the jobsite for ERM. Ensure the subcontractor has received a copy of the ERM HASP and supporting documentation prior to mobilization to the jobsite. Specify both the ERM and the subcontractor's scope of work in the ERM HASP document. Ensure that any subcontractor personnel on-site have reviewed and signed the site HASP. In all cases, require the ERM subcontractor to either develop their own site-specific HASP, or at minimum develop Job Hazard Analyses (JHA) for the specific tasks they will perform. Attach these documents to the ERM HASP as appendices. Ensure subcontractor work is overseen by ERM personnel at all times. Always include subcontractor personnel in daily jobsite tailgate safety meetings. Do not supply subcontractor personnel with personal protective equipment (PPE). If ERM is performing air monitoring for the subcontractor, ensure calibration of air monitoring equipment is done before and after each use. At a minimum, air monitoring equipment must be calibrated at least once per day. Document equipment calibration and file with the site HASP.
Exposure to Toxic and Hazardous Chemical Substances (designate in the JHA the specific chemicals of concern)	Determine whether there is a potential for exposure to any toxic or hazardous chemical substances in the work area prior to performing any work that may involve handling of one or more of the chemicals or may result in exposure through production, research, or process activities. This would include, but not be limited to, OSHA's 13 regulated carcinogens, and the following: • Acrylonitrile • Asbestos • Benzene • Cadmium • Chromium (VI) • Coke oven emissions • Cotton Dust • Ethylene oxide • Formaldehyde • Hydrogen sulfide • Inorganic arsenic • Lead • Methylene chloride • Methylenedianiline • Vinyl chloride • 1,2-dibromo-3-chloropropane • 1,3-butadiene
	If any of the substances are identified, conduct an exposure assessment to determine whether employees have the potential to be exposed above any action level identified in the substance-specific regulations.
	Where the initial assessment identifies the potential for employee exposures above an established action level or permissible exposure limit, develop a site-specific program to address all required regulatory concerns for that substance. Completed programs shall be included in the site-specific health and safety plan.
	Ensure the health and safety plan specifies the airborne contaminants that may be encountered and the need for respiratory protection. Ensure the plan provides a selection process for the respirator and cartridge type, develops actions levels for upgrades/downgrades of respiratory protection, describes cartridge change out schedules, and provides information on medical surveillance criteria and respirator fit testing requirements.
	Prior to donning any respirator, complete a thorough inspection to ensure it is in good operating condition. Inspected elements should include, but not be limited to, straps, sealing surfaces, inhalation/exhalation vales, and facepieces. Do not use respirators with any signs of damage.
	Where necessary, replace damaged parts. If repair is not possible, discard and replace entire respirator.
	Clean and disinfect respirators using a mild soap and water solution following use. Where respirator sharing is allowed, ensure respirators are cleaned and sanitized before being exchanged by employees.

JHA Development Checklist

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Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Respiratory Protection	For cartridge-type respirators, affix the cartridges to the respirator as indicated in the manufacturer's guidelines. Cartridges should be hand tightened only.
	Employee must be clean shaven in those areas of the face where the respirator makes skin contact, including any inner nose cups.
	Don the respirator prior to other personal protective equipment in the head/neck area so that nothing comes between the respirator straps and the head surface. Safety glasses, hard hats, etc. must be donned after the respirator.
	For cartridge-type respirators, perform a positive and negative fit check to ensure a good respirator seal.
	Adjustments made while wearing tight-fitting respirators within the work area may result in a compromised respirator seal. If this occurs, stop work, move to an area with no chemical contamination (go through the decontamination process, if present), readjust the respirator, and perform positive and negative fit-checks to ensure a proper facepiece seal.
	If it becomes difficult to breathe due to particulate clogging of respirator cartridges, stop work, move to an area with no chemical contamination (go through the decontamination process, if present), replace the cartridges, readjust the respirator, and perform positive and negative fit-checks to ensure a proper facepiece seal.
	If using a chemical catridge and you either (1) reach or exceed the required wear time as described in the cartridge change schedule or (2) detect any evidence of chemical breakthrough (odors, tastes, burning sensations, etc.), stop work, move to an area with no chemical contamination (go through the decontamination process, if present), replace the cartridges, readjust the respirator, and perform positive and negative fit-checks to ensure a proper facepiece seal. If chemical breakthrough was detected, determine what level of exposure may have occurred through testing of the work atmosphere.
	If a decontamination line is present, proceed through the line as directed. If no decontamination line is present, remove all other PPE except clean gloves before removing the respirator. Once removed, clean as directed.
Natural Hazards (designate in JHA the specific natural hazards associated with the task step)	For sites where poison ivy, oak, and sumac are present, have a poison ivy wash available for employees on-site. If exposure occurs and no poison ivy wash is available, employees should wash in cool water and use soap. Keep work areas free from clutter so that ground surfaces can be easily seen by employees. **Working around poisonous insects:** Use insect repellant containing DEET at all times on the jobsite. Periodically throughout the day and at the end of the day, perform a thorough “tick-check” to ensure ticks or other insects are found and removed promptly. Avoid obvious conical mounds of dirt that may indicate ants, wasps, or other flying insects. Before reaching into dark or damp spaces such as monitoring well-heads, inspect the area thoroughly to ensure spiders are not present. Always take a shower as soon as possible after leaving a jobsite for the day to remove any insects, such as chiggers. **Working around snakes:** Visually inspect the work are prior to beginning any work to located areas with high grass and underbrush. Do not walk through these areas if at all possible to avoid snakes. Wear leather steel-toe boots and snake chaps in areas where snakes are suspected or confirmed to be present. Do not attempt to kill snakes, as people are commonly bitten attempting this. **Working around feral animals:** High rat populations within an enclosed space present a hazard of Hanta virus. Spray such areas with bleach solution prior to performing any work in the area (10 parts water to 1 part household bleach). If dogs or other animals are spotted that are acting strangely, do not approach them. Contact the local animal control center for assistance.

		Severity				
		Minor (1)	Moderate (3)	Serious (5)	Severe (7)	Catastrophic (10)
Probability	Almost Certain (6)	6	18	30	42	60
	Likely (5)	5	15	25	35	50
	Possible (4)	4	12	20	28	40
	Heard of (3)	3	9	15	21	30
	Unlikely (2)	2	6	10	14	20
	Rare (1)	1	3	5	7	10

Risk Rating

Extreme	High	Low

Risk Rating

Extreme	36
High	19
Medium	6
Low	0

ERM

JHA
Job Hazard Analysis

Project Number:	516919	Project / Client Name:	Pre Design Investigation/ G.W. Lisk
Project Manager:	Tim Daniluk	Location:	2 South Street, Clifton Springs, New York 14432
Partner-in-Charge:	Ernest Rossano	Date and Revision Number:	6/3/2022, Rev. 0

SPECIFIC TASK:	**Drilling and SSC**

Minimum Required PPE for Entire Task:	☑ Hard Hat ☑ Safety-Toe Shoes ☐ Hearing Protection ☐ Goggles ☐ Face Shield ☐ Respirator: N/A ☐ Other (specify): N/A ☑ Safety Glasses ☑ Reflective Vest ☐ Gloves: chemical resistant ☐ PPE clothing: Long sleeves, pants		
Additional Task-Step Specific PPE: (as indicated below under Controls)	ear plugs, heavy leather gloves, cut resistant gloves	Equipment / Tools Required:	
Training Required for this Task:	HAZWOPER 40-hr; current 8-hr Refresher Training	Permits Required for this Task:	None
Forms Associated with This Task:	SSC project plan		

JHA Developed / Reviewed By:			JHA Review In Field
Name / Job Title:	Name / Job Title:	Name / Job Title:	Field supervisor to ensure all personnel performing this task have reviewed JHA and agree to follow it. Site-specific changes to this JHA have been made as warranted based on this review. **Signature/Date:**
Alexis Harford/ Consultant I			

Task Steps[1]		**Potential Hazards & Consequences**[2]		select	**Probability**	**Severity**	**RISK**	**Controls to Eliminate or Reduce Risks**[3]	
1	Identify a Client Contact Person	1a	Client contacts that are not familiar with the site layout could cause critical information to be missed during safety planning.	H&S	3	3	9	1a	Determine degree of knowledge of our client contact by evaluating their current job duties at the site, length of time they have worked at the site, and time in their current job. If the ERM team does not feel comfortable with the level of experience of our client contact, take additional measures to ensure all pertinent subsurface utilities and services information is gathered.
2	Engage Subcontractors	2a	Subcontractors who have not been evaluated against ERM minimum safety standards or who do not meet minimum safety standards may pose more risk.	H&S	3	3	9	2a	Use only ERM subcontractors who are identified as having met our minimum safety standards. In cases where using an already-qualified subcontractor is not possible, ensure extra precautions are taken to provide safety oversight to the work.
3	Appoint an ERM Subsurface Clearance "Experienced Person" to the project	3a	ERM employees who are not experienced with SSC issues may not recognize critical zones or clues to other site utilities/services.	H&S	3	4	12	3a	Ensure a "SSC Experienced Person" is assigned to the project to provide oversight of ground penetrations and to mentor less experienced ERM employees.
4	Develop the HASP	4a	Using incorrect documents in safety planning may lead to not considering all pertinent information.	H&S	3	3	9	4a	A Level 2 WARN HASP for Intrusive Work (minimum) must be used when performing any ground penetrations, with the exception of surface soil sampling. The Level 2 HASP contains a "Site Services Model" that ERM uses to evaluate SSC hazards.
5	Make Preliminary Determinations	5a	Not recognizing or identifying critical zones poses great hazard to ERM employees in the field from contact with electricity or other utilities.	H&S	3	4	12	5a	Establish critical zones and excavation buffers (if needed) for the work. Initial critical zone determinations may change in the field but are a good starting point in hazard identification.
6	Identify Preliminary Ground Disturbance Locations	6a	Planning ground disturbance locations inside critical zones poses great hazard to ERM employees in the field from contact with electricity or other utilities.	H&S	3	3	9	6a	Ensure critical zones have been identified using the Site Services Model and then identify locations outside those critical zones up-front, if possible. If a ground disturbance inside a critical zone is absolutely necessary, notify the site PIC and obtain guidance from him/her before proceeding.
7	Public and/or Private Utility Markout	7a	Not having utilities marked may lead to a subsurface clearance strike.	PL	3	3	9	7a	Contact public and private utility markout services giving them enough time to respond. A minimum of 24-hour notification to utility locators is required in most states, and may vary higher in some states.

Task Steps[1]		Potential Hazards & Consequences[2]		select	Probability	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
8	Conduct the Site Walk	8a	Inexperienced people conducting the site walk may miss pertinent information regarding utilities and/or services.	H&S	3	4	12	8a	The "SSC Experienced Person" must lead the site walk and should be accompanied by our client contact. Each ground disturbance location should be approved by our client contact (written approval preferred, verbal approval acceptable).
9	Develop the Site Services Model	9a	Critical zones and a whole-site view of utilities and services at the site are more difficult to do if not put into the Site Services Model.	H&S	4	2	8	9a	Use the Site Services Model to identify gaps in knowledge from all drawings and other verbal information from our client contact. Identify locations of key isolation and shutoffs closest to the work area for each type of utility/service.
10	Inspect Each Ground Disturbance Location	10a	Inexperienced people conducting inspection may miss pertinent information regarding utilities and/or services.	H&S	3	4	12	10a	The "SSC Experienced Person" must lead inspection of each Ground Disturbance Location. Any visual clues of subsurface obstruction/utilities should be documented. Critical zones may have to be reassessed at this point. Use the SSC Checklist to document this inspection for each point inside a critical zone, at a minimum.
11	Finalize Critical Zone Determinations	11a	Not performing this verification step in the field may lead to a SSC strike.	H&S	3	4	12	11a	Use information gathered during pre-planning, utility markout, and site walk/inspection to verify critical zones that have been previously established. Revise critical zones as necessary. Use the SSC Checklist to document points inside critical zones. If points are confirmed inside critical zones, either step out and relocate the ground disturbance location, or contact the PIC for additional guidance.
12	Oversee setup of drilling equipment	12a	Overhead electrical/other lines may come in contact with drill rigs.	H&S	3	4	12	12a	Ensure drill rigs are set up in areas where they will not contact overhead lines when being positioned. The minimum distance for drill rig clearance is 25 feet unless special permission is granted by the utility company. When a drill rig must be maneuvered in tight quarters, the presence of a second person is required to ensure adequate clearance. If backing-up is required, two ground guides will be used: one in the direction the rig is moving and the other in the operator's normal field of vision.
		12b	Materials stored in the vicinity of drill rigs may pose various hazards to employees.	H&S	3	4	12	12b	Move tools, materials, cords, hoses, and debris to prevent trip hazards and contact with moving drill rig parts. Secure tools and equipment subject to displacement or falling. Store any flammable materials away from ignition sources and in approved containers.
13	Physically Clear all Ground Disturbance Locations	13a	Employees performing physical clearance could contact underground utility/service lines.	H&S	4	3	12	13a	Use cable avoidance tools at each location that must be physically cleared (OSHA requirement). If using a hand-auger, ensure insulated handles are in-place before their use.
		13b	Drill rig could damage electrical/utility/service lines if not physically cleared first.	H&S	3	4	12	13b	Mechanical ground penetration should not commence until a ground disturbance location is physically cleared. In certain situations drilling may occur without physical clearance – consult with the project PIC prior to making this determination.
14	Commence Drilling Operations	14a	Rotating equipment could pull employees into equipment.	H&S	3	4	12	14a	Do not wear loose or frayed clothing, loose long hair, or loose jewelry while working around rotating equipment. Tuck shirt-tails into pants. Never walk directly behind or beside drill rigs without the drill rig operator's knowledge. Keep all non-essential personnel out of the drill rig work area.
		14b	Poorly functioning drill-rig equipment could expose employees to hazardous conditions.	H&S	3	4	12	14b	Ensure drill rigs and other machinery used is inspected daily by competent, qualified individuals. Instruct drill rig operators to report any abnormalities such as equipment failure, oozing liquids or unusual odors so they can be dealt with before proceeding with work. Do not eat, drink, or smoke near the drill rig.
		14c	Noisy environments may make it difficult to communicate by vocal means.	H&S	3	4	12	14c	Wear hearing protection at all times when in the vicinity of the drill rig, or when you must raise your voice to be heard by co-workers. Maintain visual contact with the drill rig operator at all times and establish hand-signal communications for use when verbal communication is difficult.
15	Complete Drilling Operations	15a	Equipment allowed to remain running poses pinch-point and potential explosion hazards to employees	H&S	3	4	12	15	Shut down drill rigs before repairing or lubricating parts (except those that must be in motion for lubrication). Shut down mechanical equipment prior to and during fueling operations. When refueling or transferring fuel, containers and equipment must be bonded to prevent the buildup of static electricity.

Task Steps[1]		Potential Hazards & Consequences[2]		select	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). 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.

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 Development Checklist

This checklist provides common hazards and some hazard control measures for consideration, and can be used to help develop site-specific JHAs

Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Fatigue and Stress	Specifically define acceptable work hours, work duration, work weeks, consecutive days, etc. Define rest frequency and duration. Take weather, PPE, activity level into consideration. Identify activities with increased mental stress / strain, and determine if controls are warranted: multiple employees, work rotation, etc. Identify activities with limited mental stress (e.g., 'boring or dull activities' where inattention can occur), and determine if controls are warranted: multiple employees, work rotation, etc. Consider activities that may occur immediately before or after the task (e.g., driving), and determine whether controls are required (e.g., limitations on driving after 10 hr days of field activities). Remember that stress and fatigue ARE NOT LIMITED to field / construction activities.
Sharp Edges (designate in JHA the specific cut or puncture hazard associated with the task step)	Wear ____ gloves (designate type, e.g. heavy leather, cut-resistant, puncture-resistant). Wear ___ footwear (designate type, e.g. puncture-resistant insoles). Wear ___ clothing (designate type, e.g. long sleeves, heavy coveralls). Have gloves on your person at all times. Employees performing significant amounts of cutting tool use should wear high-visibility gloves to encourage awareness of where hands are being placed. Do not attempt to catch falling tools/equipment. Ensure guards are in place. Use ___ cutting tool (designate type, e.g. scissors, shears, snips). Do not use dull blades. Do not use open-bladed knives. Inspect tools/equipment in area prior to start of task to identify sharp edges and, if possible, remove/protect or position body to ensure no contact during task. Always cut away from hand, body and face. Ensure others are not in line-of-fire when cutting. Place object to be cut in a vise or on a flat surface or use another tool to hold object while cutting. Do not place fingers in ends of piping or other tubular material.
Pinch Points (designate in JHA the specific pinch hazard associated with the task step)	Wear ___ gloves (designate type, e.g. heavy leather, puncture-resistant). Have gloves on your person at all times. Inspect work area prior to start of task to identify pinch points and remove/protect to ensure do not contact during task. Consider body positioning prior to start of task to identify potential pinch points and change position to ensure do not contact during task. Identify pinch points by warning label and/or paint color. Do not position your hand or body so it can be caught between a lifted load and adjacent objects. Do not place fingers/hands between sections of multi-component/moveable items (e.g. fencing sections, sheet piling, hinged panels).
Slips / Trips / Falls from Surface Conditions (designate in JHA the specific slip, trip, fall hazard associated with the task step)	Wear ___ footwear (designate type, e.g. shoes with rubber soles or low heels, crampons). Identify and use only safe pathways and stairs when entering/exiting/working in area. Obtain additional lighting and use clear safety glasses in areas with low/unclear visibility. Inspect work area for potential slip/trip/fall obstructions prior to start of work and remove or, if not possible, mark with highly visible tape/flags, etc. Keep work area organized and free of surface obstructions during task. Immediately dry wet areas or restrict access (e.g. with warning tape, signs, cones). Remove snow/ice prior to start of work. Reassess surface conditions if weather changes and address any new hazards (e.g. slick surface developing as a result of wet/freezing conditions). Do not carry loads that restrict visibility. Do not stack objects higher than ___ (designate height). Ensure steps, walkways and shoes are not slippery or loose prior to use. Keep work area surfaces clear of debris (e.g. mud, leaves) and store tools/equipment to eliminate trip hazards when not in use. Keep eyes on path and nearby surroundings when walking. Take small steps and shuffle feet in potentially slippery areas. Walk slowly around corners and when entering/exiting doors. Use slip-resistant mats. Use handrails when going up/down stairs. Fill in/flatten uneven ground. Use steps/stepladders for access in and out of shallow trenches/excavation.
Fall from Elevated Position (designate in JHA the specific elevated hazard associated with the task step)	Use carts with high sides to contain load. Ensure load is secure and balanced prior to moving. Maintain 3-points of contact when mounting/dismounting vehicle/equipment. Maintain 3-points of contact when climbing/descending ladders. Use equipment/mechanical means (e.g. tool belt, rope) to transport tools/materials. Ensure steps, ladder rungs and shoes are not slippery or loose. Do not stand or work off top of ladder (e.g. top 2 steps of stepladder). Extend ladder at least 3-feet beyond top bearing point. Have another person hold bottom of ladder at all times while working or until top is secured; if ladder is not equipped with grip pads, hold bottom at all times. Position extension ladder at 1 foot distance for every 4 feet of working height. Do not overreach; keep body between ladder rails and both feet on same rung. Wear fall protection when working at a height of 6 feet (1.8 meters) or greater. Wear full body harness with double-locking snap hooks and shock absorbing lanyard. Inspect fall protection prior to use and do not use if: worn or frayed lanyard or webbing/stitching; locking devices, snap hooks, etc. are not working properly; metal components are worn, damaged, or have burrs, etc.; annual inspection tag is not in place and current. Connect to secure anchor point meeting fall protection specifications (capable of supporting 5,000# per person attached, above shoulder height, no sharp edges, etc.). Ensure scaffolding has secured boards, is adequately braced, has a handrail, is free of debris and holes and is in good working condition. Stand only on secured and inspected flooring and uprights. Work only within the scaffolding structure.

ERM

JHA Development Checklist

This checklist provides common hazards and some hazard control measures for consideration, and can be used to help develop site-specific JHAs

Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Back Sprain/Strain (designate in JHA the specific back sprain/strain hazard associated with the task step)	Use ___ mechanical lifting/carrying device (designate type, e.g. cart, dolly, forklift). Obtain assistance when lifting ____ (designate what, e.g. awkwardly shaped objects) or objects weighing greater than ___ (designate limit). Bend and lift with legs/arms, not back. Keep objects close to body and do not twist while lifting (turn with feet). Position work equipment to avoid over-reaching while working. Do not overload waste containers, fill ___ full (designate volume). When objects are lifted/carried by two persons, take positions on opposite ends. Store heavy/bulky items with safe access in mind. Take regular breaks every ___ (designate frequency).
Suspended Loads/Low-Hanging Objects (designate in JHA the specific suspended load, low-hanging hazard associated with the task step)	Wear hard hat. Wear ___ gloves (designate type, e.g. rubber dot for grip). Wear ___ footwear (designate type, e.g. steel-toe boots; footwear with metatarsal-protection). Do not attempt to catch falling objects. Stay ___ (designate distance) away from raised objects. Restrict access with warning tape and/or posted signs. Secure loose objects prior to lifting or moving by ___ (designate how, e.g. with straps, sideboards, use of panel cart with high sides). Remove low-hanging objects or identify (e.g. mark with highly visible paint, tape, flags) and/or communicate location to site personnel. Visually inspect equipment before beginning task. Verify latest equipment inspection/tag is current before beginning task. Inspect lifting rigging (chains/slings/cables) to ensure in good condition and do not use if defects, signs of excessive wear are identified. Verify lifting equipment is certified and rated for handling the reach and load limits for required work. Use trained spotter(s) to alert others of hazards. Use tag lines held by trained personnel to guide load and do not wrap lines around body parts. Pre-inspect travel route to ensure clearance. Keep load low to ground to ensure clear visibility when transporting. Move load using low, slow, controlled movements.
Rotating / Automated / Energized Equipment (designate in JHA the specific rotating hazard associated with the task step)	Do not work on moving equipment. De-energize all energy sources (e.g. compressed, pressurized) equipment prior to working on. Lock out/tag out equipment per LOTO procedure and verify energy isolation prior to start of task. Employees who perform LOTO must receive authorized employee training. 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. Remove/secure loose clothing, hair and jewelry. Keep hands/body/tools ___ (designate distance) away from equipment. Identify automatic-start equipment with signs/labels. Locate emergency stop/shutdown switch prior to start of task. Ensure all associated personnel are notified of work activities. De-energize hand-held and mobile equipment when not in use. Plan work lay-out/processes to avoid and/or minimize line-of-fire risks. Define and barricade personnel exclusion zones based on machine swing areas, area below crane operation, etc.
Vapors, Airborne Debris (designate in JHA the specific vapor, debris or liquid hazard associated with the task step)	Keep area ventilated by ___ (designate how, e.g. with forced draft fans, outside use only). Perform ___ monitoring (designate method and frequency) and stop work if monitoring result ___ (designate limits). Position body upwind. Keep work area wet to limit dust. Set-up work zone to restrict non-essential access and minimize off-site impacts. Wear ___ eye/face protection (designate type, e.g. safety glasses, face shield, splash goggles or combinations). Wear ___ clothing (designate type, e.g. long sleeves, paper suit). Wear ___ breathing protection (designate type, e.g. dust mask, full/half-face respirator with ___ (designate type) cartridges). Establish cartridge change-out schedule. (designate in JHA the specific ignition risks associated with the task step)
Ignition (designate in JHA the specific ignition risks associated with the task step)	Undertake work under Hot Work Permit. Monitor VOCs and LEL by ___ (designate method and frequency) and stop work if monitoring result ___ (designate limits). Seal all pipe/openings (e.g. tank holes, storm drains) in work zone that may emit vapors. Ensure all equipment in work area is intrinsically safe. Define/barricade work areas to exclude unauthorized access/external ignition sources (e.g. vehicular traffic). Keep area ventilated by ___ (designate method, e.g. with fans). Ensure lines are clear prior to disconnect and/or use dry couplings. Assess and control static risks for all work equipment and processes. Have ___ (designate number, type and size) fire extinguisher(s) on site and immediately available for use. (designate in JHA the specific high noise hazard associated with the task step)
	Determine whether noise monitoring has been necessary on other projects of similar scope. Measure noise levels with a noise dosimeter if project will last over 30 days, or for shorter work use the rule or thumb that you should be able to hear a

JHA Development Checklist

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Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
High Noise Level (designate in JHA the specific high noise hazard associated with the task step)	Measure noise levels with a noise dosimeter if project will last over 30 days, or for shorter work use the rule of thumb that you should be able to hear a person talking to you in a normal voice at 1m/3 ft. If you cannot hear them without them raising their voice the hearing protection is necessary, and noise monitorting is advisable. For any employee working on the site who has not attended hearing conservation training within the past year, review this JHA with them and document their training. Wear ___ hearing protection (designate type, e.g. ear plugs, ear muffs, double hearing protection) based on known or potential noise levels. Post warning signs at ___ (designate distance) from work area stating entry restrictions and/or type of hearing protection required. Ensure mufflers are installed in equipment. Minimize potential external/third party/community impacts by ___ (designate how). Share noise dosimetry results with your Divisional Safety Advisor so we can build up a bank of knowledge about the types of equipment at projects where hearing protection should be considered.
Heat Stress and Burns (designate in JHA the specific heat hazard associated with the task step)	**Hot Equipment:** Allow equipment/material to cool prior to working with. Use designated handles to open/move equipment. Turn off equipment and allow to cool prior to refueling. Identify hot surfaces prior to start of task and avoid direct contact with.Drink cool fluids and take rest breaks every ___ (designate frequency). Wear ___ gloves (designate type, e.g. oven mitts, thermal, etc...). Use ___ (designate type, e.g. tongs, insulated handles) tool to move equipment or materials. **Hot Weather:** Check the weather forecast in advance & be prepared for those conditions Wear ___ clothing (designate type, e.g. light-weight fabrics with long sleeves & trousers, cool vest, etc...). Schedule regular breaks, watch your colleagues using the buddy system. Use sun block for skin protection, drink cool drinks regularly (i.e.: before you become thirsty), take breaks in the shade (advice on the regularity and duration of these can be found in the SWP linked to below) Stop work if fatigue or physical stress situations develop in your or those around you High humidity, working in direct sunlight, work in contact with hot surfaces influence the severity of hot working conditions. Seek specific guidance and training if work in these conditions is necessary. (Advice is available on the SWP for heat stress available on Minerva Americas H&S pages at the following link: http://minerva.erm.com/Support/HS/AmericasHS/Safe%20Work%20Practices%20SWP/04%20-%20Heat%20Stress%20-%20updated%208-11.doc)
Cold Stress (designate in JHA the specific cold hazard associated with the task step)	Drink hot/warm fluids and take rest breaks every ____ (designate frequency) Wear ___ clothing (designate type, e.g. insulating layers, down jacket, chef coat). Wear ___ gloves (designate type, e.g. thermal, freeze-protection). In temperatures below freezing do not touch bare metal surfaces with the naked skin without adequate PPE, such as gloves. At or below 4°C/40°F adequate dry insulating clothing must be available to keep worker's core temperature at or above 36°C/96.8°F Dampness/condensation, work in contact with cold water or surfaces, and wind speed all influence the severity of cold working conditions. Seek specific guidance and training if work in these conditions is necessary. (Training is available on ERM North American Minerva page at the following link: http://minerva/erm/globalsupport/healthandsafety/NA/HS%20Training%20Materials/Home.aspx)
High Voltage/Electrical Contact (designate in JHA the specific high voltage / electrical hazard associated with the task step)	Use wooden or fiberglass ladder. Stand on non-conductive surface. Remove metal jewelry. Footwear worn around electrical circuits should be non-conductive. Ensure power cords are free of defects and exposed wires. Do not work in ___ (designate condition, e.g. thunderstorm) weather. Use___ gloves (designate type in JHA, e.g. electrical-insulted). Use ground fault circuit interrupter (GFCI). Use low voltage lighting. Ground equipment by ___ (designate how or refer to separate procedure). Pre-inspect travel route to ensure clearance. Inspect above and below ground areas prior to start of work to identify electrical lines and communicate locations to site personnel. **SSC:** Ensure completion of subsurface clearance procedure requirements. Ensure line locator service identification of underground lines. Use non-destructive drilling techniques (e.g. air-knife). When excavating, assign spotter to stop work at sign of subsurface conduits/wires. Keep ___ distance from overhead power lines (designate distance in JHA based on voltage, regulations, etc.). Lock-Out/Tag-Out (LOTO): LOTO equipment must be available as per the LOTO procedure and verify isolation of energy source prior to start of task. Tags must read "DANGER – DO NOT OPERATE" and be resistant to wear and tear by the environment they are being used in. Employees who perform LOTO must receive authorized employee training, subcontractors must provide evidence that they have (e.g.: a certficate) Wear a cotton t-shirt, Class II Electrical Arc Protection suit, Class O (low voltage) gloves, and non-conductive footwear. Only the person who placed the LOTO device is authorized to remove it, so after-hours contact information for LOTO employees must be in the HASP. Ensure all associated/potentially impacted personnel are notified of work activities. Before working on live equipment, it should be brought to a "zero-energy state" by turning off the equipment's power (at source, such as by switching off specific circuit breakers. ("Zero-energy" is not attained until the individual working on the machinery attempts to turn the machine on and is unsuccessful.) In certain situations, where machinery must stay live to do work, and Lock-Out is not possible, the Project Manager and Field Safety Officer must be directly involved when Tag-Out is taking place. For all sites where work extends beyond 1 year, a LOTO a documented process inspection must occur to check that LOTO procedures in-place are still valid.

JHA Development Checklist

This checklist provides common hazards and some hazard control measures for consideration, and can be used to help develop site-specific JHAs

Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Chemical/Liquids Contact or Release (designate in JHA the specific chemical/liquid hazard associated with the task step)	Wear ___ eye/face protection (designate type, e.g. safety glasses, face shield, chemical splash goggles or combination) Wear ___ clothing (designate type, e.g. long sleeves, paper suit, protective apron, polyethylene coated suit). Wear ___ gloves (designate type, e.g. butyl, nitrile, rubber, resistant to specific chemical/duration). Ensure that gloves and boots are taped to the suit to prevent liquid splash. Double-layering nitrile or latex protective gloves is a good idea for added protection. If acidic or caustic chemicals are present, wear outer neoprene or rubber gloves. Restrict access to work area by ___ (designate how). Use funnel when pouring liquid. Ensure bleed valves are open and lines are clear prior to disconnect and/or use dry couplings. Have ___ (designate type/amount, e.g. pads, boom) absorbent material on hand. Place container and/or absorbent/plastic sheeting under connection prior to disconnect. Store hazardous materials in dedicated container/area (e.. shed, box). Wash hands frequently. Inspect pressurized lines and all fittings/couplings to ensure integrity/closure. Assess rating and compatibility of materials used vs purpose. Ensure storage compatibility of multiple products. **<u>Hazard Communication:</u>** For each chemical product used by ERM employees or subcontractors, a SDS sheet must be obtained and kept on-file. Chemical containers must be labeled in accordance with OSHA regulations. Review SDS and container label prior to start of task/handling and follow associated requirements. Ensure all employees on the jobsite have been told about the chemical in-use and are protected. Confirm SDS is relevant when working with legacy material (e.g. historic releases). A chemical inventory list must be prepared and updated as new or different chemicals are procured. If chemical exposure occurs, even if medical symptoms are not present, inform the Field Safety Office or Office H&S Contact.
Biological Contact (designate in JHA the specific biological hazard associated with the task step)	Wear ___ clothing (designate type, e.g. long sleeves, hood, paper suit). Wear ___ gloves (designate type, e.g. fabric, nitrile). Use insect repellant. Inspect area prior to start of task and remove/avoid animal (e.g. dogs), insect (e.g. bees, wasps), plant (e.g. poison ivy) hazards if possible; otherwise reschedule work and/or contact professional service for removal. Report allergies and ensure treatment is available on site. Avoid loud noises/brightly colored clothing if bees are known to be in area.
Repetitive Motion (designate in JHA the specific repetitive motion hazard associated with the task step)	Use ___ tool and/or ___ technique (designate, e.g. ratchet wrench) to minimize repetitive stress risk. Change position frequently during job (e.g. vary grip, hand motion). Keep wrists in a neutral (straight) position as you work. When possible, rotate tasks to give body parts a rest. Take breaks every ___ (designate frequency) and do simple stretches/exercises. Ensure gloves fit hands properly to decrease stress on hand/joints.

JHA Development Checklist

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Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Traffic (designate in JHA the specific pedestrian / motorized traffic hazard associated with the task step)	Wear ___ clothing (designate type, e.g. reflective vest, neon orange/green shirt). High-visibility safety vests: class I may be used when traffic is below 25 mph, Class II for 25-50 mph, and Class 3 for >50 mph. Set up work zone to restrict non-essential access by ___ (designate how, e.g. with cones/barricades/fencing, placed specified distance apart/from work area, etc.). Avoid risks posed by detour (e.g. pedestrians forced into other traffic). Use parked vehicle with hazard lights facing oncoming traffic to protect work zone. Use buddy system to establish traffic watch. Use trained spotters when backing and when visibility is restricted. Inspect surrounding area prior to backing. Adjust mirrors and check equipment back-up alarm to confirm operational prior to start of task. Use horn to alert others prior to backing. Use traffic management consultant. Stay ___ (designate distance) from operating equipment/extended arm, etc. Make eye contact with equipment operator and receive approval prior to approaching. Ensure spotters and equipment operators maintain eye contact. Establish parking/staging/loading/unloading areas (consider equipment turning circles, swing zones etc.). Ensure trailers / trucks are rated and balanced. Chock truck/trailer wheels when not moving. Ensure load is distributed during load/unload to avoid tip/roll-over. Ensure all personnel remain outside of tip-over radius when dumping.
Improper Waste Transport / Disposal (designate in JHA the specific waste disposal hazard associated with the task step)	Designate safe waste storage area/container prior to start of task. Ensure waste materials meet container specifications prior to use. Label waste containers. Separate hazardous and non-hazardous wastes. Place waste containers in designated storage area and secure prior to leaving site. Confirm waste transport truck/container integrity prior to loading. Confirm shipping document description/approved destination with waste container label prior to off-site shipment. For unsealed/partially exposed loads, perform ___ monitoring (designate method and frequency) and stop work if monitoring result ___ (designate limits).
H&S Risks and Increase in ERM Liability caused by Subcontractors Working on the Jobsite	Select only subcontractors that have been prequalified and approved for use. Ensure a signed, executed subcontract agreement is in-place prior to subcontractors performing work on the jobsite for ERM. Ensure the subcontractor has received a copy of the ERM HASP and supporting documentation prior to mobilization to the jobsite. Specify both the ERM and the subcontractor's scope of work in the ERM HASP document. Ensure that any subcontractor personnel on-site have reviewed and signed the site HASP. In all cases, require the ERM subcontractor to either develop their own site-specific HASP, or at minimum develop Job Hazard Analyses (JHA) for the specific tasks they will perform. Attach these documents to the ERM HASP as appendices. Ensure subcontractor work is overseen by ERM personnel at all times. Always include subcontractor personnel in daily jobsite tailgate safety meetings. Do not supply subcontractor personnel with personal protective equipment (PPE). If ERM is performing air monitoring for the subcontractor, ensure calibration of air monitoring equipment is done before and after each use. At a minimum, air monitoring equipment must be calibrated at least once per day. Document equipment calibration and file with the site HASP.
Exposure to Toxic and Hazardous Chemical Substances (designate in the JHA the specific chemicals of concern)	Determine whether there is a potential for exposure to any toxic or hazardous chemical substances in the work area prior to performing any work that may involve handling of one or more of the chemicals or may result in exposure through production, research, or process activities. This would include, but not be limited to, OSHA's 13 regulated carcinogens, and the following: • Acrylonitrile • Asbestos • Benzene • Cadmium • Chromium (VI) • Coke oven emissions • Cotton Dust • Ethylene oxide • Formaldehyde • Hydrogen sulfide • Inorganic arsenic • Lead • Methylene chloride • Methylenedianiline • Vinyl chloride • 1,2-dibromo-3-chloropropane • 1,3-butadiene
	If any of the substances are identified, conduct an exposure assessment to determine whether employees have the potential to be exposed above any action level identified in the substance-specific regulations.
	Where the initial assessment identifies the potential for employee exposures above an established action level or permissible exposure limit, develop a site-specific program to address all required regulatory concerns for that substance. Completed programs shall be included in the site-specific health and safety plan.
	Ensure the health and safety plan specifies the airborne contaminants that may be encountered and the need for respiratory protection. Ensure the plan provides a selection process for the respirator and cartridge type, develops actions levels for upgrades/downgrades of respiratory protection, describes cartridge change out schedules, and provides information on medical surveillance criteria and respirator fit testing requirements.
	Prior to donning any respirator, complete a thorough inspection to ensure it is in good operating condition. Inspected elements should include, but not be limited to, straps, sealing surfaces, inhalation/exhalation vales, and facepieces. Do not use respirators with any signs of damage.
	Where necessary, replace damaged parts. If repair is not possible, discard and replace entire respirator.
	Clean and disinfect respirators using a mild soap and water solution following use. Where respirator sharing is allowed, ensure respirators are cleaned and sanitized before being exchanged by employees.

JHA Development Checklist

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Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Respiratory Protection	For cartridge-type respirators, affix the cartridges to the respirator as indicated in the manufacturer's guidelines. Cartridges should be hand tightened only.
	Employee must be clean shaven in those areas of the face where the respirator makes skin contact, including any inner nose cups.
	Don the respirator prior to other personal protective equipment in the head/neck area so that nothing comes between the respirator straps and the head surface. Safety glasses, hard hats, etc. must be donned after the respirator.
	For cartridge-type respirators, perform a positive and negative fit check to ensure a good respirator seal.
	Adjustments made while wearing tight-fitting respirators within the work area may result in a compromised respirator seal. If this occurs, stop work, move to an area with no chemical contamination (go through the decontamination process, if present), readjust the respirator, and perform positive and negative fit-checks to ensure a proper facepiece seal.
	If it becomes difficult to breathe due to particulate clogging of respirator cartridges, stop work, move to an area with no chemical contamination (go through the decontamination process, if present), replace the cartridges, readjust the respirator, and perform positive and negative fit-checks to ensure a proper facepiece seal.
	If using a chemical catridge and you either (1) reach or exceed the required wear time as described in the cartridge change schedule or (2) detect any evidence of chemical breakthrough (odors, tastes, burning sensations, etc.), stop work, move to an area with no chemical contamination (go through the decontamination process, if present), replace the cartridges, readjust the respirator, and perform positive and negative fit-checks to ensure a proper facepiece seal. If chemical breakthrough was detected, determine what level of exposure may have occurred through testing of the work atmosphere.
	If a decontamination line is present, proceed through the line as directed. If no decontamination line is present, remove all other PPE except clean gloves before removing the respirator. Once removed, clean as directed.
Natural Hazards (designate in JHA the specific natural hazards associated with the task step)	For sites where poison ivy, oak, and sumac are present, have a poison ivy wash available for employees on-site. If exposure occurs and no poison ivy wash is available, employees should wash in cool water and use soap. Keep work areas free from clutter so that ground surfaces can be easily seen by employees. **<u>Working around poisonous insects:</u>** Use insect repellant containing DEET at all times on the jobsite. Periodically throughout the day and at the end of the day, perform a thorough “tick-check” to ensure ticks or other insects are found and removed promptly. Avoid obvious conical mounds of dirt that may indicate ants, wasps, or other flying insects. Before reaching into dark or damp spaces such as monitoring well-heads, inspect the area thoroughly to ensure spiders are not present. Always take a shower as soon as possible after leaving a jobsite for the day to remove any insects, such as chiggers. **<u>Working around snakes:</u>** Visually inspect the work are prior to beginning any work to located areas with high grass and underbrush. Do not walk through these areas if at all possible to avoid snakes. Wear leather steel-toe boots and snake chaps in areas where snakes are suspected or confirmed to be present. Do not attempt to kill snakes, as people are commonly bitten attempting this. **<u>Working around feral animals:</u>** High rat populations within an enclosed space present a hazard of Hanta virus. Spray such areas with bleach solution prior to performing any work in the area (10 parts water to 1 part household bleach). If dogs or other animals are spotted that are acting strangely, do not approach them. Contact the local animal control center for assistance.

			Severity				
			Minor (1)	Moderate (3)	Serious (5)	Severe (7)	Catastrophic (10)
Probability	Almost Certain	(6)	6	18	30	42	60
	Likely	(5)	5	15	25	35	50
	Possible	(4)	4	12	20	28	40
	Heard of	(3)	3	9	15	21	30
	Unlikely	(2)	2	6	10	14	20
	Rare	(1)	1	3	5	7	10

Risk Rating

Extreme	High	Low

Risk Rating

Extreme	36
High	19
Medium	6
Low	0

ERM

JHA
Job Hazard Analysis

Project Number:	516919	Project / Client Name:	Pre Design Investigation/ G.W. Lisk
Project Manager:	Tim Daniluk	Location:	2 South Street, Clifton Springs, New York 14432
Partner-in-Charge:	Ernest Rossano	Date and Revision Number:	6/3/2022, Rev. 0

SPECIFIC TASK:	**Driving Field Vehicle**

Minimum Required PPE for Entire Task:	☑ Hard Hat ☑ Safety-Toe Shoes ☐ Hearing Protection ☐ Goggles ☐ Face Shield ☐ Respirator: N/A ☐ Other (specify): ☑ Safety Glasses ☑ Reflective Vest ☑ Gloves: chemical resistant ☑ PPE clothing: Long sleeves, pants; Sunglasses when necessary		
Additional Task-Step Specific PPE: (as indicated below under Controls)	Sunglasses to reflect glare when necessary	Equipment / Tools Required:	Field Vehicle
Training Required for this Task:	Valid Driver's License, ERM FSO training	Permits Required for this Task:	Drivers License
Forms Associated with This Task:	ERM Vehicle Safety sheet		

JHA Developed / Reviewed By:			JHA Review In Field
Name / Job Title:	Name / Job Title:	Name / Job Title:	Field supervisor to ensure all personnel performing this task have reviewed JHA and agree to follow it. Site-specific changes to this JHA have been made as warranted based on this review. **Signature/Date:**
Alexis Harford/ Consultant I			

Task Steps[1]		Potential Hazards & Consequences[2]		select	Probability	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
1	Inspect the vehicle	1a	Tire pressure, brakes, steering, headlights, and other vehicle equipment malfunction can contribute to vehicle accidents and property damage	H&S	3	3	9	1a	Use "ERM Vehicle Safety Form" to document daily inspections of the vehicle. In certain cases, a client-required form may be used instead. Do not operate any vehicle if its safety is in question.
		1b	Loose articles inside the vehicle and carried in the truck beds or on trailers can shift and cause distractions or traffic accidents	H&S	3	3	9	1b	During vehicle inspection make sure any loose articles either inside the vehicle of in truck beds/on trailers are well-secured.
2	Get in and out of the vehicle	2a	Hands, hair, or loose clothing can be caught in doors, trunk covers, and other vehicle equipment, causing injury.	H&S	3	3	9	2a	When entering or exiting a vehicle, pay attention to what you are doing & be cognizant of potential hazards.
3	Driving the vehicle	3a	Operating a vehicle presents many different hazards to employees that must be simultaneously mitigated.	H&S	3	4	12	3a	Before moving vehicles always put your seat belt on, and stop using handheld electronics. Make sure any food or drink is secured and any electronics are programmed (GPS). When moving vehicles, follow all posted speed limits and posted signs. Do not pick up hitch-hikers, and never transport people in truck beds.
4	Driving when fatigued	4a	Operating a vehicle after a full day of work or when you are fatigued drastically decreases focus and response time, and increasing the risk of being involved in a vehicle accident.	H&S	3	4	12	4a	Avoid driving more than 8 hours in one workday. If the number of hours driving to/from a jobsite combined with the number of hours to be worked on the site will equal more than 14 total hours, alternate arrangements should be arranged. Be aware of your fatigue level while driving and stop to rest if you feel overly tired.
5	Stay focused on the road	5a	Doing anything that distracts you from the road for more than 2 seconds highly increases the risk of being involved in a vehicle accident. In particular, driver inattention due to hand-held mobile phone use is currently thought to be responsible for approximately 80% of all vehicle accidents.	H&S	3	4	12	5a	Do not operate a hand-held mobile phone while driving. Use a hands-free mobile solution instead, such as a Bluetooth headset or hardwired earpiece. In some cases, all mobile phone use while driving (including answering and dialing), may be prohibited by our client. Do not perform activities while driving that will take your attention off the road for more than 2 seconds. A few of these types of activities could include programming GPS', applying makeup, changing the radio, or eating while driving. When these sorts of activities must be performed, pull to the side of the road and stop.

Task Steps[1]		Potential Hazards & Consequences[2]		select	Probability	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
6	Leaving the vehicle	6a	Leaving personal valuables and company equipment/documents in abandoned vehicles may attract thieves.	H&S	3	3	9	6a	Turn off the engine and lock any vehicle being left for even a short period of time when not on a secure jobsite. If the vehicle will be left for long periods or overnight, remove any company documents, computers, and equipment, personal valuables, or any items that would attract thieves.
7	Report and Document Vehicle Accidents and Property Damage	7a	Improper documentation of vehicle accidents and property damage caused by vehicle operation place ERM at risk.	PL	3	3	9	7a	No matter how minor a vehicle accident or property damage event is, report it as a safety event. If involved in a vehicle accident, always call the police so a report will be available, to protect your liability, and to protect ERM liability. Take as many pictures as you can of the accident scene if you can do so without placing yourself in further danger.

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). 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.

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 Development Checklist

This checklist provides common hazards and some hazard control measures for consideration, and can be used to help develop site-specific JHAs

Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Fatigue and Stress	Specifically define acceptable work hours, work duration, work weeks, consecutive days, etc. Define rest frequency and duration. Take weather, PPE, activity level into consideration. Identify activities with increased mental stress / strain, and determine if controls are warranted: multiple employees, work rotation, etc. Identify activities with limited mental stress (e.g., 'boring or dull activities' where inattention can occur), and determine if controls are warranted: multiple employees, work rotation, etc. Consider activities that may occur immediately before or after the task (e.g., driving), and determine whether controls are required (e.g., limitations on driving after 10 hr days of field activities). Remember that stress and fatigue ARE NOT LIMITED to field / construction activities.
Sharp Edges (designate in JHA the specific cut or puncture hazard associated with the task step)	Wear ____ gloves (designate type, e.g. heavy leather, cut-resistant, puncture-resistant). Wear ___ footwear (designate type, e.g. puncture-resistant insoles). Wear ___ clothing (designate type, e.g. long sleeves, heavy coveralls). Have gloves on your person at all times. Employees performing significant amounts of cutting tool use should wear high-visibility gloves to encourage awareness of where hands are being placed. Do not attempt to catch falling tools/equipment. Ensure guards are in place. Use ___ cutting tool (designate type, e.g. scissors, shears, snips). Do not use dull blades. Do not use open-bladed knives. Inspect tools/equipment in area prior to start of task to identify sharp edges and, if possible, remove/protect or position body to ensure no contact during task. Always cut away from hand, body and face. Ensure others are not in line-of-fire when cutting. Place object to be cut in a vise or on a flat surface or use another tool to hold object while cutting. Do not place fingers in ends of piping or other tubular material.
Pinch Points (designate in JHA the specific pinch hazard associated with the task step)	Wear ___ gloves (designate type, e.g. heavy leather, puncture-resistant). Have gloves on your person at all times. Inspect work area prior to start of task to identify pinch points and remove/protect to ensure do not contact during task. Consider body positioning prior to start of task to identify potential pinch points and change position to ensure do not contact during task. Identify pinch points by warning label and/or paint color. Do not position your hand or body so it can be caught between a lifted load and adjacent objects. Do not place fingers/hands between sections of multi-component/moveable items (e.g. fencing sections, sheet piling, hinged panels).
Slips / Trips / Falls from Surface Conditions (designate in JHA the specific slip, trip, fall hazard associated with the task step)	Wear ___ footwear (designate type, e.g. shoes with rubber soles or low heels, crampons). Identify and use only safe pathways and stairs when entering/exiting/working in area. Obtain additional lighting and use clear safety glasses in areas with low/unclear visibility. Inspect work area for potential slip/trip/fall obstructions prior to start of work and remove or, if not possible, mark with highly visible tape/flags, etc. Keep work area organized and free of surface obstructions during task. Immediately dry wet areas or restrict access (e.g. with warning tape, signs, cones). Remove snow/ice prior to start of work. Reassess surface conditions if weather changes and address any new hazards (e.g. slick surface developing as a result of wet/freezing conditions). Do not carry loads that restrict visibility. Do not stack objects higher than ___ (designate height). Ensure steps, walkways and shoes are not slippery or loose prior to use. Keep work area surfaces clear of debris (e.g. mud, leaves) and store tools/equipment to eliminate trip hazards when not in use. Keep eyes on path and nearby surroundings when walking. Take small steps and shuffle feet in potentially slippery areas. Walk slowly around corners and when entering/exiting doors. Use slip-resistant mats. Use handrails when going up/down stairs. Fill in/flatten uneven ground. Use steps/stepladders for access in and out of shallow trenches/excavation.
Fall from Elevated Position (designate in JHA the specific elevated hazard associated with the task step)	Use carts with high sides to contain load. Ensure load is secure and balanced prior to moving. Maintain 3-points of contact when mounting/dismounting vehicle/equipment. Maintain 3-points of contact when climbing/descending ladders. Use equipment/mechanical means (e.g. tool belt, rope) to transport tools/materials. Ensure steps, ladder rungs and shoes are not slippery or loose. Do not stand or work off top of ladder (e.g. top 2 steps of stepladder). Extend ladder at least 3-feet beyond top bearing point. Have another person hold bottom of ladder at all times while working or until top is secured; if ladder is not equipped with grip pads, hold bottom at all times. Position extension ladder at 1 foot distance for every 4 feet of working height. Do not overreach; keep body between ladder rails and both feet on same rung. Wear fall protection when working at a height of 6 feet (1.8 meters) or greater. Wear full body harness with double-locking snap hooks and shock absorbing lanyard. Inspect fall protection prior to use and do not use if: worn or frayed lanyard or webbing/stitching; locking devices, snap hooks, etc. are not working properly; metal components are worn, damaged, or have burrs, etc.; annual inspection tag is not in place and current. Connect to secure anchor point meeting fall protection specifications (capable of supporting 5,000# per person attached, above shoulder height, no sharp edges, etc.). Ensure scaffolding has secured boards, is adequately braced, has a handrail, is free of debris and holes and is in good working condition. Stand only on secured and inspected flooring and uprights. Work only within the scaffolding structure.

JHA Development Checklist

This checklist provides common hazards and some hazard control measures for consideration,
and can be used to help develop site-specific JHAs

Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Back Sprain/Strain (designate in JHA the specific back sprain/strain hazard associated with the task step)	Use ___ mechanical lifting/carrying device (designate type, e.g. cart, dolly, forklift). Obtain assistance when lifting ____ (designate what, e.g. awkwardly shaped objects) or objects weighing greater than ___ (designate limit). Bend and lift with legs/arms, not back. Keep objects close to body and do not twist while lifting (turn with feet). Position work equipment to avoid over-reaching while working. Do not overload waste containers, fill ___ full (designate volume). When objects are lifted/carried by two persons, take positions on opposite ends. Store heavy/bulky items with safe access in mind. Take regular breaks every ___ (designate frequency).
Suspended Loads/Low-Hanging Objects (designate in JHA the specific suspended load, low-hanging hazard associated with the task step)	Wear hard hat. Wear ___ gloves (designate type, e.g. rubber dot for grip). Wear ___ footwear (designate type, e.g. steel-toe boots; footwear with metatarsal-protection). Do not attempt to catch falling objects. Stay ___ (designate distance) away from raised objects. Restrict access with warning tape and/or posted signs. Secure loose objects prior to lifting or moving by ___ (designate how, e.g. with straps, sideboards, use of panel cart with high sides). Remove low-hanging objects or identify (e.g. mark with highly visible paint, tape, flags) and/or communicate location to site personnel. Visually inspect equipment before beginning task. Verify latest equipment inspection/tag is current before beginning task. Inspect lifting rigging (chains/slings/cables) to ensure in good condition and do not use if defects, signs of excessive wear are identified. Verify lifting equipment is certified and rated for handling the reach and load limits for required work. Use trained spotter(s) to alert others of hazards. Use tag lines held by trained personnel to guide load and do not wrap lines around body parts. Pre-inspect travel route to ensure clearance. Keep load low to ground to ensure clear visibility when transporting. Move load using low, slow, controlled movements.
Rotating / Automated / Energized Equipment (designate in JHA the specific rotating hazard associated with the task step)	Do not work on moving equipment. De-energize all energy sources (e.g. compressed, pressurized) equipment prior to working on. Lock out/tag out equipment per LOTO procedure and verify energy isolation prior to start of task. Employees who perform LOTO must receive authorized employee training. 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. Remove/secure loose clothing, hair and jewelry. Keep hands/body/tools ___ (designate distance) away from equipment. Identify automatic-start equipment with signs/labels. Locate emergency stop/shutdown switch prior to start of task. Ensure all associated personnel are notified of work activities. De-energize hand-held and mobile equipment when not in use. Plan work lay-out/processes to avoid and/or minimize line-of-fire risks. Define and barricade personnel exclusion zones based on machine swing areas, area below crane operation, etc.
Vapors, Airborne Debris (designate in JHA the specific vapor, debris or liquid hazard associated with the task step)	Keep area ventilated by ___ (designate how, e.g. with forced draft fans, outside use only). Perform ___ monitoring (designate method and frequency) and stop work if monitoring result ___ (designate limits). Position body upwind. Keep work area wet to limit dust. Set-up work zone to restrict non-essential access and minimize off-site impacts. Wear ___ eye/face protection (designate type, e.g. safety glasses, face shield, splash goggles or combinations). Wear ___ clothing (designate type, e.g. long sleeves, paper suit). Wear ___ breathing protection (designate type, e.g. dust mask, full/half-face respirator with ___ (designate type) cartridges). Establish cartridge change-out schedule. (designate in JHA the specific ignition risks associated with the task step)
Ignition (designate in JHA the specific ignition risks associated with the task step)	Undertake work under Hot Work Permit. Monitor VOCs and LEL by ___ (designate method and frequency) and stop work if monitoring result ___ (designate limits). Seal all pipe/openings (e.g. tank holes, storm drains) in work zone that may emit vapors. Ensure all equipment in work area is intrinsically safe. Define/barricade work areas to exclude unauthorized access/external ignition sources (e.g. vehicular traffic). Keep area ventilated by ___ (designate method, e.g. with fans). Ensure lines are clear prior to disconnect and/or use dry couplings. Assess and control static risks for all work equipment and processes. Have ___ (designate number, type and size) fire extinguisher(s) on site and immediately available for use. (designate in JHA the specific high noise hazard associated with the task step)
	Determine whether noise monitoring has been necessary on other projects of similar scope.

JHA Development Checklist

This checklist provides common hazards and some hazard control measures for consideration, and can be used to help develop site-specific JHAs

Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
High Noise Level (designate in JHA the specific high noise hazard associated with the task step)	Measure noise levels with a noise dosimeter if project will last over 30 days, or for shorter work use the rule of thumb that you should be able to hear a person talking to you in a normal voice at 1m/3 ft. If you cannot hear them without them raising their voice the hearing protection is necessary, and noise monitorting is advisable. For any employee working on the site who has not attended hearing conservation training within the past year, review this JHA with them and document their training. Wear ___ hearing protection (designate type, e.g. ear plugs, ear muffs, double hearing protection) based on known or potential noise levels. Post warning signs at ___ (designate distance) from work area stating entry restrictions and/or type of hearing protection required. Ensure mufflers are installed in equipment. Minimize potential external/third party/community impacts by ___ (designate how). Share noise dosimetry results with your Divisional Safety Advisor so we can build up a bank of knowledge about the types of equipment at projects where hearing protection should be considered.
Heat Stress and Burns (designate in JHA the specific heat hazard associated with the task step)	**<u>Hot Equipment:</u>** Allow equipment/material to cool prior to working with. Use designated handles to open/move equipment. Turn off equipment and allow to cool prior to refueling. Identify hot surfaces prior to start of task and avoid direct contact with.Drink cool fluids and take rest breaks every ___ (designate frequency). Wear ___ gloves (designate type, e.g. oven mitts, thermal, etc...). Use ___ (designate type, e.g. tongs, insulated handles) tool to move equipment or materials. **<u>Hot Weather:</u>** Check the weather forecast in advance & be prepared for those conditions Wear ___ clothing (designate type, e.g. light-weight fabrics with long sleeves & trousers, cool vest, etc...). Schedule regular breaks, watch your colleagues using the buddy system. Use sun block for skin protection, drink cool drinks regularly (i.e.: before you become thirsty), take breaks in the shade (advice on the regularity and duration of these can be found in the SWP linked to below) Stop work if fatigue or physical stress situations develop in your or those around you High humidity, working in direct sunlight, work in contact with hot surfaces influence the severity of hot working conditions. Seek specific guidance and training if work in these conditions is necessary. (Advice is available on the SWP for heat stress available on Minerva Americas H&S pages at the following link: http://minerva.erm.com/Support/HS/AmericasHS/Safe%20Work%20Practices%20SWP/04%20-%20Heat%20Stress%20-%20updated%208-11.doc)
Cold Stress (designate in JHA the specific cold hazard associated with the task step)	Drink hot/warm fluids and take rest breaks every ____ (designate frequency) Wear ___ clothing (designate type, e.g. insulating layers, down jacket, chef coat). Wear ___ gloves (designate type, e.g. thermal, freeze-protection). In temperatures below freezing do not touch bare metal surfaces with the naked skin without adequate PPE, such as gloves. At or below 4°C/40°F adequate dry insulating clothing must be available to keep worker's core temperature at or above 36°C/96.8°F Dampness/condensation, work in contact with cold water or surfaces, and wind speed all influence the severity of cold working conditions. Seek specific guidance and training if work in these conditions is necessary. (Training is available on ERM North American Minerva page at the following link: http://minerva/erm/globalsupport/healthandsafety/NA/HS%20Training%20Materials/Home.aspx)
High Voltage/Electrical Contact (designate in JHA the specific high voltage / electrical hazard associated with the task step)	Use wooden or fiberglass ladder. Stand on non-conductive surface. Remove metal jewelry. Footwear worn around electrical circuits should be non-conductive. Ensure power cords are free of defects and exposed wires. Do not work in ___ (designate condition, e.g. thunderstorm) weather. Use___ gloves (designate type in JHA, e.g. electrical-insulted). Use ground fault circuit interrupter (GFCI). Use low voltage lighting. Ground equipment by ___ (designate how or refer to separate procedure). Pre-inspect travel route to ensure clearance. Inspect above and below ground areas prior to start of work to identify electrical lines and communicate locations to site personnel. **<u>SSC:</u>** Ensure completion of subsurface clearance procedure requirements. Ensure line locator service identification of underground lines. Use non-destructive drilling techniques (e.g. air-knife). When excavating, assign spotter to stop work at sign of subsurface conduits/wires. Keep ___ distance from overhead power lines (designate distance in JHA based on voltage, regulations, etc.). Lock-Out/Tag-Out (LOTO): LOTO equipment must be available as per the LOTO procedure and verify isolation of energy source prior to start of task. Tags must read “DANGER – DO NOT OPERATE” and be resistant to wear and tear by the environment they are being used in. Employees who perform LOTO must receive authorized employee training, subcontractors must provide evidence that they have (e.g.: a certficate) Wear a cotton t-shirt, Class II Electrical Arc Protection suit, Class O (low voltage) gloves, and non-conductive footwear. Only the person who placed the LOTO device is authorized to remove it, so after-hours contact information for LOTO employees must be in the HASP. Ensure all associated/potentially impacted personnel are notified of work activities. Before working on live equipment, it should be brought to a “zero-energy state” by turning off the equipment’s power (at source, such as by switching off specific circuit breakers. (“Zero-energy” is not attained until the individual working on the machinery attempts to turn the machine on and is unsuccessful.) In certain situations, where machinery must stay live to do work, and Lock-Out is not possible, the Project Manager and Field Safety Officer must be directly involved when Tag-Out is taking place. For all sites where work extends beyond 1 year, a LOTO a documented process inspection must occur to check that LOTO procedures in-place are still valid.

JHA Development Checklist

This checklist provides common hazards and some hazard control measures for consideration, and can be used to help develop site-specific JHAs

Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Chemical/Liquids Contact or Release (designate in JHA the specific chemical/liquid hazard associated with the task step)	Wear ___ eye/face protection (designate type, e.g. safety glasses, face shield, chemical splash goggles or combination) Wear ___ clothing (designate type, e.g. long sleeves, paper suit, protective apron, polyethylene coated suit). Wear ___ gloves (designate type, e.g. butyl, nitrile, rubber, resistant to specific chemical/duration). Ensure that gloves and boots are taped to the suit to prevent liquid splash. Double-layering nitrile or latex protective gloves is a good idea for added protection. If acidic or caustic chemicals are present, wear outer neoprene or rubber gloves. Restrict access to work area by ___ (designate how). Use funnel when pouring liquid. Ensure bleed valves are open and lines are clear prior to disconnect and/or use dry couplings. Have ___ (designate type/amount, e.g. pads, boom) absorbent material on hand. Place container and/or absorbent/plastic sheeting under connection prior to disconnect. Store hazardous materials in dedicated container/area (e.. shed, box). Wash hands frequently. Inspect pressurized lines and all fittings/couplings to ensure integrity/closure. Assess rating and compatibility of materials used vs purpose. Ensure storage compatibility of multiple products. **Hazard Communication:** For each chemical product used by ERM employees or subcontractors, a SDS sheet must be obtained and kept on-file. Chemical containers must be labeled in accordance with OSHA regulations. Review SDS and container label prior to start of task/handling and follow associated requirements. Ensure all employees on the jobsite have been told about the chemical in-use and are protected. Confirm SDS is relevant when working with legacy material (e.g. historic releases). A chemical inventory list must be prepared and updated as new or different chemicals are procured. If chemical exposure occurs, even if medical symptoms are not present, inform the Field Safety Office or Office H&S Contact.
Biological Contact (designate in JHA the specific biological hazard associated with the task step)	Wear ___ clothing (designate type, e.g. long sleeves, hood, paper suit). Wear ___ gloves (designate type, e.g. fabric, nitrile). Use insect repellant. Inspect area prior to start of task and remove/avoid animal (e.g. dogs), insect (e.g. bees, wasps), plant (e.g. poison ivy) hazards if possible; otherwise reschedule work and/or contact professional service for removal. Report allergies and ensure treatment is available on site. Avoid loud noises/brightly colored clothing if bees are known to be in area.
Repetitive Motion (designate in JHA the specific repetitive motion hazard associated with the task step)	Use ___ tool and/or ___ technique (designate, e.g. ratchet wrench) to minimize repetitive stress risk. Change position frequently during job (e.g. vary grip, hand motion). Keep wrists in a neutral (straight) position as you work. When possible, rotate tasks to give body parts a rest. Take breaks every ___ (designate frequency) and do simple stretches/exercises. Ensure gloves fit hands properly to decrease stress on hand/joints.

JHA Development Checklist

This checklist provides common hazards and some hazard control measures for consideration, and can be used to help develop site-specific JHAs

Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Traffic (designate in JHA the specific pedestrian / motorized traffic hazard associated with the task step)	Wear ___ clothing (designate type, e.g. reflective vest, neon orange/green shirt). High-visibility safety vests: class I may be used when traffic is below 25 mph, Class II for 25-50 mph, and Class 3 for >50 mph. Set up work zone to restrict non-essential access by ___ (designate how, e.g. with cones/barricades/fencing, placed specified distance apart/from work area, etc.). Avoid risks posed by detour (e.g. pedestrians forced into other traffic). Use parked vehicle with hazard lights facing oncoming traffic to protect work zone. Use buddy system to establish traffic watch. Use trained spotters when backing and when visibility is restricted. Inspect surrounding area prior to backing. Adjust mirrors and check equipment back-up alarm to confirm operational prior to start of task. Use horn to alert others prior to backing. Use traffic management consultant. Stay ___ (designate distance) from operating equipment/extended arm, etc. Make eye contact with equipment operator and receive approval prior to approaching. Ensure spotters and equipment operators maintain eye contact. Establish parking/staging/loading/unloading areas (consider equipment turning circles, swing zones etc.). Ensure trailers / trucks are rated and balanced. Chock truck/trailer wheels when not moving. Ensure load is distributed during load/unload to avoid tip/roll-over. Ensure all personnel remain outside of tip-over radius when dumping.
Improper Waste Transport / Disposal (designate in JHA the specific waste disposal hazard associated with the task step)	Designate safe waste storage area/container prior to start of task. Ensure waste materials meet container specifications prior to use. Label waste containers. Separate hazardous and non-hazardous wastes. Place waste containers in designated storage area and secure prior to leaving site. Confirm waste transport truck/container integrity prior to loading. Confirm shipping document description/approved destination with waste container label prior to off-site shipment. For unsealed/partially exposed loads, perform ___ monitoring (designate method and frequency) and stop work if monitoring result ___ (designate limits).
H&S Risks and Increase in ERM Liability caused by Subcontractors Working on the Jobsite	Select only subcontractors that have been prequalified and approved for use. Ensure a signed, executed subcontract agreement is in-place prior to subcontractors performing work on the jobsite for ERM. Ensure the subcontractor has received a copy of the ERM HASP and supporting documentation prior to mobilization to the jobsite. Specify both the ERM and the subcontractor's scope of work in the ERM HASP document. Ensure that any subcontractor personnel on-site have reviewed and signed the site HASP. In all cases, require the ERM subcontractor to either develop their own site-specific HASP, or at minimum develop Job Hazard Analyses (JHA) for the specific tasks they will perform. Attach these documents to the ERM HASP as appendices. Ensure subcontractor work is overseen by ERM personnel at all times. Always include subcontractor personnel in daily jobsite tailgate safety meetings. Do not supply subcontractor personnel with personal protective equipment (PPE). If ERM is performing air monitoring for the subcontractor, ensure calibration of air monitoring equipment is done before and after each use. At a minimum, air monitoring equipment must be calibrated at least once per day. Document equipment calibration and file with the site HASP.
Exposure to Toxic and Hazardous Chemical Substances (designate in the JHA the specific chemicals of concern)	Determine whether there is a potential for exposure to any toxic or hazardous chemical substances in the work area prior to performing any work that may involve handling of one or more of the chemicals or may result in exposure through production, research, or process activities. This would include, but not be limited to, OSHA's 13 regulated carcinogens, and the following: • Acrylonitrile • Asbestos • Benzene • Cadmium • Chromium (VI) • Coke oven emissions • Cotton Dust • Ethylene oxide • Formaldehyde • Hydrogen sulfide • Inorganic arsenic • Lead • Methylene chloride • Methylenedianiline • Vinyl chloride • 1,2-dibromo-3-chloropropane • 1,3-butadiene
	If any of the substances are identified, conduct an exposure assessment to determine whether employees have the potential to be exposed above any action level identified in the substance-specific regulations.
	Where the initial assessment identifies the potential for employee exposures above an established action level or permissible exposure limit, develop a site-specific program to address all required regulatory concerns for that substance. Completed programs shall be included in the site-specific health and safety plan.
	Ensure the health and safety plan specifies the airborne contaminants that may be encountered and the need for respiratory protection. Ensure the plan provides a selection process for the respirator and cartridge type, develops actions levels for upgrades/downgrades of respiratory protection, describes cartridge change out schedules, and provides information on medical surveillance criteria and respirator fit testing requirements.
	Prior to donning any respirator, complete a thorough inspection to ensure it is in good operating condition. Inspected elements should include, but not be limited to, straps, sealing surfaces, inhalation/exhalation vales, and facepieces. Do not use respirators with any signs of damage.
	Where necessary, replace damaged parts. If repair is not possible, discard and replace entire respirator.
	Clean and disinfect respirators using a mild soap and water solution following use. Where respirator sharing is allowed, ensure respirators are cleaned and sanitized before being exchanged by employees.

JHA Development Checklist

This checklist provides common hazards and some hazard control measures for consideration, and can be used to help develop site-specific JHAs

Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Respiratory Protection	For cartridge-type respirators, affix the cartridges to the respirator as indicated in the manufacturer's guidelines. Cartridges should be hand tightened only.
	Employee must be clean shaven in those areas of the face where the respirator makes skin contact, including any inner nose cups.
	Don the respirator prior to other personal protective equipment in the head/neck area so that nothing comes between the respirator straps and the head surface. Safety glasses, hard hats, etc. must be donned after the respirator.
	For cartridge-type respirators, perform a positive and negative fit check to ensure a good respirator seal.
	Adjustments made while wearing tight-fitting respirators within the work area may result in a compromised respirator seal. If this occurs, stop work, move to an area with no chemical contamination (go through the decontamination process, if present), readjust the respirator, and perform positive and negative fit-checks to ensure a proper facepiece seal.
	If it becomes difficult to breathe due to particulate clogging of respirator cartridges, stop work, move to an area with no chemical contamination (go through the decontamination process, if present), replace the cartridges, readjust the respirator, and perform positive and negative fit-checks to ensure a proper facepiece seal.
	If using a chemical catridge and you either (1) reach or exceed the required wear time as described in the cartridge change schedule or (2) detect any evidence of chemical breakthrough (odors, tastes, burning sensations, etc.), stop work, move to an area with no chemical contamination (go through the decontamination process, if present), replace the cartridges, readjust the respirator, and perform positive and negative fit-checks to ensure a proper facepiece seal. If chemical breakthrough was detected, determine what level of exposure may have occurred through testing of the work atmosphere.
	If a decontamination line is present, proceed through the line as directed. If no decontamination line is present, remove all other PPE except clean gloves before removing the respirator. Once removed, clean as directed.
Natural Hazards (designate in JHA the specific natural hazards associated with the task step)	For sites where poison ivy, oak, and sumac are present, have a poison ivy wash available for employees on-site. If exposure occurs and no poison ivy wash is available, employees should wash in cool water and use soap. Keep work areas free from clutter so that ground surfaces can be easily seen by employees. **Working around poisonous insects:** Use insect repellant containing DEET at all times on the jobsite. Periodically throughout the day and at the end of the day, perform a thorough “tick-check” to ensure ticks or other insects are found and removed promptly. Avoid obvious conical mounds of dirt that may indicate ants, wasps, or other flying insects. Before reaching into dark or damp spaces such as monitoring well-heads, inspect the area thoroughly to ensure spiders are not present. Always take a shower as soon as possible after leaving a jobsite for the day to remove any insects, such as chiggers. **Working around snakes:** Visually inspect the work are prior to beginning any work to located areas with high grass and underbrush. Do not walk through these areas if at all possible to avoid snakes. Wear leather steel-toe boots and snake chaps in areas where snakes are suspected or confirmed to be present. Do not attempt to kill snakes, as people are commonly bitten attempting this. **Working around feral animals:** High rat populations within an enclosed space present a hazard of Hanta virus. Spray such areas with bleach solution prior to performing any work in the area (10 parts water to 1 part household bleach). If dogs or other animals are spotted that are acting strangely, do not approach them. Contact the local animal control center for assistance.

		Severity				
		Minor (1)	Moderate (3)	Serious (5)	Severe (7)	Catastrophic (10)
Probability	Almost Certain (6)	6	18	30	42	60
	Likely (5)	5	15	25	35	50
	Possible (4)	4	12	20	28	40
	Heard of (3)	3	9	15	21	30
	Unlikely (2)	2	6	10	14	20
	Rare (1)	1	3	5	7	10

Risk Rating

Extreme	High	Low

Risk Rating	
Extreme	36
High	19
Medium	6
Low	0

ERM

JHA
Job Hazard Analysis

Project Number:	516919	Project / Client Name:	Pre Design Investigation/ G.W. Lisk
Project Manager:	Tim Daniluk	Location:	2 South Street, Clifton Springs, New York 14432
Partner-in-Charge:	Ernest Rossano	Date and Revision Number:	6/3/2022, Rev. 0

SPECIFIC TASK:	**Groundwater Well Sampling**

Minimum Required PPE for Entire Task:	☑ Hard Hat ☑ Safety-Toe Shoes ☐ Hearing Protection ☐ Goggles ☐ Face Shield ☐ Respirator: N/A ☐ Other (specify): N/A ☑ Safety Glasses ☑ Reflective Vest ☑ Gloves: chemical resistant ☑ PPE clothing: Long sleeves, pants		
Additional Task-Step Specific PPE: (as indicated below under Controls)	ear plugs, heavy leather gloves, cut resistant gloves	Equipment / Tools Required:	pump, DI water with alconox/liquinox
Training Required for this Task:	HAZWOPER 40-hr; current 8-hr Refresher Training	Permits Required for this Task:	None
Forms Associated with This Task:	Low flow forms		

JHA Developed / Reviewed By:			JHA Review In Field
Name / Job Title:	Name / Job Title:	Name / Job Title:	Field supervisor to ensure all personnel performing this task have reviewed JHA and agree to follow it. Site-specific changes to this JHA have been made as warranted based on this review. **Signature/Date:**
Alexis Harford/ Consultant I			

Task Steps[1]		Potential Hazards & Consequences[2]		select	Probability	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
1	Load / Attach / Disconnect Equipment	1a	Pinch Points	H&S	2	3	6	1a	Consider body positioning prior to start of task to identify potential pinch points and change position to ensure no contact during task. Do not position your hand or body so it can be caught in identified pinch points. Do not position your hand or body so it can be caught between a lifted load and adjacent objects. Wear heavy leather or cut-resistant gloves; have gloves on your person at all times.
		1b	Property Damage from vehicle / sample trailer movement	multiple	2	2	4	1b	Inspect surrounding area prior to backing. Use trained spotters when backing and when visibility is restricted. Ensure spotters and equipment operators maintain eye contact. Establish parking/staging/loading/unloading areas (consider equipment turning circles, swing zones, etc.). Ensure trailers/trucks are rated and balanced. Chock truck/trailer wheels when not moving. Ensure load is distributed during load/unload to avoid tip/roll-over.
		1c	Muscle strain from lifting / handling equipment	H&S	3	3	9	1c	Use cart, dolly, or get assistance. Do not lift anything manually by yourself that is awkwardly shaped or weighs more than 35 pounds. When lifting lighter objects, bend and lift with legs/arms, not back. Keep objects close to body and do not twist while lifting (turn with feet). Position work equipment to avoid over-reaching while working. Store heavy/bulky items with safe access in mind.
2	Set up / break down at well	2a	Fire / Explosion from generator	multiple	1	3	3	2a	Monitor VOCs and LEL by handheld PID and stop work if monitoring result greater than 5ppm. Follow facility/client hot work permit rules. Position generator at least 5 feet away from combustible/flammable materials. Make sure support straps for generator are clear from exhaust stream and pipe. Have fire extinguisher(s) on site and immediately available for use by trained personnel.
		2b	Getting struck by vehicular traffic and unauthorized access to work area	H&S	1	4	4	2b	Set up barricades around work zone (specify type: snow fencing, cones [min height should be such that drivers can see], delineator posts). Use parked vehicle(s) as barricades to protect work zone from oncoming traffic. Use traffic control contractor for work in public streets or at center divider of public streets. Wear reflective vest for all off-site work in or adjacent to traffic areas.

Task Steps[1]		Potential Hazards & Consequences[2]		select	Probability	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
		2c	Tripping hazards in work area	H&S	3	3	9	2c	Identify and use only safe pathways when entering/exiting/working in area. Obtain additional lighting and use clear safety glasses in areas with low/unclear visibility. Inspect work area for potential slip/trip/fall hazards prior to start of work; remove if possible, or, if not possible, cordon off with cone or mark with highly visible tape/flags, etc. Keep work area organized and free of surface obstructions during task. Immediately dry wet areas or restrict access (e.g., warning tape, signs, cones). Remove snow/ice/debris/vegetation prior to start of work. Reassess surface conditions if weather changes and address any new hazards (e.g., slick surface developing as a result of wet/freezing conditions). Do not carry loads that restrict visibility. Keep work area surfaces clear of debris (e.g., mud, leaves) and store tools/equipment to eliminate trip hazards when not in use. Keep eyes on path and nearby surroundings when walking. Fill in/flatten uneven ground. Wear footwear with appropriate traction for conditions (i.e., rubber non-slip soles, tread, crampons, etc.).
		2d	Electrical shock from portable tools	H&S	2	4	8	2d	Use GFCIs. Make sure the equipment is properly grounded. Use flexible cords that are splice-free and not worn or frayed. Do not turn on generator breaker until pump is down well.
		2e	Muscle strain from lifting / handling equipment	H&S	3	3	9	2e	See above, 1c
3	Opening and closing well cover and cap	3a	Skin / eye contact with contaminated water or free product	H&S	2	5	10	3a	Wear chemical resistant gloves selected for the specific chemials of concern and safety glasses. State glove type on Line 9 above. Have portable eyewash available on site. Ensure SDS is available (in HASP) for all chemicals of concern
		3b	Inhalation of contaminant vapors	H&S	2	5	10	3b	An exposure assessment must be conducted to identify the potential for exposures above an established action level or permissible exposure limit; and a site-specific program to address all required regulatory concerns must be included in the HASP. Perform ambient air monitoring (designate method and frequency) and if action levels are reached or exceeded, follow plan established in HASP. Position work area upwind. Set-up work zone to restrict non-essential access and minimize off-site impacts.
		3c	Back strain from bending over wellhead	H&S	3	3	9	3c	Obtain and use a chair or stool; otherwise use kneeling position or bend at knees, not waist.
		3d	Struck by / pinch point - wellhead lid	H&S	1	3	3	3d	Inspect work area prior to start of task to identify pinch points. Remove/protect or adjust body position to ensure no contact during task. Identify pinch points on wellhead by warning label and/or paint color. Do not position your hand or body so it can be caught in identified pinch points. Use an appropriate tool to assist. Wear heavy leather or cut-resistant gloves; have gloves on your person at all times.
		3e	Hit by well cap or contact with contaminated water from pressure build-up	H&S	1	3	3	3e	Open well cap slowly to allow for pressure release. Use heavy leather or cut resistant gloves and maintain firm grip (use two hands). Keep body out of the line of fire if well cap slips.
		3f	Posionous / stinging insects	H&S	2	5	10	3f	Visually inspect area around wellhead before approaching. Listen for buzzing / other noises inside vault before opening. Inspect well vault before reaching in to open well cap. Wear heavy leather or cut resistant gloves.
4	Gauging / sampling	4a	Skin / eye contact with contaminated water or free product	H&S	2	5	10	4a	Lower and raise downwell equipment slowly to avoid splashes. Wipe excess liquids from equipment as it is being raised. Wear chemical resistant gloves (selected for the specific chemials of concern) and wear safety glasses; state glove type above on Line 9. Have portable eyewash available on site. Ensure SDS is available (in HASP) for all chemicals of concern
		4b	Inhalation of contaminant vapors	H&S	2	5	10	4b	See above, 3b
		4c	Back strain from bending over wellhead / repetitive motion stress	H&S	3	3	9	4c	See above, 3c. Use a tool to minimize repetitive stress risk. Change position frequently during job (e.g., vary grip, hand motion). Keep wrists in a neutral (straight) position as you work. When possible, rotate tasks to give body parts a rest. Share tasks among employees present. Take breaks every hour and do simple stretches/exercises. Ensure gloves fit hands properly to decrease stress on hand/joints.
		4d	Struck by / pinch point - wellhead lid	H&S	1	3	3	4d	See above, 3d
		4e	Electrical shock - submersible pump	H&S	3	3	9	4e	See above, 2d. Use GFCI on the power supply, and use of a multimeter (Volt-Ohm meter) to confirm that all external parts of the pump system (i.e., sample port, sample riser, well head, etc.) are not electrically charged. Use of insulated rubber gloves is also recommended.

Task Steps[1]		Potential Hazards & Consequences[2]		select	Probability	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
		4f	Cuts from broken glass from sample container	H&S	2	5	10	4f	Store bottles in shipping container prior to filling. Inspect containers for any damage, cracks. When capping sample containers, do not place fingers across gap between cap and bottle neck. Wear chemical resistant gloves that are also cut resistant, or wear thin cut-resistant inner gloves.
		4g	Hearing damage from generator noise above 85 dbA	H&S	3	3	9	4g	Wear hearing protection when working within 20 feet of generator. Signage indicating this requirement should be affixed to generator. Measure noise levels with a noise dosimeter if project will last over 30 days or, for shorter work, use the rule or thumb that you should be able to hear a person talking to you in a normal voice at distance of 3 ft.
		4h	Spills of contaminated purge water	E	3	4	12	4h	Store purge water in dedicated containers/areas; close containers when not in use. Chemical containers must be labeled in accordance with regulations. Secure end of sample tubing to container so it doesn't slip off. Have general absorbent mats on hand. Place container and/or absorbent/plastic sheeting around wellhead. Inspect lines, tubing, hoses and all fittings/couplings to ensure integrity/closure. Assess rating and compatibility of materials used vs purpose.

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). 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.

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 Development Checklist

This checklist provides common hazards and some hazard control measures for consideration, and can be used to help develop site-specific JHAs

Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Fatigue and Stress	Specifically define acceptable work hours, work duration, work weeks, consecutive days, etc. Define rest frequency and duration. Take weather, PPE, activity level into consideration. Identify activities with increased mental stress / strain, and determine if controls are warranted: multiple employees, work rotation, etc. Identify activities with limited mental stress (e.g., 'boring or dull activities' where inattention can occur), and determine if controls are warranted: multiple employees, work rotation, etc. Consider activities that may occur immediately before or after the task (e.g., driving), and determine whether controls are required (e.g., limitations on driving after 10 hr days of field activities). Remember that stress and fatigue ARE NOT LIMITED to field / construction activities.
Sharp Edges (designate in JHA the specific cut or puncture hazard associated with the task step)	Wear ____ gloves (designate type, e.g. heavy leather, cut-resistant, puncture-resistant). Wear ___ footwear (designate type, e.g. puncture-resistant insoles). Wear ___ clothing (designate type, e.g. long sleeves, heavy coveralls). Have gloves on your person at all times. Employees performing significant amounts of cutting tool use should wear high-visibility gloves to encourage awareness of where hands are being placed. Do not attempt to catch falling tools/equipment. Ensure guards are in place. Use ___ cutting tool (designate type, e.g. scissors, shears, snips). Do not use dull blades. Do not use open-bladed knives. Inspect tools/equipment in area prior to start of task to identify sharp edges and, if possible, remove/protect or position body to ensure no contact during task. Always cut away from hand, body and face. Ensure others are not in line-of-fire when cutting. Place object to be cut in a vise or on a flat surface or use another tool to hold object while cutting. Do not place fingers in ends of piping or other tubular material.
Pinch Points (designate in JHA the specific pinch hazard associated with the task step)	Wear ___ gloves (designate type, e.g. heavy leather, puncture-resistant). Have gloves on your person at all times. Inspect work area prior to start of task to identify pinch points and remove/protect to ensure do not contact during task. Consider body positioning prior to start of task to identify potential pinch points and change position to ensure do not contact during task. Identify pinch points by warning label and/or paint color. Do not position your hand or body so it can be caught between a lifted load and adjacent objects. Do not place fingers/hands between sections of multi-component/moveable items (e.g. fencing sections, sheet piling, hinged panels).
Slips / Trips / Falls from Surface Conditions (designate in JHA the specific slip, trip, fall hazard associated with the task step)	Wear ___ footwear (designate type, e.g. shoes with rubber soles or low heels, crampons). Identify and use only safe pathways and stairs when entering/exiting/working in area. Obtain additional lighting and use clear safety glasses in areas with low/unclear visibility. Inspect work area for potential slip/trip/fall obstructions prior to start of work and remove or, if not possible, mark with highly visible tape/flags, etc. Keep work area organized and free of surface obstructions during task. Immediately dry wet areas or restrict access (e.g. with warning tape, signs, cones). Remove snow/ice prior to start of work. Reassess surface conditions if weather changes and address any new hazards (e.g. slick surface developing as a result of wet/freezing conditions). Do not carry loads that restrict visibility. Do not stack objects higher than ___ (designate height). Ensure steps, walkways and shoes are not slippery or loose prior to use. Keep work area surfaces clear of debris (e.g. mud, leaves) and store tools/equipment to eliminate trip hazards when not in use. Keep eyes on path and nearby surroundings when walking. Take small steps and shuffle feet in potentially slippery areas. Walk slowly around corners and when entering/exiting doors. Use slip-resistant mats. Use handrails when going up/down stairs. Fill in/flatten uneven ground. Use steps/stepladders for access in and out of shallow trenches/excavation.
Fall from Elevated Position (designate in JHA the specific elevated hazard associated with the task step)	Use carts with high sides to contain load. Ensure load is secure and balanced prior to moving. Maintain 3-points of contact when mounting/dismounting vehicle/equipment. Maintain 3-points of contact when climbing/descending ladders. Use equipment/mechanical means (e.g. tool belt, rope) to transport tools/materials. Ensure steps, ladder rungs and shoes are not slippery or loose. Do not stand or work off top of ladder (e.g. top 2 steps of stepladder). Extend ladder at least 3-feet beyond top bearing point. Have another person hold bottom of ladder at all times while working or until top is secured; if ladder is not equipped with grip pads, hold bottom at all times. Position extension ladder at 1 foot distance for every 4 feet of working height. Do not overreach; keep body between ladder rails and both feet on same rung. Wear fall protection when working at a height of 6 feet (1.8 meters) or greater. Wear full body harness with double-locking snap hooks and shock absorbing lanyard. Inspect fall protection prior to use and do not use if: worn or frayed lanyard or webbing/stitching; locking devices, snap hooks, etc. are not working properly; metal components are worn, damaged, or have burrs, etc.; annual inspection tag is not in place and current. Connect to secure anchor point meeting fall protection specifications (capable of supporting 5,000# per person attached, above shoulder height, no sharp edges, etc.). Ensure scaffolding has secured boards, is adequately braced, has a handrail, is free of debris and holes and is in good working condition. Stand only on secured and inspected flooring and uprights. Work only within the scaffolding structure.

JHA Development Checklist

This checklist provides common hazards and some hazard control measures for consideration,
and can be used to help develop site-specific JHAs

Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Back Sprain/Strain (designate in JHA the specific back sprain/strain hazard associated with the task step)	Use ___ mechanical lifting/carrying device (designate type, e.g. cart, dolly, forklift). Obtain assistance when lifting ____ (designate what, e.g. awkwardly shaped objects) or objects weighing greater than ___ (designate limit). Bend and lift with legs/arms, not back. Keep objects close to body and do not twist while lifting (turn with feet). Position work equipment to avoid over-reaching while working. Do not overload waste containers, fill ___ full (designate volume). When objects are lifted/carried by two persons, take positions on opposite ends. Store heavy/bulky items with safe access in mind. Take regular breaks every ___ (designate frequency).
Suspended Loads/Low-Hanging Objects (designate in JHA the specific suspended load, low-hanging hazard associated with the task step)	Wear hard hat. Wear ___ gloves (designate type, e.g. rubber dot for grip). Wear ___ footwear (designate type, e.g. steel-toe boots; footwear with metatarsal-protection). Do not attempt to catch falling objects. Stay ___ (designate distance) away from raised objects. Restrict access with warning tape and/or posted signs. Secure loose objects prior to lifting or moving by ___ (designate how, e.g. with straps, sideboards, use of panel cart with high sides). Remove low-hanging objects or identify (e.g. mark with highly visible paint, tape, flags) and/or communicate location to site personnel. Visually inspect equipment before beginning task. Verify latest equipment inspection/tag is current before beginning task. Inspect lifting rigging (chains/slings/cables) to ensure in good condition and do not use if defects, signs of excessive wear are identified. Verify lifting equipment is certified and rated for handling the reach and load limits for required work. Use trained spotter(s) to alert others of hazards. Use tag lines held by trained personnel to guide load and do not wrap lines around body parts. Pre-inspect travel route to ensure clearance. Keep load low to ground to ensure clear visibility when transporting. Move load using low, slow, controlled movements.
Rotating / Automated / Energized Equipment (designate in JHA the specific rotating hazard associated with the task step)	Do not work on moving equipment. De-energize all energy sources (e.g. compressed, pressurized) equipment prior to working on. Lock out/tag out equipment per LOTO procedure and verify energy isolation prior to start of task. Employees who perform LOTO must receive authorized employee training. 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. Remove/secure loose clothing, hair and jewelry. Keep hands/body/tools ___ (designate distance) away from equipment. Identify automatic-start equipment with signs/labels. Locate emergency stop/shutdown switch prior to start of task. Ensure all associated personnel are notified of work activities. De-energize hand-held and mobile equipment when not in use. Plan work lay-out/processes to avoid and/or minimize line-of-fire risks. Define and barricade personnel exclusion zones based on machine swing areas, area below crane operation, etc.
Vapors, Airborne Debris (designate in JHA the specific vapor, debris or liquid hazard associated with the task step)	Keep area ventilated by ___ (designate how, e.g. with forced draft fans, outside use only). Perform ___ monitoring (designate method and frequency) and stop work if monitoring result ___ (designate limits). Position body upwind. Keep work area wet to limit dust. Set-up work zone to restrict non-essential access and minimize off-site impacts. Wear ___ eye/face protection (designate type, e.g. safety glasses, face shield, splash goggles or combinations). Wear ___ clothing (designate type, e.g. long sleeves, paper suit). Wear ___ breathing protection (designate type, e.g. dust mask, full/half-face respirator with ___ (designate type) cartridges). Establish cartridge change-out schedule. (designate in JHA the specific ignition risks associated with the task step)
Ignition (designate in JHA the specific ignition risks associated with the task step)	Undertake work under Hot Work Permit. Monitor VOCs and LEL by ___ (designate method and frequency) and stop work if monitoring result ___ (designate limits). Seal all pipe/openings (e.g. tank holes, storm drains) in work zone that may emit vapors. Ensure all equipment in work area is intrinsically safe. Define/barricade work areas to exclude unauthorized access/external ignition sources (e.g. vehicular traffic). Keep area ventilated by ___ (designate method, e.g. with fans). Ensure lines are clear prior to disconnect and/or use dry couplings. Assess and control static risks for all work equipment and processes. Have ___ (designate number, type and size) fire extinguisher(s) on site and immediately available for use. (designate in JHA the specific high noise hazard associated with the task step)
	Determine whether noise monitoring has been necessary on other projects of similar scope. Measure noise levels with a noise dosimeter if project will last over 30 days, or for shorter work use the rule or thumb that you should be able to hear a

JHA Development Checklist

This checklist provides common hazards and some hazard control measures for consideration, and can be used to help develop site-specific JHAs

Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
High Noise Level (designate in JHA the specific high noise hazard associated with the task step)	Measure noise levels with a noise dosimeter if project will last over 30 days, or for shorter work use the rule of thumb that you should be able to hear a person talking to you in a normal voice at 1m/3 ft. If you cannot hear them without them raising their voice the hearing protection is necessary, and noise monitorting is advisable. For any employee working on the site who has not attended hearing conservation training within the past year, review this JHA with them and document their training. Wear ___ hearing protection (designate type, e.g. ear plugs, ear muffs, double hearing protection) based on known or potential noise levels. Post warning signs at ___ (designate distance) from work area stating entry restrictions and/or type of hearing protection required. Ensure mufflers are installed in equipment. Minimize potential external/third party/community impacts by ___ (designate how). Share noise dosimetry results with your Divisional Safety Advisor so we can build up a bank of knowledge about the types of equipment at projects where hearing protection should be considered.
Heat Stress and Burns (designate in JHA the specific heat hazard associated with the task step)	**Hot Equipment:** Allow equipment/material to cool prior to working with. Use designated handles to open/move equipment. Turn off equipment and allow to cool prior to refueling. Identify hot surfaces prior to start of task and avoid direct contact with.Drink cool fluids and take rest breaks every ___ (designate frequency). Wear ___ gloves (designate type, e.g. oven mitts, thermal, etc...). Use ___ (designate type, e.g. tongs, insulated handles) tool to move equipment or materials. **Hot Weather:** Check the weather forecast in advance & be prepared for those conditions Wear ___ clothing (designate type, e.g. light-weight fabrics with long sleeves & trousers, cool vest, etc...). Schedule regular breaks, watch your colleagues using the buddy system. Use sun block for skin protection, drink cool drinks regularly (i.e.: before you become thirsty), take breaks in the shade (advice on the regularity and duration of these can be found in the SWP linked to below) Stop work if fatigue or physical stress situations develop in your or those around you High humidity, working in direct sunlight, work in contact with hot surfaces influence the severity of hot working conditions. Seek specific guidance and training if work in these conditions is necessary. (Advice is available on the SWP for heat stress available on Minerva Americas H&S pages at the following link: http://minerva.erm.com/Support/HS/AmericasHS/Safe%20Work%20Practices%20SWP/04%20-%20Heat%20Stress%20-%20updated%208-11.doc)
Cold Stress (designate in JHA the specific cold hazard associated with the task step)	Drink hot/warm fluids and take rest breaks every ____ (designate frequency) Wear ___ clothing (designate type, e.g. insulating layers, down jacket, chef coat). Wear ___ gloves (designate type, e.g. thermal, freeze-protection). In temperatures below freezing do not touch bare metal surfaces with the naked skin without adequate PPE, such as gloves. At or below 4°C/40°F adequate dry insulating clothing must be available to keep worker's core temperature at or above 36°C/96.8°F Dampness/condensation, work in contact with cold water or surfaces, and wind speed all influence the severity of cold working conditions. Seek specific guidance and training if work in these conditions is necessary. (Training is available on ERM North American Minerva page at the following link: http://minerva/erm/globalsupport/healthandsafety/NA/HS%20Training%20Materials/Home.aspx)
High Voltage/Electrical Contact (designate in JHA the specific high voltage / electrical hazard associated with the task step)	Use wooden or fiberglass ladder. Stand on non-conductive surface. Remove metal jewelry. Footwear worn around electrical circuits should be non-conductive. Ensure power cords are free of defects and exposed wires. Do not work in ___ (designate condition, e.g. thunderstorm) weather. Use___ gloves (designate type in JHA, e.g. electrical-insulted). Use ground fault circuit interrupter (GFCI). Use low voltage lighting. Ground equipment by ___ (designate how or refer to separate procedure). Pre-inspect travel route to ensure clearance. Inspect above and below ground areas prior to start of work to identify electrical lines and communicate locations to site personnel. **SSC:** Ensure completion of subsurface clearance procedure requirements. Ensure line locator service identification of underground lines. Use non-destructive drilling techniques (e.g. air-knife). When excavating, assign spotter to stop work at sign of subsurface conduits/wires. Keep ___ distance from overhead power lines (designate distance in JHA based on voltage, regulations, etc.). Lock-Out/Tag-Out (LOTO): LOTO equipment must be available as per the LOTO procedure and verify isolation of energy source prior to start of task. Tags must read “DANGER – DO NOT OPERATE” and be resistant to wear and tear by the environment they are being used in. Employees who perform LOTO must receive authorized employee training, subcontractors must provide evidence that they have (e.g.: a certficate) Wear a cotton t-shirt, Class II Electrical Arc Protection suit, Class O (low voltage) gloves, and non-conductive footwear. Only the person who placed the LOTO device is authorized to remove it, so after-hours contact information for LOTO employees must be in the HASP. Ensure all associated/potentially impacted personnel are notified of work activities. Before working on live equipment, it should be brought to a “zero-energy state” by turning off the equipment’s power (at source, such as by switching off specific circuit breakers. (“Zero-energy” is not attained until the individual working on the machinery attempts to turn the machine on and is unsuccessful.) In certain situations, where machinery must stay live to do work, and Lock-Out is not possible, the Project Manager and Field Safety Officer must be directly involved when Tag-Out is taking place. For all sites where work extends beyond 1 year, a LOTO a documented process inspection must occur to check that LOTO procedures in-place are still valid.

JHA Development Checklist

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Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Chemical/Liquids Contact or Release (designate in JHA the specific chemical/liquid hazard associated with the task step)	Wear ___ eye/face protection (designate type, e.g. safety glasses, face shield, chemical splash goggles or combination) Wear ___ clothing (designate type, e.g. long sleeves, paper suit, protective apron, polyethylene coated suit). Wear ___ gloves (designate type, e.g. butyl, nitrile, rubber, resistant to specific chemical/duration). Ensure that gloves and boots are taped to the suit to prevent liquid splash. Double-layering nitrile or latex protective gloves is a good idea for added protection. If acidic or caustic chemicals are present, wear outer neoprene or rubber gloves. Restrict access to work area by ___ (designate how). Use funnel when pouring liquid. Ensure bleed valves are open and lines are clear prior to disconnect and/or use dry couplings. Have ___ (designate type/amount, e.g. pads, boom) absorbent material on hand. Place container and/or absorbent/plastic sheeting under connection prior to disconnect. Store hazardous materials in dedicated container/area (e.. shed, box). Wash hands frequently. Inspect pressurized lines and all fittings/couplings to ensure integrity/closure. Assess rating and compatibility of materials used vs purpose. Ensure storage compatibility of multiple products. **Hazard Communication:** For each chemical product used by ERM employees or subcontractors, a SDS sheet must be obtained and kept on-file. Chemical containers must be labeled in accordance with OSHA regulations. Review SDS and container label prior to start of task/handling and follow associated requirements. Ensure all employees on the jobsite have been told about the chemical in-use and are protected. Confirm SDS is relevant when working with legacy material (e.g. historic releases). A chemical inventory list must be prepared and updated as new or different chemicals are procured. If chemical exposure occurs, even if medical symptoms are not present, inform the Field Safety Office or Office H&S Contact.
Biological Contact (designate in JHA the specific biological hazard associated with the task step)	Wear ___ clothing (designate type, e.g. long sleeves, hood, paper suit). Wear ___ gloves (designate type, e.g. fabric, nitrile). Use insect repellant. Inspect area prior to start of task and remove/avoid animal (e.g. dogs), insect (e.g. bees, wasps), plant (e.g. poison ivy) hazards if possible; otherwise reschedule work and/or contact professional service for removal. Report allergies and ensure treatment is available on site. Avoid loud noises/brightly colored clothing if bees are known to be in area.
Repetitive Motion (designate in JHA the specific repetitive motion hazard associated with the task step)	Use ___ tool and/or ___ technique (designate, e.g. ratchet wrench) to minimize repetitive stress risk. Change position frequently during job (e.g. vary grip, hand motion). Keep wrists in a neutral (straight) position as you work. When possible, rotate tasks to give body parts a rest. Take breaks every ___ (designate frequency) and do simple stretches/exercises. Ensure gloves fit hands properly to decrease stress on hand/joints.

JHA Development Checklist

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Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Traffic (designate in JHA the specific pedestrian / motorized traffic hazard associated with the task step)	Wear ___ clothing (designate type, e.g. reflective vest, neon orange/green shirt). High-visibility safety vests: class I may be used when traffic is below 25 mph, Class II for 25-50 mph, and Class 3 for >50 mph. Set up work zone to restrict non-essential access by ___ (designate how, e.g. with cones/barricades/fencing, placed specified distance apart/from work area, etc.). Avoid risks posed by detour (e.g. pedestrians forced into other traffic). Use parked vehicle with hazard lights facing oncoming traffic to protect work zone. Use buddy system to establish traffic watch. Use trained spotters when backing and when visibility is restricted. Inspect surrounding area prior to backing. Adjust mirrors and check equipment back-up alarm to confirm operational prior to start of task. Use horn to alert others prior to backing. Use traffic management consultant. Stay ___ (designate distance) from operating equipment/extended arm, etc. Make eye contact with equipment operator and receive approval prior to approaching. Ensure spotters and equipment operators maintain eye contact. Establish parking/staging/loading/unloading areas (consider equipment turning circles, swing zones etc.). Ensure trailers / trucks are rated and balanced. Chock truck/trailer wheels when not moving. Ensure load is distributed during load/unload to avoid tip/roll-over. Ensure all personnel remain outside of tip-over radius when dumping.
Improper Waste Transport / Disposal (designate in JHA the specific waste disposal hazard associated with the task step)	Designate safe waste storage area/container prior to start of task. Ensure waste materials meet container specifications prior to use. Label waste containers. Separate hazardous and non-hazardous wastes. Place waste containers in designated storage area and secure prior to leaving site. Confirm waste transport truck/container integrity prior to loading. Confirm shipping document description/approved destination with waste container label prior to off-site shipment. For unsealed/partially exposed loads, perform ___ monitoring (designate method and frequency) and stop work if monitoring result ___ (designate limits).
H&S Risks and Increase in ERM Liability caused by Subcontractors Working on the Jobsite	Select only subcontractors that have been prequalified and approved for use. Ensure a signed, executed subcontract agreement is in-place prior to subcontractors performing work on the jobsite for ERM. Ensure the subcontractor has received a copy of the ERM HASP and supporting documentation prior to mobilization to the jobsite. Specify both the ERM and the subcontractor's scope of work in the ERM HASP document. Ensure that any subcontractor personnel on-site have reviewed and signed the site HASP. In all cases, require the ERM subcontractor to either develop their own site-specific HASP, or at minimum develop Job Hazard Analyses (JHA) for the specific tasks they will perform. Attach these documents to the ERM HASP as appendices. Ensure subcontractor work is overseen by ERM personnel at all times. Always include subcontractor personnel in daily jobsite tailgate safety meetings. Do not supply subcontractor personnel with personal protective equipment (PPE). If ERM is performing air monitoring for the subcontractor, ensure calibration of air monitoring equipment is done before and after each use. At a minimum, air monitoring equipment must be calibrated at least once per day. Document equipment calibration and file with the site HASP.
Exposure to Toxic and Hazardous Chemical Substances (designate in the JHA the specific chemicals of concern)	Determine whether there is a potential for exposure to any toxic or hazardous chemical substances in the work area prior to performing any work that may involve handling of one or more of the chemicals or may result in exposure through production, research, or process activities. This would include, but not be limited to, OSHA's 13 regulated carcinogens, and the following: • Acrylonitrile • Asbestos • Benzene • Cadmium • Chromium (VI) • Coke oven emissions • Cotton Dust • Ethylene oxide • Formaldehyde • Hydrogen sulfide • Inorganic arsenic • Lead • Methylene chloride • Methylenedianiline • Vinyl chloride • 1,2-dibromo-3-chloropropane • 1,3-butadiene
	If any of the substances are identified, conduct an exposure assessment to determine whether employees have the potential to be exposed above any action level identified in the substance-specific regulations.
	Where the initial assessment identifies the potential for employee exposures above an established action level or permissible exposure limit, develop a site-specific program to address all required regulatory concerns for that substance. Completed programs shall be included in the site-specific health and safety plan.
	Ensure the health and safety plan specifies the airborne contaminants that may be encountered and the need for respiratory protection. Ensure the plan provides a selection process for the respirator and cartridge type, develops actions levels for upgrades/downgrades of respiratory protection, describes cartridge change out schedules, and provides information on medical surveillance criteria and respirator fit testing requirements.
	Prior to donning any respirator, complete a thorough inspection to ensure it is in good operating condition. Inspected elements should include, but not be limited to, straps, sealing surfaces, inhalation/exhalation vales, and facepieces. Do not use respirators with any signs of damage.
	Where necessary, replace damaged parts. If repair is not possible, discard and replace entire respirator.
	Clean and disinfect respirators using a mild soap and water solution following use. Where respirator sharing is allowed, ensure respirators are cleaned and sanitized before being exchanged by employees.

JHA Development Checklist

ERM

This checklist provides common hazards and some hazard control measures for consideration, and can be used to help develop site-specific JHAs

Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Respiratory Protection	For cartridge-type respirators, affix the cartridges to the respirator as indicated in the manufacturer's guidelines. Cartridges should be hand tightened only.
	Employee must be clean shaven in those areas of the face where the respirator makes skin contact, including any inner nose cups.
	Don the respirator prior to other personal protective equipment in the head/neck area so that nothing comes between the respirator straps and the head surface. Safety glasses, hard hats, etc. must be donned after the respirator.
	For cartridge-type respirators, perform a positive and negative fit check to ensure a good respirator seal.
	Adjustments made while wearing tight-fitting respirators within the work area may result in a compromised respirator seal. If this occurs, stop work, move to an area with no chemical contamination (go through the decontamination process, if present), readjust the respirator, and perform positive and negative fit-checks to ensure a proper facepiece seal.
	If it becomes difficult to breathe due to particulate clogging of respirator cartridges, stop work, move to an area with no chemical contamination (go through the decontamination process, if present), replace the cartridges, readjust the respirator, and perform positive and negative fit-checks to ensure a proper facepiece seal.
	If using a chemical catridge and you either (1) reach or exceed the required wear time as described in the cartridge change schedule or (2) detect any evidence of chemical breakthrough (odors, tastes, burning sensations, etc.), stop work, move to an area with no chemical contamination (go through the decontamination process, if present), replace the cartridges, readjust the respirator, and perform positive and negative fit-checks to ensure a proper facepiece seal. If chemical breakthrough was detected, determine what level of exposure may have occurred through testing of the work atmosphere.
	If a decontamination line is present, proceed through the line as directed. If no decontamination line is present, remove all other PPE except clean gloves before removing the respirator. Once removed, clean as directed.
Natural Hazards (designate in JHA the specific natural hazards associated with the task step)	For sites where poison ivy, oak, and sumac are present, have a poison ivy wash available for employees on-site. If exposure occurs and no poison ivy wash is available, employees should wash in cool water and use soap. Keep work areas free from clutter so that ground surfaces can be easily seen by employees. **<u>Working around poisonous insects:</u>** Use insect repellant containing DEET at all times on the jobsite. Periodically throughout the day and at the end of the day, perform a thorough “tick-check” to ensure ticks or other insects are found and removed promptly. Avoid obvious conical mounds of dirt that may indicate ants, wasps, or other flying insects. Before reaching into dark or damp spaces such as monitoring well-heads, inspect the area thoroughly to ensure spiders are not present. Always take a shower as soon as possible after leaving a jobsite for the day to remove any insects, such as chiggers. **<u>Working around snakes:</u>** Visually inspect the work are prior to beginning any work to located areas with high grass and underbrush. Do not walk through these areas if at all possible to avoid snakes. Wear leather steel-toe boots and snake chaps in areas where snakes are suspected or confirmed to be present. Do not attempt to kill snakes, as people are commonly bitten attempting this. **<u>Working around feral animals:</u>** High rat populations within an enclosed space present a hazard of Hanta virus. Spray such areas with bleach solution prior to performing any work in the area (10 parts water to 1 part household bleach). If dogs or other animals are spotted that are acting strangely, do not approach them. Contact the local animal control center for assistance.

		Severity				
		Minor (1)	Moderate (3)	Serious (5)	Severe (7)	Catastrophic (10)
Probability	Almost Certain (6)	6	18	30	42	60
	Likely (5)	5	15	25	35	50
	Possible (4)	4	12	20	28	40
	Heard of (3)	3	9	15	21	30
	Unlikely (2)	2	6	10	14	20
	Rare (1)	1	3	5	7	10

Risk Rating

Extreme	High	Low

Risk Rating

Extreme	36
High	19
Medium	6
Low	0

ERM

JHA
Job Hazard Analysis

Project Number:	516919	Project / Client Name:	Pre Design Investigation/ G.W. Lisk
Project Manager:	Tim Daniluk	Location:	2 South Street, Clifton Springs, New York 14432
Partner-in-Charge:	Ernest Rossano	Date and Revision Number:	6/3/2022, Rev. 0

SPECIFIC TASK:	**Hand Augering and Soil Sampling**

Minimum Required PPE for Entire Task:	☑ Hard Hat ☑ Safety-Toe Shoes ☐ Hearing Protection ☐ Goggles ☐ Face Shield ☐ Respirator N/A ☐ Other (specify): N/A ☑ Safety Glasses ☐ Reflective Vest ☑ Gloves chemical resistant ☑ PPE clothing Long sleeves, pants		
Additional Task-Step Specific PPE: (as indicated below under Controls)	N/A	Equipment / Tools Required:	Hand auger with non-conductive nad/or insulated handles and upper shaft
Training Required for this Task:	SSC Experienced Person (EP)	Permits Required for this Task:	S1-ERM-007-FM3 – SSC Location Disturbance Permit (inside critical zones)
Forms Associated with This Task:	S1-ERM-007-FM1 – SSC Field Process Checklist S1-ERM-007-FM2 – SSC Field Process Checklist for RG Sites		

JHA Developed / Reviewed By:			JHA Review In Field
Name / Job Title:	Name / Job Title:	Name / Job Title:	Field supervisor to ensure all personnel performing this task have reviewed JHA and agree to follow it. Site-specific changes to this JHA have been made as warranted based on this review. **Signature/Date:**
Alexis Harford/ Consultant I			

Task Steps[1]		Potential Hazards & Consequences[2]		select	Probability	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
1	Set up at location	1a	Tripping hazards in work area	H&S	3	3	9	1a	Identify and use only safe pathways when entering/exiting/working in area. Obtain additional lighting and use clear safety glasses in areas with low/unclear visibility. Inspect work area for potential slip/trip/fall hazards prior to start of work; remove if possible, or, if not possible, cordon off with cone or mark with highly visible tape/flags, etc. Keep work area organized and free of surface obstructions during task. Immediately dry wet areas or restrict access (e.g., warning tape, signs, cones). Remove snow/ice/debris/vegetation prior to start of work. Reassess surface conditions if weather changes and address any new hazards (e.g., slick surface developing as a result of wet/freezing conditions). Do not carry loads that restrict visibility. Keep work area surfaces clear of debris (e.g., mud, leaves) and store tools/equipment to eliminate trip hazards when not in use. Keep eyes on path and nearby surroundings when walking. Fill in/flatten uneven ground. Wear footwear with appropriate traction for conditions (i.e., rubber non-slip soles, tread, crampons, etc.).
		1b	Getting struck by vehicular traffic and unauthorized access to work area	H&S	1	4	4	1b	Set up barricades around work zone (specify type: snow fencing, cones [min height should be such that drivers can see], delineator posts). Use parked vehicle(s) as barricades to protect work zone from oncoming traffic. Use traffic control contractor for work in public streets or at center divider of public streets. Wear reflective vest for all off-site work in or adjacent to traffic areas.
		1c	Muscle strain from lifting / handling equipment	H&S	3	3	9	1c	Use cart, dolly, or get assistance. Do not lift anything manually by yourself that is awkwardly shaped or weighs more than 35 pounds. When lifting lighter objects, bend and lift with legs/arms, not back. Keep objects close to body and do not twist while lifting (turn with feet). Position work equipment to avoid over-reaching while working. Store heavy/bulky items with safe access in mind.
		1d	Biological Hazards - insects, snakes, plants, wildlife	H&S	2	5	10	1d	Inspect work area upon arrival - do not proceed if biological hazards are identified - leave work area and contact PM. Clear brush/high grass from work area. Use insect repellent. Identify employees with known sensitivities to hazardous plants or insects; reassign sensitive employees or provide appropriate addt'l PPE, such as a bee sting kit. Wear long sleeve shirt and pants.

Task Steps[1]		Potential Hazards & Consequences[2]		select	Probability	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
2	Hand augering	2a	Injury or damage if striking underground utility lines / structures	multiple	2	5	10	2a	Follow ERM SSC Process, perform all utility location activities. Ensure contractors performing hand augering have been briefed on ERM SSC process requirements (use checklist form noted above - ERM-1511-FM5 - SSC Review Checklist for Contractors), and are overseen at ALL times by an ERM SSC EP. Hand auger slowly and don't force the hand auger if there is an obstruction that could be an underground line. Use correct auger head for the material to be encountered. Do not use pointed pry bar to pound into the borehole. If pea gravel, brick, or other non-native materials encountered, stop work immediately and contact ERM PM. If resistance encountered, stop and contact PM.
		2b	Improper tool use or tool condition resulting in injury	H&S	3	3	9	2b	Ensure personnel have been properly trained on use of hand auger. Inspect all tools and equipment IMMEDIATELY prior to use; if faulty or inappropriate, do not proceed until repaired or replaced. Use blunt-end probe to free hard to remove or sticky soil. Clear bucket by pushing material/tool away from body.
		2c	Muscle strain or overexertion from hand auger operation	H&S	3	3	9	2c	Do not force hand auger - if you get refusal, contact PM to determine safe step-out distance. Use appropriate auger cutting head for soil type encountered. Do not reach, stretch, or twist when using hand auger. Use 3' and 5' flights to keep handle between shoulders and thighs (keep back straight). Stretch muscles before starting work. Take breaks regularly. Use 5 gallon bucket of water as lubricant for augers.
		2d	Exposure to soil containing hazardous materials	H&S	3	4	12	2d	Wear nitrile gloves when collecting soil samples. Monitor breathing zone/work area with PID if soil contains VOCs. Follow HASP requirements for upgrading PPE and doning respirators.
		2e	Cuts/abrasions from sharp and rough materials	H&S	2	4	8	2e	Wear leather/heavy work gloves (with sufficient grip) while hand augering. Clear soil from auger bucket wih blunt-end tool, not hands.
3	Shoveling / collecting soil into containers	3a	Muscle strain or overexertion	H&S	3	3	9	3a	Do not lift more than 50 lbs without assistance. Do not move drums without drum dolly. For single-person tasks, transfer soil to smaller containers such as 5-gallon buckets filled 1/2-way.
		3b	Pinch Points - Drum Lids	H&S	1	3	3	3b	Wear leather/heavy work gloves when opening/closing drum lids. Use the proper tool - 15/16" socket and ratchet and flathead screwdriver. Keep fingers clear of "line of fire".
		3c	Mismanagement of wastes	E	2	3	6	3c	Coordinate with ERM PM and client/site contacts prior to job start for proper waste management instructions. Containers must be labelled properly BEFORE adding any waste materials.
		3d	Cut from broken glass or sharp edge of metal sleeve	H&S	2	5	10	3d	Inspect hand auger to make sure there are no sharp edges or barbs that could cut a hand. File down if needed. Wear cut resistant gloves. Store sample containers in shipping container prior to filling. Inspect containers for any damage, cracks. When capping sample containers, do not place fingers across gap between cap and bottle neck. Wear chemical resistant gloves that are also cut resistant, or wear thin cut-resistant inner gloves.
		3e	Exposure to soil containing hazardous materials	H&S	2	5	10	3e	See above, 2d.
4	Decontamination of equipment (over containment)	4a	Cuts/abrasions from sharp and rough materials	H&S	2	4	8	4a	See above, 2e. Do not use hands to wash off auger blades - use wire brush or other tool.
		4b	Exposure to soil containing hazardous materials	H&S	2	5	10	4b	See above, 2d.
		4c	Mismanagement of wastes	E	2	3	6	4c	See above, 3c. Conduct all decon activities over containment.
5	Backfill hole	5a	Tripping hazard from open or improperly backfilled borehole	H&S	2	4	8	5a	Do not leave open holes unattended. If this is not feasible, consult PM for instructions. Completely backfill all holes with bentonite chips [or specify other material], compact, and hydrate thoroughly; Revisit auger locations within 24 hours to ensure no settling.
6	Secure site	6a	Hazards from Poor Site Housekeeping - Tripping Hazards, Mismanaged Wastes	multiple	3	3	9	6a	Remove all tools, equipment, cones, debris, trash from site before leaving. Secure all equipment from theft, vandalism, energizing equipment. Contact waste management contractor and arrange for waste container pickup. Leave containers in secure, agreed-upon location; if off-site, DO NOT leave containers unattended!

Task Steps[1]		Potential Hazards & Consequences[2]		select	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). 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.

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 Development Checklist

This checklist provides common hazards and some hazard control measures for consideration,
and can be used to help develop site-specific JHAs

Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Fatigue and Stress	Specifically define acceptable work hours, work duration, work weeks, consecutive days, etc. Define rest frequency and duration. Take weather, PPE, activity level into consideration. Identify activities with increased mental stress / strain, and determine if controls are warranted: multiple employees, work rotation, etc. Identify activities with limited mental stress (e.g., 'boring or dull activities' where inattention can occur), and determine if controls are warranted: multiple employees, work rotation, etc. Consider activities that may occur immediately before or after the task (e.g., driving), and determine whether controls are required (e.g., limitations on driving after 10 hr days of field activities). Remember that stress and fatigue ARE NOT LIMITED to field / construction activities.
Sharp Edges (designate in JHA the specific cut or puncture hazard associated with the task step)	Wear ____ gloves (designate type, e.g. heavy leather, cut-resistant, puncture-resistant). Wear ___ footwear (designate type, e.g. puncture-resistant insoles). Wear ___ clothing (designate type, e.g. long sleeves, heavy coveralls). Have gloves on your person at all times. Employees performing significant amounts of cutting tool use should wear high-visibility gloves to encourage awareness of where hands are being placed. Do not attempt to catch falling tools/equipment. Ensure guards are in place. Use ___ cutting tool (designate type, e.g. scissors, shears, snips). Do not use dull blades. Do not use open-bladed knives. Inspect tools/equipment in area prior to start of task to identify sharp edges and, if possible, remove/protect or position body to ensure no contact during task. Always cut away from hand, body and face. Ensure others are not in line-of-fire when cutting. Place object to be cut in a vise or on a flat surface or use another tool to hold object while cutting. Do not place fingers in ends of piping or other tubular material.
Pinch Points (designate in JHA the specific pinch hazard associated with the task step)	Wear ___ gloves (designate type, e.g. heavy leather, puncture-resistant). Have gloves on your person at all times. Inspect work area prior to start of task to identify pinch points and remove/protect to ensure do not contact during task. Consider body positioning prior to start of task to identify potential pinch points and change position to ensure do not contact during task. Identify pinch points by warning label and/or paint color. Do not position your hand or body so it can be caught between a lifted load and adjacent objects. Do not place fingers/hands between sections of multi-component/moveable items (e.g. fencing sections, sheet piling, hinged panels).
Slips / Trips / Falls from Surface Conditions (designate in JHA the specific slip, trip, fall hazard associated with the task step)	Wear ___ footwear (designate type, e.g. shoes with rubber soles or low heels, crampons). Identify and use only safe pathways and stairs when entering/exiting/working in area. Obtain additional lighting and use clear safety glasses in areas with low/unclear visibility. Inspect work area for potential slip/trip/fall obstructions prior to start of work and remove or, if not possible, mark with highly visible tape/flags, etc. Keep work area organized and free of surface obstructions during task. Immediately dry wet areas or restrict access (e.g. with warning tape, signs, cones). Remove snow/ice prior to start of work. Reassess surface conditions if weather changes and address any new hazards (e.g. slick surface developing as a result of wet/freezing conditions). Do not carry loads that restrict visibility. Do not stack objects higher than ___ (designate height). Ensure steps, walkways and shoes are not slippery or loose prior to use. Keep work area surfaces clear of debris (e.g. mud, leaves) and store tools/equipment to eliminate trip hazards when not in use. Keep eyes on path and nearby surroundings when walking. Take small steps and shuffle feet in potentially slippery areas. Walk slowly around corners and when entering/exiting doors. Use slip-resistant mats. Use handrails when going up/down stairs. Fill in/flatten uneven ground. Use steps/stepladders for access in and out of shallow trenches/excavation.
Fall from Elevated Position (designate in JHA the specific elevated hazard associated with the task step)	Use carts with high sides to contain load. Ensure load is secure and balanced prior to moving. Maintain 3-points of contact when mounting/dismounting vehicle/equipment. Maintain 3-points of contact when climbing/descending ladders. Use equipment/mechanical means (e.g. tool belt, rope) to transport tools/materials. Ensure steps, ladder rungs and shoes are not slippery or loose. Do not stand or work off top of ladder (e.g. top 2 steps of stepladder). Extend ladder at least 3-feet beyond top bearing point. Have another person hold bottom of ladder at all times while working or until top is secured; if ladder is not equipped with grip pads, hold bottom at all times. Position extension ladder at 1 foot distance for every 4 feet of working height. Do not overreach; keep body between ladder rails and both feet on same rung. Wear fall protection when working at a height of 6 feet (1.8 meters) or greater. Wear full body harness with double-locking snap hooks and shock absorbing lanyard. Inspect fall protection prior to use and do not use if: worn or frayed lanyard or webbing/stitching; locking devices, snap hooks, etc. are not working properly; metal components are worn, damaged, or have burrs, etc.; annual inspection tag is not in place and current. Connect to secure anchor point meeting fall protection specifications (capable of supporting 5,000# per person attached, above shoulder height, no sharp edges, etc.). Ensure scaffolding has secured boards, is adequately braced, has a handrail, is free of debris and holes and is in good working condition. Stand only on secured and inspected flooring and uprights. Work only within the scaffolding structure.

JHA Development Checklist

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Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Back Sprain/Strain (designate in JHA the specific back sprain/strain hazard associated with the task step)	Use ___ mechanical lifting/carrying device (designate type, e.g. cart, dolly, forklift). Obtain assistance when lifting ____ (designate what, e.g. awkwardly shaped objects) or objects weighing greater than ___ (designate limit). Bend and lift with legs/arms, not back. Keep objects close to body and do not twist while lifting (turn with feet). Position work equipment to avoid over-reaching while working. Do not overload waste containers, fill ___ full (designate volume). When objects are lifted/carried by two persons, take positions on opposite ends. Store heavy/bulky items with safe access in mind. Take regular breaks every ___ (designate frequency).
Suspended Loads/Low-Hanging Objects (designate in JHA the specific suspended load, low-hanging hazard associated with the task step)	Wear hard hat. Wear ___ gloves (designate type, e.g. rubber dot for grip). Wear ___ footwear (designate type, e.g. steel-toe boots; footwear with metatarsal-protection). Do not attempt to catch falling objects. Stay ___ (designate distance) away from raised objects. Restrict access with warning tape and/or posted signs. Secure loose objects prior to lifting or moving by ___ (designate how, e.g. with straps, sideboards, use of panel cart with high sides). Remove low-hanging objects or identify (e.g. mark with highly visible paint, tape, flags) and/or communicate location to site personnel. Visually inspect equipment before beginning task. Verify latest equipment inspection/tag is current before beginning task. Inspect lifting rigging (chains/slings/cables) to ensure in good condition and do not use if defects, signs of excessive wear are identified. Verify lifting equipment is certified and rated for handling the reach and load limits for required work. Use trained spotter(s) to alert others of hazards. Use tag lines held by trained personnel to guide load and do not wrap lines around body parts. Pre-inspect travel route to ensure clearance. Keep load low to ground to ensure clear visibility when transporting. Move load using low, slow, controlled movements.
Rotating / Automated / Energized Equipment (designate in JHA the specific rotating hazard associated with the task step)	Do not work on moving equipment. De-energize all energy sources (e.g. compressed, pressurized) equipment prior to working on. Lock out/tag out equipment per LOTO procedure and verify energy isolation prior to start of task. Employees who perform LOTO must receive authorized employee training. 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. Remove/secure loose clothing, hair and jewelry. Keep hands/body/tools ___ (designate distance) away from equipment. Identify automatic-start equipment with signs/labels. Locate emergency stop/shutdown switch prior to start of task. Ensure all associated personnel are notified of work activities. De-energize hand-held and mobile equipment when not in use. Plan work lay-out/processes to avoid and/or minimize line-of-fire risks. Define and barricade personnel exclusion zones based on machine swing areas, area below crane operation, etc.
Vapors, Airborne Debris (designate in JHA the specific vapor, debris or liquid hazard associated with the task step)	Keep area ventilated by ___ (designate how, e.g. with forced draft fans, outside use only). Perform ___ monitoring (designate method and frequency) and stop work if monitoring result ___ (designate limits). Position body upwind. Keep work area wet to limit dust. Set-up work zone to restrict non-essential access and minimize off-site impacts. Wear ___ eye/face protection (designate type, e.g. safety glasses, face shield, splash goggles or combinations). Wear ___ clothing (designate type, e.g. long sleeves, paper suit). Wear ___ breathing protection (designate type, e.g. dust mask, full/half-face respirator with ___ (designate type) cartridges). Establish cartridge change-out schedule. (designate in JHA the specific ignition risks associated with the task step)
Ignition (designate in JHA the specific ignition risks associated with the task step)	Undertake work under Hot Work Permit. Monitor VOCs and LEL by ___ (designate method and frequency) and stop work if monitoring result ___ (designate limits). Seal all pipe/openings (e.g. tank holes, storm drains) in work zone that may emit vapors. Ensure all equipment in work area is intrinsically safe. Define/barricade work areas to exclude unauthorized access/external ignition sources (e.g. vehicular traffic). Keep area ventilated by ___ (designate method, e.g. with fans). Ensure lines are clear prior to disconnect and/or use dry couplings. Assess and control static risks for all work equipment and processes. Have ___ (designate number, type and size) fire extinguisher(s) on site and immediately available for use. (designate in JHA the specific high noise hazard associated with the task step)
	Determine whether noise monitoring has been necessary on other projects of similar scope. Measure noise levels with a noise dosimeter if project will last over 30 days, or for shorter work use the rule or thumb that you should be able to hear a

JHA Development Checklist

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Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
High Noise Level (designate in JHA the specific high noise hazard associated with the task step)	Measure noise levels with a noise dosimeter if project will last over 30 days, or for shorter work use the rule of thumb that you should be able to hear a person talking to you in a normal voice at 1m/3 ft. If you cannot hear them without them raising their voice the hearing protection is necessary, and noise monitorting is advisable. For any employee working on the site who has not attended hearing conservation training within the past year, review this JHA with them and document their training. Wear ___ hearing protection (designate type, e.g. ear plugs, ear muffs, double hearing protection) based on known or potential noise levels. Post warning signs at ___ (designate distance) from work area stating entry restrictions and/or type of hearing protection required. Ensure mufflers are installed in equipment. Minimize potential external/third party/community impacts by ___ (designate how). Share noise dosimetry results with your Divisional Safety Advisor so we can build up a bank of knowledge about the types of equipment at projects where hearing protection should be considered.
Heat Stress and Burns (designate in JHA the specific heat hazard associated with the task step)	**Hot Equipment:** Allow equipment/material to cool prior to working with. Use designated handles to open/move equipment. Turn off equipment and allow to cool prior to refueling. Identify hot surfaces prior to start of task and avoid direct contact with.Drink cool fluids and take rest breaks every ___ (designate frequency). Wear ___ gloves (designate type, e.g. oven mitts, thermal, etc...). Use ___ (designate type, e.g. tongs, insulated handles) tool to move equipment or materials. **Hot Weather:** Check the weather forecast in advance & be prepared for those conditions Wear ___ clothing (designate type, e.g. light-weight fabrics with long sleeves & trousers, cool vest, etc...). Schedule regular breaks, watch your colleagues using the buddy system. Use sun block for skin protection, drink cool drinks regularly (i.e.: before you become thirsty), take breaks in the shade (advice on the regularity and duration of these can be found in the SWP linked to below) Stop work if fatigue or physical stress situations develop in your or those around you High humidity, working in direct sunlight, work in contact with hot surfaces influence the severity of hot working conditions. Seek specific guidance and training if work in these conditions is necessary. (Advice is available on the SWP for heat stress available on Minerva Americas H&S pages at the following link: http://minerva.erm.com/Support/HS/AmericasHS/Safe%20Work%20Practices%20SWP/04%20-%20Heat%20Stress%20-%20updated%208-11.doc)
Cold Stress (designate in JHA the specific cold hazard associated with the task step)	Drink hot/warm fluids and take rest breaks every ____ (designate frequency) Wear ___ clothing (designate type, e.g. insulating layers, down jacket, chef coat). Wear ___ gloves (designate type, e.g. thermal, freeze-protection). In temperatures below freezing do not touch bare metal surfaces with the naked skin without adequate PPE, such as gloves. At or below 4°C/40°F adequate dry insulating clothing must be available to keep worker's core temperature at or above 36°C/96.8°F Dampness/condensation, work in contact with cold water or surfaces, and wind speed all influence the severity of cold working conditions. Seek specific guidance and training if work in these conditions is necessary. (Training is available on ERM North American Minerva page at the following link: http://minerva/erm/globalsupport/healthandsafety/NA/HS%20Training%20Materials/Home.aspx)
High Voltage/Electrical Contact (designate in JHA the specific high voltage / electrical hazard associated with the task step)	Use wooden or fiberglass ladder. Stand on non-conductive surface. Remove metal jewelry. Footwear worn around electrical circuits should be non-conductive. Ensure power cords are free of defects and exposed wires. Do not work in ___ (designate condition, e.g. thunderstorm) weather. Use___ gloves (designate type in JHA, e.g. electrical-insulted). Use ground fault circuit interrupter (GFCI). Use low voltage lighting. Ground equipment by ___ (designate how or refer to separate procedure). Pre-inspect travel route to ensure clearance. Inspect above and below ground areas prior to start of work to identify electrical lines and communicate locations to site personnel. **SSC:** Ensure completion of subsurface clearance procedure requirements. Ensure line locator service identification of underground lines. Use non-destructive drilling techniques (e.g. air-knife). When excavating, assign spotter to stop work at sign of subsurface conduits/wires. Keep ___ distance from overhead power lines (designate distance in JHA based on voltage, regulations, etc.). Lock-Out/Tag-Out (LOTO): LOTO equipment must be available as per the LOTO procedure and verify isolation of energy source prior to start of task. Tags must read "DANGER – DO NOT OPERATE" and be resistant to wear and tear by the environment they are being used in. Employees who perform LOTO must receive authorized employee training, subcontractors must provide evidence that they have (e.g.: a certficate) Wear a cotton t-shirt, Class II Electrical Arc Protection suit, Class O (low voltage) gloves, and non-conductive footwear. Only the person who placed the LOTO device is authorized to remove it, so after-hours contact information for LOTO employees must be in the HASP. Ensure all associated/potentially impacted personnel are notified of work activities. Before working on live equipment, it should be brought to a "zero-energy state" by turning off the equipment's power (at source, such as by switching off specific circuit breakers. ("Zero-energy" is not attained until the individual working on the machinery attempts to turn the machine on and is unsuccessful.) In certain situations, where machinery must stay live to do work, and Lock-Out is not possible, the Project Manager and Field Safety Officer must be directly involved when Tag-Out is taking place. For all sites where work extends beyond 1 year, a LOTO a documented process inspection must occur to check that LOTO procedures in-place are still valid.

JHA Development Checklist

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Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Chemical/Liquids Contact or Release (designate in JHA the specific chemical/liquid hazard associated with the task step)	Wear ___ eye/face protection (designate type, e.g. safety glasses, face shield, chemical splash goggles or combination) Wear ___ clothing (designate type, e.g. long sleeves, paper suit, protective apron, polyethylene coated suit). Wear ___ gloves (designate type, e.g. butyl, nitrile, rubber, resistant to specific chemical/duration). Ensure that gloves and boots are taped to the suit to prevent liquid splash. Double-layering nitrile or latex protective gloves is a good idea for added protection. If acidic or caustic chemicals are present, wear outer neoprene or rubber gloves. Restrict access to work area by ___ (designate how). Use funnel when pouring liquid. Ensure bleed valves are open and lines are clear prior to disconnect and/or use dry couplings. Have ___ (designate type/amount, e.g. pads, boom) absorbent material on hand. Place container and/or absorbent/plastic sheeting under connection prior to disconnect. Store hazardous materials in dedicated container/area (e.. shed, box). Wash hands frequently. Inspect pressurized lines and all fittings/couplings to ensure integrity/closure. Assess rating and compatibility of materials used vs purpose. Ensure storage compatibility of multiple products. **Hazard Communication:** For each chemical product used by ERM employees or subcontractors, a SDS sheet must be obtained and kept on-file. Chemical containers must be labeled in accordance with OSHA regulations. Review SDS and container label prior to start of task/handling and follow associated requirements. Ensure all employees on the jobsite have been told about the chemical in-use and are protected. Confirm SDS is relevant when working with legacy material (e.g. historic releases). A chemical inventory list must be prepared and updated as new or different chemicals are procured. If chemical exposure occurs, even if medical symptoms are not present, inform the Field Safety Office or Office H&S Contact.
Biological Contact (designate in JHA the specific biological hazard associated with the task step)	Wear ___ clothing (designate type, e.g. long sleeves, hood, paper suit). Wear ___ gloves (designate type, e.g. fabric, nitrile). Use insect repellant. Inspect area prior to start of task and remove/avoid animal (e.g. dogs), insect (e.g. bees, wasps), plant (e.g. poison ivy) hazards if possible; otherwise reschedule work and/or contact professional service for removal. Report allergies and ensure treatment is available on site. Avoid loud noises/brightly colored clothing if bees are known to be in area.
Repetitive Motion (designate in JHA the specific repetitive motion hazard associated with the task step)	Use ___ tool and/or ___ technique (designate, e.g. ratchet wrench) to minimize repetitive stress risk. Change position frequently during job (e.g. vary grip, hand motion). Keep wrists in a neutral (straight) position as you work. When possible, rotate tasks to give body parts a rest. Take breaks every ___ (designate frequency) and do simple stretches/exercises. Ensure gloves fit hands properly to decrease stress on hand/joints.

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Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Traffic (designate in JHA the specific pedestrian / motorized traffic hazard associated with the task step)	Wear ___ clothing (designate type, e.g. reflective vest, neon orange/green shirt). High-visibility safety vests: class I may be used when traffic is below 25 mph, Class II for 25-50 mph, and Class 3 for >50 mph. Set up work zone to restrict non-essential access by ___ (designate how, e.g. with cones/barricades/fencing, placed specified distance apart/from work area, etc.). Avoid risks posed by detour (e.g. pedestrians forced into other traffic). Use parked vehicle with hazard lights facing oncoming traffic to protect work zone. Use buddy system to establish traffic watch. Use trained spotters when backing and when visibility is restricted. Inspect surrounding area prior to backing. Adjust mirrors and check equipment back-up alarm to confirm operational prior to start of task. Use horn to alert others prior to backing. Use traffic management consultant. Stay ___ (designate distance) from operating equipment/extended arm, etc. Make eye contact with equipment operator and receive approval prior to approaching. Ensure spotters and equipment operators maintain eye contact. Establish parking/staging/loading/unloading areas (consider equipment turning circles, swing zones etc.). Ensure trailers / trucks are rated and balanced. Chock truck/trailer wheels when not moving. Ensure load is distributed during load/unload to avoid tip/roll-over. Ensure all personnel remain outside of tip-over radius when dumping.
Improper Waste Transport / Disposal (designate in JHA the specific waste disposal hazard associated with the task step)	Designate safe waste storage area/container prior to start of task. Ensure waste materials meet container specifications prior to use. Label waste containers. Separate hazardous and non-hazardous wastes. Place waste containers in designated storage area and secure prior to leaving site. Confirm waste transport truck/container integrity prior to loading. Confirm shipping document description/approved destination with waste container label prior to off-site shipment. For unsealed/partially exposed loads, perform ___ monitoring (designate method and frequency) and stop work if monitoring result ___ (designate limits).
H&S Risks and Increase in ERM Liability caused by Subcontractors Working on the Jobsite	Select only subcontractors that have been prequalified and approved for use. Ensure a signed, executed subcontract agreement is in-place prior to subcontractors performing work on the jobsite for ERM. Ensure the subcontractor has received a copy of the ERM HASP and supporting documentation prior to mobilization to the jobsite. Specify both the ERM and the subcontractor's scope of work in the ERM HASP document. Ensure that any subcontractor personnel on-site have reviewed and signed the site HASP. In all cases, require the ERM subcontractor to either develop their own site-specific HASP, or at minimum develop Job Hazard Analyses (JHA) for the specific tasks they will perform. Attach these documents to the ERM HASP as appendices. Ensure subcontractor work is overseen by ERM personnel at all times. Always include subcontractor personnel in daily jobsite tailgate safety meetings. Do not supply subcontractor personnel with personal protective equipment (PPE). If ERM is performing air monitoring for the subcontractor, ensure calibration of air monitoring equipment is done before and after each use. At a minimum, air monitoring equipment must be calibrated at least once per day. Document equipment calibration and file with the site HASP.
Exposure to Toxic and Hazardous Chemical Substances (designate in the JHA the specific chemicals of concern)	Determine whether there is a potential for exposure to any toxic or hazardous chemical substances in the work area prior to performing any work that may involve handling of one or more of the chemicals or may result in exposure through production, research, or process activities. This would include, but not be limited to, OSHA's 13 regulated carcinogens, and the following: • Acrylonitrile • Asbestos • Benzene • Cadmium • Chromium (VI) • Coke oven emissions • Cotton Dust • Ethylene oxide • Formaldehyde • Hydrogen sulfide • Inorganic arsenic • Lead • Methylene chloride • Methylenedianiline • Vinyl chloride • 1,2-dibromo-3-chloropropane • 1,3-butadiene
	If any of the substances are identified, conduct an exposure assessment to determine whether employees have the potential to be exposed above any action level identified in the substance-specific regulations.
	Where the initial assessment identifies the potential for employee exposures above an established action level or permissible exposure limit, develop a site-specific program to address all required regulatory concerns for that substance. Completed programs shall be included in the site-specific health and safety plan.
	Ensure the health and safety plan specifies the airborne contaminants that may be encountered and the need for respiratory protection. Ensure the plan provides a selection process for the respirator and cartridge type, develops actions levels for upgrades/downgrades of respiratory protection, describes cartridge change out schedules, and provides information on medical surveillance criteria and respirator fit testing requirements.
	Prior to donning any respirator, complete a thorough inspection to ensure it is in good operating condition. Inspected elements should include, but not be limited to, straps, sealing surfaces, inhalation/exhalation vales, and facepieces. Do not use respirators with any signs of damage.
	Where necessary, replace damaged parts. If repair is not possible, discard and replace entire respirator.
	Clean and disinfect respirators using a mild soap and water solution following use. Where respirator sharing is allowed, ensure respirators are cleaned and sanitized before being exchanged by employees.

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Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Respiratory Protection	For cartridge-type respirators, affix the cartridges to the respirator as indicated in the manufacturer's guidelines. Cartridges should be hand tightened only.
	Employee must be clean shaven in those areas of the face where the respirator makes skin contact, including any inner nose cups.
	Don the respirator prior to other personal protective equipment in the head/neck area so that nothing comes between the respirator straps and the head surface. Safety glasses, hard hats, etc. must be donned after the respirator.
	For cartridge-type respirators, perform a positive and negative fit check to ensure a good respirator seal.
	Adjustments made while wearing tight-fitting respirators within the work area may result in a compromised respirator seal. If this occurs, stop work, move to an area with no chemical contamination (go through the decontamination process, if present), readjust the respirator, and perform positive and negative fit-checks to ensure a proper facepiece seal.
	If it becomes difficult to breathe due to particulate clogging of respirator cartridges, stop work, move to an area with no chemical contamination (go through the decontamination process, if present), replace the cartridges, readjust the respirator, and perform positive and negative fit-checks to ensure a proper facepiece seal.
	If using a chemical catridge and you either (1) reach or exceed the required wear time as described in the cartridge change schedule or (2) detect any evidence of chemical breakthrough (odors, tastes, burning sensations, etc.), stop work, move to an area with no chemical contamination (go through the decontamination process, if present), replace the cartridges, readjust the respirator, and perform positive and negative fit-checks to ensure a proper facepiece seal. If chemical breakthrough was detected, determine what level of exposure may have occurred through testing of the work atmosphere.
	If a decontamination line is present, proceed through the line as directed. If no decontamination line is present, remove all other PPE except clean gloves before removing the respirator. Once removed, clean as directed.
Natural Hazards (designate in JHA the specific natural hazards associated with the task step)	For sites where poison ivy, oak, and sumac are present, have a poison ivy wash available for employees on-site. If exposure occurs and no poison ivy wash is available, employees should wash in cool water and use soap. Keep work areas free from clutter so that ground surfaces can be easily seen by employees. **Working around poisonous insects:** Use insect repellant containing DEET at all times on the jobsite. Periodically throughout the day and at the end of the day, perform a thorough “tick-check” to ensure ticks or other insects are found and removed promptly. Avoid obvious conical mounds of dirt that may indicate ants, wasps, or other flying insects. Before reaching into dark or damp spaces such as monitoring well-heads, inspect the area thoroughly to ensure spiders are not present. Always take a shower as soon as possible after leaving a jobsite for the day to remove any insects, such as chiggers. **Working around snakes:** Visually inspect the work are prior to beginning any work to located areas with high grass and underbrush. Do not walk through these areas if at all possible to avoid snakes. Wear leather steel-toe boots and snake chaps in areas where snakes are suspected or confirmed to be present. Do not attempt to kill snakes, as people are commonly bitten attempting this. **Working around feral animals:** High rat populations within an enclosed space present a hazard of Hanta virus. Spray such areas with bleach solution prior to performing any work in the area (10 parts water to 1 part household bleach). If dogs or other animals are spotted that are acting strangely, do not approach them. Contact the local animal control center for assistance.

		Severity				
		Minor (1)	Moderate (3)	Serious (5)	Severe (7)	Catastrophic (10)
Probability	Almost Certain (6)	6	18	30	42	60
	Likely (5)	5	15	25	35	50
	Possible (4)	4	12	20	28	40
	Heard of (3)	3	9	15	21	30
	Unlikely (2)	2	6	10	14	20
	Rare (1)	1	3	5	7	10

Risk Rating

Extreme	High	Low

Risk Rating

Extreme	36
High	19
Medium	6
Low	0

ERM

JHA
Job Hazard Analysis

Project Number:	516919	Project / Client Name:	Pre Design Investigation/ G.W. Lisk
Project Manager:	Tim Daniluk	Location:	2 South Street, Clifton Springs, New York 14432
Partner-in-Charge:	Ernest Rossano	Date and Revision Number:	6/3/2022, Rev. 0

SPECIFIC TASK:	**Using Hand Tools**

Minimum Required PPE for Entire Task:	☑ Hard Hat ☑ Safety-Toe Shoes ☐ Hearing Protection ☐ Goggles ☐ Face Shield ☐ Respirator: N/A ☐ Other (specify): N/A ☑ Safety Glasses ☑ Reflective Vest ☑ Gloves: chemical resistant ☑ PPE clothing: Long sleeves, pants		
Additional Task-Step Specific PPE: (as indicated below under Controls)	Cut-resitant gloves	Equipment / Tools Required:	Miscellaneous hand tools (screwdrivers, hammers, cutting tools, etc.)
Training Required for this Task:	Tool Specific	Permits Required for this Task:	N/A
Forms Associated with This Task:	NA		

JHA Developed / Reviewed By:			JHA Review In Field
Name / Job Title:	Name / Job Title:	Name / Job Title:	Field supervisor to ensure all personnel performing this task have reviewed JHA and agree to follow it. Site-specific changes to this JHA have been made as warranted based on this review. **Signature/Date:**
Alexis Harford/ Consultant I			

Task Steps[1]		Potential Hazards & Consequences[2]		select	Probability	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
1a	Gather tools to take to jobsite	1a	An improper tool available at jobsites encourages unsafe behaviors and could lead to injury or property damage	H&S	2	5	10	1a	Ensure tools taken to jobsites are kept in optimal condition (sharp, clean, oiled, etc.) to ensure efficient operation. Tools must only be used for their intended purposes – tools should not be used as pry-bars. Ensure power cords attached to powered-equipment are not damaged. Inspect all power cords for damage prior to use. Remove all damaged tools and cords from service. Any damaged tool or electrical cord must be tagged and taken out of service. If a tool is designed to be handles and used with two hands then two hands must be used. Only use tools for their intended purpose and according to instructions.
		1b	Muscle strain from lifting / handling equipment	H&S	3	3	9	1b	Use cart, dolly, or get assistance. Do not lift anything manually by yourself that is awkwardly shaped or weighs more than 35 pounds. When lifting lighter objects, bend and lift with legs/arms, not back. Keep objects close to body and do not twist while lifting (turn with feet). Position work equipment to avoid over-reaching while working. Store heavy/bulky items with safe access in mind.
		1c	pinch points	H&S	2	3	6	1c	Do not position your hand or body so it can be caught in identified pinch points. Do not position your hand or body so it can be caught between a lifted load and adjacent objects. Wear heavy leather or cut-resistant gloves; have gloves on your person at all times.
2a	Using cutting tools	2a	Major and/or minor laceration bodily injury	H&S	2	5	10	2a	Fixed open-blade knives (such as pocket knives) may not be used on ERM jobsites. Cut-resistant gloves must be worn while using cutting tools or sharp objects. Employees performing significant amounts of cutting tool use should wear high-visibility gloves to encourage awareness of where hands are being placed. Review *Cutting Tools - Operational Control Document* prior to performing cutting tasks.
3a	Using screwdrivers	3a	Puncture and laceration bodily injuries	H&S	2	5	10	3a	Do not hold objects in the palm of your hand and press a screwdriver into it – these objects should be placed on a flat surface. Do not use screwdrivers as hammers or as a cutting tool, or use screwdrivers with broken handles. Use insulated screwdrivers for work on electrical equipment.

Task Steps[1]		Potential Hazards & Consequences[2]		select	Probability	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
4a	Using hammers / sledgehammers	4a	Creation of sparks which can cause bodily harm or damage to property or fire	multiple	1	5	5	4a	Use brass hammers and tools in areas where creating sparks would pose ignition hazards.
		4b	Particles may lodge in employee's eyes	H&S	2	4	8	4b	Always use safety glasses when striking any object with a hammer. If hammer-head shows signs of mushrooming, replace it immediately.
		4c	Loose handles may create a projectile hazard - causing bodily injury or property damage	multiple	2	5	10	4c	Replace any hammer with a loose handle so the hammer-head does not detach and cause injuries.
		4d	Smashed fingers	H&S	2	5	10	4d	Do not position your hand or body so it is in line of fire. Use minimal force when first driving nails and fingers are being used to hold nailhead in place. Use a stake driver tool for driving stakes to keep your hands out of line of fire of sledgehammer. Wear heavy leather gloves; have gloves on your person at all times.

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). 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.

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 Development Checklist

This checklist provides common hazards and some hazard control measures for consideration,
and can be used to help develop site-specific JHAs

Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Fatigue and Stress	Specifically define acceptable work hours, work duration, work weeks, consecutive days, etc. Define rest frequency and duration. Take weather, PPE, activity level into consideration. Identify activities with increased mental stress / strain, and determine if controls are warranted: multiple employees, work rotation, etc. Identify activities with limited mental stress (e.g., 'boring or dull activities' where inattention can occur), and determine if controls are warranted: multiple employees, work rotation, etc. Consider activities that may occur immediately before or after the task (e.g., driving), and determine whether controls are required (e.g., limitations on driving after 10 hr days of field activities). Remember that stress and fatigue ARE NOT LIMITED to field / construction activities.
Sharp Edges (designate in JHA the specific cut or puncture hazard associated with the task step)	Wear ____ gloves (designate type, e.g. heavy leather, cut-resistant, puncture-resistant). Wear ___ footwear (designate type, e.g. puncture-resistant insoles). Wear ___ clothing (designate type, e.g. long sleeves, heavy coveralls). Have gloves on your person at all times. Employees performing significant amounts of cutting tool use should wear high-visibility gloves to encourage awareness of where hands are being placed. Do not attempt to catch falling tools/equipment. Ensure guards are in place. Use ___ cutting tool (designate type, e.g. scissors, shears, snips). Do not use dull blades. Do not use open-bladed knives. Inspect tools/equipment in area prior to start of task to identify sharp edges and, if possible, remove/protect or position body to ensure no contact during task. Always cut away from hand, body and face. Ensure others are not in line-of-fire when cutting. Place object to be cut in a vise or on a flat surface or use another tool to hold object while cutting. Do not place fingers in ends of piping or other tubular material.
Pinch Points (designate in JHA the specific pinch hazard associated with the task step)	Wear ___ gloves (designate type, e.g. heavy leather, puncture-resistant). Have gloves on your person at all times. Inspect work area prior to start of task to identify pinch points and remove/protect to ensure do not contact during task. Consider body positioning prior to start of task to identify potential pinch points and change position to ensure do not contact during task. Identify pinch points by warning label and/or paint color. Do not position your hand or body so it can be caught between a lifted load and adjacent objects. Do not place fingers/hands between sections of multi-component/moveable items (e.g. fencing sections, sheet piling, hinged panels).
Slips / Trips / Falls from Surface Conditions (designate in JHA the specific slip, trip, fall hazard associated with the task step)	Wear ___ footwear (designate type, e.g. shoes with rubber soles or low heels, crampons). Identify and use only safe pathways and stairs when entering/exiting/working in area. Obtain additional lighting and use clear safety glasses in areas with low/unclear visibility. Inspect work area for potential slip/trip/fall obstructions prior to start of work and remove or, if not possible, mark with highly visible tape/flags, etc. Keep work area organized and free of surface obstructions during task. Immediately dry wet areas or restrict access (e.g. with warning tape, signs, cones). Remove snow/ice prior to start of work. Reassess surface conditions if weather changes and address any new hazards (e.g. slick surface developing as a result of wet/freezing conditions). Do not carry loads that restrict visibility. Do not stack objects higher than ___ (designate height). Ensure steps, walkways and shoes are not slippery or loose prior to use. Keep work area surfaces clear of debris (e.g. mud, leaves) and store tools/equipment to eliminate trip hazards when not in use. Keep eyes on path and nearby surroundings when walking. Take small steps and shuffle feet in potentially slippery areas. Walk slowly around corners and when entering/exiting doors. Use slip-resistant mats. Use handrails when going up/down stairs. Fill in/flatten uneven ground. Use steps/stepladders for access in and out of shallow trenches/excavation.
Fall from Elevated Position (designate in JHA the specific elevated hazard associated with the task step)	Use carts with high sides to contain load. Ensure load is secure and balanced prior to moving. Maintain 3-points of contact when mounting/dismounting vehicle/equipment. Maintain 3-points of contact when climbing/descending ladders. Use equipment/mechanical means (e.g. tool belt, rope) to transport tools/materials. Ensure steps, ladder rungs and shoes are not slippery or loose. Do not stand or work off top of ladder (e.g. top 2 steps of stepladder). Extend ladder at least 3-feet beyond top bearing point. Have another person hold bottom of ladder at all times while working or until top is secured; if ladder is not equipped with grip pads, hold bottom at all times. Position extension ladder at 1 foot distance for every 4 feet of working height. Do not overreach; keep body between ladder rails and both feet on same rung. Wear fall protection when working at a height of 6 feet (1.8 meters) or greater. Wear full body harness with double-locking snap hooks and shock absorbing lanyard. Inspect fall protection prior to use and do not use if: worn or frayed lanyard or webbing/stitching; locking devices, snap hooks, etc. are not working properly; metal components are worn, damaged, or have burrs, etc.; annual inspection tag is not in place and current. Connect to secure anchor point meeting fall protection specifications (capable of supporting 5,000# per person attached, above shoulder height, no sharp edges, etc.). Ensure scaffolding has secured boards, is adequately braced, has a handrail, is free of debris and holes and is in good working condition. Stand only on secured and inspected flooring and uprights. Work only within the scaffolding structure.

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Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Back Sprain/Strain (designate in JHA the specific back sprain/strain hazard associated with the task step)	Use ___ mechanical lifting/carrying device (designate type, e.g. cart, dolly, forklift). Obtain assistance when lifting ____ (designate what, e.g. awkwardly shaped objects) or objects weighing greater than ___ (designate limit). Bend and lift with legs/arms, not back. Keep objects close to body and do not twist while lifting (turn with feet). Position work equipment to avoid over-reaching while working. Do not overload waste containers, fill ___ full (designate volume). When objects are lifted/carried by two persons, take positions on opposite ends. Store heavy/bulky items with safe access in mind. Take regular breaks every ___ (designate frequency).
Suspended Loads/Low-Hanging Objects (designate in JHA the specific suspended load, low-hanging hazard associated with the task step)	Wear hard hat. Wear ___ gloves (designate type, e.g. rubber dot for grip). Wear ___ footwear (designate type, e.g. steel-toe boots; footwear with metatarsal-protection). Do not attempt to catch falling objects. Stay ___ (designate distance) away from raised objects. Restrict access with warning tape and/or posted signs. Secure loose objects prior to lifting or moving by ___ (designate how, e.g. with straps, sideboards, use of panel cart with high sides). Remove low-hanging objects or identify (e.g. mark with highly visible paint, tape, flags) and/or communicate location to site personnel. Visually inspect equipment before beginning task. Verify latest equipment inspection/tag is current before beginning task. Inspect lifting rigging (chains/slings/cables) to ensure in good condition and do not use if defects, signs of excessive wear are identified. Verify lifting equipment is certified and rated for handling the reach and load limits for required work. Use trained spotter(s) to alert others of hazards. Use tag lines held by trained personnel to guide load and do not wrap lines around body parts. Pre-inspect travel route to ensure clearance. Keep load low to ground to ensure clear visibility when transporting. Move load using low, slow, controlled movements.
Rotating / Automated / Energized Equipment (designate in JHA the specific rotating hazard associated with the task step)	Do not work on moving equipment. De-energize all energy sources (e.g. compressed, pressurized) equipment prior to working on. Lock out/tag out equipment per LOTO procedure and verify energy isolation prior to start of task. Employees who perform LOTO must receive authorized employee training. 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. Remove/secure loose clothing, hair and jewelry. Keep hands/body/tools ___ (designate distance) away from equipment. Identify automatic-start equipment with signs/labels. Locate emergency stop/shutdown switch prior to start of task. Ensure all associated personnel are notified of work activities. De-energize hand-held and mobile equipment when not in use. Plan work lay-out/processes to avoid and/or minimize line-of-fire risks. Define and barricade personnel exclusion zones based on machine swing areas, area below crane operation, etc.
Vapors, Airborne Debris (designate in JHA the specific vapor, debris or liquid hazard associated with the task step)	Keep area ventilated by ___ (designate how, e.g. with forced draft fans, outside use only). Perform ___ monitoring (designate method and frequency) and stop work if monitoring result ___ (designate limits). Position body upwind. Keep work area wet to limit dust. Set-up work zone to restrict non-essential access and minimize off-site impacts. Wear ___ eye/face protection (designate type, e.g. safety glasses, face shield, splash goggles or combinations). Wear ___ clothing (designate type, e.g. long sleeves, paper suit). Wear ___ breathing protection (designate type, e.g. dust mask, full/half-face respirator with ___ (designate type) cartridges). Establish cartridge change-out schedule. (designate in JHA the specific ignition risks associated with the task step)
Ignition (designate in JHA the specific ignition risks associated with the task step)	Undertake work under Hot Work Permit. Monitor VOCs and LEL by ___ (designate method and frequency) and stop work if monitoring result ___ (designate limits). Seal all pipe/openings (e.g. tank holes, storm drains) in work zone that may emit vapors. Ensure all equipment in work area is intrinsically safe. Define/barricade work areas to exclude unauthorized access/external ignition sources (e.g. vehicular traffic). Keep area ventilated by ___ (designate method, e.g. with fans). Ensure lines are clear prior to disconnect and/or use dry couplings. Assess and control static risks for all work equipment and processes. Have ___ (designate number, type and size) fire extinguisher(s) on site and immediately available for use. (designate in JHA the specific high noise hazard associated with the task step)
	Determine whether noise monitoring has been necessary on other projects of similar scope. Measure noise levels with a noise dosimeter if project will last over 30 days, or for shorter work use the rule or thumb that you should be able to hear a

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Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
High Noise Level (designate in JHA the specific high noise hazard associated with the task step)	Measure noise levels with a noise dosimeter if project will last over 30 days, or for shorter work use the rule of thumb that you should be able to hear a person talking to you in a normal voice at 1m/3 ft. If you cannot hear them without them raising their voice the hearing protection is necessary, and noise monitorting is advisable. For any employee working on the site who has not attended hearing conservation training within the past year, review this JHA with them and document their training. Wear ___ hearing protection (designate type, e.g. ear plugs, ear muffs, double hearing protection) based on known or potential noise levels. Post warning signs at ___ (designate distance) from work area stating entry restrictions and/or type of hearing protection required. Ensure mufflers are installed in equipment. Minimize potential external/third party/community impacts by ___ (designate how). Share noise dosimetry results with your Divisional Safety Advisor so we can build up a bank of knowledge about the types of equipment at projects where hearing protection should be considered.
Heat Stress and Burns (designate in JHA the specific heat hazard associated with the task step)	**Hot Equipment:** Allow equipment/material to cool prior to working with. Use designated handles to open/move equipment. Turn off equipment and allow to cool prior to refueling. Identify hot surfaces prior to start of task and avoid direct contact with.Drink cool fluids and take rest breaks every ___ (designate frequency). Wear ___ gloves (designate type, e.g. oven mitts, thermal, etc...). Use ___ (designate type, e.g. tongs, insulated handles) tool to move equipment or materials. **Hot Weather:** Check the weather forecast in advance & be prepared for those conditions Wear ___ clothing (designate type, e.g. light-weight fabrics with long sleeves & trousers, cool vest, etc...). Schedule regular breaks, watch your colleagues using the buddy system. Use sun block for skin protection, drink cool drinks regularly (i.e.: before you become thirsty), take breaks in the shade (advice on the regularity and duration of these can be found in the SWP linked to below) Stop work if fatigue or physical stress situations develop in your or those around you High humidity, working in direct sunlight, work in contact with hot surfaces influence the severity of hot working conditions. Seek specific guidance and training if work in these conditions is necessary. (Advice is available on the SWP for heat stress available on Minerva Americas H&S pages at the following link: http://minerva.erm.com/Support/HS/AmericasHS/Safe%20Work%20Practices%20SWP/04%20-%20Heat%20Stress%20-%20updated%208-11.doc)
Cold Stress (designate in JHA the specific cold hazard associated with the task step)	Drink hot/warm fluids and take rest breaks every ____ (designate frequency) Wear ___ clothing (designate type, e.g. insulating layers, down jacket, chef coat). Wear ___ gloves (designate type, e.g. thermal, freeze-protection). In temperatures below freezing do not touch bare metal surfaces with the naked skin without adequate PPE, such as gloves. At or below 4°C/40°F adequate dry insulating clothing must be available to keep worker's core temperature at or above 36°C/96.8°F Dampness/condensation, work in contact with cold water or surfaces, and wind speed all influence the severity of cold working conditions. Seek specific guidance and training if work in these conditions is necessary. (Training is available on ERM North American Minerva page at the following link: http://minerva/erm/globalsupport/healthandsafety/NA/HS%20Training%20Materials/Home.aspx)
High Voltage/Electrical Contact (designate in JHA the specific high voltage / electrical hazard associated with the task step)	Use wooden or fiberglass ladder. Stand on non-conductive surface. Remove metal jewelry. Footwear worn around electrical circuits should be non-conductive. Ensure power cords are free of defects and exposed wires. Do not work in ___ (designate condition, e.g. thunderstorm) weather. Use___ gloves (designate type in JHA, e.g. electrical-insulted). Use ground fault circuit interrupter (GFCI). Use low voltage lighting. Ground equipment by ___ (designate how or refer to separate procedure). Pre-inspect travel route to ensure clearance. Inspect above and below ground areas prior to start of work to identify electrical lines and communicate locations to site personnel. **SSC:** Ensure completion of subsurface clearance procedure requirements. Ensure line locator service identification of underground lines. Use non-destructive drilling techniques (e.g. air-knife). When excavating, assign spotter to stop work at sign of subsurface conduits/wires. Keep ___ distance from overhead power lines (designate distance in JHA based on voltage, regulations, etc.). Lock-Out/Tag-Out (LOTO): LOTO equipment must be available as per the LOTO procedure and verify isolation of energy source prior to start of task. Tags must read "DANGER – DO NOT OPERATE" and be resistant to wear and tear by the environment they are being used in. Employees who perform LOTO must receive authorized employee training, subcontractors must provide evidence that they have (e.g.: a certficate) Wear a cotton t-shirt, Class II Electrical Arc Protection suit, Class O (low voltage) gloves, and non-conductive footwear. Only the person who placed the LOTO device is authorized to remove it, so after-hours contact information for LOTO employees must be in the HASP. Ensure all associated/potentially impacted personnel are notified of work activities. Before working on live equipment, it should be brought to a "zero-energy state" by turning off the equipment's power (at source, such as by switching off specific circuit breakers. ("Zero-energy" is not attained until the individual working on the machinery attempts to turn the machine on and is unsuccessful.) In certain situations, where machinery must stay live to do work, and Lock-Out is not possible, the Project Manager and Field Safety Officer must be directly involved when Tag-Out is taking place. For all sites where work extends beyond 1 year, a LOTO a documented process inspection must occur to check that LOTO procedures in-place are still valid.

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Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Chemical/Liquids Contact or Release (designate in JHA the specific chemical/liquid hazard associated with the task step)	Wear ___ eye/face protection (designate type, e.g. safety glasses, face shield, chemical splash goggles or combination) Wear ___ clothing (designate type, e.g. long sleeves, paper suit, protective apron, polyethylene coated suit). Wear ___ gloves (designate type, e.g. butyl, nitrile, rubber, resistant to specific chemical/duration). Ensure that gloves and boots are taped to the suit to prevent liquid splash. Double-layering nitrile or latex protective gloves is a good idea for added protection. If acidic or caustic chemicals are present, wear outer neoprene or rubber gloves. Restrict access to work area by ___ (designate how). Use funnel when pouring liquid. Ensure bleed valves are open and lines are clear prior to disconnect and/or use dry couplings. Have ___ (designate type/amount, e.g. pads, boom) absorbent material on hand. Place container and/or absorbent/plastic sheeting under connection prior to disconnect. Store hazardous materials in dedicated container/area (e.. shed, box). Wash hands frequently. Inspect pressurized lines and all fittings/couplings to ensure integrity/closure. Assess rating and compatibility of materials used vs purpose. Ensure storage compatibility of multiple products. **Hazard Communication:** For each chemical product used by ERM employees or subcontractors, a SDS sheet must be obtained and kept on-file. Chemical containers must be labeled in accordance with OSHA regulations. Review SDS and container label prior to start of task/handling and follow associated requirements. Ensure all employees on the jobsite have been told about the chemical in-use and are protected. Confirm SDS is relevant when working with legacy material (e.g. historic releases). A chemical inventory list must be prepared and updated as new or different chemicals are procured. If chemical exposure occurs, even if medical symptoms are not present, inform the Field Safety Office or Office H&S Contact.
Biological Contact (designate in JHA the specific biological hazard associated with the task step)	Wear ___ clothing (designate type, e.g. long sleeves, hood, paper suit). Wear ___ gloves (designate type, e.g. fabric, nitrile). Use insect repellant. Inspect area prior to start of task and remove/avoid animal (e.g. dogs), insect (e.g. bees, wasps), plant (e.g. poison ivy) hazards if possible; otherwise reschedule work and/or contact professional service for removal. Report allergies and ensure treatment is available on site. Avoid loud noises/brightly colored clothing if bees are known to be in area.
Repetitive Motion (designate in JHA the specific repetitive motion hazard associated with the task step)	Use ___ tool and/or ___ technique (designate, e.g. ratchet wrench) to minimize repetitive stress risk. Change position frequently during job (e.g. vary grip, hand motion). Keep wrists in a neutral (straight) position as you work. When possible, rotate tasks to give body parts a rest. Take breaks every ___ (designate frequency) and do simple stretches/exercises. Ensure gloves fit hands properly to decrease stress on hand/joints.

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Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Traffic (designate in JHA the specific pedestrian / motorized traffic hazard associated with the task step)	Wear ___ clothing (designate type, e.g. reflective vest, neon orange/green shirt). High-visibility safety vests: class I may be used when traffic is below 25 mph, Class II for 25-50 mph, and Class 3 for >50 mph. Set up work zone to restrict non-essential access by ___ (designate how, e.g. with cones/barricades/fencing, placed specified distance apart/from work area, etc.). Avoid risks posed by detour (e.g. pedestrians forced into other traffic). Use parked vehicle with hazard lights facing oncoming traffic to protect work zone. Use buddy system to establish traffic watch. Use trained spotters when backing and when visibility is restricted. Inspect surrounding area prior to backing. Adjust mirrors and check equipment back-up alarm to confirm operational prior to start of task. Use horn to alert others prior to backing. Use traffic management consultant. Stay ___ (designate distance) from operating equipment/extended arm, etc. Make eye contact with equipment operator and receive approval prior to approaching. Ensure spotters and equipment operators maintain eye contact. Establish parking/staging/loading/unloading areas (consider equipment turning circles, swing zones etc.). Ensure trailers / trucks are rated and balanced. Chock truck/trailer wheels when not moving. Ensure load is distributed during load/unload to avoid tip/roll-over. Ensure all personnel remain outside of tip-over radius when dumping.
Improper Waste Transport / Disposal (designate in JHA the specific waste disposal hazard associated with the task step)	Designate safe waste storage area/container prior to start of task. Ensure waste materials meet container specifications prior to use. Label waste containers. Separate hazardous and non-hazardous wastes. Place waste containers in designated storage area and secure prior to leaving site. Confirm waste transport truck/container integrity prior to loading. Confirm shipping document description/approved destination with waste container label prior to off-site shipment. For unsealed/partially exposed loads, perform ___ monitoring (designate method and frequency) and stop work if monitoring result ___ (designate limits).
H&S Risks and Increase in ERM Liability caused by Subcontractors Working on the Jobsite	Select only subcontractors that have been prequalified and approved for use. Ensure a signed, executed subcontract agreement is in-place prior to subcontractors performing work on the jobsite for ERM. Ensure the subcontractor has received a copy of the ERM HASP and supporting documentation prior to mobilization to the jobsite. Specify both the ERM and the subcontractor's scope of work in the ERM HASP document. Ensure that any subcontractor personnel on-site have reviewed and signed the site HASP. In all cases, require the ERM subcontractor to either develop their own site-specific HASP, or at minimum develop Job Hazard Analyses (JHA) for the specific tasks they will perform. Attach these documents to the ERM HASP as appendices. Ensure subcontractor work is overseen by ERM personnel at all times. Always include subcontractor personnel in daily jobsite tailgate safety meetings. Do not supply subcontractor personnel with personal protective equipment (PPE). If ERM is performing air monitoring for the subcontractor, ensure calibration of air monitoring equipment is done before and after each use. At a minimum, air monitoring equipment must be calibrated at least once per day. Document equipment calibration and file with the site HASP.
Exposure to Toxic and Hazardous Chemical Substances (designate in the JHA the specific chemicals of concern)	Determine whether there is a potential for exposure to any toxic or hazardous chemical substances in the work area prior to performing any work that may involve handling of one or more of the chemicals or may result in exposure through production, research, or process activities. This would include, but not be limited to, OSHA's 13 regulated carcinogens, and the following: • Acrylonitrile • Asbestos • Benzene • Cadmium • Chromium (VI) • Coke oven emissions • Cotton Dust • Ethylene oxide • Formaldehyde • Hydrogen sulfide • Inorganic arsenic • Lead • Methylene chloride • Methylenedianiline • Vinyl chloride • 1,2-dibromo-3-chloropropane • 1,3-butadiene
	If any of the substances are identified, conduct an exposure assessment to determine whether employees have the potential to be exposed above any action level identified in the substance-specific regulations.
	Where the initial assessment identifies the potential for employee exposures above an established action level or permissible exposure limit, develop a site-specific program to address all required regulatory concerns for that substance. Completed programs shall be included in the site-specific health and safety plan.
	Ensure the health and safety plan specifies the airborne contaminants that may be encountered and the need for respiratory protection. Ensure the plan provides a selection process for the respirator and cartridge type, develops actions levels for upgrades/downgrades of respiratory protection, describes cartridge change out schedules, and provides information on medical surveillance criteria and respirator fit testing requirements.
	Prior to donning any respirator, complete a thorough inspection to ensure it is in good operating condition. Inspected elements should include, but not be limited to, straps, sealing surfaces, inhalation/exhalation vales, and facepieces. Do not use respirators with any signs of damage.
	Where necessary, replace damaged parts. If repair is not possible, discard and replace entire respirator.
	Clean and disinfect respirators using a mild soap and water solution following use. Where respirator sharing is allowed, ensure respirators are cleaned and sanitized before being exchanged by employees.

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Hazards	Some Methods To Eliminate/Control Hazard for JHA Consideration:
Respiratory Protection	For cartridge-type respirators, affix the cartridges to the respirator as indicated in the manufacturer's guidelines. Cartridges should be hand tightened only.
	Employee must be clean shaven in those areas of the face where the respirator makes skin contact, including any inner nose cups.
	Don the respirator prior to other personal protective equipment in the head/neck area so that nothing comes between the respirator straps and the head surface. Safety glasses, hard hats, etc. must be donned after the respirator.
	For cartridge-type respirators, perform a positive and negative fit check to ensure a good respirator seal.
	Adjustments made while wearing tight-fitting respirators within the work area may result in a compromised respirator seal. If this occurs, stop work, move to an area with no chemical contamination (go through the decontamination process, if present), readjust the respirator, and perform positive and negative fit-checks to ensure a proper facepiece seal.
	If it becomes difficult to breathe due to particulate clogging of respirator cartridges, stop work, move to an area with no chemical contamination (go through the decontamination process, if present), replace the cartridges, readjust the respirator, and perform positive and negative fit-checks to ensure a proper facepiece seal.
	If using a chemical catridge and you either (1) reach or exceed the required wear time as described in the cartridge change schedule or (2) detect any evidence of chemical breakthrough (odors, tastes, burning sensations, etc.), stop work, move to an area with no chemical contamination (go through the decontamination process, if present), replace the cartridges, readjust the respirator, and perform positive and negative fit-checks to ensure a proper facepiece seal. If chemical breakthrough was detected, determine what level of exposure may have occurred through testing of the work atmosphere.
	If a decontamination line is present, proceed through the line as directed. If no decontamination line is present, remove all other PPE except clean gloves before removing the respirator. Once removed, clean as directed.
Natural Hazards (designate in JHA the specific natural hazards associated with the task step)	For sites where poison ivy, oak, and sumac are present, have a poison ivy wash available for employees on-site. If exposure occurs and no poison ivy wash is available, employees should wash in cool water and use soap. Keep work areas free from clutter so that ground surfaces can be easily seen by employees. **<u>Working around poisonous insects:</u>** Use insect repellant containing DEET at all times on the jobsite. Periodically throughout the day and at the end of the day, perform a thorough “tick-check” to ensure ticks or other insects are found and removed promptly. Avoid obvious conical mounds of dirt that may indicate ants, wasps, or other flying insects. Before reaching into dark or damp spaces such as monitoring well-heads, inspect the area thoroughly to ensure spiders are not present. Always take a shower as soon as possible after leaving a jobsite for the day to remove any insects, such as chiggers. **<u>Working around snakes:</u>** Visually inspect the work are prior to beginning any work to located areas with high grass and underbrush. Do not walk through these areas if at all possible to avoid snakes. Wear leather steel-toe boots and snake chaps in areas where snakes are suspected or confirmed to be present. Do not attempt to kill snakes, as people are commonly bitten attempting this. **<u>Working around feral animals:</u>** High rat populations within an enclosed space present a hazard of Hanta virus. Spray such areas with bleach solution prior to performing any work in the area (10 parts water to 1 part household bleach). If dogs or other animals are spotted that are acting strangely, do not approach them. Contact the local animal control center for assistance.

		Severity				
		Minor (1)	Moderate (3)	Serious (5)	Severe (7)	Catastrophic (10)
Probability	Almost Certain (6)	6	18	30	42	60
	Likely (5)	5	15	25	35	50
	Possible (4)	4	12	20	28	40
	Heard of (3)	3	9	15	21	30
	Unlikely (2)	2	6	10	14	20
	Rare (1)	1	3	5	7	10

Risk Rating

Extreme	High	Low

Risk Rating

Extreme	36
High	19
Medium	6
Low	0

ERM

JHA
Job Hazard Analysis

ERM-1115-FM1 - JHA Template
Version: 1.4
Revision Date: 08/31/2018

Project Number:		Project / Client Name:	Pilot Test/ GW Lisk
Project Manager:	Tim Daniluk	Location:	2 South Street, Clifton Springs NY 14432
Partner-in-Charge:	E. Rossano	Date and Revision Number:	02/20/2023, Rev. 0

SPECIFIC TASK:	**Injection of emulsified vegetable oil, bioaugmentation culture, and water**

Minimum Required PPE for Entire Task:	☐Hard Hat ☑Safety-Toe Shoes ☐Hearing Protection ☐Goggles ☐Face Shield ☐Respirator <enter type and cartridge type> ☐Other (specify): ☑Safety Glasses ☑Reflective Vest ☑Gloves Nitrile Gloves ☐PPE clothing As noted below for particular activities		
Additional Task-Step Specific PPE: (as indicated below under Controls)	Chemical and splash protection as noted below	Equipment / Tools Required:	Heavy equipment (equipment trailer with storage tanks, drum pump, hoses/piping)
Training Required for this Task:	OSHA 40 hour HAZWOPER; current 8-hr refresher	Permits Required for this Task:	NA
Forms Associated with This Task:	NA		

JHA Developed / Reviewed By:			JHA Review In Field
Name / Job Title:	Name / Job Title:	Name / Job Title:	Field supervisor to ensure all personnel performing this task have reviewed JHA and agree to follow it. Site-specific changes to this JHA have been made as warranted based on this review. **Signature/Date:**
Katherine Popyack/ Geology CL2			

	Task Steps[1]		Potential Hazards & Consequences[2]	select	Probability	Consequence	RISK		Controls to Eliminate or Reduce Risks[3]
1	Prepare injectate/ transfer to bucket/tote	1a	Chemical spills	H&S	Possible	Medium	8	1a	Inspect drum for leaks prior to opening. Notify PM immediately if drum has leaks. Set up drum pump and hosing before turning on drum pump. Turn on drum pump slowly. Use nitrile gloves and safety glasses to minimize contact with oil and solution. Do not overfill buckets/totes with oil (max 80% full). Transfer filled buckets/totes to clear, stable location in vehicle. Secure buckets/totes in vehicle prior to mobilization to injection well.
		1b	Slips, trips, and falls	H&S	Possible	minor	4	1b	Clear path between vehicle and oil and culture drums. Maintain clean work area.
		1c	Exhaustion or injury due to poor ergonomics or heat stress during mixing activities	H&S	Possible	Medium	8	1c	During mixing or chemical transfer activities, the field team may over-heat or over-exert themselves while manipulating hoses and the drum pump. Wear layers so they can be removed during warm weather conditions. Bring drinking water on site to stay hydrated. Do not attempt to lift or move the drums.
2	Mobilize to injection well	2a	Spills	H&S	Possible	Medium	8	2a	Ensure lids of buckets/totes are securely fashioned. Do not overfill buckets (max 80% full). Ensure buckets/totes are in stable, flat location in vehicle. Ensure buckets/totes are secured in vehicle. Drive slowly to avoid tipping buckets/totes. Avoid speed bumps if possible. Drive with hazard lights on to alert traffic to go around you. Place plastic sheeting inside vehicle to protect it from potential spills.
3	Set up work area	3a	Traffic accident	H&S	Possible	Serious	12	3a	Set up cones and barricades around work space. Park car strategically to warn oncoming traffic and protect yourself while working. Use buddy system to watch and warn each other of oncoming traffic. Place cones in upgradient traffic area to alert incoming cars of work ahead.
		3b	Slips, trips, and falls	H&S	Possible	minor	4	3b	Maintain clean work area. Store well cover and screws away from the work area while well is open. Be careful around open borehole.
		3c	Cuts on hands	H&S	Possible	Medium	8	3c	Use work gloves and proper tools to open and close wells. Have a first aid kit on hand
4	Injection of oil and bioaugmentation culture	4a	Spills	H&S	Possible	Medium	8	4a	Set up hoses in open well before removing oil and culture bucket/tote from car. Use nitrile gloves and safety glasses when handling solutions. Connect the hoses and totes. Inject the solutions slowly down the well and carefully monitor well head of current well if possible.
		4b	Fatigue	H&S	Likely	Medium	10	4b	Stay hydrated, fed, and well rested.
5	Closing well	5a	cuts on hands	H&S	Possible	Medium	8	5a	Use work gloves and proper tools to open and close wells.

Task Steps[1]		Potential Hazards & Consequences[2]		select	Probability	Consequence	RISK	Controls to Eliminate or Reduce Risks[3]	
6	Mobilize back to storage area	6a	Spills	H&S	Possible	Minor	4	6a	Ensure lids of buckets/totes are securely fashioned. Ensure buckets/totes are in stable, flat location in vehicle. Ensure buckets/totes are secured in vehicle. Drive slowly to avoid tipping buckets/totes. Avoid speed bumps if possible. Drive with hazard lights on to alert traffic to around you.

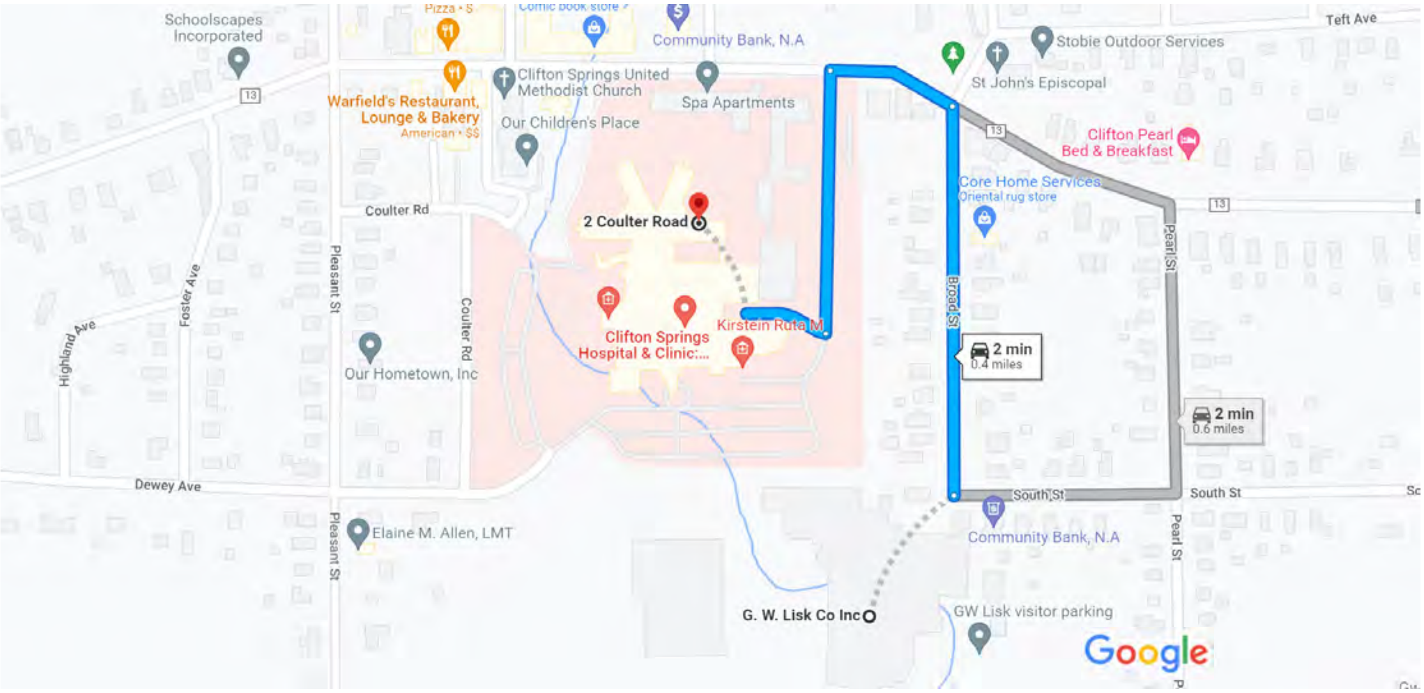
ONE JHA PER TASK. CONTRACTORS MUST PROVIDE THEIR OWN JHAS. JHAS SHOULD BE WRITTEN IN PLAIN LANGUAGE AND SHOULD BE NO MORE THAN 2-3 PAGES IN LENGTH.

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
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”).
4. Select the probability of occurrence and consequence 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].

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

Google Maps G. W. Lisk Co Inc to 2 Coulter Rd, Clifton Springs, NY 14432 Drive 0.4 mile, 2 min



Map data ©2022 Google 200 ft

G. W. Lisk Co Inc

2 South St, Clifton Springs, NY 14432

1. Head on South St

0.0 mi

2. South St turns right and becomes Broad St

0.2 mi

3. Turn left onto E Main St

335 ft

4. Turn left onto Ambulance Dr

0.1 mi

5. Turn right

213 ft

2 Coulter Rd

Clifton Springs, NY 14432

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

1. Purpose and Scope

This document establishes procedures for the proper storage, handling, and use of compressed gas cylinders. This procedure is applicable to ERM field and office operations where compressed gas cylinders are used.

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 supervision; and
- Correct any deficiencies in the implementation of this procedure as identified by the Business Unit Health and Safety Director.

Project Manager/Supervisor: Responsible for the following elements:

- Implement program during project or office activities involving the use of compressed gas cylinders;
- Perform observations of ERM work processes to assess whether or not employees are operating in accordance with this procedure; and
- Correct, in conjunction with the PIC and the Business Unit Health and Safety Director, any observed deficiencies in the implementation of this procedure.

Business Unit Health and Safety 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 complying with the requirements stated within the procedure.

3. Definitions

Not applicable.

4. Procedure

4.1 Identification

The contents of a compressed gas cylinder should be readily identified by stencil, stamp or label affixed to the cylinder. No compressed gas cylinder should be used or accepted for use that does not legibly identify the contents of the cylinder.

A copy of the Safety Data Sheet (SDS) for the compressed gas contained in the cylinder must be acquired, maintained on-site, and available for immediate review.

Cylinders which are empty must be labeled as such ("Empty" or "MT"). Empty cylinders must be segregated from full cylinders as indicated in Section 4.3.

4.2 Handling

Use the following procedures when handling a compressed gas cylinder:

- Move cylinders in a vertical position using a suitable hand truck or cart. If cylinders need to be raised, use a cylinder cage or cradle. Secure the cylinder to the handling equipment using straps or other appropriate securing methods. Never lift a cylinder by the valve cap or use a magnet to lift the cylinder.
- Never roll, drag, or slide cylinders. Do not drop them or allow them to strike each other.
- Ensure the valve cap and any valve seals are in place and remain in place until cylinders have been secured in position and are ready to use.
- Wear the appropriate personal protective equipment when handling cylinders. This should include, at a minimum, safety glasses, leather gloves, and steel-toed boots.

4.3 Storage

Use the following procedures when storing compressed gas cylinders:

- Store cylinders in a dry, cool, well-ventilated, fire-resistant, and secured area designated specifically for that purpose. Avoid storage in very low or very high temperatures. Do not place cylinders adjacent heat sources.
- Protect the storage location from weather and wet or damp grounds, and place it away from combustible or corrosive materials, heavily traveled areas, and emergency exits. Ensure storage areas provide sufficient access for cylinder handling.
- Store cylinders upright with valve caps and any valve seals in place. Use brackets, chains, or straps around the upper third of the cylinder to secure cylinders in storage.

- Group stored cylinders based their hazard class. Post conspicuous signage that identifies the gas or hazard class.
- Provide adequate space between groups of cylinders or segregate by partition. A minimum of 20 feet (6 meters) must be maintained between oxidizers and flammable gases. A firewall five feet (1.5 meters) high with a 30-minute fire rating can be substituted.
- Segregate full and empty cylinders. Designated areas for separate storage should be labeled. Note that empty cylinders may have residual pressure and should be handled as though they were full.
- Store hoses, connectors, gauges, cylinder valves, regulators, and other appliances used with compressed gas cylinders when not in use. Storage should be in a cool, dry area which can protect the appliances from damage.

4.4 Inspection

Cylinder suppliers have the responsibility for complete inspection of compressed gas cylinders prior to delivery. ERM employees shall perform daily visual inspections of cylinders in use. The following visual criteria will be used assessed during inspection:

- Dents
- Cuts or gouges
- Corrosion
- Pitting
- Bulges
- Burned spots
- Damage to valve threads and/or cylinder neck

If damage to the cylinder is identified or the cylinder is thought to be deficient in any manner, the cylinder shall be removed from service. The supplier will be notified and requested to inspect and, if necessary, repair or replace the cylinder.

Prior to use, hoses, connectors, gauges, cylinders valves, regulators and other appliances will be inspected for the presence of damage, grease, oil, dirt, solvents, or any other suspected concerns or substances. If appliances are left connected to the cylinder for more than 24 hours, they will also be inspected as part of the daily visual inspections of cylinder itself.

4.5 Usage

The following procedures apply to the usage of cylinders:

- Leave valve protection caps in place and hand tighten until cylinders are secure and either in use or connected for use. Replace caps when removing a cylinder from use, placing in storage, and/or returning to the supplier. Valve caps shall remain in place when cylinders are in storage.
- Tag the cylinder "Do Not Use" if a cylinder cap cannot be removed by hand. Return the cylinder to storage and alert the supplier to replace the cylinder.
- Use only those tools supplied and/or approved by the cylinder supplier to open and close cylinder valves. Do not tighten connections or attempt repairs while the system is under pressure.
- Equip the cylinders with the appropriate regulator. Consult the cylinder supplier for information on the correct regulator type, as needed.
- Keep cylinder valves closed except when the cylinder is being used.
- When opening a cylinder valve, stand to the side of the regulator and open slowly. Never discharge cylinder contents toward any other person.
- Transfer of compressed gases from one container to another shall only be performed by properly trained and qualified personnel provided by the supplier. ERM personnel are not allowed to attempt transfer operations.

4.6 Leaking Cylinders

Cylinder leaks are most likely to be found in one of four locations:

- Valve threads
- Pressure relief devices
- Valve stems
- Valve outlets

When assembling cylinders and appliances, and before using, perform a leak check at the points indicated above. Leak checks can be performed using soapy water.

If a cylinder is found to be leaking, identify the type of gas contained within the cylinder and determine if the leaking cylinder can be safely moved to a well-ventilated location. Additional safe handling procedures are dependent upon the cylinder contents.

- For inert gases, contact the supplier for assistance.
- For flammable or oxidizers, post signs in the area warning of potential fire hazards. Eliminate any ignition sources in the area. If ignition should take place, do not attempt to extinguish the flame unless the gas supply can also be stopped, as this may lead to an accumulation of gas and a possible explosion. Contact the local fire department and cylinder

supplier immediately. If safe to do so, take action to cool and protect nearby cylinders from the fire.

- For corrosives and toxics, secure the area and evacuate all personnel. Contact the local fire department or hazmat team, as well as the cylinder supplier immediately. Personnel attempting to contain the leak should only do if they have the appropriate training and personal protective equipment to do so.

4.7 Training

ERM employees required to work with compressed gas cylinders will complete training in their use, handling and storage. Training will be documented through ERM's Academy Learning Management System.

5. References

- Compressed Gas Association – Pamphlet P1 (*Safe Handling of Compressed Gases in Containers*)

- ISO Standard 11625 (*Gas Cylinders – Safe Ha*ndling)

Document Control Information

Original Effective Date: 2/3/15

Policy Approval by: Millard Griffin

Approval Signature: Millard P. Griffin Jr.

Revision History

Section	Reason for Revision	Date
All	New document.	2/3/15
1	Revised Applicability.	1/12/16
All	Updated Document Number; updated titles (Section 2); updated paragraph alignment throughout; updated referenced document numbers (Section 4); updated References (Section 5)	1/11/17
All	Minor language changes throughout	8/3/20

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

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 Control Risk Group (CRG) 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 <u>is not permitted to drive</u> 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.
- 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.
- 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” by Control Risk Group (CRG) 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). A copy of the JMP shall be maintained with the traveller 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)

At a minimum, the driver of a motorcycle or motor bike on company business shall comply with the following:

- No passengers shall be permitted.
- Driver shall wear a suitable helmet.
- The driver's helmet shall have a 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.
- A specific JHA has been completed and approved by the BU MP for the motorcycle / motor bike travel, and no other means of travel is feasible.

ATVs may only be used if a specific JHA has been completed and approved by the BU MP. Three-wheeled ATVs are not permitted for use at any time.

Note that the use of motorcycles, motor bikes, and/or ATVs may be prohibited by certain clients.

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 responsibly 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 Control Information

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Approved by: Gary Beswick on 27 January 2021

Approval Signature: Gary Beswick

Revision History

Section	Version: Reason for Revision	Date
All	1.0: New document.	29 Dec 2014
4.2.1; 4.4.1; 4.4.5	2.0: 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
Header	2.1: Modified date to show correct year.	22 July 2015
All	2.2: Updated links, tagline, and document number	28 Dec 2016
All	3.0: Sections reorganized for clarity; included reference to Driver Acknowledgement Curriculum; included reference to High Risk Location JMP requirement and template	6 May 2020
4.4.5	3.1: Require that all RCEO vehicle waivers include an expiration date.	2 Sept 2020
4.3	3.2: Documented the requirement to record vehicle events in ECS	27 Jan 2021
Reference	3.3: Updated reference URLs; changed version number but did not update issue date	13 Aug 2021

1. Purpose and Scope

This procedure describes the requirements for prevention of occupational noise-induced hearing loss in those employees working in potentially noisy 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 work day.

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 Health and Safety Director or other staff member.

Project Manager: 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 Business Unit Health and Safety Director, any observed deficiencies in the implementation of this procedure.

Regional Health and Safety Director: Responsible for the development and implementation of this procedure.

Business Unit Health and Safety 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.
- **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

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 protector no longer effective.

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 will be maintained in good condition. Employees will 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 exposure to an 8-hour TWA of 85 dB or less. The FSO, with assistance from the Business Unit 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

Hazard recognition and general awareness training, which include discussion of hearing conservation elements, is provided to all ERM employees during the new hire orientation process which occurs during the first two weeks of employment. 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.

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, additional 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.

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 Control Information

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Policy Approval by: Millard Griffin

Approval Signature:

Revision History

Section	Reason for Revision	Date
All	New document.	3/17/14
All	Reformatted document. Minor language changes for clarity.	6/24/15
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.	12/15/15
4.6	Updated training requirements	8/3/16
All	Updated Document Number; updated titles (Section 2); updated paragraph alignment throughout; updated referenced document numbers (Section 4); updated References (Section 5)	1/6/17
1, 4.5, 5	Revised Purpose statement (Section 1); added information on compliance with client requirements (Section 4.5); added reference to Ontario regulations	6/26/18
All	Minor language revisions and grammar corrections.	4/13/20

1. Purpose and Scope

This procedure establishes minimum requirements for work in environments where exposures to heat 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 Health and Safety Director or other staff member.

Project Manager: 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 Business Unit Health and Safety Director, any observed deficiencies in the implementation of this procedure.

Business Unit Health and Safety 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

- **Acclimatization –** The temporary adaptation of the body to work in the heat. Acclimatization peaks in most people within 4 to 14 days of regular work for at least two hours per day in the heat.
- **Heat Illness –** A serious medical condition resulting from the body's inability to cope with a particular heat load; includes heat cramps, heat rash, heat exhaustion, and heat stroke.
- **Environmental risk factors for heat illness –** Working conditions that create the possibility that heat illness could occur, including air temperature, relative humidity, radiant heat from the sun and other sources, conductive heat sources such as the ground, air movement,

workload severity and duration, protective clothing and personal protective equipment worn by employees (e.g., impervious clothing vs. standard work attire).

- **Personal risk factors for heat illness –** Factors such as an individual's age, degree of acclimatization, health, water consumption, alcohol consumption, caffeine consumption, and use of prescription medications that affect the body's water retention or other physiological responses to heat.
- **Shade –** Blockage of direct sunlight. One indicator that blockage is sufficient is when objects do not cast a shadow in the area of blocked sunlight. Shade is not adequate when heat in the area of shade defeats the purpose of shade, which is to allow the body to cool. For example, a car sitting in the sun does not provide acceptable shade to a person inside it, unless the car is running with air conditioning. Shade may be provided by any natural or artificial means that does not expose employees to unsafe or unhealthy conditions and that does not deter or discourage access or use.
- **Temperature –** The dry bulb temperature in degrees Fahrenheit (°F) or Celsius (°C).

4. Procedure

4.1 Classification and Prevention

4.1.1 Heat Stroke

- Condition: (a) Hot dry red skin, (b) high and rising core temperature 105°F (40 °C) and over; and (c) brain disorders, including mental confusion, loss of consciousness, convulsions, or coma, as core temperature continues to rise. Heat stroke can be fatal if treatment is delayed.
- Predisposing Factors: (a) Sustained exertion in heat by non-acclimatized workers; (b) obesity and lack of physical fitness; (c) recent alcohol intake; (d) dehydration; (e) individual susceptibility; and (f) chronic cardiovascular disease in the elderly.
- Corrective Actions: Immediate and rapid cooling by immersion in chilled water with massage or by wrapping in wet sheet with vigorous fanning with cool dry air. Avoid overcooling. Treat shock if present. Seek medical attention.
- Prevention: Medical screening of workers. Selection based on health and physical fitness. Acclimatization for 8 to 14 days by graded work and heat exposure. Monitoring workers during sustained work in severe heat environments.

4.1.2 Heat Exhaustion

- Clinical Features: (a) Fatigue, nausea, headache, giddiness; (b) skin clammy and moist, complexion pale, muddy, or with hectic flush; and (c) may faint on standing, with rapid pulse and low blood pressure.
- Predisposing Factors: (1) Sustained exertion in heat, (2) lack of acclimatization, and (3) failure to replace water and/or salt lost in sweat.
- Treatment: Remove to cooler environment. Provide fluids with electrolytes such as Gatorade™ or equivalent. Seek medical attention.
- Prevention: Acclimatize workers using a breaking-in schedule for 1 to 2 weeks. Supplement dietary salt only during acclimatization. Ensure ample drinking water, Gatorade™ or equivalent is available at all times and taken frequently during the day.

4.1.3 Heat Cramps

- Clinical Features: Painful spasms of muscles used during work (arms, legs, or abdominal). Onset can occur during or after work hours.
- Predisposing Factors: (1) Heavy sweating during hot work and (2) drinking large volumes of water without replacing salt loss.
- Treatment: Drinking liquids with salt supplement such as Gatorade™ or equivalent. Seek medical attention.
- Prevention: Adequate salt intake with meals. In un-acclimatized persons, provide salted (0.1 percent) drinking water.

4.1.4 Heat Rash

- Clinical Features: Profuse tiny raised red blisters on affected areas. Pricking sensations during heat exposure.
- Predisposing Factors: Unrelieved exposure to humid heat with skin continuously wet with un-evaporated sweat.
- Treatment: Seek medical attention.
- Prevention: Cooled resting and sleeping quarters to allow skin to dry between heat exposures.

4.2 Prevention Procedures

Working in a hot environment requires that employers take precautions and provide adequate protection to prevent heat stress. The following procedures should be utilized on ERM project sites to recognize and prevent heat stress conditions.

4.2.1 Monitoring and Risk Evaluation

- Track the weather forecast for the job site and use forecasted information to plan daily activities. Forecasts may be obtained from National Weather Service, Weather Channel, local news, or other available reliable source.
- Review this procedure at daily tailgate safety meetings, including:
  - Encouraging employees to drink plenty of water and not wait until they are thirsty,
  - Reminding employees of their right to take a cool-down rest in the shade when necessary,
  - Establishing the number and schedule of water and rest breaks, and
  - Reviewing the signs and symptoms of heat illness and emergency response procedures in the project-specific health and safety plan (HASP) with all workers onsite.
- Use a thermometer to measure the outdoor temperature in an area where there is no shade. While the temperature measurement must be taken in an area with full sunlight, the bulb or sensor of the thermometer should be shielded while taking the measurement (e.g., with the hand or some other object) from direct contact by sunlight.
- The U.S. Occupational Safety and Health Administration (OSHA) has made available a Heat Safety Tool for use on smartphones (https://www.osha.gov/SLTC/heatillness/heat_index/heat_app.html). The tool allows workers and supervisors to calculate the heat index for their worksite and, based on the heat index, display a risk level to outdoor workers. The tool also provides reminders about the measures that should be taken at that risk level to protect workers from heat-related illness.

4.2.2 Establishing Work Assignments and Work/Rest Regimens

- Make assignments for work involving physical labor and heat stress based on physical fitness level of available labor pool. Employees newly exposed to heat should begin their work level at 50% of suggested work schedule and increase level by 10% per day to allow for acclimatization.
- An employee who has been newly assigned to a high heat area should be closely observed by the supervisor or Field Safety Officer (FSO) for the first 14 days of the employee's employment.
- Supervision and the “buddy system” should be used to carefully observe workers in heat stress environments to evaluate each individual’s susceptibility to heat stress. Any employee exhibiting signs of heat stress should be promptly investigated.
- All employees shall be closely observed by the supervisor or FSO during a heat wave. For purposes of this section, “heat wave” means any day in which the predicted high temperature

for the day will be at least 80 °F (27 °C) and at least 10 °F (5 °C) higher than the average high daily temperature in the preceding five days.

- Initiate a modified work/rest regimen when ambient temperatures and protective clothing create a potential heat stress hazard. If ambient temperatures are greater than or equal to 90°F (32 °C), the work-rest schedules provided in NAM-1323-WI3 (Heat Stress Work/Rest Schedules) should be implemented.
- Rest periods should be taken in a shaded area as described in Section 4.2.3 with open air movement, if available, as this will considerably reduce the effects of heat stress.
- Employees shall be allowed and encouraged to take a preventative cool-down rest in the shade for a period of no less than five minutes at a time when they feel the need to do so to protect themselves from overheating. Such access to shade shall be permitted at all times. An individual employee who takes a preventative cool-down rest:
  - Shall be monitored and asked if he or she is experiencing symptoms of heat illness;
  - Shall be encouraged to remain in the shade; and
  - Shall not be ordered back to work until any signs or symptoms of heat illness have abated, but in no event less than five minutes in addition to the time needed to access the shade.
- If an employee exhibits signs or reports symptoms of heat illness while taking a preventative cool-down rest or during a preventative cool-down rest period, the supervisor or FSO shall provide appropriate first aid or emergency response, as outlined in Section 4.2.5.
- Schedule physically demanding and strenuous tasks, or tasks requiring full-body chemical protection, for early in the day, if possible.
- Protective clothing inhibits the transfer of heat between the body and the surrounding environment. This can increase the onset of heat stress symptoms. The following consideration should be evaluated when protective clothing is worn in heat stress environments.
  - More frequent rest breaks in the shade;
  - Worker rotation to provide frequent breaks in cool areas;
  - Wear ice vests or vortex tubes, if practical; and
  - Schedule changes to accommodate work at night or early morning hours.

4.2.3 Provision of Water and Shade

- Employees shall have access to potable drinking water that is fresh, pure, suitably cool, and provided to employees free of charge. The water shall be located as close as practicable to the areas where employees are working. Where drinking water is not plumbed or otherwise continuously supplied, it shall be provided in sufficient quantity at the beginning of the work shift to provide one quart per employee per hour for drinking for the entire shift. Supervisors or FSOs may begin the shift with smaller quantities of water if they have effective procedures for replenishment during the shift as needed to allow employees to drink one quart or more per hour. The frequent drinking of water shall be encouraged.

- When the outdoor temperature in the work area exceeds 80 °F (27 °C), the supervisor or FSO must establish and maintain one or more areas with shade at all times while employees are present that are either open to the air or provided with ventilation or cooling. The amount of shade present shall be at least enough to accommodate 25% of the number of employees on recovery or rest periods, so that they can sit in a normal posture fully in the shade without having to be in physical contact with each other. The shade must be located as close as practicable to the areas where employees are working.
- When the outdoor temperature in the work area does not exceed 80 °F (27 °C), the supervisor or FSO must either provide shade or provide timely access to shade upon an employee's request.
- Where it is infeasible or unsafe to have a shade structure, or otherwise to have shade present on a continuous basis, the project team may utilize alternative procedures for providing access to shade if the alternative procedures provide equivalent protection. Cooling measures other than shade (e.g., use of misting machines) may be provided in lieu of shade if these measures are at least as effective as shade in allowing employees to cool.

4.2.4 High Heat Procedures

When the temperature equals or exceeds 95 °F (35 °C), the following procedures will be implemented to the extent practicable:

- Ensuring that effective communication by voice, observation, or electronic means is maintained so that employees at the work site can contact a supervisor or the FSO when necessary. An electronic device, such as a cell phone or text messaging device, may be used for this purpose only if reception in the area is reliable.
- Observing employees for alertness and signs or symptoms of heat illness. The ERM project team must ensure effective employee observation/monitoring by implementing one or more of the following:
    - Supervisor or FSO observation of 20 or fewer employees,
    - Mandatory buddy system,
    - Regular communication with sole employee such as by radio or cellular phone, or
    - Other effective means of observation.

- Designating one or more employees on each worksite as authorized to call for emergency medical services, and allowing other employees to call for emergency services when no designated employee is available.
- Reminding employees throughout the work shift to drink plenty of water.
- Reviewing the heat stress procedures at daily tailgate safety meetings, encouraging employees to drink plenty of water, and reminding employees of their right to take a cool-down rest when necessary.

4.2.5 Emergency Response Procedures

- If a supervisor or FSO observes, or any employee reports, any signs or symptoms of heat illness, the supervisor or FSO must take immediate action commensurate with the severity of the illness.
- When an employee displays possible signs or symptoms of heat illness, the supervisor or FSO will check the employee and determine whether resting in the shade and drinking cool water will suffice or if emergency service providers will need to be called. WorkCare Incident Intervention (888-449-7787) should also be contacted to provide guidance on appropriate care.
- An employee exhibiting signs or symptoms of heat illness must be monitored and not left alone or sent home without being offered onsite first aid and/or being provided with emergency medical services in accordance with the site HASP.
- If the signs or symptoms are indicators of severe heat illness (such as, but not limited to, decreased level of consciousness, staggering, vomiting, disorientation, irrational behavior or convulsions, incoherent speech, red and hot face), the supervisor or FSO must implement emergency response procedures outlined in the HASP. Emergency service providers must be contacted immediately, and while the ambulance is in route, initiate first aid (follow guidance in Section 4.1.1).
- In the event a heat stress related incident or near miss occurs, the supervisor or FSO will notify the PIC and PM and report the event following guidelines in the HASP.

4.3 Training Requirements

All field employees, including supervisors, shall be provided training on heat stress and working in hot environments in the language that they understand. Training shall be provided prior to working in hot environments and will be documented in ERM's Academy Learning Management System (LMS). Employee training to recognize heat stress conditions and the methods necessary to prevent and treat heat stress include:

- The environmental and personal risk factors for heat illness, as well as the added burden of heat load on the body caused by exertion, clothing, and personal protective equipment.

- How to monitor weather reports and how to respond to hot weather advisories.
- The procedures for providing water, shade, cool-down rests, and access to first aid as well as the employees' right to stop work without retaliation.
- The importance of frequent consumption of small quantities of water, up to four cups per hour, when the work environment is hot and employees are likely to be sweating more than usual in the performance of their duties.
- The concept, importance, and methods of acclimatization.
- The different types of heat illness, the common signs and symptoms of heat illness, and appropriate first aid and/or emergency responses to the different types of heat illness.
- The importance to employees of immediately reporting any symptoms or signs of heat illness in themselves or in co-workers.
- ERM procedures contained in the HASP for responding to signs or symptoms of possible heat illness, including how emergency medical services will be provided should they become necessary.

5. References

- California Division of Occupational Safety and Health (Cal/OSH) Heat Illness Prevention Standard – California Labor Code Section 226.7
- National Institute for Occupational Safety and Health (NIOSH) Criteria for a Recommended Standard, Occupational Exposure to Heat and Hot Environments (2016)
- ERM Work Instruction NAM-1323-WI3 (*Heat Stress Work Rest Schedule*)

Document Control Information

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Policy Approval by: Millard Griffin

Approval Signature: Millard P. Griffin Jr.

Revision History

Section	Reason for Revision	Date
All	New document.	4/26/10
All	Reformatted document. Edits for clarity; addition of new regulatory information,	6/5/15
4.2.1; 4.2.2; 5	Deleted references to ACGIH TLVs; language added confusion to implementation of procedure	6/8/16
All	Updated Document Number; updated titles (Section 2); updated paragraph alignment throughout; updated referenced document numbers (Section 4); changes shade requirements (Section 4); updated References (Section 5)	1/16/17
4.2.2; 5	Removed work-rest tables. Added reference to revised work/rest tables based on NIOSH documentation (Section 4). Updated References (Section 5).	1/27/20

1. Purpose and Scope

This document establishes procedures for the protection of personnel working on field projects with the potential for exposure to insect and arachnid bites, including mosquitoes and ticks. The standard applies to all North America 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 supervision and working on their projects; and
- Correcting any deficiencies in the implementation of this procedure as identified by the Business Unit Health and Safety 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 Business Unit Health and Safety Director, any observed deficiencies in the implementation of this procedure.

Business Unit Health and Safety 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

Babesiosis: A rare, severe and sometimes fatal tick-borne disease caused by various types of *Babesia*, a microscopic parasite that infects red blood cells. It is transmitted by the bite of an infected *Ixodes* tick (e.g., deer ticks).

DEET: A synonym of N,N-dimethyl-meta-toluamide. It is the most common active ingredient in insect repellents, providing protection against mosquitoes, ticks, fleas, chiggers, and many other biting insects.

Lyme disease: An infectious disease caused by the *Borrelia* bacteria, it is transmitted to humans by the bite of infected *Ixodes* ticks (e.g., deer ticks). Signs of infection may include a red rash (sometimes seen as a bulls-eye), fever, headache, weariness, joint pains, heart palpitations, and memory loss.

Permethrin: A chemical belonging to the pyrethroid family that is widely used as an insecticide and insect repellent.

Picardin: A synthetic compound resembling the natural compound piperine, found in the plants that are used to produce black pepper. It is used an insect repellent for insects, ticks, and chiggers.

Rocky Mountain spotted fever: An infectious disease caused by the *Rickettsia* bacteria; it is transmitted to humans by the bite of infected *Dermacentor* ticks, a type of hard shelled tick (e.g., dog ticks). Initial signs and symptoms include sudden onset of fever, headache, and muscle pain, followed by development of a substantial rash. The disease is fatal in 3 to 5% of those who contract it.

West Nile virus: A member of the virus family *Flaviviridae* spread by various species of mosquitoes. Most infections (~80%) cause no symptoms. In less than 1% of cases, severe infection occurs which may result in neurological disease affecting the central nervous system, including encephalitis (inflammation of the brain) and meningitis (inflammation of the membranes covering the brain and spinal cord).

Zika virus: A member of the virus family *Flaviviridae* spread by the daytime-active *Aedes* mosquitoes. Zika virus is related to dengue, yellow fever, Japanese encephalitis, and West Nile viruses. It typically causes no or only mild symptoms, although it may spread from a pregnant woman to the fetus, potentially resulting in microencephaly and other severe brain problems. Zika infections in adults can result in Guillain-Barre syndrome.

4. Standard

4.1 Hazard Assessment and Project Planning

Prior to the initiation of field work, the project team is required to perform a hazard assessment of the planned scope of work. This is done to identify any hazards that may affect project operations and the safety of ERM staff, as well as to identify the appropriate methods for mitigation. Mosquitos have the potential to transmit the West Nile or Zika Virus and ticks can transmit various tick-borne diseases such as Lyme disease, Rocky Mountain spotted fever, and *Babesiosis*. Therefore, if it is determined that any member of the project field team is likely to be exposed to mosquito or tick prone environments, the mitigation measures described in Section 4.2 of this standard need to be incorporated in the development of the project health and safety plan (HASP) and job hazard analysis (JHA).

4.2 Mitigation Measures

4.2.1 Avoidance Measures

Exposure avoidance must be considered as first priority before entering the field. An effort should be made to schedule work to avoid hours of peak mosquito activity, which are during the early morning and evening hours. Additionally, the identification of biting insect habitats such as grasslands, prairies, woodlands, and wetlands should be identified, communicated to the field staff, and avoided to the extent practical.

The following measures must be implemented while out in the field:

- Avoid sitting on the ground.
- Wear long-sleeved, light colored garments.
- Tuck shirts into pants waistlines and tuck pants into socks or boots.
- Conduct tick checks frequently, on self and on each other, by scanning clothes, exposed skin, and equipment for ticks. At a minimum, this should be done during breaks and before entering vehicles. Ticks generally climb upward in search of exposed skin.
- Shake off clothing and examine equipment before entering vehicles.
- Check vehicle for ticks. Placing a white or light colored cover over vehicle seats will aid with visual identification of ticks on the seats after the completion of field work.

The following measures must be implemented when returning home or to the hotel at the end of the day:

- Shower as soon as you return to your room from the field. Showering should take place before doing any other activity.
- Wash and dry clothes in dryer for 20 minutes if possible; and
- Conduct a full body tick check using a mirror. Ticks generally climb upward until they reach a protected or creased area where they will attach to the host, often the back of the knee, groin, navel, armpit, ears, or nape of the neck.

4.2.2 Application of Topical Insect Repellent

While in the field, project team members are required to carry and periodically apply repellent containing DEET or an effective DEET alternative (e.g., Picaridin). For safe application of the repellent follow the manufacturer’s application instructions printed on the bottle’s label.

Application tips and suggestions:

- Apply repellents only to exposed skin or clothing, as directed on the product label. Do not apply repellents under clothing.

- Repellents should be applied to field gear (e.g., backpacks) for additional protection.
- If wearing flame resistant clothing (FRC), make sure the repellent is safe to use with FRC. Some repellents can damage FRC.
- Never use repellents over cuts, wounds, or irritated skin.
- When using sprays, do not spray directly on face. Spray on hands first and then apply to face. Do not apply repellents directly to eyes or mouth, and apply sparingly around ears.
- Wash hands after application to avoid accidental exposure to eyes or ingestion.
- Use enough repellent to cover exposed skin and clothing. If biting insects do not respond to applied repellents, apply a second application.
- After returning indoors, wash repellent-treated skin.

Repellant product-specific Safety Data Sheets (SDS) should be obtained and kept with the project HASP.

4.2.3 Field Clothing and Pretreatment

In addition to the application of topical repellent, team members working in project environments that present a risk of staff exposure to biting insects (as determined by the project team) are required to use treated clothing. ***Please note that this section is not applicable to operations conducted in Canada. Although permethrin-treated clothing is allowed by Health Canada, sources of pre-treated clothing are highly limited and self-application of permethrin treatments are prohibited. Additionally, shipment of treated clothing across the border is illegal without special approvals and should not be undertaken by ERM staff.***

The cost of clothing treatment is considered a personal protective equipment expense and should be budgeted by the project team. There are two options for clothing treatment:

- **Factory-Applied Clothing Treatment:** Factory applied insect repellent to apparel has been proven to be the most effective option available to prevent exposure to mosquitos and ticks. There are several clothing brands (including, but not limited to, InsectShield®, ExOfficio®, and Columbia®) that sell garments treated with permethrin that can minimize exposure to biting insects. Costs of these garments vary and can range from $50 to $100 USD for a shirt or pants.

  For untreated garments owned by staff that are more adapted to heavy field use (e.g., jeans, high-vis shirts, Carhartts®), Insect Shield® offers a service to treat garments with a formulation of permethrin. The garments to be treated are mailed to InsectShield® and returned within a week. The product is United States Environmental Protection Agency (USEPA) registered, which is designed to evaluate a proposed product to ensure it will not have adverse effects on people or the environment. InsectShield® states that the treatment can last up to 70 washes. A "how-to" video, shipping details, and pricing guide can be found on their website (www.insectshield.com). The standard cost to treat clothing ranges from $8 to $12 USD per garment. Cost options should be factored into project budgets.

- **Self-Applied Clothing Treatment:** Insect repellent that is self-applied to field clothing by the employee can also be an effective method of bite prevention. Several types of repellents are available for purchase that can be applied to clothing in either a spray or a liquid soak method. These products are available from retailers, including but not limited to, Walmart, Bass Pro Shop, and Cabela's.
  - Permethrin Spray – Non-aerosol and aerosol spray treatments can be effective against ticks, chiggers, and mosquitoes. Typically, one bottle contains enough spray to treat up to two outfits. One treatment will last up to six washings or six weeks.
  - Permethrin Soak Treatment – Less common, these kits provide the same protection for clothing as the Permethrin spray, but in a soak treatment that is effective for six washings or six weeks. Soak your items in the solution for two hours and hang to dry.

It is important to note that due to the shorter effective duration for self-applied clothing treatments, an employee-maintained schedule for reapplication of the product should be implemented through the duration of the field season. Permethrin should never be applied directly to skin – only to clothing, gear, or other fabrics as directed on the product label. If self-applying repellents to clothing, it is important to read and follow the manufacturer's directions on how to prepare, treat, and the dry the clothing as part of the treatment process.

4.2.4 Employee Reaction to Repellents/Treatments

ERM recommends that the employee "test" repellents and treated clothing prior to field use. If an employee experiences a rash or other reaction, such as itching or swelling, from an insect repellent, the affected area should be washed with mild soap and water and discontinue use of the repellent. If a severe reaction has occurred, WorkCare should be called for further guidance.

4.2.5 Staff Substitutions

ERM will not require staff to use chemically treated clothing or repellents if they have health concerns. However, when the project HASP identifies a reasonable potential for ERM staff to be exposed to biting insects, the PM and PIC are responsible to ensure that field staff are properly equipped, educated, and willing to apply topical insect repellent and utilize treated clothing. In the event that an employee is not willing to wear treated clothing, apply insect repellent, or identify an effective alternative to either, then their role in the field effort should be reconsidered by the project management.

For more information regarding bite prevention strategies and clothing treatment options, contact your Business Unit Health and Safety Director.

5. References

- ERM Procedure NAM-1110-PR1 (*Project Health and Safety*)
- ERM Procedure NAM-1310-PR1 (*Personal Protective Equipment*)

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Approval Signature: Millard P. Griffin Jr.

Revision History

Section	Reason for Revision	Date
All	New document.	4/29/16
All	Updated Document Number; updated titles (Section 2); updated paragraph alignment throughout; updated referenced document numbers (Section 4); updated References (Section 5)	1/10/17
Section 4	General updates to Section 4 to provide general clarification to requirements and ensure protective measures are adequate.	7/30/20
4.2.3	Updated information on Canadian requirements for permethrin treatment of clothing	2/24/21

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 Health and Safety Director.

Project Manager/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 or not employees are operating in accordance with this procedure; and
- Correct, in conjunction with the PIC and the Business Unit Health and Safety Director, any observed deficiencies in the implementation of this procedure.

Business Unit Health and Safety 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 as a result 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 Safety Eyewear*) provides additional details regarding purchase and care of prescription safety glasses.

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 and cold, and other hand injuries. NAM-1324-PR1 (*Safe Use of Cutting Tools*) provides additional information on gloves types providing protection from cuts.

4.2.4 Head Protection

Hard hats approved by the American National Standards Institute (ANSI)/International Safety Equipment Association (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 where worn frontward or backward.

4.2.5 Body Protection

Body protection may be required for a number of workplace hazards including, but not limited to:

- Extreme heat or hold

- Flames and sparks
- Impacts from equipment and materials
- Skin exposure to hazardous chemicals
- Exposure to bloodborne pathogens
- 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 the 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 shall receive initial training on risk assessment and hazard identification as part of EMR's Observation and Feedback Program (OFP) 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 employee 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), Project Manager, or Business Unit Health and Safety 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 Work Instruction NAM-1310-WI3 (*Selection, Care, and Use of Flame-Resistant Clothing*)
- ERM Procedure NAM-1311-PR1 (*Respiratory Protection*)
- ERM Procedure NAM-1312-PR1 (*Hearing Conversation*)
- ERM Procedure NAM-1324-PR1 (*Safe Use of Cutting Tools*)

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All	New document.	2/10/15
All	Reformatted to meet ERM Global standards; language changes for clarity	1/14/16
All	Updated Document Number; updated titles (Section 2); updated paragraph alignment throughout; updated referenced document numbers (Section 4); updated References (Section 5)	1/10/17
4.3	Included discussion of risk assessment training	1/16/18
4.1	Revised criteria for workplace hazard assessments	2/15/19
All	Minor language changes	2/26/20
4.2.4	Added reference to Z89.1	5/15/20
4.2.5	Added section on body protection	5/26/21

1. Purpose and Scope

To ensure that Short Service Employees (SSEs) are identified, adequately supervised, trained and managed in order to prevent injury to themselves, injury to others, property damage, or environmental harm.

2. Roles and Responsibilities

Business Unit Managing Partner (BUMP): complete a formal meeting with new employee SSEs, approximately three months after their hire date, as part of the Passport to Safety program Note: it is permissible, although not recommended, to delegate this activity to a Country/Entity MP or an Area Manager. If the BUMP does delegate this discussion, they are responsible for communicating this delegation into their BU (all Passport to Safety documents only reference a "BUMP Check-in Meeting"). In addition, in no case can the check-in meeting be delegated to an SSE's Line Manager, unless they also happen to serve the BUMP role.

Line Manager: Identify SSEs that they manage (considering both new employees and existing employees new to their role); ensure that all SSEs work with appropriate mentors, ensure that new employees complete the Passport to Safety program and formally approve completion of the Passport to Safety program in the ERM Academy.

Project Manager (PM): Ensure SSEs are identified and appropriately supervised; act as the SSE mentor while assigned to the field (or assign an appropriate mentor); ensure that clients are notified (if required) when SSEs are assigned to projects.

Short Service Employee (SSE): Ensure they have received the appropriate safety awareness and induction training; work with formally and informally assigned mentors; ensure that PICs, PMs and Project Team members are aware of their SSC status; track (and maintain) progress through the Passport to Safety curriculum.

3. Definitions

FlexForce Employee: An employee, hired under the FlexForce staffing model and specifically identified in HRIS as a 'project-based, fixed-term' employee.

Lone Work: Individuals are considered to be conducting "lone works" when their normal duties require them to work where they cannot be seen or heard by another person; cannot expect a visit from another worker or member of the public during the normal course of their work; and/or where assistance is not readily available

Passport to Safety: A structured curriculum, typically requiring six months to complete, that introduces a new employee to ERM's various safety tools, systems, and expectations. All new employees (with the exception of FlexForce employees) are automatically enrolled in the

Passport to Safety curriculum on the ERM Academy. All employees (including FlexForce) are considered SSEs until they have completed the Passport to Safety Curriculum.

Short Service Employee (SSE): A new employee that has not completed their Passport to Safety program, **OR** an existing employee that is taking on a significantly new role.

4. Procedure

4.1 SSE Identification and Management

4.1.1 New Employees

All new employees are automatically added to the Passport to Safety curriculum on the ERM Academy (with the exception of FlexForce employees). ***ERM-1611-GU1 – Passport to Safety – Quick Reference Guide*** summarizes the current elements of the program.

Line Managers are responsible to:

- Monitor the SSE's progress toward completing the Passport to Safety Curriculum, and help answer any questions or address any issues they may have;
- Help the SSE determine which *optional* activities to complete in the Passport to Safety Curriculum;
- Conduct two formal check-in meetings with the SSE; and
- Approve the SSE's completion of the Passport to Safety Curriculum in ERM Academy to signify that they are ready to graduate from the program.

Throughout the Passport to Safety program, SSEs shall be formally and informally mentored, as described in Section 4.2.

4.1.2 Existing Employees

Line Managers are responsible for identifying existing employees that have had a significant change in role, and should be included as SSEs. The Line Manager should consider an employee for inclusion in the SSE program if there are significant differences in:

- Job responsibilities / duties from previous assignments;
- Work processes / practices from previous assignments;
- Equipment / tools from previous assignments; and
- Skill level, relationships with co-workers.

In these circumstances, the Line Manager shall work with the employee to identify one or more mentors that can provide guidance to the SSE as they transition into their new role. Typically, the Existing Employee SSE process will take approximately six months.

It is the SSE's responsibility to notify PICs, PMs and project team members of their status, so that project teams remain in compliance with the requirements of Section 4.3.

4.2 Mentoring SSEs

Mentors are experienced team members with appropriate knowledge, skills, and training related to the tasks being performed and who display appropriate safety leadership and work ethic. Typically, more than one mentor will assist an SSE depending upon the type of work and work location, thus allowing maximum oversight and demonstration of appropriate skills and knowledge, and compliance with client expectations, where applicable.

Mentors will provide regular review, coaching and feedback to the SSE to enhance their understanding of ERM safety policies and procedures, as well as determining their continued suitability for field operations. Mentors should assess the SSE's knowledge in the following areas:

- ERM's safety policies and procedures;
- Client-specific health and safety policies and procedures (as applicable);
- Applicable safety resources;
- Proper use of personal protective equipment (PPE);
- Reporting of incidents, near misses, and safe behaviors;
- Use of the Event Communication System (ECS);
- Required training for assigned job operations;
- Principles of the See.Own.Share program;
- Use of Stop Work authority; and
- Basic hazard identification.

Mentors should be prepared to discuss the above with the SSE's Line Manager when determining if a SSE is ready for graduation from the SSE program.

4.3 Use of SSEs for Field Work

4.3.1 Field Project Planning

The Project Manager shall ensure that all SSEs are identified in the HASP. Project teams should staff field work such that SSEs have adequate supervision and oversight. SSE are not permitted to conduct lone work, and situations in which an SSE is the only ERM employee on site to conduct field work should be avoided if possible. If an SSE will conduct field work without direct supervision, then a communication plan should be established. The communication plan must ensure the availability of phone communication with a suitable mentor and minimum check-ins at the beginning and end of the work shift.

The PM shall ensure that the make-up of field personnel within a Project meets the following:

- SSEs are prohibited from conducting lone work.
- Situations where an SSE is the only ERM employee on site to conduct field work should be avoided.
- Teams may not have more than one SSE for field teams of 2 to 4 persons.
- SSEs may not exceed 20% of the field teams for teams of more than 5 persons.

The above field team composition requirement can be waived for FlexForce employees **only**, if a documented wavier has been developed by the project team, reviewed by the Regional Safety Lead (or designee) and the FlexForce SME; and approved by the BUMP

SSEs may not perform the following roles on ERM field projects:

- Field Safety Officer (FSO) on field projects conducted under a Level 2 Health and Safety Plan.
- Subsurface Clearance (SSC) Experienced Person on projects involving ground disturbance.
- Aquatic Experienced Person on projects involving vessels.

The composition of the proposed project team shall be communicated to the client, where required.

4.3.2 Field Project Visual Identification

The PIC and / or PM shall determine if SSEs must be visually identifiable. This determination should consider:

- Whether multiple contractors are working in close proximity.
- Whether the SSE's activities are being directed and/or guided by others.
- The risk associated with the activities performed by the SSE.
- Client requirements.

When required, the SSE shall be identified:

- By the SSE wearing a high-visibility orange hardhat; or
- By displaying a visible sticker on their hard hat that includes the letters 'SSE'.

4.4 Graduation of Employees from the SSE Program

For a new employee to graduate from the SSE program, the employee must have completed the Passport to Safety program and the Line Manager must approve completion of the Passport to Safety Curriculum in the ERM Academy. When evaluating whether an SSE is ready to graduate from the program, the Line Manager should consult with appropriate mentors to evaluate the SSE's understanding of ERM's safety culture and requirements. When approving completion, the Line Manager should confirm that the employee exhibited safe behavior for 6 months (e.g. incident free performance, proactive participation in safety programs, participation in safety meetings and general awareness of ERM's safety requirements).

An existing employee (that has significantly changed roles) can graduate from the SSE program after a six month period. At the end of the six month period (or earlier, if the Line Manager feels it appropriate), the Line Manager shall discuss the employee's progress with applicable mentors. If there are no objections from the mentors, and the Line Manager and SSE are in agreement, then the employee's designation as SSE shall be removed. No formal documentation is required.

If an SSE has significant field experience from a previous job, can demonstrate adequate knowledge of ERM safety policies and appropriate skills in their field operations, and has completed all required training, the SSE's Line Manager may allow early graduation. For new employees, this means that all mandatory elements of the Passport to Safety curriculum have been completed, and the Line Manager has approved the Curriculum. For existing employees, this means that the Line Manager has completed the mentor consultation and employee discussion, and all agree that the employee is ready for graduation.

4.5 Subcontractors

Project Managers shall ensure that subcontractors are aware of the requirements of this Procedure during the procurement process and field activities. ERM subcontractors are expected to manage SSE using their own process that meets the requirements of this procedure.

5. References

- ERM-1611-GU1 - Passport to Safety - Quick Reference Guide

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Approval Signature: Gary Beswick

Revision History

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All	1.0: New document.	29 Dec 2014
All	1.1: Updated links, tagline, and document number	28 Dec 2016
4.2	1.2: Clarified the inclusion of SSE in field teams	6 March 2019
All	2.0: Included reference to the Passport to Safety program; clarified the requirements for existing employee participation in the program	14 Feb 2020
3; 4.3.1	2.1: Included definition of FlexForce employee, and FlexForce field team waiver allowance	27 Apr 2020
2, 4.1.1, References	2.2: Updated referenced URLs, clarified that FlexForce employees are not automatically assigned P2S	13 Aug 2021
4.2	2.3: Updated OFP reference to See.Own.Share	15 Apr 2022

1. Purpose and Scope

A chemical spill is defined as the uncontrolled release of a hazardous chemical; 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;
- In the event of a spill on a project site, ensure that quick and effective cleanup is conducted.

Project Manager/Supervisor: Responsible for the following elements:

- Ensure that this procedure is implemented on projects which include a risk of chemical spill;

Business Unit Health and Safety Director: Responsible for the following elements:

- Ensure provision and completion of appropriate spill prevention and response training to affected staff;
- Periodically evaluate the effectiveness of this procedure;

Field Safety Officer: Responsible for the following elements:

- Take necessary steps to minimize the potential for spills when working with chemicals;
- 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;
- 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

Storage

- Avoid storing chemicals in areas where they may be knocked over and broken/ruptured.
- Be aware of 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; and
  - 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.

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.

Transfer

- When transferring chemicals between containers, pay careful attention to 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.

Usage

- Employees must wear appropriate PPE when handling chemicals.
- 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.

Disposal

- Do not mix incompatible wastes as this may lead to uncontrolled chemical reactions.
- Properly 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 Project Managers/Field Safety Officers (FSOs) shall:

- Ensure only adequately trained employees or subcontractors in spill response procedures will respond to the spill.
- Determine what type of material has been spilled.
- Consider all safety factors. Check 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 Business Unit Health and Safety 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;
  - Sweep up absorbent and properly dispose of contaminant pads/booms; and
  - Contain contaminated waste for proper disposal.
- Notify the Business Unit Health and Safety 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:

- Container for containing contaminated cleanup materials;
- Absorbent pads;
- Spill “socks” or “pigs”;
- Absorbent material;
- 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 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

- USEPA Consolidated List of Chemicals (https://www.epa.gov/sites/production/files/2015-03/documents/list_of_lists.pdf)

Document Control Information

Original Effective Date: 3/11/15

Policy Approval by: Millard Griffin

Approval Signature: Millard P. Griffin Jr.

Revision History

Section	Reason for Revision	Date
All	New procedure.	3/11/15
All	Updated Document Number; updated titles (Section 2); updated paragraph alignment throughout	1/11/17
4	Corrected paragraph numbering; changed references from "MSDS" to "SDS"	6/29/17
1, 4, 5	Updated Purpose statement (Section 1); revised procedural elements to eliminate quantity limitations (Section 4); updated Reference section (Section 5)	7/16/18
All	Minor language revisions throughout; updated subcontractor references	2/18/20

1. Purpose and Scope

This document establishes the minimum requirements for travel risk planning and documenting international travel. One of the following means of online documentation is required for **all** international travel:

- Travel Notification Form (TNF) for specifically identified Low Risk Countries,
- Online registration for travel under a Pre-approved Travel Procedure (PATP), or
- Travel Risk Assessment (TRA)

Local processes/procedures may be developed for domestic travel.

2. Roles and Responsibilities

Local Managing Partner (Local MP). Consider travel risk in proposal Go / No Go decisions.

Global Legal Compliance & Officer / Global Insurance Director. Ensure that Trade Sanctioned, No-Go and Insurance-restricted countries are correctly identified on the "Travel Country Matrix" SharePoint List on the Travel Safety Resources site.

International Traveler. Travel internationally only after appropriate online documentation has been completed; prepare a TRA when required.

Local H&S Lead. Participate in the TRA review and approval workflow for employees within their BU or Country/Entity.

Partner in Charge (PIC). Ensure online documentation is completed and approved for all international travel on their projects; approve Low and Medium risk TRAs.

Regional CEO (RCEO). Approve, in consultation with the Regional H&S Lead, any ERM international High Risk travel to their Region; consider travel risk in Go / No Go decisions.

Regional Health and Safety (H&S) Lead. Participate in the TRA approval workflow for ERM international High Risk travel to their Region; ensure the information in the "TRA Approval Matrix" SharePoint list remains accurate for their Region.

3. Definitions

Designated reviewer/approver: The TRA reviewer/approver identified in the current "TRA Approval Matrix" SharePoint list on the Travel Safety Resources site.

Delegated reviewer/approver: An individual assigned review/approval authority by the Designated reviewer/approver, and having similar qualifications as the Designated individual.

International Travel: Travel to any country different from the country in which the ERM employee's permanent office is located.

Pre-approved Travel Procedure (PATP): A project- or office-specific document that summarizes the risk and risk mitigation associated with a particular location/site/project. Travelers agree to follow the requirements of a PATP by submitting an online travel documentation form that references the applicable PATP.

4. Requirements

4.1 Assessing Travel Risk

Travel risk should be considered at all stages of proposal and project management. Potential travel risk should be evaluated during the proposal stage, and travel to high risk locations (as defined by CRG, ISOS, the TRA process, or other means) should be minimized. The Local MP and RCEO of affected travelers should be involved in Go/No Go decision for high risk travel at the proposal stage. Proposals shall include provisions enabling ERM to react if the situation in a country or area deteriorates during a project.

If international travel is deemed appropriate, then the requirements of this procedure will apply.

4.2 Preparation and Submission of Travel Documentation

All employees engaging in international travel shall meet the requirements of this procedure and shall document their travel using the "Travel Risk Assessment" tool on the Travel Safety Resources site. Selecting your destination country within the Travel Risk Assessment tool will show you the options available for that location (e.g., a Travel Notification form, and Office-specific PATP, a Project-specific PATP or a Standard TRA).

No international travel shall occur without online documentation: either the submission of a Travel Notification Form (TNF), registration under a PATP, or approval of a TRA.

The completion of a TRA does not relieve the requirement for completing a HASP in accordance with *Health and Safety Planning Procedure*. To the extent possible, the information provided in the HASP should not duplicate the information provided in the TRA.

4.2.1 Travel Notification Form (TNF)

The Travel Notification Form (TNF) can be used for travel to a specific list of Low Risk countries identified on the Travel Safety Resources page. The TNF documents travel logistical information (for use in the event of an emergency), and does not require any review or approval.

The Regional H&S Lead can recommend a country for inclusion/removal from the Travel Notification list, with approval issued by the associated RCEO and the Global HS Director.

4.2.2 Pre-Approved Travel Procedure (PATP)

When a variety of individuals are traveling to a similar project or location, the PIC may choose to prepare a PATP. The PATP is an offline document that clearly describes all required travel risk mitigation activities, traveler pre-trip submissions (e.g., itinerates), and notifications. Review and approval of the offline PATP shall be commensurate with the destination risk and in accordance with TRA Approval process defined in Section 4.3.

One week prior to each individual's trip, the traveler shall register their use of the PATP and travel logistics using the online Travel Documentation tool. Travel may not occur until the traveler receives email confirmation that the PIC (or Line Manager) has approved their online submission.

4.2.3 Travel Risk Assessment (TRA)

For all other international travel, a Travel Risk Assessment (TRA) is required. The employee shall allow sufficient time for the required TRA review and approval prior to travel. The recommended time frame to give notice of proposed travel is seven business days.

All High Risk TRAs must be received by the approving RCEO for final review and decision on approval at least 48 hours prior to departure. If departure is on a Sunday, then the TRA must be received by Thursday. A TRA not meeting this requirement will not be approved without a one-on-one discussion between the approving RCEO and the project PIC. Any proposed travel to locations rated as Extreme will require longer lead time and ultimately the review and decision on approval of the travel by the Group CEO.

In limited cases, a project may require that an individual travel multiple times to the same location. In this case, a *Multi-trip TRA* can be prepared and submitted for approval. A multi-trip TRA shall identify the overall duration of anticipated travel (e.g., between January 1 and May 30); the TRA is only valid between these dates. One week prior to each individual trip, the traveler should submit their upcoming travel dates into the online TRA tool, and complete any required notifications.

4.3 Review and Approval of online Travel Documentation

A Travel Notification form does not require review or approval. No international travel is permitted until email confirmation of TNF submission has been received.

Registration for travel under a PATP requires online approval from the project PIC or the traveler's line manager. No travel is permitted until email approval has been received from the TRA system.

Review and approval of a standard TRA (and the offline PATP document) is commensurate with the location risk (Low, Medium, High-Medical Only, High or Extreme). When a completed TRA is submitted by the international traveler, the form enters the Approval workflow process, as defined on the Travel Safety Resources site. Designated reviewers and approvers will receive an email notifying them that a TRA is pending approval.

A designated reviewer/approver may delegate review/approval authority to a similarly qualified individual. It is the responsibility of all designated reviewers/approvers to ensure that a process is in place to forward TRA notification emails to their delegate(s) when they are out of the office or unavailable (or otherwise delegate the TRA review).

During the review and approval process, the traveler is responsible for ensuring that changes to the travel start date are accurately reflected in the TRA system (e.g., if the travel is postponed or canceled).

4.4 Implementation and Supervision

A copy of the approved TRA or PATP will be maintained with the traveler(s) during their trip. The PIC shall ensure that the requirements of the TRA or PATP and all identified mitigation techniques are understood by and available to all travelers. All travelers must sign the TRA to confirm the information is correct, agree to the identified risk mitigation activities, and confirm they are comfortable with the travel.

Prior to travel, the traveler shall update the online travel documentation as required to ensure the information remains current and accurate (e.g., changes to hotel, air flight numbers, contact numbers, etc.). So long as no significant changes are made (specifically, changes that would have impacted a reviewer or approver decision), the updated documentation does not need to be re-reviewed. Updates are critical to ensure ERM has access to accurate information in the event of an emergency.

4.5 Training

Training associated with international travel is summarized on Table 1; these training modules are available on the ERM Academy. Additional location-specific training may be required.

4.6 Non-conformance with this Process

Any travel that commences without the required (Approved) travel documentation shall be entered into ECS as a near miss. For purposes of this determination, travel commences when the traveler boards the first flight associated with the travel. The ECS entry will be classified as a Near Miss and assigned a Potential Severity based on the overall risk rating of the country to be visited (when multiple countries/areas are associated with the travel, then the most severe rating shall apply) as follows:

- Low Risk rating (or failure to submit a TNF) shall be assigned a Potential Severity of 3
- Medium Risk or High Risk–Medical Only shall be assigned a Potential Severity of 5
- High Risk rating shall be assigned a Potential Severity of 7
- Extreme Risk rating shall be assigned a Potential Severity of 10

Table 1 - International Travel and TRA Usage Training Requirements

	International Travel Related Requirements				TRA Process Related Requirement
Activity	**Module 1 - International Travel - Introduction**	**Module 2 - International Travel to High Risk Destinations**	**Malaria Awareness & Prevention Policy Introduction**	**Malaria for Travelers and Expatriates**	**Module 3 - Using the Travel Risk Assessment Process**
Creating, preparing or reviewing a TRA					Required prior to TRA use
Any international travel	Required prior to travel				
International travel to a High or Extreme risk destination	Required prior to travel	Required prior to travel			
Travel to a malarial area (per ISOS)			Required prior to travel	Required prior to travel	

5. References

- ERM-1110-PR1 – Health and Safety Planning Procedure
- Travel Safety Resources Page (to launch the TRA)

Document Control Information

Original Effective Date: 1 April 2015

Approved by: Gary Beswick on 13 August 2021

Approval Signature: Gary Beswick

Revision History

Section	Version: Reason for Revision	Date
All	1.0: New document.	29 Dec 2014
4.2	2.0: Changed Global CEO to Director of Operations for Extreme Risk	14 May 2014
4.1, 4.2 & 4.5	3.0: Sections 4.1 and 4.2 – clarified the applicability of the procedure to all international travel. Section 4.5 - updated entire section to accurately reflect current training requirements associated with international travel and TRA usage.	8 October 2015
All	3.1: Updated links, tagline, and document number	28 Dec 2016
All	4.0: Updated to reference TNF; clarified the three types on acceptable online documentation	15 Aug 2017
Ref.	4.1: Updated hyperlink to Travel Safety Resources page.	11 July 2018
Ref.	5.0: Triannual review; and URL updates	13 August 2021

ERM Vehicle Safety Checklist

Date	Operator	Project#	Mileage
Vehicle Make/Model License#		Company Vehicle? ☐ Y ☐ N	

I. Inspection	Before Driving: OK	Before Driving: Deficient	Before Driving: N/A	Comments
<u>Prior to Use, and Weekly Thereafter</u> for all vehicles used for field work.				
All glass and mirrors	☐	☐	☐	
Engine Fluids (oil, radiator coolant)	☐	☐	☐	
Headlights (incl Hi/Lo lights)	☐	☐	☐	
Horn	☐	☐	☐	
Instrumentation warning lights	☐	☐	☐	
Misc. vibration, noise, loose parts (requires comment)	☐	☐	☐	
Overall vehicle cleanliness/damage	☐	☐	☐	
Reverse warning/alarm	☐	☐	☐	
Seatbelts for all seats	☐	☐	☐	
Tail Lights / Brake lights	☐	☐	☐	
Tires - visual condition/tread/pressure	☐	☐	☐	
Turn signal / hazard lights	☐	☐	☐	
Under vehicle – leaks	☐	☐	☐	
Windshield cleanliness and lack of damage/cracks	☐	☐	☐	
Windshield wipers & fluid	☐	☐	☐	

Required H&S supplies/ equipment	☐ Anti-lock brakes	☐ Air bags	☐ First aid kit	☐ Reflective safety vest (for all occupants)	☐ Spare tire and jack – in good condition	☐ Roadside warning (triangles or flares)
Optional H&S supplies/equipment	☐ Jumper cables	☐ Fire Extinguisher	☐ Torch / flashlight	☐ 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***.

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: 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, 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 various wastes;
- Evaluation of specific personal protective equipment to be worn, including requirement to use appropriate gloves;
- Sampling, analysis, and proper characterization of any wastes and interface 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 during the project. As part of the review of project hazards, the ERM Project Manager and PIC will evaluate the project scope to assess whether the project will likely involve waste generation by ERM or if ERM will be directly responsible for managing wastes.

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 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 overall plan. A general proposed format for including the necessary components in the plan to address such activities is presented in NAM-1122-FM2 (*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 Activities*)
- ERM Form NAM-1122-FM2 (*Project Execution Activities*)

Document Control Information

Original Effective Date: 6/9/11

Policy Approval by: Millard Griffin

Approval Signature: Millard P. Griffin Jr.

Revision History

Section	Reason for Revision	Date
All	New document.	6/9/11
All	Reformatted document. Revision of document language in several areas.	6/25/15
All	Updated Document Number; updated titles (Section 2); updated paragraph alignment throughout; updated referenced document numbers (Section 4); updated References (Section 5)	1/14/17
4	Added information on PPE selection	7/31/18
All	Fixed broken links; edited subcontractor references; minor language revisions	2/18/20

Project Name/ Location:				**Phone:**	
Project Number:		**Date:**		**Time:**	
Meeting Leader:					

Today's Work Tasks(s)	**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.**

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 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?
☐ Is everyone fit for duty today (i.e., in a physical, mental, and emotional state 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)?
☐ 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.

Perform

Conditions 1-4 require that you **STOP WORK** and consult with a second person. Conditions 5-9, proceed with caution

E

1 Refer to the appropriate Partner to decide.
2 Ask a specialist with more knowledge to advise.
3 Consult with your supervisor before starting
4 Discuss with a colleague to assist.

H

M

5 How can risk be reduced?
6 Look for another way to do the job if possible.
7 Re-check your safety controls (JSA, PPE, Procedures)
8 Re-check the area before proceeding.
9 Proceed with the usual level of safety awareness.

L

ERM-1140-FM1, Version 8

Scan

Take two minutes to: scan **LOW** scan **MEDIUM** scan **HIGH**

Safety AT ERM
Risk Management

SNAP

Scan Notice Analyze Perform Assessment

ERM

Activity Level Risk Review

Notice

Notice the hazards and the quality of the control measures in place. Ask yourself the following questions…

1 Have I looked and identified all the hazards?	☐ Yes ☐ No
2 Will the job be done as already discussed?	☐ Yes ☐ No
3 Are the resources I need available? (PPE, tools, people)	☐ Yes ☐ No
4 Can the job be done without causing an incident?	☐ Yes ☐ No
5 Is everything the same since I last did this task?	☐ Yes ☐ No
6 Are others protected from my activities in the area?	☐ Yes ☐ No
7 Have I identified emergency devices and locations and do I know what to do?	☐ Yes ☐ No
8 Do I have safe access to and from my work area?	☐ Yes ☐ No
9 Is my work area clean and tidy?	☐ Yes ☐ No

If you answered NO to any of the above then consider this when you ANALYZE

Analyze

What is the most likely adverse consequence from an incident?
What is the probability of this type of incident occurring?

Probability of an incident	Exposure to the risk	Consequence/Outcome Injury	Impact	
				E
o Almost certain		Multiple fatalities	o Catastrophic	
o Has happened		Fatality	o Major	H
o Possible	o Weekly	Disability	o Significant	
o Heard of	o Daily	Serious (LTI)	o Serious	M
o Unlikely	o Current Task	Medical Treatment	o Moderate	
o Almost impossible		First Aid	o Minor	L

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: Date Plan Completed:	Field Work Start Date: 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:	*Check all that apply:* ☐ Point disturbances (manual / hand digging only) ☐ Point disturbances (using mechanized equipment) ☐ Excavation / trenching / grading ☐ Removal / coring / drilling of concrete, asphalt, etc. ☐ 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 location meets criteria for Remote/Greenfield Site	☐	☐	☐	If Yes, project teams can elect to complete the SSC Project Plan for Remote/Greenfield Sites (ERM-1511-FM2) instead of this form

[1] Current certification on ERM Academy is required. SSC EP not required for Remote / Greenfield sites, as defined in the ERM Global SSC Procedure (ERM-1511-PR1).

Subsurface Clearance Project Plan

Site Walk						
Identified Visual Clue	**Yes**	**No**		**Identified Visual Clue**	**Yes**	**No**
Lights				Pipeline markers		
Signage				Fire hydrants		
Sewer drains / cleanouts / drop inlets[2]				Sprinkler systems		
Cable markers				Water meters		
Utility poles with conduit leading to the ground				Natural gas meters		
Utility vaults / boxes[2]				UST fill ports and vent pipes		
Manholes[2]				Equipment locations		
Pavement scarring				Steam lines		
Distressed vegetation or vegetation in linear pattern				Remote buildings with no visible utilities		
Overhead utility lines				Other (specify):		
Solar panels / wind power generation				Other (specify):		
Comments:						

	Yes	No	N/A	Comments
Visual clues / site features integrated into Site Services Model				

Utility Markouts	Yes	No	N/A	Comments
Public Utility Locates completed (where available)?				
Responses received from ALL companies notified?				
List utilities notified:				

	Yes	No	N/A	Comments
Private Utility Locates completed [3] (waiver required if "NO")				
Utilities clearly marked with agreed method?				
Private locate findings documented?				

Private Utility Locate Performed by:	Years or experience operating detection equipment: Date of most recent training on equipment operation:
Type of equipment / methods used:	
Date(s) of most recent maintenance/servicing and calibration (if applicable) of detection equipment:	
Note any limitations (e.g. sources of interference, geology, etc.):	

[2] Coordinate with site contacts to safely open and visually inspect any manholes, drains, vaults, cleanouts, or other similar structures.
[3] Not required for Remote / Greenfield sites, except where required by local regulations or client procedures.

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? Yes	Present? No	Present? Un-known	Anticipated depth (note units)	Located? Yes	Located? No	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)
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 / Time

Operating Critical Zone Determination

Are there any ground disturbance locations <u>known</u> or <u>suspected</u> 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): ________ *(Note that this plan must be reviewed and approved by the PIC before any clearance activities commence)*	*Attach additional sheets to completely describe clearance method, tools and depth if these will vary during the process from location to location.*			
	Yes	**No**	**N/A**	**Comments**
Clearance technique to be used (indicate which method): ☐ Compressed air excavation *(ERM preferred method)* ☐ Pressurized water excavation ☐ Hand digging ☐ Hand augering ☐ Soil probe rod *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*				Provide rationale if NOT using preferred method of compressed air excavation: ☐ Scope of work limited to hand digging only ☐ Equipment not available ☐ Cannot meet technical objectives (e.g., vapor pins) ☐ 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 LARGER OF: 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: ☐ Outside Critical Zones, to a minimum of 5 feet (1.5 meters). *Note: typical site utility depths should be considered and may warrant deeper clearance* ☐ 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. ☐ 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 *(Note that this plan must be reviewed and approved by the PIC before any disturbance activities commence)*	**Yes**	**No**	**N/A**	**Comments**
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" or be received via e-mail 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 direct ERM supervision of ground disturbance activities: • SSC EP to oversee execution of the SSC Process (can include the entire project or specific SSC-related tasks), or • Direct oversight of subcontractors for Remote/Greenfield sites or shallow hand digging no deeper than 1.5 feet / 0.5 m)				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 / Time

Additional Notes or Learnings

Subsurface Clearance
Project Plan – Critical Zone Sketch Map

Site/Project Name: ____________________

Client: ____________________

ERM Project No.: ____________________

SSC EP / Field Team Lead: ____________________

A sketch map must be developed for each ground disturbance location inside a Critical Zone (one map per location – attach additional maps as needed). Disturbance within a Critical Zone can only proceed with both PIC and Local MP (or designee) approval.

GROUND DISTURBANCE LOCATION ID:

GROUND DISTURBANCE LOCATION DESCRIPTION:

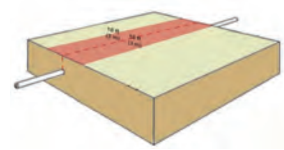
Instructions:

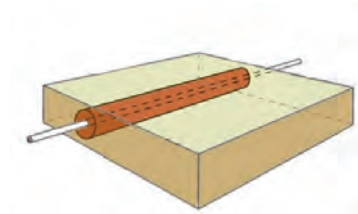
1. Create a sketch of the disturbance (in the space to left or attach) that is drawn to scale and contains the following information:
   a. The disturbance location
   b. Surface landmarks and overhead obstructions (buildings, roads, overhead lines, etc.)
   c. Subsurface utilities and structures:
      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 (junction boxes, drains, disturbed concrete, signage, etc.)
   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) Review Checklist for Subcontractors

Site Name:	
Client:	
ERM Project No.:	
Subcontractor activities to be performed on site:	

Use this form to conduct and document review with subcontractor personnel, to ensure they have been properly briefed on the applicable components of ERM's SSC Procedure (ERM-1511-PR1).

TOPIC	REVIEWED	N/A	COMMENTS
All personnel on ERM projects are empowered to stop work, without fear of reprimand, if it is unsafe to proceed or if there are concerns or questions.	☐	☐	
If at any time during project execution, the scope of work or site conditions change, work should be stopped and the potential impacts of the change discussed.	☐	☐	
Ground disturbance activities may NOT be performed at any location without authorization by the ERM SSC Experienced Person (EP) or field team lead. Unless explicitly authorized by ERM's SSC EP, Partner-in-Charge <u>and</u> Local Managing Partner, clearance activities may NOT be performed at any location unless the ERM SSC EP or field team lead is physically present.	☐	☐	
Unless explicitly authorized by ERM's SSC EP, Partner-in-Charge <u>and</u> Local Managing Partner, ground disturbance may NOT be performed within 10 feet (3 meters) distance (referred to as the "Critical Zone") of any subsurface structure.	☐	☐	"The Critical Zone" 
Unless authorized by the ERM SSC EP, ground disturbance / clearance activities must NOT be performed in areas that are in direct conflict with any markings made by public or private utility locators.	☐	☐	
Unless explicitly authorized by ERM's Partner-in-Charge and Local Managing Partner, all borehole and small test pit locations must be cleared prior to use of mechanized equipment. Required clearance depths and diameters are as follows: • Physically clear to a diameter that is the LARGER OF: 4 inches (10 cm), or at least 125% of the largest downhole tool to be used. • Physically clear to a minimum depth as follows: o Outside Critical Zones, to 5 feet (1.5 meters). o Inside Critical Zones, to 8 feet (2.4 meters) at a minimum, and deeper if necessary to clear to depths greater than 8 feet for deeper utilities and structures. o For locations with frozen soils, to 2 feet (0.6 meters) beyond the bottom of the frost line at the site.	☐	☐	

TOPIC	REVIEWED	N/A	COMMENT:
Mechanical digging is prohibited inside a 2-foot (0.6-meter) distance (referred to as the "Excavation Buffer") in all directions from subsurface structures that will be intentionally exposed due to ground disturbance activities. Removal of material inside the Excavation Buffer may only proceed by hand or by compressed air excavation (if allowed by law and authorized in writing by the owner / operator the structure).	☐	☐	**"The Excavation Buffer"** 
For all equipment brought to the site, the minimum horizontal distance from any point on the equipment to the nearest overhead electrical power line must adhere to the minimum safe clearance requirements stipulated by regulation, utility companies, client requirements, and/or industry best practice. Other access constraints should be reviewed to plan vehicle moves accordingly.	☐	☐	
If subsurface structures are to be de-energized prior to ground disturbance activities, only trained personnel may do so via a formal, written energy isolation program.	☐	☐	
For compressed air excavation equipment, the operators should wear coveralls, ear, eye and hard hat protection. Safety precautions associated with compressed air must be employed. Grounding the hose and the tanker may also be required and should be assessed prior to start of operations. Filtering devices should be used to reduce release of materials and dust to the environment.	☐	☐	
Subcontractor personnel should be observant during ground disturbance activities for the presence of warning signs indicating non-native soil, fill materials, and/or the presence of unexpected subsurface structures. Any evidence of warning signs, unexpected encounters with subsurface structures, or any other near misses or incidents must result in immediate work stoppage and be reported to the ERM SSC EP or field team lead.	☐	☐	
In the event of contact or potential contact with a subsurface structure, 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.	☐	☐	
Once clearance is completed, holes must be secured or covered in order to prevent slips, trips and falls until mechanical advancement commences.	☐	☐	
Subcontractor personnel must participate, as requested, in investigations of near misses and incidents.	☐	☐	
Subcontractors must comply with all other applicable regulatory or client requirements.	☐	☐	
Other topics discussed:	☐	☐	

N/A = Not applicable to this project.

REQUIREMENTS FOR TOOLS AND EQUIPMENT:

- A JHA must be developed for each subcontractor task. JHAs 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.
- Blades on shovels and post-hole diggers must have rounded or blunt edges. Tools that come to a point, e.g., pick axes or pointed spades, are not to be used for clearance.
- Crow bars, pinch bars or pry bars must not be used to break hardened soil or backfill. The ERM SSC EP or field team lead may authorize 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.
- Electric-powered equipment must have ground fault protection.
- Equipment must be inspected prior to use, maintained according to manufacturer recommendations, and operated only by trained personnel. Training documentation must be provided upon request.
- Manual / hand tools must be used properly and not “over-muscled.” In case of refusal or difficult advancement, the contractor must stop work and notify the ERM EP or field team lead.
- Rig- or stand-mounted concrete coring equipment must be anchored to the ground/floor using proper anchors.

Checklist Completed By: (SSC Experienced Person or Field Team Lead)		
Name (Print)	Name (Sign)	Date / Time

Reviewed By: (All Subcontractor Personnel)		
Name (Print)	Name (Sign)	Date / Time

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 requirements of this procedure do not apply for 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).

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 Remote-Greenfield 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

Phase of SSC Activity	Local MP	PIC	PM	EP	GE	Local Safety
Project Planning Phase (continued)						
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

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.

[1] Shared accountability with 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.

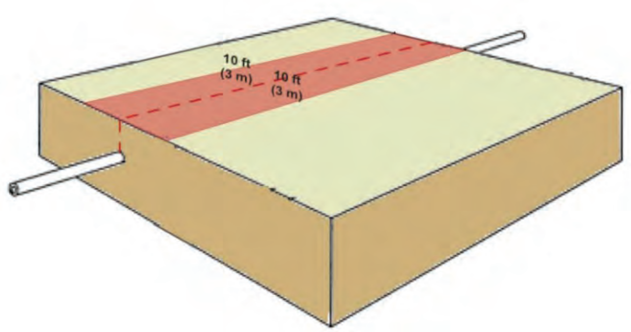
Compressed Air Excavation – the use of compressed air to make a cut, cavity, trench or depression in the earth's surface. Also known as "vacuum extraction," "vac-ex," "air knifing," and/or "soft digging."

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:

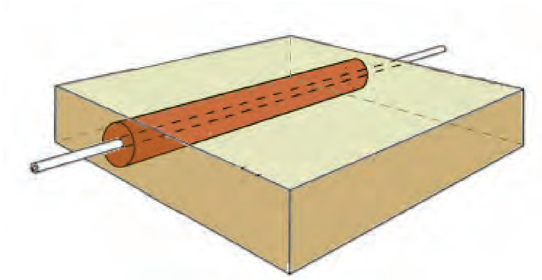


Detection Equipment – any equipment used for the detection of subsurface structures including, but not limited to, devices that utilize electromagnetic detection, magnetic detection, ground penetrating radar (GPR), acoustic detection, and video surveillance (e.g., sewer cameras). Guidance on the selection and applicability of detection equipment is provided in Appendix 3.

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.

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.

Remote/Greenfield Site – sites that are situated in remote/rural or wilderness areas, with no evidence of subsurface structures present after completing the relevant SSC process steps outlined in Section 4, and where ONLY hand digging or hand augering is to be conducted. To be classified as Remote/Greenfield, a site must meet all of the criteria set forth in Appendix 2, as determined by the project PIC.

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 (excluding man-made debris) located beneath the surface of the ground or within or below engineered surfaces. 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 1.

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 the project location is a Remote/Greenfield site as defined in Section 3, or 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, right-of-ways, 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 currently 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.

9) Remote/Greenfield Site Determination. If applicable, the PIC should use the available information obtained in previous steps to determine if the site meets the Remote/Greenfield criteria as defined in Appendix 2. Document this determination in the SSC Project Plan.

4.3 Public Utility Locates

The following steps are required:

1) Where they exist, the public utility locator(s) must be contacted 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) Determine if there are utility owners/operators (including municipal water and sewer) that are not subscribers to the public utility locate service. If there are utility owners/operators that do not subscribe to the service or if a public one-call service is not available, 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 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) For Remote/Greenfield sites, if no utilities are identified or suspected during the site walk, and as a result the Remote/Greenfield site status is confirmed, the steps outlined in Sections 4.5 and 4.6 do not apply (except where required by local regulations or client procedures). However, if there is any evidence of the possible presence of subsurface structures or useful property identified at the project location during the site walk, ground disturbance activities must be stopped immediately and the PIC contacted. If the presence of subsurface structures or useful property is confirmed, then the site is no longer considered a Remote/Greenfield site and must be fully risk-assessed using all the required steps in the SSC process.

10) Document the activities performed and results of the visual clues survey in the SSC Project Plan.

4.5 Private Utility Markouts

NOTE: The SSC steps outlined in this section do not need to be completed for Remote/Greenfield sites, except where required by local regulations or client procedures.

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 3. 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 3.
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

NOTE: The SSC steps outlined in this section do not need to be completed for Remote/Greenfield sites, except where required by local regulations or client procedures.

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:

1. 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.
2. 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.
3. 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.

4. 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:
      1. Outside Critical Zones, to 5 feet (1.5 meters). Note: typical site utility depths should be considered and may warrant deeper clearance.
      2. 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.
      3. 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:
      1. 4 inches (10 cm); or
      2. 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.

8. 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

9. 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

4. 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).

5. 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 direct ERM supervision of ground disturbance activities as follows:
   a. 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] or
   b. Waive the requirement for direct ERM oversight of subcontractors, provided the scope of work is restricted to ground disturbance on a Remote/Greenfield site or will only involve shallow hand digging no deeper than 1.5 feet / 0.5 m. The use of subcontractors without direct ERM oversight shall be done in accordance with ERM's SUBS process.
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 4, 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,

[2] An SSC EP is not required to oversee SSC activities at Remote/Greenfield sites, as defined in Section 3 and Appendix 2. A waiver is not needed for these sites.

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 5.

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 5.

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. <u>The completed SSC Project Plan must be reviewed and approved by the PIC before any point disturbance clearance or ground disturbance activities may begin.</u> 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 Project Plan for Remote/Greenfield Sites (ERM-1511-FM2) –** version of the SSC Project Plan that can be used as an alternative for Remote/Greenfield sites, as defined in Section 3 and Appendix 2.
- **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 utility or structure that is verified as not damaged, or is determined to be NOT 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.

   Also, refusal caused by rocks, difficult geology, debris, 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-1511-FM1 - SSC Project Plan
- ERM-1511-FM2 - SSC Project Plan for Remote/Greenfield Sites
- 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-1140-FM2 – Request for Procedure / Process Deviation
- ERM-1530-PR1 – Aquatic Work Management Program
- ERM-1545-GU1 - Guidance on Avoiding Contact with Overhead Utility Lines
- ERM-1200-PR1- Event and Non-conformity Management Procedure
- ERM-1220-PR1 - Event Investigation Procedure
- ERM-1934-PR1 - Monitoring and Measurement Procedure

Document Control Information

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Approval Signature: Gary Beswick

Revision History

Section	Version No: Reason for Revision	Date
All	2.0: Major Revision	Sept 2009
All	3.0: Major Revision.	April 2013
All	3.0: Clarified near miss reporting	October 2013
All	3.1: Formatted for upload to Document Control System (DCS); added approval signature block for GHSD; Modified language in Appendix A flowchart for physical clearance requirements to match procedure text; removed field forms for upload to DCS as separate controlled documents	February 2015
All	3.2: Clarified applicability of SSC Process as it applies to contractors and third parties, inundated areas, areas covered by snow/ice, and UXO/MEC; removed 1 foot (0.3 meter) depth exemption from definition of ground disturbance; clarified definition of intercept / near miss related to abandoned structures designated for removal; added reference to SSC Field Review Checklist for Contractors; added waiver for SSC EP presence when hand digging in uppermost 1 foot; made other minor revisions for clarity but without changing content.	March 2015
All	4.0: Re-formatted. Removed public locate waiver. Modified SSC EP waiver. Merged SSC Project Plan with SSC Field Checklist forms. Removed SSC Location Disturbance Permit. Made explicit requirement for PIC/PM approval of SSC project Plan after completion of certain steps in SSC process. Removed references to “non-conductive” tools. Revised SSC flow chart in Appendix 1. Numerous other changes to respond to incident trends.	May 2017
4.8	4.1: Clarified core diameters must meet or exceed ‘the larger of 4 inches or’ 125% OD.	June 2017
11	4.2: Updated all links to post official version to DCS.	Sept 2017
1,5	4.3: SSC procedure not applicable to underwater ground disturbances in water deeper than 6 ft / 2m. Modified waiver to allow for no direct ERM supervision of subcontractor ground disturbance if site is Remote/Greenfield or hand digging <1.5 ft / 0.5 m)	June 2020
4.1, 4.2, 4.4, 4.5, 4.6, 4.9, 8, 9	4.4 & 4.5: Clarified expectations for determining clearance depths prior to use of mechanized equipment; any unexpected encounters require the area to be reclassified as a Critical Zone. Defined expectations around: SSC Training requirements, tracking of client-received files and deliverables, full utilization of all client- or third party-provided information, full inspection of all visual clues, notation of 3-phase power (if present), and PIC/PM review meeting responsibilities.	Oct 2020, Nov 2020
4.1, 4.4, 6	4.6: Noted the additional hazards that may occur during visual inspection (in Section 4.4); clarified that only employees directly involved in SSC ground disturbance activities require SSC GE status.	Feb 2021
Appendix 3	4.7: Clarifications added to Appendix 3	Mar 2021
References	4.8: Updated reference URLs; changed version number but did not update issue date	13 Aug 2021
All	4.9: Minor text revisions for clarity; no significant changes to process. Section 4.1 – clarified that ground disturbance activities post-SSC can be performed / overseen by an SSC GE; Section 5 – clarified how waivers can be applied	29 April 2022

Subsurface Clearance (SSC) Process – Overview Flow Chart
ERM-1511-PR1 – Appendix 1

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 Project Plan for Remote/Greenfield Sites (ERM-1511-FM2)
- 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

* - Step not required for Remote / Greenfield projects

Subsurface Clearance (SSC) Process – Detailed Flow Chart
ERM-1511-PR1 – Appendix 1

MAIN PROCESS STEPS
[SSC Procedure Section 4]

DOES THE PROJECT MEET SSC CRITERIA?

SSC is required before any activities that involve penetration of the ground surface to any depth, and / or the drilling, coring, or removal of engineered surfaces such as pavement or concrete.

Examples include:
- Hand digging or hand auger
- Drilling, direct-push or Geoprobe® borings
- Well installation or well over-drilling
- Excavation, trenching, or grading
- Coring/drilling into concrete or asphalt
- Installation of soil vapor points
- Driving of posts, stakes, rods, poles, or sheet piles.

NO

Project does not require SSC Process

YES

TRAINING & STAFFING

All employees working on, managing, or serving as PIC on SSC projects must have current SSC Certification.

An SSC Experienced Person (EP) must be assigned to the project, unless:

1. The project is a Remote / Greenfield site, as defined in the SSC Procedure; or
2. A waiver has been issued

KNOWLEDGABLE CONTACT(S)

Identify all contact person(s) knowledgeable of the subsurface and/or historical operations at the work location. Request any available information from them and review preliminary site services model with them. Request participation of the contact person(s) during the site walk and visual clues survey.

GATHER SITE INFORMATION

Obtain all available and relevant site-related information, such as:
- as-built drawings and site plans
- aerial photographs
- information obtained as part of previous site investigations
- soil surveys and/or boring logs

PUBLIC UTILITY LOCATE

Where they exist, public utility locator(s) must be contacted to provide all available information and services. Where available, they should also be asked to mark utilities at the site in accordance with local regulatory requirements.

SITE WALK

Conduct a visual survey of planned ground disturbance locations and surrounding areas to identify signs of potential subsurface utilities and structures. If available, contact person(s) should participate and approve planned ground disturbance locations.

If ANY evidence of subsurface utilities or structures are identified at a Remote/Greenfield site, the team must STOP WORK and review the findings with the PIC.

PRIVATE UTILITY LOCATE*

Use a private utility locator to locate and mark utilities on the project site. All available and site-appropriate detection equipment and methods should be used, and the findings of the private utility locate must be documented.

* This step is not required for Remote/Greenfield sites, except where required by local regulations or client procedures.

CRITICAL ZONE DETERMINATION*

If any planned ground disturbance locations will be inside Critical Zones (within 10 feet or 3 meters) of any identified subsurface structure:
- The locations must be moved outside the Critical Zone, or
- The locations must be approved by waiver

* This step is not required for Remote/Greenfield sites, provided that the site walk confirms there are NO subsurface utilities or structures present.

PIC must approve completed SSC Project Plan before any ground disturbance occurs!

STOP

CLEARANCE

For **Point Disturbance Locations:**
- Use an approved clearance method (refer to SSC Procedure) to clear each location to the required depths and diameters

For **Excavations and Trenches:**
- Clear areas as necessary to confirm the presence / absence of services
- Communicate Excavation Buffers to contractors
- No mechanical digging inside Excavation Buffers! (2 feet or 0.6 meters)

During clearance, the SSC EP should be observant for the presence of warning signs indicating non-native soil, fill materials, or the presence of unexpected subsurface structures.

FIELD DOCUMENTS
[SSC Procedure Section 7]

SSC PROJECT PLAN
- *ERM-1511-FM1*
- Completed for each phase of ground disturbance activities
- Documents sources of information and field activities, and includes Site Services Model
- Includes waiver approvals
- Must be reviewed and approved by the PIC before ground disturbance may begin

SSC PROJECT PLAN FOR REMOTE / GREENFIELD SITES
- *ERM-1511-FM2*
- This version of the SSC Project Plan can be used as an alternative for Remote / Greenfield sites

SSC MENTORSHIP CARD
- *ERM-1511-FM4*
- Can be used by SSC GEs to document field mentoring received by different SSC EPs.

SSC REVIEW CHCKLIST FOR SUBCONTRACTORS
- *ERM-1511-FM5*
- Used to conduct and document safety meetings with subcontractor personnel, to ensure they have been briefed on the applicable components of ERM's SSC Process.

AUDITING
[SSC Procedure Section 10]

SSC AUDIT FORM
- *ERM-1511-FM3*
- SSC PICs and BU MPs must complete at least 1 SSC audit per year
- Online form available on Active Leadership Audit Program (ALAP) page
- Final audits must be uploaded via the online form
- Any deficiencies should be closed out immediately if possible, or entered in the online audit form as Corrective and Preventive Actions (CAPAs)

MANAGING CHANGE
[SSC Procedure Section 8]

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 of change include (but are not limited to):
- Changes in the locations, dimensions, or extent of planned ground disturbance locations
- Changes in equipment or methods to be used
- Changes in project personnel (including contractors)
- Changes in site conditions (e.g., newly identified or suspected utilities, weather, other nearby activities)
- The presence of any warning signs while digging
- Any safety event or identified hazard

SAFETY EVENT REPORTING
[SSC Procedure Section 9]

If there is an unexpected encounter with a subsurface utility or structure (or any other safety event):
1. Stop work and secure / stabilize the situation (this could include getting medical attention for any injured or ill persons, evacuating the area, notifying owner / operator of damage, etc.). ERM and subcontractor personnel must observe a no touch principle.
2. Immediately notify the PIC, PM, and H&S Team
3. Do not re-start work without the concurrence of the SSC EP, PIC, PM, and H&S
4. Enter the event into the Event Communication System (ECS) within 24 hours
5. Follow-up investigation and management review will be conducted per ERM's Event Management and Investigation procedures.

Appendix 2: Remote/Greenfield Site Criteria

Remote/Greenfield sites are those situated in remote/rural or wilderness areas, with no evidence of subsurface structures present after completing the relevant SSC process steps outlined in Section 4, and where ONLY hand digging or hand augering is to be conducted. To be classified as a Remote/Greenfield site (or to classify portions of a larger site as Remote/Greenfield), the Partner-in-Charge (PIC) of the project must possess sufficient knowledge and experience to evaluate the site based on the following criteria and be able to determine the possible presence or absence of subsurface structures.

For a site to be classified as "Remote/Greenfield", the answer to ALL of the following questions must be "NO."

1. Will the scope of ERM or subcontractor activities include any form of mechanized digging/excavation, or the drilling, coring, or removal of engineered surfaces such as pavement or concrete?
2. Did a review of the most recent available maps and aerial photos or historical maps or aerial photos indicate the presence of anthropogenic activity that might have resulted in the presence of subsurface structures or useful property?
3. Is the site used for commercial purposes (excluding field agriculture or tree planting/harvesting) or was it so used based on the review of available maps and aerial photos?
4. Is the proposed site within 1.0 kilometer of a developed area (town, city or other large human settlement) that exceeds more than 50 inhabitants?
5. Is the proposed site within 100 meters of an isolated habitation dwelling (defined as the only habitation dwelling within 500 meters)?
6. Unexploded Ordinance/Munitions of Explosive Concern (UXO/MEC) risks have been assessed and UXO/MEC is present or potentially present?

Remote/Greenfield site status must be confirmed in the field by completing the site walk and visual clues survey as outlined in Section 4.4 of the SSC Procedure. If any evidence of subsurface structures is identified, the site must no longer be considered a Remote/Greenfield site.

Appendix 3: Guidance on Selection and Use of Detection Equipment

3.1 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

3.2 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** <12" diameter **Y**	**Y**	**Y**
Sewer/Water Line (Non-metallic)	**R**	**R**	**R**	**R**	**G**	>12" diameter **G** <12" diameter **Y**	**G**	**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** <12" diameter **Y**	**R**	**G**
Natural Gas Line (Non-metallic/PVC)[7]	**R**	**R**	**R**	**R**	**R**	>12" diameter G <12" diameter Y	**R**	**R**
Metallic/Non-Metallic Line (w/Tracer Wire)	**G**	**G**	**G**	**Y**	**Y**	>12" diameter **G** <12" diameter **Y**	**Y**	**Y**
Metallic/Non-Metallic Line (w/o Tracer Wire)	**R**	**R**	**Y**	**Y**	**Y**	>12" diameter **G** <12" diameter **Y**	**Y**	**R**
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.
8 = Access: induce unique electronic signature, apply acoustical impulse, or insert probe/beacon/sonde.

3.3 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 4: 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 direct ERM supervision of ground disturbance activities as follows:
    a. 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);[3] or
    b. Waive the requirement for direct ERM oversight of subcontractors, provided the scope of work is restricted to ground disturbance on a Remote/Greenfield site or will only involve shallow hand digging no deeper than 1.5 feet / 0.5 m. The use of subcontractors without direct ERM oversight shall be done in accordance with ERM's Subcontractor Use Basic Standards (SUBS) process.
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.

[3] An SSC EP is not required to oversee SSC activities at Remote/Greenfield sites, as defined in Section 3 and Appendix 2. A waiver is not needed for these sites.

2. Relative hazard of striking the services known or suspected to be present (i.e., not confirmed as absent from the site).

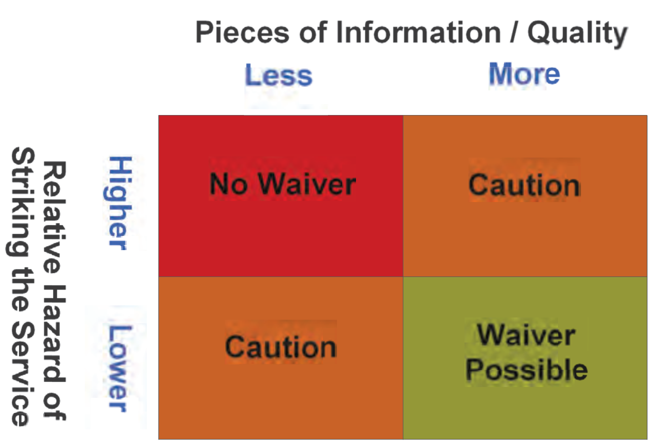
The relative hazard of striking a service can be prioritized in terms of the potential severity of such a strike in terms of health, safety, environmental, or financial / reputational consequences. All other things being equal, an example prioritized list of common underground services – from high hazard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

a. High / medium voltage electrical cables
b. Low voltage electrical cables
c. Pressurized gas lines
d. Other pressurized pipelines
e. Fiber optic cables
f. Gravity drain process sewers
g. Gravity drain sanitary sewers
h. 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



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								
	Present?			Anticipated depth (note units)	Located?		Status (active, inactive, abandoned, etc)	Comments (For each, describe how located and quality of information available)
Utility / Structure	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.

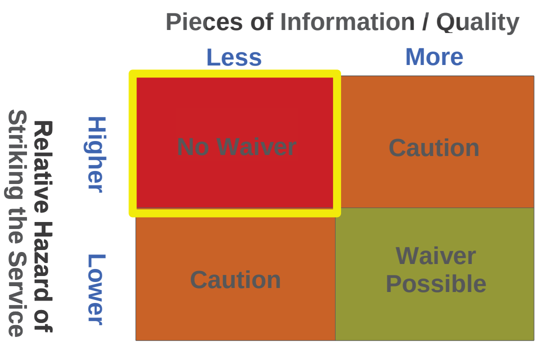
What follows is an illustration of the decision-making process, based on the situation presented in the Example Project.

<u>Waiver Decision: Private Markouts</u>

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 <u>zero lines of evidence concerning the route of the hydrogen pipeline</u>.

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).

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:

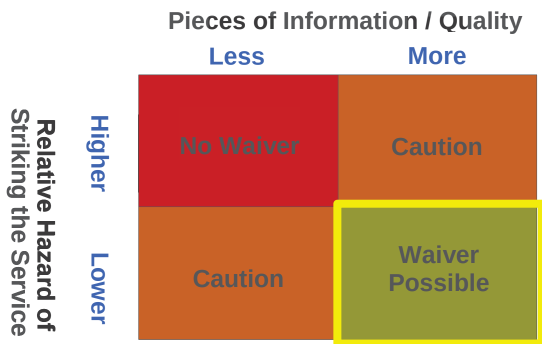
- If possible, energized pipes or cables within the Critical Zone should be de-energized.
- Ground disturbance activities within the Critical Zone do not present an unacceptable safety, environmental, or operational risk, either on-site or off-site.

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.

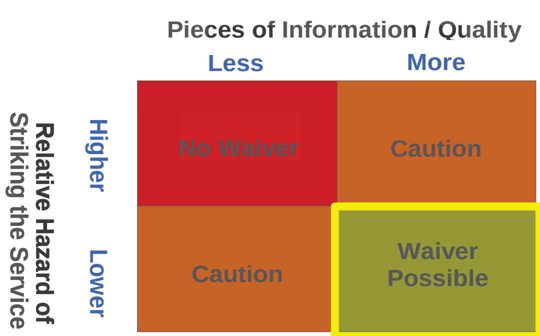
Waiver Decision: Point Disturbance Clearance

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?

The Point Disturbance Clearance Waiver Decision



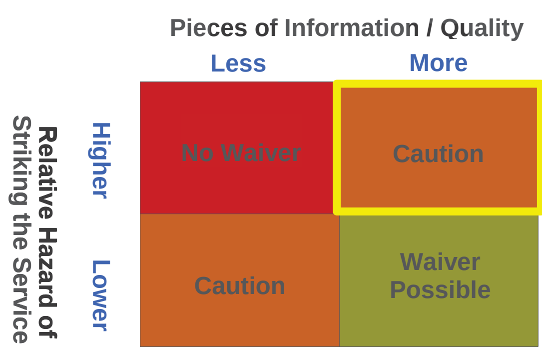
There are multiple, good quality lines of evidence that confirm the routes of nearby services (as well as the absence of others), and the former process sewer ranks low in terms of relative hazard. In this case, the PIC is reasonably assured that waiving the point disturbance clearance requirement is 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 Wavier 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?
- 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 5 – 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.

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 Health and Safety Director.

Project Manager (PM)/Supervisor/Area Manager: Responsible for the following elements:

- Perform observations of ERM work processes to assess whether or not employees are operating in accordance with the procedure; and
- Correct, in conjunction with the PIC and the Business Unit Health and Safety Director, any observed deficiencies in the implementation of the procedure.

Business Unit Health and Safety Director: Responsible for the following elements:

- Evaluate implementation of the procedure by Business Unit (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, Health and Safety (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 of 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 Work Site 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 are 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 ERM H&S Procedure 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 ERM Procedure 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.

4.3.2 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.

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 Control Information

Original Effective Date: 8/5/14

Policy Approval by: Millard Griffin

Approval Signature: ______________________

Revision History

Section	Reason for Revision	Date
All	Revised and edited to meet new Global SMS requirements and update procedures	8/5/14
All	Changed “Case Management” to “Injury/Illness Management”.	12/30/14
Intro, 4, 5	Updated Applicability. Updated references in Sections 4 and 5.	1/12/16
All	Updated Document Number; updated titles (Section 2); updated paragraph alignment throughout; updated referenced document numbers (Section 4); updated References (Section 5)	1/10/17
4	Language revisions throughout.	2/20/20
4.3	Revised information on return to work policies, including transitional work	8/19/20
4.2.3	Added information on applicability of WorkCare Incident Intervention services.	4/13/21

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 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, 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 Health and Safety Director.

Area Manager/Project Manager: 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 ore moved 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.

Business Unit Health and Safety Director: Responsible for the following elements:

- Assist PICs, Area Managers, and Project Managers 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/Project Manager 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 chemical 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 NAM-1301-WI1 (*Examples of Common Labeling Systems*).

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 complaint with the 16-section GHS recommendations which has 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, Project Managers will determine during HASP development if ERM employees will use chemicals during execution of the project. During this development and review period, the Project Manager 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 Project Manager will work with the Business Unit Health and Safety 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 Business Unit Health and Safety 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 Project Manager/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 Project Manager 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 Project Manager 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 Project Manager 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-1301-FM1 (*Chemical Inventory Sheet*)
- ERM Work Instruction NAM-1301-WI1 (*Examples of Common Labeling Systems*)
- 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 Control Information

Original Effective Date: 1/29/15

Policy Approval by: Millard Griffin

Approval Signature:

Revision History

Section	Reason for Revision	Date
All	Changed format; updated to meet state and federal regulations	6/2/15
4.1	Require all portable containers to have equivalent labels except where noted	8/18/16
All	Updated Document Number; updated titles (Section 2); updated paragraph alignment throughout; updated referenced document numbers (Section 4); updated References	1/16/17
All	Updated titles and procedures to address WHMIS requirements	1/23/18
1, 4, 5	Revised Purpose statement (Section 1); minor changes to labeling and training requirements (Section 4); added reference to US and Canada regulations	6/26/18
4.1	Added additional information regarding replacement of label information	2/15/19
All	Minor language revisions throughout.	3/25/20
4, 5	Removed reference to NAM-1301-WI2. Updated references.	3/27/20

1. Project Information

Name/Location	
Project Number	
Date/Time	

2. Instrument Information

Type	
Brand	
Model	

3. Calibration Details (use one form per instrument per day)

Type	Calibration Gas Value	Measured Result	Correction Factor (CF) Needed?[1] (Yes/No)
Fresh Air	NA		NA
Zero Gas			NA
Span Gas #1:			
Span Gas #2:			
Span Gas #3:			
Span Gas #4:			

4. Monitoring Results

Time	Contaminant	Location	Result	CF (if needed)	Adjusted Result (Result x CF)

Time	Contaminant	Location	Result	CF (if needed)	Adjusted Result (Result x CF)

5. Completion[2]

Name	
Signature	

6. Notes

1. Correction factors (CF) may be needed for instrumentation where the span gas used is different from the chemical of concern (COC) being evaluated. Many air monitors, such as photoionization detectors (PIDs), are broadband instruments which will respond to all gases which the detector will ionize. Because the instrument will respond differently to the span gas than the COC, a CF can be applied to adjust the reading, producing a result more indicative of actual COC concentrations.

   The CF for a compound is developed under laboratory conditions by the manufacturer and is the ratio of the instrument response to the calibration gas over the instrument response to the COC. Therefore, the true concentration of the COC can be obtained by multiplying the monitor response by the CF. The instrument manufacturer's documentation will provide a list of CFs where applicable.

   Note that some instrumentation is designed to adjust for CFs automatically and produce true readings. Consult instrument documentation to determine if this is a feature of your instrument.

2. Retain completed form in project files.

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 Health and Safety Director.

Project Manager/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 or not employees are operating in accordance with this procedure; and
- Correct, in conjunction with the PIC and the Business Unit Health and Safety Director, any observed deficiencies in the implementation of this procedure.

Business Unit Health and Safety 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 as a result 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 Safety Eyewear*) provides additional details regarding purchase and care of prescription safety glasses.

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 and cold, and other hand injuries. NAM-1324-PR1 (*Safe Use of Cutting Tools*) provides additional information on gloves types providing protection from cuts.

4.2.4 Head Protection

Hard hats approved by the American National Standards Institute (ANSI)/International Safety Equipment Association (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 where worn frontward or backward.

4.2.5 Body Protection

Body protection may be required for a number of workplace hazards including, but not limited to:

- Extreme heat or hold

- Flames and sparks
- Impacts from equipment and materials
- Skin exposure to hazardous chemicals
- Exposure to bloodborne pathogens
- 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 the 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 shall receive initial training on risk assessment and hazard identification as part of EMR's Observation and Feedback Program (OFP) 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 employee 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), Project Manager, or Business Unit Health and Safety 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 Work Instruction NAM-1310-WI3 (*Selection, Care, and Use of Flame-Resistant Clothing*)
- 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 Control Information

Original Effective Date: 2/10/15

Policy Approval by: Millard Griffin

Approval Signature:

Revision History

Section	Reason for Revision	Date
All	New document.	2/10/15
All	Reformatted to meet ERM Global standards; language changes for clarity	1/14/16
All	Updated Document Number; updated titles (Section 2); updated paragraph alignment throughout; updated referenced document numbers (Section 4); updated References (Section 5)	1/10/17
4.3	Included discussion of risk assessment training	1/16/18
4.1	Revised criteria for workplace hazard assessments	2/15/19
All	Minor language changes	2/26/20
4.2.4	Added reference to Z89.1	5/15/20
4.2.5	Added section on body protection	5/26/21

1. Purpose and Scope

This procedure identifies jobs and tasks at ERM where occupational exposure to bloodborne pathogens (i.e., human immunodeficiency virus (HIV), hepatitis B and C viruses, and others) may occur and develops controls to eliminate or significantly reduce the risk of exposure to infectious bloodborne diseases. This procedure will also discuss provisions for employees to receive personal protective equipment (PPE), Hepatitis B vaccinations, training, and confidential medical evaluations and follow-up (if needed). This document applies to all ERM US field 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 Health and Safety Director.

Project Manager (PM)/Area Manager: Responsible for the following elements:

- Performing observations of ERM work processes to assess whether or not 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, Business Unit Health and Safety Director, and the Program Administrators, any observed deficiencies in the implementation of this procedure.

Business Unit Health and Safety 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.

Regional Health and Safety Director: Responsible for the following elements:

- Implementing this procedure throughout the Region; and
- Evaluating the Exposure Control Plan (*NAM-1325-WI1*) on an annual basis.

3. Definitions

Bloodborne Pathogens: Pathogenic microorganisms that are present in human blood and can cause disease in humans. These pathogens include, but are not limited to, hepatitis B and C virus and HIV.

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 Exposure Determination

On ERM project sites, the PIC and PM, with assistance from the Business Unit Health and Safety Director, will perform an exposure determination concerning which employees may or may not have exposure to bloodborne pathogens. This exposure determination will be conducted as part of the initial project risk assessment and will be included in health and safety planning documents. Employees will be classified into two categories:

- Employees formally designated as part of their job to perform tasks that may involve direct contact with blood or potentially infectious body fluids. Typically ERM FSOs will be included in this category. These employees will require initial and annual training, will be offered the Hepatitis B vaccination series, and will be required to follow those procedures outlines in NAM-1325-WI1 (*Exposure Control Plan*).
- Employees not assigned to jobs or tasks that involve exposure to blood or potentially infectious body fluids, but who could, in extraordinary situations, voluntarily assist injured or ill individuals and, therefore, could have exposure to bloodborne pathogens. These employees will follow post-exposure procedures as outlined in NAM-1325-WI1 in an exposure occurs.

4.2 Engineering Controls

Since ERM is a consulting firm, there are no typical operations applicable to bloodborne pathogens requiring engineering controls. However, if conditions warrant the use of engineering controls with regard to bloodborne pathogens (e.g., significant and continued exposure to sharps, site cleanups involving medical or infectious wastes), appropriate controls will be developed, examined, and maintained or replaced on an annual basis to ensure their effectiveness.

4.3 Exposure Control Methods

All employees will utilize universal precautions – an approach to infection control where all human blood and body fluids are treated as potentially infectious. Appropriate engineering and work practice controls (e.g., sharps disposal containers, performing procedures to prevent splashing) will be used to eliminate or minimize exposure to employees. Personal protective equipment (e.g., disposable gloves, face masks with eye protection) will be provided and used in order to place a barrier between the employee and the blood or body fluids.

Hands are to be washed immediately with soap and water after removing gloves or performing any work with blood or body fluids. Housekeeping and decontamination of work surfaces with EPA-registered germicides or a bleach solution diluted 1:10 with water, will be performed as needed to maintain a safe working environment.

In the event that an employee is exposed to blood or body fluids, they should immediately flush and clean the affected area with copious amounts of soap and water. WorkCare, ERM's Medical Services provider, will arrange a confidential medical evaluation and follow-up with an occupational physician for the employee as soon as possible following the report of an exposure incident.

Regulated biohazardous waste (contaminated sharps or items that are capable of releasing blood or body fluids through employee handling) will be disposed of in special waste receptacles lined with red bags and incinerated per federal and state regulations. This does not include small amounts of waste from a minor wound which can be sealed in a plastic bag and disposed of in regular trash

4.4 Hepatitis B Vaccination

The Hepatitis B vaccination series will be made available at no cost to all employees who have been designated to perform tasks that may involve direct exposure to bloodborne pathogens (i.e., FSOs). Further, this vaccination series will be made immediately available to employees that have had an occupational bloodborne exposure incident, whether as a result of their assigned tasks or occurring as a result of incidental contact.

Employees may choose to decline the Hepatitis B vaccination upon offer by completing NAM-1325-FM1 (*Hepatitis B Vaccination Declination Form*) or equivalent. If in the future the employee desires to complete the vaccination series due to continued occupational exposure, it will be provided at no cost.

Medical records will be maintained for the employee's duration of employment plus 30 years.

4.5 Training

Initial and refresher training classes for bloodborne pathogens are available through ERM's Academy Learning Management System (LMS). Training will be conducted for all employees assigned to tasks where occupational exposure may occur. Records will be maintained for a minimum of three years.

4.6 Access and Review of Written Procedures

All employees or their representatives and governmental officials may request a copy of any written program by contacting their Business Unit Health and Safety Director.

This procedure will be reviewed annually and whenever necessary to include new or modified tasks or procedures.

5. References

- ERM Procedure NAM-1811-PR1 (*Access to Medical and Exposure Records*)
- ERM Form NAM-1325-FM1 (*Hepatitis B Vaccination Declination Form*)
- ERM Work Instruction NAM-1325-WI1 (*Exposure Control Plan*)
- Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.151 (*Medical Services and First Aid*)
- OSHA 29 CFR 1910.1030 (*Bloodborne Pathogens*)

Document Control Information

Original Effective Date: 2/22/16

Policy Approval by: Millard Griffin

Approval Signature: Millard P. Griffin Jr.

Revision History

Section	Reason for Revision	Date
All	New document.	2/22/16
4	Added information on record retention	1/19/18
1, 4	Minor language revisions	6/8/20
All	Removed references to Floor Wardens.	10/6/21

<table>
<tr><td rowspan="4"></td><td colspan="2">Applicability:</td><td rowspan="2">Procedure</td><td>Document Number:</td><td>Version:</td></tr>
<tr><td colspan="2">North America</td><td>NAM-1329-PR1</td><td>4</td></tr>
<tr><td>Title:</td><td colspan="2">Hand Tools and Portable Power Equipment</td><td>Last Revision Date:</td><td>2/4/21</td></tr>
</table>

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 a 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 Health and Safety Director or other staff member.

Project Manager: 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 Business Unit Health and Safety Director, any observed deficiencies in the implementation of this procedure.

Business Unit Health and Safety 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.

Underwriters Laboratories (UL): A global product safety testing and certification organization.

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 (extension cords) 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.
- 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.
- 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 safety and health risks.

4.2 Hand Tool Use

- Do not force tools beyond their capacity or use cheater bars or other instruments to increase their capacity.
- 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.
- Ensure that hands, fingers, and other body parts are out of the line of fire during tool usage.
- Brace yourself when using the tool in case the tool slips.

4.3 Portable Power Tool Use

- Loose clothing, long hair, loose jewelry, rings and chains are not allowed while working with power tools.
- Hands shall be kept clear of all cutting, rotating, or moving parts of powered tools.
- Portable power tools shall be safety tested and certified by Underwriters Laboratories (UL) or an equivalent authority.
- Electric power tools must be either double-insulated or equipped with a 3-wire grounded wiring and plug.
- Adapters which interrupt the continuity of the equipment grounding connection shall not be used.
- 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.
- 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 ERM Procedures NAM-1302-PR1 (Equipment Maintenace and Calibration) and ERM-1934-PR1 (Monitoring and Measurement).

5. References

- Occupational Health and Safety Adminsitration (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*)

Document Control Information

Original Effective Date: 6/29/15

Policy Approval by: Millard Griffin

Approval Signature:

Revision History

Section	Reason for Revision	Date
All	New document.	6/29/2015
All	Updated Document Number; updated titles (Section 2); updated paragraph alignment throughout; updated referenced document numbers (Section 4); updated References (Section 5)	1/10/17
All	Minor language updates	8/20/20
4	Added information on ergonomic risk and rentention of maintenance records	2/4/21

MATERIAL SAFETY DATA SHEET

ALCONOX®

Prepared to U.S. OSHA, CMA, ANSI, Canadian WHMIS, Australian WorkSafe, Japanese Industrial Standard JIS Z 7250:2000, and European Union REACH Regulations

SECTION 1 - PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME:	**ALCONOX®**	
CHEMICAL FAMILY NAME:	Detergent.	
PRODUCT USE:	Critical-cleaning detergent for laboratory, healthcare and industrial applications	
U.N. NUMBER:	Not Applicable	
U.N. DANGEROUS GOODS CLASS:	Non-Regulated Material	
SUPPLIER/MANUFACTURER'S NAME:	Alconox, Inc.	
ADDRESS:	30 Glenn St., Suite 309, White Plains, NY 10603. USA	
EMERGENCY PHONE:	**TOLL-FREE in USA/Canada**	800-255-3924
	International calls	813-248-0585
BUSINESS PHONE:	914-948-4040	
DATE OF PREPARATION:	May 2011	
DATE OF LAST REVISION:	February 2008	

SECTION 2 - HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: This product is a white granular powder with little or no odor. Exposure can be irritating to eyes, respiratory system and skin. It is a non-flammable solid. The Environmental effects of this product have not been investigated.

US DOT SYMBOLS

Non-Regulated

CANADA (WHMIS) SYMBOLS

EUROPEAN and (GHS) Hazard Symbols

Signal Word: **Warning!**

EU LABELING AND CLASSIFICATION:

Classification of the substance or mixture according to Regulation (EC) No1272/2008 Annex 1
EC# 205-633-8 This substance is not classified in the Annex I of Directive 67/548/EEC
EC# 268-356-1 This substance is not classified in the Annex I of Directive 67/548/EEC
EC# 231-838-7 This substance is not classified in the Annex I of Directive 67/548/EEC
EC# 231-767-1 This substance is not classified in the Annex I of Directive 67/548/EEC
EC# 207-638-8 Index# 011-005-00-2
EC# 205-788-1 This substance is not classified in the Annex I of Directive 67/548/EEC

GHS Hazard Classification(s):
Eye Irritant Category 2A

Hazard Statement(s):
H319: Causes serious eye irritation

Precautionary Statement(s):
P260: Do not breath dust/fume/gas/mist/vapors/spray
P264: Wash hands thoroughly after handling
P271: Use only in well ventilated area.
P280: Wear protective gloves/protective clothing/eye protection/face protection/

Hazard Symbol(s):
[Xi] Irritant

Risk Phrases:
R20: Harmful by inhalation
R36/37/38: Irritating to eyes, respiratory system and skin

Safety Phrases:
S8: Keep container dry
S22: Do not breath dust
S24/25: Avoid contact with skin and eyes

HEALTH HAZARDS OR RISKS FROM EXPOSURE:

ACUTE: Exposure to this product may cause irritation of the eyes, respiratory system and skin. Ingestion may cause gastrointestinal irritation including pain, vomiting or diarrhea.

CHRONIC: This product contains an ingredient which may be corrosive.

TARGET ORGANS: ACUTE: Eye, respiratory System, Skin CHRONIC: None Known

SECTION 3 - COMPOSITION and INFORMATION ON INGREDIENTS

HAZARDOUS INGREDIENTS:	CAS #	EINECS #	ICSC #	WT %	HAZARD CLASSIFICATION; RISK PHRASES
Sodium Bicarbonate	144-55-8	205-633-8	1044	33 - 43%	HAZARD CLASSIFICATION: None RISK PHRASES: None
Sodium (C10 – C16) Alkylbenzene Sulfonate	68081-81-2	268-356-1	Not Listed	10 – 20%	HAZARD CLASSIFICATION: None RISK PHRASES: None
Sodium Tripolyphosphate	7758-29-4	231-838-7	1469	5 - 15%	HAZARD CLASSIFICATION: None RISK PHRASES: None
Tetrasodium Pyrophosphate	7722-88-5	231-767-1	1140	5 - 15%	HAZARD CLASSIFICATION: None RISK PHRASES: None
Sodium Carbonate	497-19-8	207-638-8	1135	1 - 10%	HAZARD CLASSIFICATION: [Xi] Irritant RISK PHRASES: R36
Sodium Alcohol Sulfate	151-21-3	205-788-1	0502	1 – 5%	HAZARD CLASSIFICATION: None RISK PHRASES: None
Balance of other ingredients are non-hazardous or less than 1% in concentration (or 0.1% for carcinogens, reproductive toxins, or respiratory sensitizers).					

NOTE: ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-2004 format. This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR, EU Directives and the Japanese Industrial Standard *JIS Z 7250: 2000*.

SECTION 4 - FIRST-AID MEASURES

Contaminated individuals of chemical exposure must be taken for medical attention if any adverse effect occurs. Rescuers should be taken for medical attention, if necessary. Take copy of label and MSDS to health professional with contaminated individual.

EYE CONTACT: If product enters the eyes, open eyes while under gentle running water for at least 15 minutes. Seek medical attention if irritation persists.

SKIN CONTACT: Wash skin thoroughly after handling. Seek medical attention if irritation develops and persists. Remove contaminated clothing. Launder before re-use.

INHALATION: If breathing becomes difficult, remove victim to fresh air. If necessary, use artificial respiration to support vital functions. Seek medical attention if breathing dificulty continues.

INGESTION: If product is swallowed, call physician or poison control center for most current information. If professional advice is not available, do not induce vomiting. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or who cannot swallow. Seek medical advice. Take a copy of the label and/or MSDS with the victim to the health professional.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing skin, or eye problems may be aggravated by prolonged contact.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and reduce over-exposure.

SECTION 5 - FIRE-FIGHTING MEASURES

FLASH POINT: Not Flammable

AUTOIGNITION TEMPERATURE: Not Applicable

FLAMMABLE LIMITS (in air by volume, %): Lower (LEL): NA Upper (UEL): NA

FIRE EXTINGUISHING MATERIALS: As appropriate for surrounding fire. Carbon dioxide, foam, dry chemical, halon, or water spray.

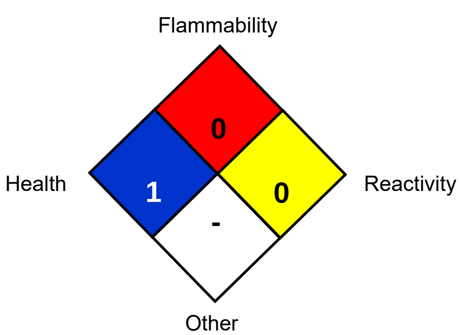
UNUSUAL FIRE AND EXPLOSION HAZARDS: This product is non-flammable and has no known explosion hazards.

Explosion Sensitivity to Mechanical Impact: Not Sensitive.

Explosion Sensitivity to Static Discharge: Not Sensitive

SPECIAL FIRE-FIGHTING PROCEDURES: Incipient fire responders should wear eye protection. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. Isolate materials not yet involved in the fire and protect personnel. Move containers from fire area if this can be done without risk; otherwise, cool with carefully applied water spray. If possible, prevent runoff water from entering storm drains, bodies of water, or other environmentally sensitive areas.

NFPA RATING SYSTEM



HMIS RATING SYSTEM

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

HEALTH HAZARD (BLUE)	**1**
FLAMMABILITY HAZARD (RED)	**0**
PHYSICAL HAZARD (YELLOW)	**0**

PROTECTIVE EQUIPMENT

EYES	RESPIRATORY	HANDS	BODY
	See Sect 8		See Sect 8

For Routine Industrial Use and Handling Applications

Hazard Scale: 0 = Minimal **1** = Slight **2** = Moderate **3** = Serious **4** = Severe * = Chronic hazard

SECTION 6 - ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Personnel should be trained for spill response operations.

SPILLS: Contain spill if safe to do so. Prevent entry into drains, sewers, and other waterways. Sweep, shovel or vacuum spilled material and place in an appropriate container for re-use or disposal. Avoid dust generation if possible. Dispose of in accordance with applicable Federal, State, and local procedures (see Section 13, Disposal Considerations).

SECTION 7 - HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting this product ON YOU or IN YOU. Wash thoroughly after handling this product. Do not eat, drink, smoke, or apply cosmetics while handling this product. Avoid breathing dusts generated by this product. Use in a well-ventilated location. Remove contaminated clothing immediately.

STORAGE AND HANDLING PRACTICES: Containers of this product must be properly labeled. Store containers in a cool, dry location. Keep container tightly closed when not in use. Store away from strong acids or oxidizers.

SECTION 8 - EXPOSURE CONTROLS - PERSONAL PROTECTION

EXPOSURE LIMITS/GUIDELINES:

Chemical Name	CAS#	ACGIH TWA	OSHA TWA	SWA
Sodium Bicarbonate	144-55-8	10 mg/m³ Total Dust	15 mg/m³ Total Dust	10 mg/m³ Total Dust
Sodium (C10 – C16) Alkylbenzene Sulfonate	68081-81-2	10 mg/m³ Total Dust	15 mg/m³ Total Dust	10 mg/m³ Total Dust
Sodium Tripolyphosphate	7758-29-4	10 mg/m³ Total Dust	15 mg/m³ Total Dust	10 mg/m³ Total Dust
Tetrasodium Pyrophosphate	7722-88-5	5 mg/m³	5 mg/m³	5 mg/m³
Sodium Carbonate	497-19-8	10 mg/m³ Total Dust	15 mg/m³ Total Dust	10 mg/m³ Total Dust
Sodium Alcohol Sulfate	151-21-3	10 mg/m³ Total Dust	15 mg/m³ Total Dust	10 mg/m³ Total Dust

Currently, International exposure limits are not established for the components of this product. Please check with competent authority in each country for the most recent limits in place.

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation to ensure exposure levels are maintained below the limits provided below. Use local exhaust ventilation to control airborne dust. Ensure eyewash/safety shower stations are available near areas where this product is used.

The following information on appropriate Personal Protective Equipment is provided to assist employers in complying with OSHA regulations found in 29 CFR Subpart I (beginning at 1910.132) or equivalent standard of Canada, or standards of EU member states (including EN 149 for respiratory PPE, and EN 166 for face/eye protection), and those of Japan. Please reference applicable regulations and standards for relevant details.

RESPIRATORY PROTECTION: Based on test data, exposure limits should not be exceeded under normal use conditions when using Alconox Detergent. Maintain airborne contaminant concentrations below guidelines listed above, if applicable. If necessary, use only respiratory protection authorized in the U.S. Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), equivalent U.S. State standards, Canadian CSA Standard Z94.4-93, the European Standard EN149, or EU member states.

EYE PROTECTION: Safety glasses. If necessary, refer to U.S. OSHA 29 CFR 1910.133 or appropriate Canadian Standards.

HAND PROTECTION: Use chemical resistant gloves to prevent skin contact.. If necessary, refer to U.S. OSHA 29 CFR 1910.138 or appropriate Standards of Canada.

BODY PROTECTION: Use body protection appropriate to prevent contact (e.g. lab coat, overalls). If necessary, refer to appropriate Standards of Canada, or appropriate Standards of the EU, Australian Standards, or relevant Japanese Standards.

SECTION 9 - PHYSICAL and CHEMICAL PROPERTIES

PHYSICAL STATE:	Solid
APPEARANCE & ODOR:	White granular powder with little or no odor.
ODOR THRESHOLD (PPM):	Not Available
VAPOR PRESSURE (mmHg):	Not Applicable
VAPOR DENSITY (AIR=1):	Not Applicable.
BY WEIGHT:	Not Available
EVAPORATION RATE (nBuAc = 1):	Not Applicable.
BOILING POINT (C°):	Not Applicable.
FREEZING POINT (C°):	Not Applicable.
pH:	9.5 (1% aqueous solution)
SPECIFIC GRAVITY 20°C: (WATER =1)	0.85 – 1.1
SOLUBILITY IN WATER (%)	>10% w/w
COEFFICIENT OF WATER/OIL DIST.:	Not Available
VOC:	None
CHEMICAL FAMILY:	Detergent

SECTION 10 - STABILITY and REACTIVITY

STABILITY: Product is stable
DECOMPOSITION PRODUCTS: When heated to decomposition this product produces Oxides of carbon (COx)
MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Strong acids and strong oxidizing agents.
HAZARDOUS POLYMERIZATION: Will not occur.
CONDITIONS TO AVOID: Contact with incompatible materials and dust generation.

SECTION 11 - TOXICOLOGICAL INFORMATION

TOXICITY DATA: Toxicity data is available for mixture:

CAS# 497-19-8 LD50 Oral (Rat)	4090 mg/kg
CAS# 497-19-8 LD50 Oral (Mouse)	6600 mg/kg
CAS# 497-19-8 LC50 Inhalation (Rat)	2300 mg/m³ 2H
CAS# 497-19-8 LC50 Inhalation (Mouse)	1200 mg/m³ 2H
CAS# 7758-29-4 LD50 Oral (Rat)	3120 mg/kg
CAS# 7758-29-4 LD50 Oral (Mouse)	3100 mg/kg
CAS# 7722-88-5 LD50 Oral (Rat)	4000 mg/kg

SUSPECTED CANCER AGENT: None of the ingredients are found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, IARC and therefore is not considered to be, nor suspected to be a cancer-causing agent by these agencies.
IRRITANCY OF PRODUCT: Contact with this product can be irritating to exposed skin, eyes and respiratory system.
SENSITIZATION OF PRODUCT: This product is not considered a sensitizer.
REPRODUCTIVE TOXICITY INFORMATION: No information concerning the effects of this product and its components on the human reproductive system.

SECTION 12 - ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.
ENVIRONMENTAL STABILITY: No Data available at this time.
EFFECT OF MATERIAL ON PLANTS or ANIMALS: No evidence is currently available on this product's effects on plants or animals.

EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on this product's effects on aquatic life.

SECTION 13 - DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations, those of Canada, Australia, EU Member States and Japan.

SECTION 14 - TRANSPORTATION INFORMATION

US DOT; IATA; IMO; ADR:
THIS PRODUCT IS NOT HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.
PROPER SHIPPING NAME: Non-Regulated Material
HAZARD CLASS NUMBER and DESCRIPTION: Not Applicable
UN IDENTIFICATION NUMBER: Not Applicable
PACKING GROUP: Not Applicable.
DOT LABEL(S) REQUIRED: Not Applicable
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2004): Not Applicable
MARINE POLLUTANT: None of the ingredients are classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B)

U.S. DEPARTMENT OF TRANSPORTATION (DOT) SHIPPING REGULATIONS:
This product is not classified as dangerous goods, per U.S. DOT regulations, under 49 CFR 172.101.

TRANSPORT CANADA, TRANSPORTATION OF DANGEROUS GOODS REGULATIONS:
This product is not classified as Dangerous Goods, per regulations of Transport Canada.

INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA):
This product is not classified as Dangerous Goods, by rules of IATA:

INTERNATIONAL MARITIME ORGANIZATION (IMO) DESIGNATION:
This product is not classified as Dangerous Goods by the International Maritime Organization.

EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY ROAD (ADR):

This product is not classified by the United Nations Economic Commission for Europe to be dangerous goods.

SECTION 15 - REGULATORY INFORMATION

UNITED STATES REGULATIONS

SARA REPORTING REQUIREMENTS: This product is not subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act., as follows: None

TSCA: All components in this product are listed on the US Toxic Substances Control Act (TSCA) inventory of chemicals.

SARA 311/312:

Acute Health:	Yes	Chronic Health:	No	Fire:	No	Reactivity:	No

U.S. SARA THRESHOLD PLANNING QUANTITY: There are no specific Threshold Planning Quantities for this product. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lb (4,540 kg) may apply, per 40 CFR 370.20.

U.S. CERCLA REPORTABLE QUANTITY (RQ): None

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): None of the ingredients are on the California Proposition 65 lists.

CANADIAN REGULATIONS:

CANADIAN DSL/NDSL INVENTORY STATUS: All of the components of this product are on the DSL Inventory

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: No component of this product is on the CEPA First Priorities Substance Lists.

CANADIAN WHMIS CLASSIFICATION and SYMBOLS: This product is categorized as a Controlled Product, Hazard Class D2B as per the Controlled Product Regulations

EUROPEAN ECONOMIC COMMUNITY INFORMATION:

EU LABELING AND CLASSIFICATION:

Classification of the mixture according to Regulation (EC) No1272/2008. See section 2 for details.

AUSTRALIAN INFORMATION FOR PRODUCT:

AUSTRALIAN INVENTORY OF CHEMICAL SUBSTANCES (AICS) STATUS: All components of this product are listed on the AICS.

STANDARD FOR THE UNIFORM SCHEDULING OF DRUGS AND POISONS: Not applicable.

JAPANESE INFORMATION FOR PRODUCT:

JAPANESE MINISTER OF INTERNATIONAL TRADE AND INDUSTRY (MITI) STATUS: The components of this product are not listed as Class I Specified Chemical Substances, Class II Specified Chemical Substances, or Designated Chemical Substances by the Japanese MITI.

INTERNATIONAL CHEMICAL INVENTORIES:

Listing of the components on individual country Chemical Inventories is as follows:

Asia-Pac:	Listed
Australian Inventory of Chemical Substances (AICS):	Listed
Korean Existing Chemicals List (ECL):	Listed
Japanese Existing National Inventory of Chemical Substances (ENCS):	Listed
Philippines Inventory if Chemicals and Chemical Substances (PICCS):	Listed
Swiss Giftliste List of Toxic Substances:	Listed
U.S. TSCA:	Listed

SECTION 16 - OTHER INFORMATION

PREPARED BY: Paul Eigbrett Global Safety Management, 10006 Cross Creek Blvd. Suite 440, Tampa, FL 33647

ANNEX:

IDENTIFIED USES OF ALCONOX® AND DIRECTIONS FOR USE

Used to clean: Healthcare instruments, laboratory ware, vacuum equipment, tissue culture ware, personal protective equipment, sampling apparatus, catheters, tubing, pipes, radioactive contaminated articles, optical parts, electronic components, pharmaceutical apparatus, cosmetics manufacturing equipment, metal castings, forgings and stampings, industrial parts, tanks and reactors. Authorized by USDA for use in federally inspected meat and poultry plants. Passes inhibitory residue test for water analysis. FDA certified.

Used to remove: Soil, grit, grime, buffing compound, slime, grease, oils, blood, tissue, salts, deposits, particulates, solvents, chemicals, radioisotopes, radioactive contaminations, silicon oils, mold release agents.

Surfaces cleaned: Corrosion inhibited formulation recommended for glass, metal, stainless steel, porcelain, ceramic, plastic, rubber and fiberglass. Can be used on soft metals such as copper, aluminum, zinc and magnesium if rinsed promptly. Corrosion testing may be advisable.

Cleaning method: Soak, brush, sponge, cloth, ultrasonic, flow through clean-inplace. Will foam—not for spray or machine use.

Directions: Make a fresh 1% solution (2 1/2 Tbsp. per gal., 1 1/4 oz. per gal. or 10 grams per liter) in cold, warm, or hot water. If available use warm water. Use cold water for blood stains. For difficult soils, raise water temperature and use more detergent. Clean by soak, circulate, wipe, or ultrasonic method. Not for spray machines, will foam. For nonabrasive scouring, make paste. Use 2% solution to soak frozen stopcocks. To remove silver tarnish, soak in 1% solution in aluminum container. RINSE THOROUGHLY—preferably with running water. For critical cleaning, do final or all rinsing in distilled, deionized, or purified water. For food contact surfaces, rinse with potable water. Used on a wide range of glass, ceramic, plastic, and metal surfaces. Corrosion testing may be advisable.

APPENDIX B COMMUNITY AIR MONITORING PLAN

COMMUNITY AIR MONITORING PLAN
G.W. LISK FACILITY
2 SOUTH STREET – CLIFTON SPRINGS, NEW YORK

This Community Air Monitoring Plan (CAMP) involves real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of the designated work area when intrusive activities are in progress. Intrusive activities may include soil excavation, grading, staging, movement, or handling; test pitting or trenching; and/or the installation of soil borings and monitoring wells. The CAMP provides a measure of protection for on-Site workers and the downwind community (i.e., potential off-Site receptors including residences, parks, businesses, etc.) not directly involved with the subject work activities. Routine monitoring is required to evaluate concentrations and corrective action and/or work stoppage may be required to abate emissions detected at concentrations above specified action levels. Routine data collected during implementation of the CAMP may also help document that work activities did not spread compounds of potential concern off-Site through the air. Reliance on the procedures and action levels described in this CAMP should not preclude simple, common sense measures to keep VOCs, dust, and odors at a minimum around work areas.

COMMUNITY AIR MONITORING PLAN

VOC concentrations in air will be measured using calibrated photoionization detectors (PIDs). Particulate matter concentrations will be measured using calibrated electronic aerosol monitors.

Relevant weather conditions including wind direction, speed, humidity, temperature, and precipitation will be evaluated and recorded prior to the initiation of subsurface intrusive activities. Background readings of VOCs and particulate matter will be collected on Site prior to the initiation of field work on each day that subsurface intrusive work will be performed. Additional background measurements may be collected if weather conditions change significantly.

Continuous monitoring for VOCs and particulate matter will be performed upwind and downwind of the work area during subsurface intrusive activities.

Periodic monitoring for VOCs will be performed during non-intrusive activities if requested by a New York State Department of Environmental Conservation (NYSDEC) and/or New York State Department of Health (NYSDOH) on-Site representative. Non-intrusive activities include any work activity that does not disturb the subsurface or staged soil piles, including routine Site visits, installation of remedial equipment, operations and maintenance (O&M), surveying, etc. Periodic monitoring, if performed, will consist of collecting readings downwind of the work area at the following intervals:

- upon arrival at a sample location or other work activity location;
- during performance of the relevant work activity; and
- prior to leaving a sample location or other work activity location.

VOC MONITORING, RESPONSE LEVELS, AND ACTIONS

VOCs will be monitored at the downwind perimeter on a continuous basis during intrusive activities. Upwind concentrations will be measured continuously or at the start of each workday, during the work activity, and at the end of each work day to establish background conditions. Monitoring equipment will be calibrated at least once a day (excludes equipment that requires factory calibration). Calibration may be performed more frequently if Site conditions or instrument operating conditions are highly variable. The monitoring equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below. The monitoring equipment will be equipped with an alarm to indicate an exceedance of a specified action level.

1. If the ambient air concentration of total VOCs at the downwind perimeter exceeds 5 parts per million (ppm) above background (upwind perimeter) for the 15-minute time-weighted average, work activities will be temporarily halted and monitoring continued. If the total VOC concentration readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

2. If total VOC concentrations at the downwind perimeter persists at concentrations greater than 5 ppm over background but less than 25 ppm, work activities will be halted, the source of the VOCs identified, corrective action will be taken to abate emissions (if the source is related to Site remedial activities), and monitoring will be continued. After these steps, work activities will resume provided that the total VOC concentration 200 feet downwind of the work area, or half the distance to the nearest potential receptor, whichever is less (but in no case less than 20 feet), is below 5 ppm above background for the 15-minute average.

3. If the total VOC concentration is greater than 25 ppm above background at the downwind perimeter, intrusive work activities will be halted and the source of the VOCs will be identified. Work will resume when additional continuous monitoring demonstrates that VOC concentrations have dropped below 25 ppm for a minimum of one-half hour, and the total VOC concentration 200 feet downwind of the work area, or half the distance to the

nearest potential receptor, whichever is less (but in no case less than 20 feet), is below 5 ppm above background for the 15-minute time-weighted average.

4. All 15-minute readings will be recorded and will be available for review by NYSDEC and/or NYSDOH personnel. Instantaneous VOC readings (if any) used for decision purposes will also be recorded.

PARTICULATE MONITORING, RESPONSE LEVELS, AND ACTIONS

Fugitive dust migration from the work area will be visually assessed during intrusive activities. Particulate concentrations will be monitored continuously at the downwind perimeter during intrusive activities. Particulate monitoring will be performed using real-time electronic aerosol monitoring equipment capable of measuring particulate matter less than 10-micrometers in size (PM-10) and capable of integrating over a period of 15 minutes for comparison to the airborne particulate action levels referenced below. The monitoring equipment will be equipped with an alarm to indicate an exceedance of a specified action level.

1. If the downwind PM-10 concentration is 100 micrograms per cubic meter ($\mu g/m^3$) greater than background for the 15-minute period, or if airborne dust is observed leaving the work area, dust suppression techniques will be employed. Work may continue with dust suppression techniques provided that downwind PM-10 concentration does not exceed 150 $\mu g/m^3$ above background and provided that significant visible dust is not migrating from the work area.

2. If downwind PM-10 concentrations are greater than 150-$\mu g/m^3$ above background after the implementation of dust suppression activities, intrusive activities will be stopped and a re-evaluation of the intrusive activities will be initiated. Work can resume provided that dust suppression measures and/or other controls are successful in reducing the downwind PM-10 concentration to within 150 mcg/m^3 of background and in preventing significant visible dust migration.

3. All 15-minute readings will be recorded and will be available for review by NYSDEC and/or NYSDOH personnel. Instantaneous readings (if any) used for decision purposes will also be recorded.

APPENDIX C QUALITY ASSURANCE PROJECT PLAN

Work Plan

G.W. Lisk Company, Inc.

Quality Assurance Project Plan

G.W. Lisk Facility
2 South Street
Clifton Springs, New York

June 2022

ERM Consulting & Engineering, Inc.
www.erm.com

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1.0 INTRODUCTION

On behalf of G.W. Lisk Company, Inc., (G.W. Lisk), ERM Consulting and Engineering, Inc. (ERM) has prepared this Quality Assurance Project Plan (QAPP) for a Pre Design Investigation (PDI) at the G.W. Lisk Inc. Facility located at 2 South Street in the Village of Clifton Springs, Ontario County, New York (the Site).

The figure numbers referenced in this QAPP are the same figures referenced in the narrative portion of the PDI Work Plan.

1.1 PURPOSE AND OBJECTIVES

This QAPP identifies the necessary procedures for an orderly, accurate, and efficient data collection and analysis program for the project, and ensures that data meet quality objectives. The objectives for monitoring and ensuring data quality include the following:

- identify key responsibilities and qualifications of staff responsible for data quality monitoring;
- ensure that samples are properly managed both in the field and the laboratory;
- ensure realistic data quality goals that will produce data of known and acceptable quality are established; and
- ensure that data are accurate, complete, and verifiable.

1.2 SITE LOCATION

The Site is located at 2 South Street in the Village of Clifton Springs, Ontario County, New York.

1.3 SITE HISTORY

Figure 2 of the PDI work plan shows the layout of the Site including specific parcels and surrounding areas. The G.W. Lisk Property encompasses two parcels which together comprise approximately 26.654 acres. The Site is located within a primarily residential area. Prior to the 1910s, this area was developed as agricultural land. Land use became increasingly residential in nature throughout the early to mid-1900s. The Site was originally developed with one building by 1910. Between 1985 and 1995 the Site was increasingly developed with building expansions and property improvements, including paved parking areas. The Site has existed in its current configuration since 2006.

1.4 PRE DESIGN INVESTIGATION OBJECTIVES

The primary goal of the PDI is to address and mitigate potential contaminants that are present in the groundwater at the Site at concentrations above applicable standards, criteria, and guidance (SCGs).

2.0 QUALITY ASSURANCE OBJECTIVES

Quality objectives ensure that data collected are sufficient to meet the intended project goals. Quality objectives are pre-established goals that are used to monitor and assess the progress and quality of the work performed. It is essential to define quality objectives prior to initiation of any project work to ensure that activities yield data sufficient to meet project objectives.

Quality objectives are divided into two categories: data quality objectives (DQOs) and quality assurance objectives (QAOs). The DQOs are associated with the overall project objective as it relates to data collection. The QAOs define acceptance limits for project-generated data as they relate to data quality.

2.1 DATA QUALITY OBJECTIVES

DQOs are qualitative and quantitative criteria required to support the decision making process. DQOs define the uncertainty in a data set and are expressed in terms of precision, accuracy, representatives, completeness, and comparability (PARCC). The DQOs apply to both characterization and confirmation samples at the site. These parameters are defined as follows:

- **Precision:** a measure of mutual agreement among measurements of the same property usually under prescribed similar conditions. Precision is best expressed in terms of the standard deviation. Various measures of precision exist depending upon the “prescribed similar conditions”.
- **Accuracy:** the degree of agreement of a measurement (or an average of measurements) with an accepted reference of “true value”. Accuracy is one estimate of the bias in a system.
- **Representativeness**: expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.
- **Completeness:** a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal conditions

- **Comparability:** expresses the confidence with which one data set can be compared with another. Comparability is a qualitative, not quantitative measurement, as in the case of accuracy and precision. Comparability is assessed by reviewing results or procedures for data that do not agree with expected results.

It is the responsibility of the field team to collect representative and complete samples. It is the responsibility of the field-screening chemist at the laboratory to analyze these samples using accepted protocols resulting in data that meet PARCC standards.

2.2 FIELD SAMPLING QUALITY OBJECTIVES

The overall quality of sample results depends on proper sample management. Management of samples begins at the time of collection and continues throughout the analytical process. To ensure samples are collected and managed properly and consistently, field procedures for sample collection activities have been developed for the project. The laboratory also has procedures that ensure a proper and consistent analytical process.

Field procedures include descriptions of equipment and procedures required to perform a specific task. The purpose is to increase reproducibility and to document each of the steps required to perform the task. Approved and correctly implemented field procedures should produce data of acceptable quality that meet project DQOs.

2.3 LABORATORY DATA QUALITY OBJECTIVES

The laboratory will demonstrate analytical precision and accuracy by the analysis of laboratory duplicates and by adherence to accepted manufacture and procedural methodologies.

The performance of the laboratory will be evaluated by the Project Manager and Project Quality Assurance Officer during data reduction. The evaluation will include a review of all deliverables for completeness and accuracy when applicable.

The Laboratory DQOs are provided in Table 1

3.0 QUALITY CONTROL PROCEDURES

This section presents a general overview of the quality assurance and quality control procedures that will be implemented during the PDI.

These quality control procedures are to be implemented as follows:

- in the field; and
- in the laboratory utilized for selected sample analyses.

3.1 FIELD QC ACTIVITIES

Several types of field QC samples will be collected and submitted for analysis during the project. Each type of QC sample monitors a different aspect of the field effort. Analytical results for QC samples provide information regarding the adequacy of the sample collection and transportation of samples.

The frequency of field QC samples collected will depend on the total number of samples being collected. Specifics of the sampling activities, including collection frequency and sampling procedures, are described in the field procedures. The types of field QC samples that will be generated during the project are defined below.

- **Field** (**Blind) duplicates** – Field or blind duplicates are used to monitor field and laboratory precision, as well as matrix heterogeneity.

- **Equipment** (**Field) blanks** – Equipment or field blanks are used to monitor field sampling equipment as well as field decontamination procedures.

- **Matrix Spike/Matrix Spike duplicates** – Matrix spike and matrix spike duplicates are used to monitor laboratory precision.

A field QC sample summary is included in Table 2. A list of sample analyses is included in Table 3.

3.2 LABORATORY QC ACTIVITIES

Laboratory QC samples will include the use of method blanks, MS, laboratory control samples, laboratory duplicates, and surrogate spikes. The five types of laboratory QC samples are defined below.

- **Method blanks** - Method blanks are used to monitor and ensure that the analytical system is free of contamination due either to carryover from previous samples or from laboratory procedures.

- **Laboratory Control samples** – Laboratory control samples are used to monitor the accuracy of the analytical procedure without the potential interferences of a matrix.

- **Laboratory Duplicate samples** - Laboratory duplicatesamples are used to monitor and assess laboratory precision, as well as potential matrix heterogeneity.

4.0 CALIBRATION PROCEDURES

Calibration is an integral part of ensuring that results are quantitated correctly. Instruments that are not calibrated either to manufacturers and/or method specifications are likely to produce unreliable results. Proper procedures must be followed and sufficient documentation maintained to ensure calibrations are performed correctly and that sample quantitations accurately reflect sample concentrations.

During the course of this PDI, instruments that may be used in the field in conjunction with sampling activities include a photoionization detector (PID) and particulate (i.e., dust) meters. A maintenance, calibration, and operation program will be implemented to ensure that routine calibration and maintenance is performed on all field instruments. The program will be monitored by the Field Team Leader. Trained team members will perform scheduled calibration, field calibrations, checks, and instrument maintenance prior to use each day. Additionally, calibration will be checked as necessary to ascertain that proper measurements are being taken.

Team members are familiar with the field calibration, operation, and maintenance of the equipment, and will perform the prescribed field operating procedures outlined in the operation and field manuals accompanying the respective instrument. Field personnel will keep records of all field instruments calibrations and field checks in the field logbooks. Calibration information recorded in field logbooks will include date, time, instrument model and serial number, a description of calibration or field check procedure, and any instrument deviations.

If on-site monitoring equipment should fail, the Field Team Leader will be contacted immediately. Replacement equipment will be provided or the malfunction will be repaired in a timely fashion.

5.0 ANALYTICAL PROCEDURES AND DATA EVALUATION

Groundwater samples will be collected for analysis for some or all of the following analytes: volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs) and United States Environmental Protection Agency (USEPA) Target Analyte List (TAL) metals. In general, laboratory analytical procedures will adhere to USEPA SW-846 methodology, although other methods will be utilized as appropriate. Samples will be analyzed by a New York State Department of Health (NYSDOH)-approved environmental laboratory familiar with Contract Laboratory Protocols (CLP). A summary of anticipated samples to be collected is presented in Table 3.

Compound Specific Isotope Analysis (CSIA) will be conducted to measure the ratio of stable isotopes ($^{13}C/^{12}C$) of a contaminant. In addition, QuantArray analytical procedure will also be conducted to quantify a broad spectrum of contaminant degrading microorganisms and functional genes in a single analysis.

Upon receipt of analytical reports from the laboratory, ERM will evaluate data packages and confirm that samples were analyzed within required holding time and at proper detection limits. The laboratory will provide NYSDEC Analytical Services Protocol (ASP) Category B deliverables.

The project Quality Assurance/Quality Control (QA/QC) officer will review the data packages and prepare a Data Usability Summary Report (DUSR) in accordance with NYSDEC guidance in DER-10 (NYSDEC, 2010). At a minimum, the following information will be evaluated:

- chain-of-custody forms;
- date sampled/date analyzed;
- raw data;
- initial and continuing instrument calibrations;
- matrix spikes;
- laboratory duplicate analyses;
- surrogate recoveries (organics); and
- laboratory control samples (inorganics).

Data reduction will consist of presenting analytical results on summary tables. Data resulting from characterization analyses will then be used to evaluate potential remedial options.

6.0 PROJECT PERSONNEL

ERM will staff this project with persons having expertise in the tasks to be performed and experience working on NYSDEC-regulated sites. Key project personnel that will be involved with this project are summarized below.

Ernie Rossano, P.G. will be the Partner--in-Charge for this project. Mr. Rossano has over 30 years of environmental remediation and varied hydrogeologic experience. His experience includes the design of monitoring well networks, surface and subsurface water quality monitoring, management of large scale remedial investigations and remedial actions, aquifer test analysis, tank removal and associated soils assessment, fate and transport modeling, construction monitoring, and data management using GIS systems. Mr. Rossano will be responsible for all ERM activities on the project and assists the ERM Project Manager in planning, coordinating, and controlling all work performed on this project. He has overall responsibility for developing the QAPP, monitoring the quality of the technical and managerial aspects of the project, and implementing the QAPP and corrective measures, where necessary.

Tim Daniluk P.G. will be the senior project manager, lead geologist, and Qualified Environmental Professional for this project. Mr. Daniluk is a licensed Professional Geologist and has over 10 years of diversified environmental consulting experience including project management, geologic and hydrogeologic investigations, high resolution site characterization techniques, site remediation, regulatory negotiations, geologic mapping, document reviews, aquifer testing and analysis, field leadership, statistical analysis of geologic data. Mr. Daniluk will be responsible for coordination and detailed technical aspects of the project and management of all field activities.

Stephen Mirabello P.E. will be the lead engineer for this project. Mr. Mirabello has over 16 years of professional experience. He has extensive experience with NYSDEC and USEPA working with private and public sector clients to manage sites with chlorinated VOC, SVOC, PCB, TPH, PAH, and metals impacts. Mr. Mirabello has worked on many projects at designated Brownfield Cleanup Program (BCP) and Voluntary Cleanup Program (VCP) sites.

Andrew Coenen, will be the QA/QC Officer for this project. Mr. Coenen has 24 years of general analytical chemistry experience, six years of analytical laboratory experience, and 15 years of environmental consulting experience, including analytical data validation, sampling and analysis programs, quality assurance programs, technical support, and QA oversight for fixed laboratory and field analysis. Mr. Coenen has knowledge of numerous analytical methodologies and experience in data validation of analytical data package deliverables for adherence to USEPA CLP and non-CLP and NYSDEC ASP protocols. Mr. Coenen will be responsible for establishing and maintaining an accurate and representative database for data collected during the investigation, monitoring data quality, conducting data review, and preparing a DUSR in accordance with NYSEDC guidelines.

Table 1A
Laboratory Data Quality Objectives - VOCs
G.W. Lisk Company, Inc.
Clifton Springs, New York

Matrix	QC Compounds	CAS Number	Blind Field Duplicate Precision(% RPD)	Method Blanks	Reporting Limit (ug/l)	Method Detection Limit (ug/l)	LCS Accuracy (% Rec.)^2	LCS Precision (% RPD.)^2	Surrogate Accuracy (% Rec.)^2	MS/MSD Accuracy (% Rec)^2	MS/MSD Precision (% RPD)^2
	All Compounds		**≤ 50**	**≤ RL**							
	1,1,1-Trichloroethane	71-55-6			0.57	0.19	70-130	30		70-130	30
	1,1,2,2-Tetrachloroethane	79-34-5			0.57	0.19	70-130	30		70-130	30
	1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113)	76-13-1			4.5	0.79	50-139	30		50-139	30
	1,1,2-Trichloroethane	79-00-5			1.1	0.3	70-130	30		70-130	30
	1,1-Dichloroethane	75-34-3			1.1	0.16	70-130	30		70-130	30
	1,1-Dichloroethene	75-35-4			1.1	0.27	65-135	30		65-135	30
	1,2,3-Trichlorobenzene	87-61-6			2.3	0.36	70-130	30		70-130	30
	1,2,4-Trichlorobenzene	120-82-1			2.3	0.31	70-130	30		70-130	30
	1,2-Dibromo-3-chloropropane	96-12-8			3.4	1.1	68-130	30		68-130	30
	1,2-Dichlorobenzene	95-50-1			2.3	0.16	70-130	30		70-130	30
	1,2-Dichloroethane	107-06-2			1.1	0.29	70-130	30		70-130	30
	1,2-Dichloropropane	78-87-5			1.1	0.14	70-130	30		70-130	30
	1,3-Dichlorobenzene	541-73-1			2.3	0.17	70-130	30		70-130	30
	1,4-Dichlorobenzene	106-46-7			2.3	0.19	70-130	30		70-130	30
	1,4-Dioxane	123-91-1			91	40	65-136	30		65-136	30
	2-Butanone	78-93-3			11	2.5	70-130	30		70-130	30
	2-Hexanone	591-78-6			11	1.3	70-130	30		70-130	30
	4-Methyl-2-pentanone	108-10-1			11	1.4	70-130	30		70-130	30
	Acetone	67-64-1			11	5.5	54-140	30		54-140	30
	Benzene	71-43-2			0.57	0.19	70-130	30		70-130	30
	Bromodichloromethane	75-27-4			0.57	0.12	70-130	30		70-130	30
	Bromoform	75-25-2			4.5	0.28	70-130	30		70-130	30
	Bromomethane	74-83-9			2.3	0.66	57-147	30		57-147	30
	Carbon disulfide	75-15-0			11	5.2	59-130	30		59-130	30
	Carbon tetrachloride	56-23-5			1.1	0.26	70-130	30		70-130	30
Soil	Chlorobenzene	108-90-7			0.57	0.14	70-130	30		70-130	30
	Chlorobromomethane	74-97-5			2.3	0.23	70-130	30		70-130	30
	Chloroethane	75-00-3			2.3	0.51	50-151	30		50-151	30
	Chloroform	67-66-3			1.7	0.16	70-130	30		70-130	30
	Chloromethane	74-87-3			4.5	1	52-130	30		52-130	30
	cis-1,2-Dichloroethene	156-59-2			1.1	0.2	70-130	30		70-130	30
	cis-1,3-Dichloropropene	10061-01-5			0.57	0.18	70-130	30		70-130	30
	Cyclohexane	110-82-7			11	0.62	59-142	30		59-142	30
	Dibromochloromethane	124-48-1			1.1	0.16	70-130	30		70-130	30
	Dichlorodifluoromethane (Freon 12)	75-71-8			11	1	30-146	30		30-146	30
	Ethylbenzene	100-41-4			1.1	0.16	70-130	30		70-130	30
	Ethylene dibromide	106-93-4			1.1	0.32	70-130	30		70-130	30
	Isopropylbenzene (Cumene)	98-82-8			1.1	0.12	70-130	30		70-130	30
	m,p-Xylenes	179601-23-1			2.3	0.64	70-130	30		70-130	30
	Methyl Acetate	79-20-9			4.5	1.1	51-146	30		51-146	30
	Methyl cyclohexane	108-87-2			4.5	0.68	70-130	30		70-130	30
	Methyl tert butyl ether	1634-04-4			2.3	0.23	66-130	30		66-130	30
	Methylene chloride	75-09-2			5.7	2.6	70-130	30		70-130	30
	o-Xylene	95-47-6			1.1	0.33	70-130	30		70-130	30
	Styrene	100-42-5			1.1	0.22	70-130	30		70-130	30
	Tetrachloroethene	127-18-4			0.57	0.22	70-130	30		70-130	30
	Toluene	108-88-3			1.1	0.62	70-130	30		70-130	30
	trans-1,2-Dichloroethene	156-60-5			1.7	0.16	70-130	30		70-130	30
	trans-1,3-Dichloropropene	10061-02-6			1.1	0.31	70-130	30		70-130	30
	Trichloroethene	79-01-6			0.57	0.16	70-130	30		70-130	30
	Trichlorofluoromethane (Freon 11)	75-69-4			4.5	0.79	70-139	30		70-139	30
	Vinyl chloride	75-01-4			1.1	0.38	67-130	30		67-130	30
	1,2-Dichloroethane-d4								70-130		
Soil	Toluene-d8								70-130		
Surrogates	4-Bromofluorobenzene								70-130		
	Dibromofluoromethane								70-130		

Notes:
1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Alpha. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; LCS = Laboratory Check Sample; RL = Reporting Limit.

Table 1A
Laboratory Data Quality Objectives - VOCs
G.W. Lisk Company, Inc.
Clifton Springs, New York

Matrix	QC Compounds	CAS Number	Blind Field Duplicate Precision(% RPD)	Method Blanks	Reporting Limit (ug/kg)	Method Detection Limit (ug/kg)	LCS Accuracy (% Rec.)²	LCS Precision (% RPD.)²	Surrogate Accuracy (% Rec.)²	MS/MSD Accuracy (% Rec)²	MS/MSD Precision (% RPD)²
	All Compounds		**≤ 50**	**≤ RL**							
	1,1,1-Trichloroethane	71-55-6			2.5	0.7	67-130	20		67-130	20
	1,1,2,2-Tetrachloroethane	79-34-5			0.5	0.17	67-130	20		67-130	20
	1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113)	76-13-1			2.5	0.7	70-130	20		70-130	20
	1,1,2-Trichloroethane	79-00-5			1.5	0.5	70-130	20		70-130	20
	1,1-Dichloroethane	75-34-3			2.5	0.7	70-130	20		70-130	20
	1,1-Dichloroethene	75-35-4			0.5	0.17	61-145	20		61-145	20
	1,2,3-Trichlorobenzene	87-61-6			2.5	0.7	70-130	20		70-130	20
	1,2,4-Trichlorobenzene	120-82-1			2.5	0.7	70-130	20		70-130	20
	1,2-Dibromo-3-chloropropane	96-12-8			2.5	0.7	41-144	20		41-144	20
	1,2-Dichlorobenzene	95-50-1			2.5	0.7	70-130	20		70-130	20
	1,2-Dichloroethane	107-06-2			0.5	0.13	70-130	20		70-130	20
	1,2-Dichloropropane	78-87-5			1	0.14	70-130	20		70-130	20
	1,3-Dichlorobenzene	541-73-1			2.5	0.7	70-130	20		70-130	20
	1,4-Dichlorobenzene	106-46-7			2.5	0.7	70-130	20		70-130	20
	1,4-Dioxane	123-91-1			250	61	56-162	20		56-162	20
	2-Butanone	78-93-3			5	1.9	63-138	20		63-138	20
	2-Hexanone	591-78-6			5	1	57-130	20		57-130	20
	4-Methyl-2-pentanone	108-10-1			5	1	59-130	20		59-130	20
	Acetone	67-64-1			5	1.5	58-148	20		58-148	20
	Benzene	71-43-2			0.5	0.16	70-130	20		70-130	20
	Bromodichloromethane	75-27-4			0.5	0.19	67-130	20		67-130	20
	Bromoform	75-25-2			2	0.65	54-136	20		54-136	20
	Bromomethane	74-83-9			2.5	0.7	39-139	20		39-139	20
	Carbon disulfide	75-15-0			5	1	51-130	20		51-130	20
	Carbon tetrachloride	56-23-5			0.5	0.13	63-132	20		63-132	20
Water	Chlorobenzene	108-90-7			2.5	0.7	75-130	20		75-130	20
	Chlorobromomethane	74-97-5			2.5	0.7	70-130	20		70-130	20
	Chloroethane	75-00-3			2.5	0.7	55-138	20		55-138	20
	Chloroform	67-66-3			2.5	0.7	70-130	20		70-130	20
	Chloromethane	74-87-3			2.5	0.7	64-130	20		64-130	20
	cis-1,2-Dichloroethene	156-59-2			2.5	0.7	70-130	20		70-130	20
	cis-1,3-Dichloropropene	10061-01-5			0.5	0.14	70-130	20		70-130	20
	Cyclohexane	110-82-7			10	0.27	70-130	20		70-130	20
	Dibromochloromethane	124-48-1			0.5	0.15	63-130	20		63-130	20
	Dichlorodifluoromethane (Freon 12)	75-71-8			5	1	36-147	20		36-147	20
	Ethylbenzene	100-41-4			2.5	0.7	70-130	20		70-130	20
	Ethylene dibromide	106-93-4			2	0.65	70-130	20		70-130	20
	Isopropylbenzene (Cumene)	98-82-8			2.5	0.7	70-130	20		70-130	20
	m,p-Xylenes	179601-23-1			2.5	0.7	70-130	20		70-130	20
	Methyl Acetate	79-20-9			2	0.23	70-130	20		70-130	20
	Methyl cyclohexane	108-87-2			10	0.4	70-130	20		70-130	20
	Methyl tert butyl ether	1634-04-4			2.5	0.7	63-130	20		63-130	20
	Methylene chloride	75-09-2			2.5	0.7	70-130	20		70-130	20
	o-Xylene	95-47-6			2.5	0.7	70-130	20		70-130	20
	Styrene	100-42-5			2.5	0.7	70-130	20		70-130	20
	Tetrachloroethene	127-18-4			0.5	0.18	70-130	20		70-130	20
	Toluene	108-88-3			2.5	0.7	70-130	20		70-130	20
	trans-1,2-Dichloroethene	156-60-5			2.5	0.7	70-130	20		70-130	20
	trans-1,3-Dichloropropene	10061-02-6			0.5	0.16	70-130	20		70-130	20
	Trichloroethene	79-01-6			0.5	0.18	70-130	20		70-130	20
	Trichlorofluoromethane (Freon 11)	75-69-4			2.5	0.7	62-150	20		62-150	20
	Vinyl chloride	75-01-4			1	0.07	55-140	20		55-140	20
	1,2-Dichloroethane-d4								70-130		
Water	Toluene-d8								70-130		
Surrogates	4-Bromofluorobenzene								70-130		
	Dibromofluoromethane								70-130		

Notes:
1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Alpha. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; LCS = Laboratory Check Sample; RL = Reporting Limit.

Table 1B
Laboratory Data Quality Objectives - SVOCs
G.W. Lisk Company, Inc.
Clifton Springs, New York

Matrix	QC Compounds	CAS Number	Blind Field Duplicate Precision(% RPD)	Method Blanks	Reporting Limit (ug/kg)	Method Detection Limit (ug/kg)	LCS Accuracy (% Rec.)[2]	LCS Precision (% RPD.)[2]	Surrogate Accuracy (% Rec.)[2]	MS/MSD Accuracy (% Rec)[2]	MS/MSD Precision (% RPD)[2]
Soil	**All Compounds**		≤ 50	≤ RL							
	1,2,4,5-Tetrachlorobenzene	95-94-3			200	21	40-117	50		40-117	50
	1,4-Dioxane	123-91-1			9.21	2.35	40-140	30		40-140	30
	2,3,4,6-Tetrachlorophenol	58-90-2			200	40	40-140	50		40-140	50
	2,4,5-Trichlorophenol	95-95-4			200	38	30-130	50		30-130	50
	2,4,6-Trichlorophenol	88-06-2			120	38	30-130	50		30-130	50
	2,4-Dichlorophenol	120-83-2			180	32	30-130	50		30-130	50
	2,4-Dimethylphenol	105-67-9			200	65	30-130	50		30-130	50
	2,4-Dinitrophenol	51-28-5			950	92	4-130	50		4-130	50
	2,4-Dinitrotoluene	121-14-2			200	40	40-132	50		40-132	50
	2,6-Dinitrotoluene	606-20-2			200	34	40-140	50		40-140	50
	2-Chloronaphthalene	91-58-7			200	20	40-140	50		40-140	50
	2-Chlorophenol	95-57-8			200	23	25-102	50		25-102	50
	2-Methylnaphthalene	91-57-6			240	24	40-140	50		40-140	50
	2-Nitroaniline	88-74-4			200	38	47-134	50		47-134	50
	2-Nitrophenol	88-75-5			430	74	30-130	50		30-130	50
	3,3'-Dichlorobenzidine	91-94-1			200	53	40-140	50		40-140	50
	3-Methylphenol/4-Methylphenol	65794-96-9			280	31	30-130	50		30-130	50
	3-Nitroaniline	99-09-2			200	37	26-129	50		26-129	50
	4-Bromophenyl phenyl ether	101-55-3			200	30	40-140	50		40-140	50
	4-Chloro-3-methylphenol	59-50-7			200	30	26-103	50		26-103	50
	4-Chloroaniline	106-47-8			200	36	40-140	50		40-140	50
	4-Chlorophenyl phenyl ether	7005-72-3			200	21	40-140	50		40-140	50
	4-Nitrophenol	100-02-7			280	81	11-114	50		11-114	50
	Acenaphthene	83-32-9			160	20	31-137	50		31-137	50
	Acenaphthylene	208-96-8			160	30	40-140	50		40-140	50
	Acetophenone	98-86-2			200	24	14-144	50		14-144	50
	Anthracene	120-12-7			120	39	40-140	50		40-140	50
	Atrazine	1912-24-9			160	69	40-140	50		40-140	50
	Benzaldehyde	100-52-7			260	53	40-140	50		40-140	50
	Benzo(a)anthracene	56-55-3			120	22	40-140	50		40-140	50
	Benzo(a)pyrene	50-32-8			160	48	40-140	50		40-140	50
	Benzo(b)fluoranthene	205-99-2			120	33	40-140	50		40-140	50
	Benzo(ghi)perylene	191-24-2			160	23	40-140	50		40-140	50
	Benzo(k)fluoranthene	207-08-9			120	32	40-140	50		40-140	50
	Biphenyl	92-52-4			450	46	37-127	50		37-127	50
	Bis(2-chloroethoxy)methane	111-91-1			210	20	40-117	50		40-117	50
	Bis(2-chloroisopropyl)ether	39638-32-9			240	34	40-140	50		40-140	50
	Bis(2-ethylhexyl)phthalate	117-81-7			200	68	40-140	50		40-140	50
	Butyl benzyl phthalate	85-68-7			200	50	40-140	50		40-140	50
	Caprolactam	105-60-2			200	60	15-130	50		15-130	50
	Carbazole	86-74-8			200	19	54-128	50		54-128	50
	Chrysene	218-01-9			120	20	40-140	50		40-140	50
	Dibenzo(a,h)anthracene	53-70-3			120	23	40-140	50		40-140	50
	Dibenzofuran	132-64-9			200	19	40-140	50		40-140	50
	Dichloroethyl ether	111-44-4			180	27	40-140	50		40-140	50
	Diethyl phthalate	84-66-2			200	18	40-140	50		40-140	50
	Dimethyl phthalate	131-11-3			200	42	40-140	50		40-140	50
	Di-n-butylphthalate	84-74-2			200	38	40-140	50		40-140	50
	Dinitro-o-cresol	534-52-1			510	95	10-130	50		10-130	50
	Di-n-octylphthalate	117-84-0			200	67	40-140	50		40-140	50
	Fluoranthene	206-44-0			120	23	40-140	50		40-140	50
	Fluorene	86-73-7			200	19	40-140	50		40-140	50
	Hexachlorobenzene	118-74-1			120	22	40-140	50		40-140	50
	Hexachlorobutadiene	87-68-3			200	29	40-140	50		40-140	50
	Hexachlorocyclopentadiene	77-47-4			570	180	40-140	50		40-140	50
	Hexachloroethane	67-72-1			160	32	40-140	50		40-140	50
	Indeno(1,2,3-cd)pyrene	193-39-5			160	28	40-140	50		40-140	50
	Isophorone	78-59-1			180	26	40-140	50		40-140	50
	Naphthalene	91-20-3			200	24	40-140	50		40-140	50
	Nitrobenzene	98-95-3			180	29	40-140	50		40-140	50
	n-Nitrosodi-n-propylamine	621-64-7			200	30	32-121	50		32-121	50
	n-Nitrosodiphenylamine	86-30-6			160	22	36-157	50		36-157	50
	o-Cresol	95-48-7			200	31	30-130.	50		30-130.	50
	Pentachlorophenol	87-86-5			160	44	17-109	50		17-109	50
	Phenanthrene	85-01-8			120	24	40-140	50		40-140	50
	Phenol	108-95-2			200	30	26-90	50		26-90	50
	p-Nitroaniline	100-01-6			200	82	41-125	50		41-125	50
	Pyrene	129-00-0			120	20	35-142	50		35-142	50
Soil Surrogates	1,4-Dioxane-d8								15-110		
	2,4,6-Tribromophenol								10-136		
	2-Fluorobiphenyl								30-120		
	2-Fluorophenol								25-120		
	4-Terphenyl-d14								18-120		
	Nitrobenzene-d5								23-120		
	Phenol-d6								10-120		

Notes:
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Table 1B
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G.W. Lisk Company, Inc.
Clifton Springs, New York

Matrix	QC Compounds	CAS Number	Blind Field Duplicate Precision(% RPD)	Method Blanks	Reporting Limit (ug/l)	Method Detection Limit (ug/l)	LCS Accuracy (% Rec.)[2]	LCS Precision (% RPD.)[2]	Surrogate Accuracy (% Rec.)[2]	MS/MSD Accuracy (% Rec)[2]	MS/MSD Precision (% RPD)[2]
Water	**All Compounds**		**≤ 50**	**≤ RL**							
	1,2,4,5-Tetrachlorobenzene	95-94-3			10	0.44	2-134	30		2-134	30
	1,4-Dioxane	123-91-1			0.15	0.0339	40-140	30		40-140	30
	2,3,4,6-Tetrachlorophenol	58-90-2			5	0.84	40-140	30		40-140	30
	2,4,5-Trichlorophenol	95-95-4			5	0.77	30-130	30		30-130	30
	2,4,6-Trichlorophenol	88-06-2			5	0.61	30-130	30		30-130	30
	2,4-Dichlorophenol	120-83-2			5	0.41	30-130	30		30-130	30
	2,4-Dimethylphenol	105-67-9			5	1.8	30-130	30		30-130	30
	2,4-Dinitrophenol	51-28-5			20	6.6	20-130	30		20-130	30
	2,4-Dinitrotoluene	121-14-2			5	1.2	48-143	30		48-143	30
	2,6-Dinitrotoluene	606-20-2			5	0.93	40-140	30		40-140	30
	2-Chlorophenol	95-57-8			2	0.48	27-123	30		27-123	30
	2-Methylphenol	95-48-7			5	0.49	30-130	30		30-130	30
	2-Nitroaniline	88-74-4			5	0.5	52-143	30		52-143	30
	2-Nitrophenol	88-75-5			10	0.85	30-130	30		30-130	30
	3,3'-Dichlorobenzidine	91-94-1			5	1.6	40-140	30		40-140	30
	3-Methylphenol/4-Methylphenol	65794-96-9			5	0.48	30-130	30		30-130	30
	3-Nitroaniline	99-09-2			5	0.81	25-145	30		25-145	30
	4,6-Dinitro-o-cresol	534-52-1			10	1.8	20-164	30		20-164	30
	4-Bromophenyl phenyl ether	101-55-3			2	0.38	40-140	30		40-140	30
	4-Chloroaniline	106-47-8			5	1.1	40-140	30		40-140	30
	4-Chlorophenyl phenyl ether	7005-72-3			2	0.49	40-140	30		40-140	30
	4-Nitroaniline	100-01-6			5	0.8	51-143	30		51-143	30
	4-Nitrophenol	100-02-7			10	0.67	Oct-80	30		29495	30
	Acetophenone	98-86-2			5	0.53	39-129	30		39-129	30
	Atrazine	1912-24-9			10	0.76	40-140	30		40-140	30
	Benzaldehyde	100-52-7			5	0.53	40-140	30		40-140	30
	Biphenyl	92-52-4			2	0.46	40-140	30		40-140	30
	Bis(2-chloroethoxy)methane	111-91-1			5	0.5	40-140	30		40-140	30
	Bis(2-chloroethyl)ether	111-44-4			2	0.5	40-140	30		40-140	30
	Bis(2-chloroisopropyl)ether	39638-32-9			2	0.53	40-140	30		40-140	30
	Bis(2-ethylhexyl)phthalate	117-81-7			3	1.5	40-140	30		40-140	30
	Butyl benzyl phthalate	85-68-7			5	1.2	40-140	30		40-140	30
	Caprolactam	105-60-2			10	3.3	10-130	30		10-130	30
	Carbazole	86-74-8			2	0.49	55-144	30		55-144	30
	Dibenzofuran	132-64-9			2	0.5	40-140	30		40-140	30
	Diethyl phthalate	84-66-2			5	0.38	40-140	30		40-140	30
	Dimethyl phthalate	131-11-3			5	1.8	40-140	30		40-140	30
	Di-n-butylphthalate	84-74-2			5	0.39	40-140	30		40-140	30
	Di-n-octylphthalate	117-84-0			5	1.3	40-140	30		40-140	30
	Hexachlorocyclopentadiene	77-47-4			20	0.69	40-140	30		40-140	30
	Isophorone	78-59-1			5	1.2	40-140	30		40-140	30
	NDPA/DPA	86-30-6			2	0.42	40-140	30		40-140	30
	Nitrobenzene	98-95-3			2	0.77	40-140	30		40-140	30
	n-Nitrosodi-n-propylamine	621-64-7			5	0.64	29-132	30		29-132	30
	p-Chloro-m-cresol	59-50-7			2	0.35	23-97	30		23-97	30
	Phenol	108-95-2			5	0.57	12-110	30		12-110	30
Water Surrogates	1,4-Dioxane-d8								15-110		
	2-Fluorophenol								21-120		
	Phenol-d6								10-120		
	Nitrobenzene-d5								23-120		
	2-Fluorobiphenyl								15-120		
	2,4,6-Tribromophenol								10-120		
	4-Terphenyl-d14								41-149		

Notes:
1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Alpha. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; LCS = Laboratory Check Sample; RL = Reporting Limit.

Table 1C
Laboratory Data Quality Objectives - Metals
G.W. Lisk Company, Inc.
Clifton Springs, New York

Matrix	QC Compounds	CAS Number	Blind Field Duplicate Precision(% RPD)	Method Blanks	Reporting Limit (mg/l)	Method Detection Limit (mg/l)	LCS Accuracy (% Rec.)[2]	LCS Precision (% RPD)[2]
Water	**All Compounds**		**≤ 50**	**≤ RL**				
	Aluminum	7429-90-5			0.1	0.032	50-150	20
	Antimony	7440-36-0			0.05	0.007	19-250	20
	Arsenic	7440-38-2			0.005	0.002	70-130	20
	Barium	7440-39-3			0.01	0.002	75-125	20
	Beryllium	7440-41-7			0.005	0.001	75-125	20
	Cadmium	7440-43-9			0.005	0.001	75-125	20
	Calcium	7440-70-2			0.1	0.035	73-128	20
	Chromium	7440-47-3			0.01	0.002	70-130	20
	Cobalt	7440-48-4			0.02	0.002	75-125	20
	Copper	7440-50-8			0.01	0.002	75-125	20
	Iron	7439-89-6			0.05	0.009	35-165	20
	Lead	7439-92-1			0.01	0.003	72-128	20
	Magnesium	7439-95-4			0.1	0.015	62-138	20
	Manganese	7439-96-5			0.01	0.002	74-126	20
	Mercury	7439-97-6			0.0002	0.00009	60-140	20
	Nickel	7440-02-0			0.025	0.002	70-130	20
	Potassium	7440-09-7			2.5	0.237	59-141	20
	Selenium	7782-49-2			0.01	0.004	68-132	20
	Silver	7440-22-4			0.007	0.003	68-131	20
	Sodium	7440-23-5			2	0.12	35-165	20
	Thallium	7440-28-0			0.02	0.003	68-131	20
	Vanadium	7440-62-2			0.01	0.002	59-141	20
	Zinc	7440-66-6			0.05	0.002	70-130	20

Notes:
1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Alpha. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; LCS = Laboratory Check Sample; RL = Reporting Limit.

Table 2
Quality Control Sample Summary
G.W. Lisk Company, Inc.
Clifton Springs, New York

Quality Control (QC) Checks	Minimum Frequency	Soil QA/QC Samples	Groundwater QA/QC Samples
Equipment Blank (EB)	1 per day, per matrix sampled	1 per day of sampling	1 per day of sampling
Trip Blank (TB)	1 per sample shipment (VOCs only)	1 per VOC sample shipment	1 per VOC sample shipment
Blind Field Duplicate (DUP)	1 per 20 samples, per matrix	1	3
Matrix Spike (MS)	1 per 20 samples, per matrix	1	3
Matrix Spike Duplicate (MSD)	1 per 20 samples, per matrix	1	3

Notes:
Duplicate and MS/MSD samples must be taken from full suite groundwater wells
Equipment Blanks to be taken from sampling equipment

Table 3
Sample Analyses
G.W. Lisk Company, Inc.
Clifton Springs, New York

Analytical Parameter	Analytical USEPA Method Reference	Sample Preservation	Holding Time	Container
VOCs+TICs	8260C	HCl, 4° C	14 days	(3) 40 ml VOA Vials
SVOCs+TICs	8270D	4° C	7 days	(2) 250 ml Amber Glass bottle
Dissolved Gases	RSKSOP-175	HCl, 4° C	14 days	(2) 20 ml VOA Vials
Alkalinity	SM2320B	4° C	14 days	250 ml Plastic bottle no headspace
TOC	SM5310C	H_2SO_4, 4° C	28 days	(2) 40 ml VOA Vials
Nitrate	E353.2	4° C	48 hours	250 ml Plastic bottle
Nitrite	E353.2	4° C	48 hours	250 ml Plastic bottle
Sulfate	E300	4° C	28 days	250 ml Plastic bottle
Chloride	E300	4° C	28 days	250 ml Plastic bottle
Mercury	7471A	HNO_3, 4° C	28 days	250 ml Plastic bottle
TAL Metals	6010D	HNO_3, 4° C	180 days	500 ml Plastic bottle
Dissolved Metals	6010D	HNO_3, 4° C	180 days	500 ml Plastic bottle
CSIA	--	HCl, 4° C	24 hours	(4) VOA Vials
QuantArray	--	4° C	24 hours	1 liter poly bottle

Notes:
HCl : Hydrochloric Acid
H_2SO_4 : Sulphuric Acid
HNO_3 : Nitric Acid

APPENDIX D INVESTIGATION PERSONNEL AND QUALIFICATIONS

Ernest Rossano, PG

Senior Partner/Area Manager
North America

Mr. Ernest Rossano's experience includes directing projects through various regulatory programs, including The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), The Resource Conservation and Recovery Act (RCRA), The Industrial Site Recovery Act (ISRA), NY State Superfund, NY State Brownfield Program, and New York City Voluntary Cleanup Program. Includes the design of monitoring well networks for volatile organics, hydrocarbons, and collection of basic hydrogeologic parameters; seismic, downhole geophysical and sample log analysis and correlation; supervision and analysis of pump tests in confined and unconfined strata; numerical modeling of groundwater flow and solute transport; and management of large-scale remedial investigations and remedial actions.

Experience: Over 30 years of varied site investigation and remediation experience in both unconsolidated sediments and fractured rock environments

LinkedIn: https://www.linkedin.com/in/ernie-rossano-98646850/

Email: Ernie.Rossano@erm.com

Education

- M.S., Hydrogeology, State University of New York at Stony Brook, 1992
- B.S., Geology, Southampton College, New York, 1984

Professional Affiliations and Registrations

- Certified Professional Geologist (American Institute of Professional Geologists) #8225
- New York State Professional Geologist #000541
- Board Member for Sustainable Long Island
- Board Member NYC Brownfield Partnership
- American Institute of Professional Geologists
- Association of Ground Water Scientists & Engineers

Fields of Competence

- Regulatory negotiation and strategic guidance
- Management of groundwater pollution investigations
- Analysis of surface and groundwater flow systems
- Surface and subsurface water quality monitoring
- In situ permeability testing/infiltration testing
- Stratigraphic analysis, correlation, and interpretation
- Multimedia sampling
- Tank removal and associated soils assessment
- Aquifer test analysis
- Groundwater modeling
- Fate & transport modeling
- Applied geophysics
- Municipal water supply
- Soil vapor extraction
- Air sparging
- Bioventing/biosparging
- Design & installation of horizontal wells
- Construction management
- Data management using geographic information system (GIS) systems

Key Industry Sectors

- Pharmaceutical/healthcare
- Manufacturing
- Oil & gas

Key Projects

Supervision of field activities
Supervision of field activities, including aquifer testing, test borings, well installation, recovery well construction, soil vapor and groundwater sampling, and data evaluation.

Design and installation of a static hydrocarbon recovery system
Design and installation of a static hydrocarbon recovery system using 29 wells to recover more than 450,000 gallons of product.

Supervision of tank removal
Supervision of tank removal and subsequent soils evaluation for contamination.

Design and installation of municipal supply well
Design and installation of a municipal supply well yielding more than 1,000 gallons per minute. Supervised all aspects of well construction and acceptance testing.

Three-dimensional groundwater flow model, New Jersey
Three-dimensional groundwater flow model of New Jersey Coastal Plain deposits, to determine recovery well locations and rates, and feasibility of recharging treated effluent.

Pilot testing of soil vapor extraction
Pilot testing of soil vapor extraction and air sparging at several sites with varied hydrogeologic settings.

Pilot testing of bioventing and biosparging
Pilot testing of bioventing and biosparging in glacial outwash deposits in New York.

Project Manager for design, construction, and operation of 4000 standard cubic feet per minute (scfm) air sparge and 6200 scfm soil vapor extraction system
Project Manager for the design, construction, and operation of a 4000-scfm air sparge and 6200-scfm soil vapor extraction system consisting of 181 vertical and three horizontal sparge wells and 33 vertical and one horizontal soil vapor extraction wells. Provided direct construction management supervision for installation of four horizontal wells averaging 1,100 feet in length. As Project Manager, was responsible for construction management of aboveground treatment system components.

Constructed a transport model of hydrocarbons in glacial terrain
Regional scale three-dimensional flow and solute transport model of hydrocarbons in glacial terrain in New York used to negotiate favorable cleanup criteria for the client.

Constructed a flow and transport model of chlorinated solvent plume, Long Island, NY
Flow and transport model of a chlorinated solvent plume on Long Island, New York. Constructed a model involving the movement of groundwater and chlorinated solvents in highly-permeable glacial sediments. This model utilized the MT3D code and site-specific decay rates to demonstrate fate and transport.

Constructed a flow and transport model of chlorinated solvent plume, New Jersey
Flow and transport model of a chlorinated solvent plume in East Rutherford, New Jersey. Constructed a model involving the movement of groundwater and chlorinated solvents in overburden sediments and wetland areas. This model utilized the RT3D code and site-specific decay rates to develop a Classification Exception Area and demonstrate monitored natural attenuation.

Site decommissioning and remedial investigation, New York
Managed a site decommissioning and remedial investigation for a large defense industry client. Investigation results indicated significant chromium

contamination in soil and groundwater and led to inclusion in the New York State Voluntary Cleanup Program. Sediment and surface water samples were collected from multiple locations in the East River as part of the remedial investigation. Additional investigation and remediation are pending New York State Department of Environmental Conservation (NYSDEC) review. Chosen remedial methods were excavation and in situ stabilization/reduction. As Project Manager, was responsible for construction management aspect of implementing the remedial strategy.

Database setup and management for remedial investigation projects
Database setup and management for multiple large remedial investigation projects using GIS/Key. Database outputs include geologic and chemical cross sections, isoconcentration maps, graphs, data tables, and statistical analysis. Exports from databases have been used in groundwater flow and solute transport modeling.

Management of Industrial Site Recovery Act (ISRA) project
Management of a large ISRA project on a site contaminated with metals and chlorinated solvents. Key aspects of this project include litigation support, active groundwater remediation, off-site plume delineation, groundwater monitoring, data management, and soil remediation.

Brownfield projects, New York City
Principal-in-Charge of multiple Brownfield projects in the New York City area, including two sites in the Bronx that were managed from the initial stage supporting the Brownfield program application through the issuance of Certificates of Completion.
The two Bronx, NY properties were remediated prior to redevelopment as mixed income housing. Both sites had known underground storage tanks, and it was suspected that additional tanks were likely present based on past operations. One site had an open spill case with significant free-phase gasoline contamination. Previous investigations had revealed that both sites contained “urban fill” contaminated with volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), heavy metals, and polychlorinated biphenyls. Groundwater was impacted by VOCs, SVOCs, and metals. ERM completed a thorough remedial investigation, a remedial design, a qualitative risk assessment, and remedial design including bid specifications and drawings. Specifications included the need for underpinning several multiple story buildings, sheeting and shoring, and dewatering. The excavation plan required a combination of sidewall sloping, sheet pilings, underpinning, and tiebacks for structural support. In accordance with the Brownfield’s cleanup program, a comprehensive community participation plan was prepared and fact sheets produced for the various elements of the project.
Principal-in-Charge of a brownfield site in Jamaica, NY, utilizing the New York City Voluntary Cleanup Program administered by the New York City Mayor’s Office of Environmental Remediation. This site was “e” designated for hazardous materials and noise. ERM supervised the remediation of the site to achieve a Track 1 cleanup by excavation of the entire site to 14 feet. This cleanup allowed for completely unrestricted development of the site.
Principal-in-Charge of remediation of a brownfield site located on Webster Avenue in the Bronx, NY.
Work on this site included demolition of the existing building and excavation of soil to varying depths across the site to allow for the construction of two buildings. One building was designated for affordable housing and the other as supportive housing. Each of these buildings had a vapor barrier installed and the affordable housing building also required a sub slab depressurization system to prevent potentially harmful vapors from entering the building which was constructed as slab on grade. The supportive housing building had a basement dug out to 14 feet, which was in close proximity to the water table and required a specialized foundation to prevent both water and vapor intrusion.

Petroleum Remediation JFK Airport
Principal-in-Charge of a petroleum remediation project at a major New York airport. The remediation consisted of the installation of a soil vapor extraction/air sparge system, which operated for approximately 1 year. Work included negotiations with the Port Authority and NYSDEC, pilot testing, system design, system operation, and following closure system abandonment.

Principal-in-Charge of expert work on a major urban waterbody Superfund site in USEPA Region 2
Coordinates a diverse staff of environmental professionals in support of a contributing potentially responsible parties in the development of expert opinion on potential contribution to the overall impacts to the waterbody.

Principal-in-Charge of groundwater remediation utilizing pump & treat and injections to enhance natural biodegradation of dissolved chlorinated hydrocarbons
Investigation of source area and off site plume extent, Installation of recovery wells and operation & maintenance of a groundwater treatment system. Installation and operation & maintenance of three sub slab depressurization systems to control vapor intrusion.

Key Projects ERM Prior to Joining

Water quality, Long Island, New York
Comparison of major land use with the overall water quality of Long Island, New York.

Management and supervision of monitoring well network
Management and supervision of monitoring well network using over 1,000 wells. Correlation of data for use in United States Geological Survey (USGS) published annual reports

Stream gauging and surface water, Long Island, New York, National Stream Quality Accounting Network (NASQAN), and National Water Quality Assessment (NAWQA)
Stream gauging and surface water sampling on Long Island for the USGS NASQAN and NAWQA programs.

Timothy Daniluk, PG

Principal Consultant, Geologist, P.G.

Mr. Timothy Daniluk is a Senior Project Manager within ERM based in Syracuse, NY with over 10 years of experience in the field of hydrogeology. Tim has extensive experience with project management, chemical and biological injections, aquifer testing and analysis, and associated calculations and reporting. Tim has led field efforts on many projects including high profile sites with media attention. Tim has a specialized skill set with emerging contaminants including 1,4-Dioxane and perfluorinated compounds (PFCs) including special procedures necessary for proper preparation, sample collection, and analysis. Tim has managed projects ranging from maintenance of onsite treatment to full remedial investigations and site characterizations. Tim also has experience with advanced techniques such as Membrane Interface Probe (MIP), and WaterlooAPS.

Experience: 10.5 years' experience in professional consulting and hydrogeology

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LinkedIn: https://www.linkedin.com/in/timothy-daniluk-b87112a3/

Education

- *Advanced Aquifer Testing Techniques For Improved Hydrogeologic Site Characterization. West Chester University*, West Chester, PA, USA May 2019.
- Midwest Geosciences Group *Aquifer Testing for Improved Hydrogeologic Site Characterization*. Fort Collins, CO, USA. October 2017
- Nielsen Environmental Field School monitoring well design, construction, and development field course. San Diego, CA, USA. April 2012
- Nielsen Environmental Field School groundwater, surface water, and sediment field courses. Las Cruces, NM, USA. October 2011
- M.S. Hydrogeology, Syracuse University, USA, 2011
- B.S. Water Resources, State University of New York College at Brockport, USA, 2009

Professional Affiliations and Registrations

- New York State Licensed Professional Geologist (License Number: 000275-1)
- Central New York Association of Professional Geologists

Fields of Competence

- Subsurface clearance
- Well design
- Remedial injections
- Groundwater, surface water, and sediment
- Site characterization
- Hydraulic conductivity testing and analysis
- Remedial Investigations
- Soil vapor intrusion
- Aqtesolv
- PFAS sampling
- Reporting
- WaterlooAPS™ and MIP
- Project Management
- Maintenance and operation of treatment systems

Key Industry Sectors

- Manufacturing
- Oil and Gas
- Chemical
- Pharmaceutical

Key Projects

Groundwater Intrusion, Multiple sites, New York
Reviewed vertical surface water profiles, Thermal Infrared Imagery (TIR), geochemical parameters, and samples from pore water, surface water, groundwater, sediment, and soil to analyze locations of potential groundwater influence to surface water.

Aquifer Testing, Multiple Sites, USA
Designed, conducted, and analyzed step-drawdown and constant rate pumping tests and slug tests performed data analysis using Aqtesolv to generate hydraulic conductivity values.

Site Investigation, Finger Lakes, NY
Directed all subsurface activities in the field, including MIP and Waterloo^{APS} technologies. Integral in design and placement of monitoring well network, sediment and surface water sampling, tree core sampling, subsequent analysis of data, and CSM development. Designed and led several rounds of hydrogeologic characterization efforts. Coordinated final reporting efforts.

Aquifer Testing, Michigan
Onsite field leader for 72-hour constant rate pumping test. Performed subsequent hydrogeologic analysis and generated report and deliverable.

Soil Vapor Intrusion IRM, Finger Lakes, NY
Managed soil vapor IRM with expanding scope and scheduling constraints.

PFAS Sampling
Extensive experience designing programs and sampling for poly- and perfluorinated alkyl substances (PFAS) in various media at seven sites.

Phase II and Site Characterization, Kentucky
Managed all aspects of Phase II PFAS investigation, reporting, design and implementation of site characterization including regulator and Client relations. PFAS-focused.

Brownfield Cleanup, New York
10 months as environmental inspector and oversight of construction operations during a NYSDEC brownfield excavation and cleanup project

Environmental and Construction Oversight, Pennsylvania
One year of environmental and construction oversight for pipeline and well pad construction in Pennsylvania

Brownfield Cleanup, New York
Environmental inspector and oversight of construction and excavation operations during a NYSDEC brownfield cleanup project. Also managed all aspects of a Remedial Investigation on and off-site.

Soil Vapor Intrusion Mitigation, Finger Lakes
Oversight of contractors sealing slab cracks, installation of sample ports, data analysis, and project management of SVI investigation

Long-Term O&M, Utica, NY
Managing project involving Sub-Slab Depressurization System, onsite landfill, and maintenance of engineering controls and telemetry system and sampling.

Long-Term O&M, Finger Lakes, NY
Weekly maintenance and troubleshooting for CVOC groundwater pump and treat system with air sparge pre-treatment, filtration, and carbon finishing.

Emerging Contaminant Site Characterization
Managed on and subsequent off-site characterization for a project in Kentucky involving PFAS in all media including regulatory deliverables and meetings with government officials.

Publications

- Gordon, RP, LK Lautz, TL Daniluk. 2013. Spatial patterns of hyporheic exchange and biogeochemical cycling around cross-vane restoration structures: The role of the hyporheic zone and implications for stream restoration design. Water Resources Research. Vol 49, Issue 4, pp 2040-2055.
- Daniluk, TL, LK Lautz, RP Gordon, TE Endreny. 2012. Impacts of stream restoration on surface water-groundwater interaction. Hydrological Processes. Vol. 27, Issue 25, pp 3730-3746.
- Daniluk, TL, LK Lautz, RP Gordon. 2010. Water, heat and solute fluxes through hyporheic zones at stream restoration sites and their associated reference stream. Abstract, American Geophysical Union.

Stephen A. Mirabello, P.E.

Senior Engineer

Stephen is a Senior Engineer based out of ERMs Ewing office. He is experienced with active and passive remedial design for contamination in all phases, groundwater treatment system operation and maintenance, site investigations, project management, field geologic assessments, logging and sampling and permitting. He has worked closely with both private and public sector clients to manage contaminated sites for chlorinated VOC, SVOC, PCB, TPH, PAH, and metals in soil, sediment, groundwater, and air. Private sector client include pharmaceutical, manufacturing, and power and utilities. He has also worked with NYSDEC, NJDEP, EPA and US Army Corps of Engineers on remedial investigations and designs on respective superfund sites in NY and NJ.

Experience: 17 years' experience in Contaminated Site Management

Email: stephen.mirabello@erm.com

LinkedIn: https://www.linkedin.com/in/stephen-mirabello-p-e-62265819/

Education

- MS, Environmental Engineering, Cornell University, USA, 2006
- BS, Forest Engineering, SUNY College of Environmental Science and Forestry, USA, 2004

Professional Affiliations and Registrations

Professional Engineer – Environmental NY#089550

- Professional Engineer – Environmental NJ#24GE05093800

Languages

- English, native speaker

Fields of Competence

- Contaminated site remedial design
- Contaminated site investigation
- Facility decommissioning
- Project management

Key Industry Sectors

- Power
- Chemical
- Manufacturing & Pharmaceutical
- Government

Publications

- Marabello D.A , Mirabello, S.A., Macbeth T., Lamandella R., Wright J, Kuder T. 2015 "Advanced Field Testing to Support Monitored Natural Attenuation of a Dichloromethane Groundwater Plume in Bedrock." Presented at the 3rd International Symposium on Bioremediation and Sustainable Environmental Technologies. Miami Florida
- Mirabello, S.A., Marabello D.A, Chenenko, R.A, Evans, P.J, 2013. "Demonstration of an Effective Natural Attenuation Remedy for a Methylene Chloride Source at a Former Pharmaceutical Site in New Jersey." Presented at the 2nd International Symposium on Bioremediation and Sustainable Environmental Technologies. Jacksonville Florida.

Key Projects

Public Utility – Composite Capping - Design and Installation.
Stephen is the Lead Engineer for the design and implementation of a composite cap as a remedy for soil and groundwater impacts at an active electrical station. Design included specification of asphalt, and impermeable Geosynthetic clay liner cap overlain with stone or landscaping. Responsibilities include preparation of bid specifications, local and state permit preparations, submittal review, and supervision of remedial implementation.

Former Biomedical Device Manufacturer –Soil Remedial Action.
Stephen is the Lead Engineer for the design and implementation of a soil remedy consisting of excavation, permeable and impermeable capping, and fencing with deed restrictions. Design included repair specification of asphalt, permeable cap, and fencing. Responsibilities include preparation of bid specifications, local and state permit preparations, submittal review, and supervision of remedial implementation.

Electronic Manufacturer – Soil Vapor Mitigation Design
Stephen is the Engineer-Of-Record for an investigation and design of remedial measures for an active electronic manufacturing operation. Responsibilities included site inspection, NYSDEC communication, and design and oversight of implementation of measures to mitigate sub-slab vapors present, and groundwater contamination at the site. Remedy and evaluations included the assessment of bioremediation of groundwater contamination, sealing of slab penetrations, increased airflow, collection of confirmation samples, and institutional controls. For completed measures he drafted the Construction Completion Report and Interim Site Management Plan for the remedy and periodic monitoring in accordance with DER-10 guidance

Public Utility – Operations and Maintenance – Pump and Treat - MGP Contamination.
Stephen is the facility engineer for an active fifty gallon per minute groundwater pump and treat facility for former manufactured gas plant related contamination. Treatment units include clay and mixed media filters, flocculation/sedimentation, ion exchange, and carbon adsorption. Responsibilities include site inspections, operator and client communication, audits, and review of data for NJDEP permit compliance.

Pharmaceutical Facility – RCRA and TSCA Soil Remedial Actions
Stephen was a senior engineer overseeing the preparation of bid documents, remedial action workplan, and field implementation for several phases of remediation at production facility for a pharmaceutical client. Remediation included RCRA remediation of over 11,000 tons lead-impacted soil, TSCA remediation of soils at active electrical substations, excavations under for active rail lines, and compliance with NJDEP Land Use permitting stipulations.

Packaging Manufacturer – Design and Cap Repair
Stephen was the Senior Engineer and task manager for the remediation of multiple areas-of concern for a manufacturing client. Design included excavation underneath active equipment and structural supports inside a facility compressor room and restoration of a mixed cover cap in addition to preparation of associated workplans, requests for proposal, and field staff, contractor, and site operator management.

Concrete Plant – Stormwater Pollution Prevention Plan

Stephen was the Engineer-Of-Record for the preparation of a NYSDEC Stormwater Pollution Prevention Plan for a concrete producing facility in NY. Responsibilities included stormwater calculations, control sizing, NYSDEC communication and certification of the final SWPP.

Former Manufacturer - Soil Removal Remedial Action

Stephen was the Engineer-Of-Record for a soil excavation at part of a NYSDEC Voluntary Cleanup Site. The remedy included deep excavation of PAH impacted soils for site dry-wells and recharge basin. He additionally drafted the Final Engineering Report and Site Management Plan for the final soil cover and sub-slab depressurization remedies and periodic monitoring in accordance with DER-10 guidance.

Key Projects Prior to Joining ERM

Fuel Oil Pipeline 20-in Decommissioning & Remedial Measure

Stephen was the Project Manager – Lead Engineer and managed the field oversight of the decommissioning of a 20-in 4.5 mile long buried fuel oil pipeline. Components of the work included plan preparation, contractor submittal review, CAMP implementation, pigging/cleaning, grouting in-place, and regular communication with NYSDEC regarding plan deviations. Post closure activities include the preparation of the Final Engineering Report that was accepted by NYSDEC.

Fuel Oil Pipeline 10-in Decommissioning Design

Stephen was the Project Manager – Lead Engineer and coordinated the preparation of the specifications and drawings for bid documents for the decommissioning of a 10 in, 2-mile long fuel oil pipeline that is both buried or present in. Special considerations and procedures were developed for portions of the pipeline that passed through environmentally sensitive or contaminated areas. In addition a field effort inclusive of plan preparation, CAMP implementation, pigging/cleaning, and pressure integrity testing is part of the design.

PCB Contaminated Superfund Site

Stephen was the Lead Engineer, project engineer for the pre-design investigation and remedial design consisting of excavation and off-site disposal, rail spur construction, flood control, soil consolidation, site regrading, soil capping, and wetland and vegetative restoration. In total over 150,000 CY of TSCA and Subtitle-D soils over 50 acres are to be removed as part of the design. This interdisplinary project requires coordination with EPA, US Army Corps of Engineers, Conrail, NJDEP and internal teams.

Generating Station Demolition Design

Stephen was the Project Manager – Lead Engineer and led the demolition design and site restoration bid package a generating station building and property. The design included demolition of the building interior/exterior structures and utilities, filling of tunnels and trenches with clean sand, site regrading and restoration of sidewalks. In addition, he was the engineer-of-record and signed and sealed engineering drawings to be used by the remedial contractor for the New York City Department of Buildings Permit application, inclusive of a builder's pavement plan.

Utility Tunnel – Feasibility Study

Stephen was the Project Manager – Lead Engineer and coordinated the preparation of an environmental feasibility study for the installation of new 36-inch Transmission Pressure Steel Gas Main across the Bronx River between Soundview Park and Hunts Point in the borough of Bronx, NY. The environmental study was concerned with determining costs and viability of removing existing 42" retired cast iron gas mains currently in the tunnel to allow placement of the new main. Specific tasks included the sampling of both the interior and exterior of the pipeline. Exterior samples included asbestos, lead paint and PCBs on both the surface and support structures. Following surface abatement, the pipe was opened to perform the interior investigation, inclusive of waste water characterization, pipeline video surveying, and sludge sampling. Cleaning and demolition work plans were developed as part of the feasibility study.

Service Station Demolition Design

Stephen was the Lead Engineer for the design specification and drawings for the demolition of a former service station in Roe Park NY. Components of the work include management of hazardous building materials, excavation of underground storage tanks, removal of contaminated soils, demolition of the property building and other above ground structures, and site restoration including backfill.

Chlorinated Solvents

Stephen was the Lead Engineer for multiple chlorinated solvents sites overseen by the NYSDEC cleanup program, he was a project engineer for the performance based design and construction of remedial measures to mitigate vapor intrusion as a result of a chlorinated solvent spill. Components included multiple SVE and AS wells, treated with vapor phase carbon adsorption. Responsibilities included analyzing pilot test data to determine radius of influence, system loss and sizing calculations and preparation the specifications.

Groundwater Remediation- Chlorinated Solvents – Operations and Maintenance

Stephen was the Project Engineer for multiple chlorinated solvents sites overseen by the NJ ISRA program and Federal agencies, he performed site inspections and maintenance to the groundwater collection system, in addition to subcontractor oversight of system improvements. Systems treated for chlorinated solvents with technologies including solids removal, air stripping, carbon treatment, NAPL separation, and metals removal. Many system improvements required the use of confined space entry procedures. In addition, he was responsible for calculations and figure creation for periodic regulatory reports as well as updating specifications in the O&M manual annually.

APPENDIX E NYSDEC APPROVAL CORRESPONDENCE

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Environmental Remediation, Region 8
6274 East Avon-Lima Road, Avon, NY 14414-9516
P: (585) 226-5353 I F: (585) 226-8139
www.dec.ny.gov

April 14, 2023

Allen Hawker
G.W. Lisk Company, Inc.
2 South Street
Clifton Springs, NY 14432

Re: Pilot Study Work Plan
G.W. Lisk NYSDEC Site No. C835026
Clifton Springs, Ontario County

Dear Mr. Hawker,

The New York State Department of Environmental Conservation (NYSDEC) and New York State Department of Health (NYSDOH), collectively referred to as the Departments, have completed their review of the *Draft Pilot Study Work Plan* dated March 2023 (electronically received 03/30/2023) prepared by ERM Consulting & Engineering, Inc.

In accordance with 6 NYCRR Part 375-1.6, the Departments have determined that the Work Plan substantially addresses the requirements of the Brownfield Cleanup Agreement, and the Work Plan is hereby conditionally approved provided that the following changes are made:

1. Two minor grammatical errors were identified on page 8.
    a. A period is missing after the word “halorespiration”
    b. The final sentence should read that negative impacts “are” not anticipated.

2. Section 1.4.4 needs to refer to the RIR as “draft” as it has not yet been approved. Work under the Supplemental RIWP will be covered under the RIR, not an SIR.

3. Please remove all draft designations and have Mr. Mirabello finalize, stamp and sign the document.

Please contact me at joshuah.klier@dec.ny.gov or (585) 226-5357 if you have any questions or to schedule a meeting or conference call to discuss these comments.

Sincerely,

Joshuah J. Klier

Joshuah J. Klier, G.I.T.
Assistant Geologist

ec:

Tim Daniluk, ERM
Stephen Mirabello, ERM
Ernie Rossano, ERM
Thomas Tuori, HSE Law
David Pratt, NYSDEC
Adam Morgan, NYSDEC
Dudley Loew, NYSDEC
Renata Ockerby, NYSDOH
Justin Deming, NYSDOH

APPENDIX F USEPA CLASS V WELL PERMIT APPLICATION

OMB No. 2040-0042 Approval Expires 4/30/2022

United States Environmental Protection Agency

Underground Injection Control
Permit Application for a Class V Well

(Collected under the authority of the Safe Drinking Water Act. Sections 1421, 1422, and 40 CFR Part 144)

For Official Use Only

Date Received:

Permit Number:

Read Attached Instructions Before Starting

I. Owner Name, Address, Phone Number and/or Email

Kristen J. Campbell, CSP
Director of Sustainability
Sprague Resources GP LLC | O: 603.430.7264
185 International Drive
Portsmouth, NH 03801
kcampbell@spragueenergy.com

II. Operator Name, Address, Phone Number and/or Email

Sprague Operating Resources LLC
40 Canal Street
Mount Vernon, NY

III. Commercial Facility

- [X] Yes
- [ ] No

IV. Ownership

- [X] Private
- [ ] Federal
- [ ] State/Tribal/ Municipal

V. Permit Action Requested

- [X] New Permit
- [ ] Permit Renewal
- [ ] Modification
- [ ] Add Well to Area Permit
- [ ] Other

VI. SIC Code(s)

5171

VII. Indian Country

- [ ] Yes
- [X] No

VIII. Type of Permit (For multiple wells, use additional page(s) to provide the information requested for each additional well)

- [ ] A. Individual
- [X] B. Area

Number of Wells: 3

Well Field and/or Project Names:

IX. Class and Type of Well (see reverse)

A. Class	B. Type (enter code(s))	C. If type code is "X," explain.
V	B	Subsurface Environmental Remediation Wells

X. Well Status

- [ ] A. Operating — Date Injection Started:
- [ ] B. Conversion — Date Well Constructed:
- [X] C. Proposed

XI. Well Information

API Number:

Permit (or EPA ID) Number:

Full Well Name:

XII. Location of Well or, for Multiple Wells, Approximate Center of Field or Project

Locate well in two directions from nearest lines of quarter section and drilling unit

Surface Location

____ 1/4 of ____ 1/4 of Section ____ Township ____ Range ____

____ ft. from (N/S) ____ Line of quarter section

____ ft. from (E/W) ____ Line of quarter section.

Latitude:

Longitude:

XIII. Attachments

In addition to this form, complete Attachments A-U (as appropriate for the specific well class) on separate sheets. Submit complete information, as required in the instructions and list all attachments, maps or other figures, by the applicable letter.

XIV. Certification

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possiblity of fine and imprisonment. (Ref. 40 CFR § 144.32)

Name and Official Title *(Please Type or Print)*	Signature	Date Signed

INSTRUCTIONS FOR FORM 7520-6 (CLASS V WELLS)

A permit application must be completed by all owners or operators of current or proposed Class I, II, and III wells, and some Class V injection wells subject to the requirement to obtain an Underground Injection Control (UIC) permit as described at 40 CFR 144.31 and others directed by a UIC official to apply for a UIC permit. Please note that the information needs vary by well class. These instructions are specific to Class V wells; other versions are available for other well classes. Please note that this form must be signed by a responsible entity as described at 40 CFR 144.32, even if the attachments are prepared by contractors or service companies. If the application covers multiple wells, use additional pages as necessary to provide all the requested information.

I. OWNER NAME, ADDRESS, PHONE AND/OR EMAIL: Enter the name and street address, city/town, state, and ZIP code of the owner of the well, well field, or company. Also provide an email address (if available) and/or a phone number.

II. OPERATOR NAME, ADDRESS, PHONE AND/OR EMAIL: Enter the name and street address, city/town, state, and ZIP code of the operator of well or well field; also provide an email address (if available) and/or a phone number. If the operator is the same as the owner, enter “same as owner.”

III. COMMERCIAL FACILITY: Check the appropriate box to indicate the type of facility. A commercial facility is a single or multiple well facility that is specifically engaged in the business of injecting waste fluids generated by third party producers that is originated off-site and transported to the facility by truck for a fee or compensation.

IV. OWNERSHIP: Check the appropriate box to indicate whether the owner of the well/facility is a private, Federal, or State/Tribal/Municipal entity.

V. TYPE OF PERMIT ACTION REQUESTED: Check “new permit” if the well has never been subject to a UIC permit (e.g., for a newly constructed or converted well). Check “permit renewal” for an application associated with extending an expiring UIC permit. Check “modification” for an application to modify an existing permit that is not expiring. Check “add well to area permit” if additional wells are to be covered under an existing UIC area permit. Check “other,” if needed and describe the situation.

VI. SIC CODES: List at least one and no more than four Standard Industrial Classification (SIC) Codes that best describe the nature of the business in order of priority. A list of SIC codes is available from the U.S. Department of Labor at https://www.osha.gov/pls/imis/sicsearch.html.

VII. INDIAN COUNTRY: Check yes if the well is located in Indian country. Indian country (as defined in 18 U.S.C. 1151) includes: all land within the limits of any Indian reservation under the jurisdiction of the U.S. government; all dependent Indian communities within the borders of the U.S.; and all Indian allotments, the Indian titles to which have not been extinguished.

VIII. TYPE OF PERMIT: Check “Individual” or “Area” to indicate the type of permit requested. Individual permits cover a single injection well, while area permits may cover more than one injection well. Note that area permits are issued at the discretion of the Director and that wells covered by an area permit must: be at one contiguous site, be under the control of one entity, and may not inject hazardous waste. If an area permit is requested, enter the ***number of wells*** to be included in the permit. In the case of a project or field that crosses State lines, it may be possible to consider an area permit if EPA has jurisdiction in all affected States (each such case will be considered individually). Also provide the ***name of the well field or project.***

IX. CLASS AND TYPE OF WELL: Enter the class (as defined in 40 CFR 144.6) and type of injection well for which a permit is requested. Use the most pertinent code selected from the table below. When selecting type “X”, please explain in the space provided.

TABLE OF CLASS V WELL TYPES

A	Industrial Well.
B	Beneficial Use Well.
C	Fluid Return Well.
D	Sewage Treatment Effluent Well.
E	Cesspool (non-domestic).
F	Septic System.
G	Experimental Technology Well.
H	Drainage Well.
I	Mine Backfill Well.
J	Waste Discharge Well.

X. WELL STATUS: Check ***Box A, Operating*** if the well currently operates as an injection well (e.g., if a permit renewal is requested or a permit is sought for an existing rule-authorized injection well). Check ***Box B, Conversion*** for an existing well not currently being utilized for injection that is proposed to be converted to an injection well. Check ***Box C, Proposed*** for an underground injection well not yet constructed or completed. Provide relevant dates if A or B are checked.

XI. WELL INFORMATION: Enter the ***API number*** (the number assigned by the local jurisdiction (usually a State Oil and Gas Agency) using the American Petroleum Institute standard numbering system). Enter the ***Permit or EPA ID number*** assigned to the injection well by the EPA or the permitting authority. If you do not have a number (e.g., for a new well), this will be provided by EPA or the permitting authority, and you can leave the field blank. Also enter the ***Full Name of the Well*** or project.

XII. LOCATION: For individual permit applications, in the fields provided, enter the location of the well using latitude and longitude and/or the Public Land Survey System. When using latitude and longitude, use decimal degrees to five or six places after the decimal, if possible; be sure to include a negative sign for the longitude of a well in the Western Hemisphere and a negative sign for the latitude of a well in the Southern Hemisphere. When using the Public Land Survey System, fill in the complete township, range, and section to the nearest quarter-quarter section. A township is north or south of the baseline, and a range is east or west of the principal meridian (e.g., T12N, R34W). Also include the distance, in feet, from the nearest north or south line and nearest east or west line of the quarter-section. For area permit applications, provide the latitude and longitude of the approximate center of the area.

XIII. ATTACHMENTS: Specific instructions for completing the attachments are presented on pages 3 through 6. Place the permit or EPA ID number (or, if none has been assigned, other identifying information such as an API number or the project name) in the upper right hand corner of each page of the attachments.

XIV. CERTIFICATION: All permit applications must be signed by either: a responsible corporate officer for a corporation, by a general partner for a partnership, by the proprietor of a sole proprietorship, or by a principal executive or ranking elected official for a public agency.

PAPERWORK REDUCTION ACT NOTICE: The public reporting and recordkeeping burden for this collection of information is estimated to average 104 hours per response for a Class V well permit application. Burden means the total time, effort, or financial resource expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal Agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to the collection of information; search data sources; complete and review the collection of information; and, transmit or otherwise disclose the information. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including the use of automated collection techniques to Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822), 1200 Pennsylvania Ave., NW, Washington, DC 20460. Include the OMB control number in any correspondence. Do not send the completed forms to this address.

Instructions for Completing Attachments to Form 7520-6 (Class V Wells)

The Underground Injection Control (UIC) program, as promulgated under the Safe Drinking Water Act (SDWA), is designed to prevent injection activity from allowing the movement of fluid containing any contaminant into underground sources of drinking water (USDWs), if the presence of that contaminant may cause a violation of any primary drinking water regulation or may otherwise adversely affect the health of persons as found at Title 40 of the Code of Federal Regulations (40 CFR) section 144.12. Any applicant for a permit under this program shall have the burden of showing that their proposed construction, operation, maintenance, conversion, plugging, abandonment, and injection activity, does not endanger USDWs.

The attachments below have been constructed to provide applicants with clear expectations as to what information EPA needs to make a determination that an applicant's proposed activities will not endanger USDWs.

Pre-Application Coordination

Coordination between the UIC program and the permit applicant prior to submittal of the permit application is an important step for efficient and effective permitting. Early discussions will ensure that the applicant is aware of all the permit application requirements, including state specific requirements found at 40 CFR part 147. These discussions may also help the applicant plan how to invest time and resources needed to develop a comprehensive and complete permit application.

Applicants are encouraged to contact their EPA regional UIC program for a pre-application coordination meeting.

When completing each attachment, please be sure to specify the units reported, e.g., of depth, pressure, temperature, etc.

Attachment A. Map(s) and Area of Review

Part I. Well Location(s)

For Individual Permits: If the surface location provided in the accompanying 7520-6 form does not adequately describe the well location (i.e., due to deviation, directional, or horizontal drilling), please describe the well's orientation and provide the top- and bottom-hole coordinates, as appropriate. If any monitoring wells are proposed as part of this permit application, provide coordinates for all monitoring wells.

For Area Permits (40 CFR § 144.33): Provide information similar to what is outlined above for individual permits for each well (existing or proposed) to be covered by this permit. In addition, provide a description of the proposed permitted area. At a minimum, this area should include all the proposed or existing wells known at the time of permit application submittal. For circular areas, this description should consist of a defined-radius from a singular point whose coordinates have been given. For polygonal areas, use a series of coordinates describing the vertices or corners of the area. Submit a Geographic Information System (GIS) file, if available.

Part II. Area of Review Size Determination (40 CFR § 146.6)

For All Permits. Give the method (fixed radius or equation) and, if appropriate, all calculations used to determine the size of the area of review (AOR). If you are uncertain as to which method to use, consult with your regional EPA office.

The AOR must be a minimum radius of one-fourth (1/4) mile from the well bore, including a well's lateral, or the proposed area permit boundary for area permits, unless the use of an equation is approved by the Director.

Part III. Map(s) (40 CFR § 144.31)

Submit a topographic map (or other map if a topographic map is unavailable) extending one mile beyond the facility property boundary showing:

- project injection well(s), well pad(s) and/or project area,
- applicable area of review,
- all outcrops of injection and confining formations,
- all surface water intake and discharge structures, and
- all hazardous waste treatment, storage, or disposal facilities.

Consult with your EPA regional office for the definition of the facility property boundary.

Within the one-fourth (1/4) mile beyond the facility property boundary or the AOR, whichever is larger, the map will also show the:

- name and location of all production wells, injection wells, abandoned wells, dry holes, and all water wells, noting their types (public water system, domestic drinking water, stock, etc.),
- springs and surface bodies of water,
- mines (surface and subsurface) and quarries, and
- other pertinent surface features, including residences, schools, hospitals, and roads.

Only information of public record and pertinent information known to the applicant is required to be included on this map. Multiple maps may be needed to display this information clearly. If a certain feature is not present in the area covered, please state so definitively (e.g., *"There are no known outcrops of the confining formation in the mapped area."*).

Part IV. Area of Review Wells and Corrective Action Plans (40 CFR § 144.55)

Submit a tabulation of data and wellbore diagrams reasonably available from public records or otherwise known to the applicant on all wells within the AOR included on the map, which penetrate the proposed confining zone(s). Such information will include:

- well name, location and depth,
- well type,
- date well was drilled,
- well construction that includes casing and cement details, including demonstrated or calculated top of cement,
- cement bond logs (if available), and
- record of well completion and plugging (if applicable).

For such wells which are improperly sealed, completed, or abandoned, also submit a plan consisting of such steps or modifications as are necessary to prevent movement of fluid into USDWs.

Part V. Landowners Information (40 CFR § 144.31 and part 147)

Identify and submit a list with the names and addresses of all owners of record of land within one-fourth (1/4) mile of the facility property boundary. This requirement may be waived by the Regional Administrator if the site is in a populous area and the Regional Administrator determines that the requirement would be impracticable.

Consult with your regional EPA office, as additional state landowner notification requirements may apply (40 CFR part 147).

Attachment B. Geological and Geophysical Information

Part I. Geological Data

Provide the following information:

- geological data on all formations from the surface to the base of the injection well, identifying all USDWs and confining and injection zone(s). This data includes the lithologic description, geological name, thickness, depth, and total dissolved solids (TDS) concentrations from these formations (if known),
- the position of all USDWs that may be affected by the proposed injection relative to the injection formation and the direction of water movement,
- the geologic structure of the local area,
- source of information for the geologic data and formation TDS,
- porosity and permeability of injection formation (if available),
- geological cross-sections proximate to the injection well that include the confining and injection zones. The cross-sections should illustrate the regional geologic setting and show the thickness and lateral continuity of the confining zone(s) through the area of review,
- within the AOR, identify known or suspected faults and fracture systems. If identified, provide proximity to the injection zone and the effect the fault/fracture system may have on the injection activities, and
- a history of seismic activity in the area and proximity to crystalline (i.e., granitic) basement.

Part II. Proposed Formation Testing Program

Provide a formation testing program to obtain data on:

- fluid pressure,
- temperature,
- estimated fracture pressure,
- physical and chemical characteristics of the formation fluids, and
- physical and chemical characteristics of the injection zone.

Attachment C. Well Construction/Conversion Information

Part I. Well Schematic Diagram (40 CFR § 144.52)

Provide a detailed proposed well schematic diagram that includes:

- identification of USDWs and confining and injection zones,
- casing and cementing details, including demonstrated or calculated top of cement,
- tubing and packer (if applicable),
- open hole or perforated intervals,
- proposed injection procedures including pump, surge, tank, and

- surface trace (if horizontal or deviated well).

For wells that are drilled and to be converted to an injection well, also provide the current well schematic diagram.

Part II. Well Construction or Conversion Procedures (40 CFR § 144.52)

Provide a detailed description of well construction or conversion procedures, that includes:

- proposed logs and other tests conducted during the drilling and construction of new well(s),
- proposed stimulation plan(s), if planned, and
- description of alarms and shut-down systems at the well (if applicable).

For wells that are drilled and to be converted to an injection well, also provide:

- well completion and cementing records, and
- previously run logs/tests.

Attachment D. Injection Operation and Monitoring Program (40 CFR § 144.54)

Submit the following information:

- flow diagram of fluid flow through the facility,
- contingency plan(s) to cope with well failure, so as to prevent migration of contaminating fluids into a USDW,
- drawing of the surface construction,
- locations of all monitoring devices (show on the map(s) referenced in section A.III. above), and
- description of sampling and monitoring devices to monitor the nature of the injected fluids, injection pressure, annulus pressure (if applicable), flowrate, and cumulative volume.

Additionally, submit the following proposed operating data for each well in the individual or area permit:

- average and maximum daily rate and volume of fluids to be injected,
- average and maximum injection pressure,
- source(s) of injection fluids (including field and formation names),
- proposed annular fluid, and
- analysis of the chemical and physical characteristics of the injection fluid. At a minimum, this should include pH, specific gravity, TDS, and conductivity. Consult with the regional EPA office for additional guidance.

Attachment E. Plugging and Abandonment Plan (40 CFR §§ 144.31 & 144.51)

Submit a plugging and abandonment (P&A) plan of the well on EPA Form 7520-19 along with a P&A diagram. The plan should include:

- type, and number of plugs to be used,
- placement of each plug including the elevation of top and bottom,
- type, grade, and quantity of cement to be used, and
- method of placement of the plugs.

Provide one or more cost estimates from an independent firm in the business of plugging and abandoning wells to conduct the work proposed in the P&A plan for EPA to contract plugging of the well. This is to ensure that EPA has adequate funding to plug the well(s) if the operator is unable to plug the well(s).

Consult with the regional EPA office for additional guidance on developing the P&A plan and cost estimate calculations.

Attachment F. Financial Assurance (40 CFR § 144.52)

Submit evidence of financial resources, such as a surety bond or financial statement, necessary for a third party to close, plug, or abandon the well in the event an owner or operator is unable to do so. The monetary amount is based on the P&A plan cost estimate provided in Attachment E.

Attachment G. Site Security and Manifest Requirements (Commercial Wells Only)

Provide a proposed site security plan. This could include fencing around the perimeter of the facility. Consult with the regional EPA office for additional guidance on manifest requirements.

Attachment H. Aquifer Exemptions (40 CFR §§ 144.7 & 146.4)

If an aquifer exemption (AE) is requested, submit the information required at 40 CFR § 144.7 and to demonstrate that the criteria found at 40 CFR § 146.4 are met. Consult with your regional EPA office for additional guidance.

Attachment I. Existing EPA Permits (40 CFR § 144.31)

Submit a listing of all permits or construction approvals received or applied for under any of the following programs:

- Hazardous Waste Management program under RCRA,
- UIC program under SDWA,
- NPDES program under CWA,
- Prevention of Significant Deterioration (PSD) program under the Clean Air Act,
- Nonattainment program under the Clean Air Act,
- National Emission Standards for Hazardous Pollutants (NESHAPS) preconstruction approval under the Clean Air Act.
- Ocean dumping permits under the Marine Protection Research and Sanctuaries Act,
- Dredge and fill permits under section 404 of CWA, and
- Other relevant environmental permits, including State permits.

Attachment J. Description of Business (40 CFR § 144.31)

Provide a brief description of the nature of the business.

Attachment K. Optional Additional Project Information (40 CFR § 144.4)

The following is a list of Federal laws that may apply prior to the issuance of permits. When any of these laws are applicable, EPA must ensure that they are followed. The optional additional information requested below will assist EPA in its analyses to satisfy these laws.

- <u>The Wild and Scenic Rivers Act, 16 U.S.C. 1273 et seq.</u>

  Identify any national wild and scenic river that may be impacted by the activities associated with the proposed project.

- <u>The National Historic Preservation Act of 1966, 16 U.S.C. 470 et seq.</u>

  Identify properties listed or eligible for listing in the National Register of Historic Places that may be affected by the activities associated with the proposed project. If previous historic and cultural resource survey(s) have been conducted, provide the results of the survey(s).

- <u>The Endangered Species Act, 16 U.S.C. 1531 et seq.</u>

  Identify any endangered or threatened species that may be affected by the activities associated with the proposed project. If a previous endangered or threatened species survey has been conducted, provide the results of the survey.

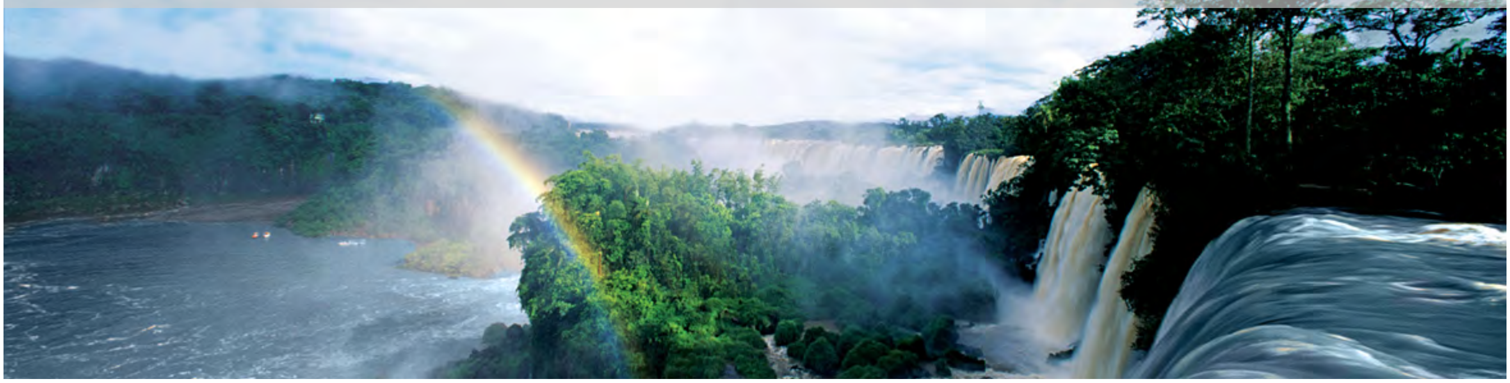
- <u>The Coastal Zone Management Act, 16 U.S.C. 1451 et seq.</u>

  Identify any coastal zones that may be affected by the activities associated with the proposed project.

APPENDIX G EOS PRO PRODUCT INFORMATION

EOSPRO

Engineered formula of emulsified vegetable oil, nutrients and vitamins optimizes distribution and contaminant degradation



Enriched emulsified vegetable oil used to stimulate anaerobic bioremediation of chlorinated solvents and other recalcitrant chemicals in contaminated groundwater

USDA CERTIFIED BIOBASED PRODUCT
PRODUCT 95%

Product Advantages

- Vitamin B12 and micronutrients
- Slow and fast release substrates
- Engineered for effective transport
- Third party validated
- Food-grade and USDA certified
- 74% fermentable carbon
- Regulatory acceptance

EOS
EOS Remediation

Experience you can rely on, Products you can trust™

+1 919.873.2204
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Brad Elkins
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EOSPRO

Technical Information

Emulsified Oils Family

Description

EOSPRO is a nutrient-enriched, DoD-validated, emulsified vegetable oil (EVO). EOSPRO is engineered to quickly stimulate microbial activity while providing long-term nourishment to enhance anaerobic bioremediation of chlorinated solvents, nitrates, perchlorate, energetics, acid mine drainage, and other recalcitrant chemicals in contaminated groundwater. EOSPRO can also be used to reduce redox sensitive metals and radionuclides. The negative surface charges on the droplets combined with small droplet size promote effective transport in the subsurface.

EOSPRO benefits include:

- Vitamin B-12 and micro-nutrients
- Rapidly-biodegradable substrates to “jump start” bacterial growth
- Slow release biodegradable substrates to promote long-term biological activity
- Engineered for effective transport in the subsurface
    - Small oil droplet size
    - Negative surface charge
- Extensive third-party validation

USDA CERTIFIED BIOBASED PRODUCT
PRODUCT 95%

EOSPRO incorporates the patented EOS® technologies that clients have trusted for more than a decade. Domestic supply made in the USA with US farmed soybeans.

Chemical & Physical Properties

Oil Emulsion Concentrate: EOSPRO	Typical
Refined and Bleached US Soybean Oil (% by wt.)	59.8
Rapidly Biodegradable Soluble Substrate (% by wt.)	4
Other Organics (emulsifiers, food additives, etc.) (% by wt.)	10
Specific Gravity	0.96 - 0.98
pH (Standard Units)	6 - 7
Median Oil Droplet Size (microns)	1.0
Organic Carbon (% by wt.)	74
Mass of Hydrogen Produced (lbs. H_2 per lbs. EOSPRO)	0.25

Packaging

Shipped in 55-gallon drums, 275-gallon IBC totes or bulk tankers (40,000 lbs.)

Handling & Storage

EOSPRO is shipped as a ready-to-use concentrated emulsion that can be diluted with water in the field to prepare a high quality suspension for easy injection. EOSPRO has a low viscosity and can be distributed with commonly available pumps or by continuous metering with a diluter (e.g., Dosatron™). Dilution ratios for EOSPRO typically range from 4:1 to 20:1 (water: EOSPRO) depending on site conditions. EOSPRO injections should be followed with additional chase water to maximize distribution of EOSPRO into the formation.

EOSPRO can be injected with EOSQR, CoBupHMg or BAC-9. Call us for more details.

For best performance, use EOSPRO as shipped, within 60 days of delivery and store at a temperature between 40°F (4°C) to 100°F (38°C).

+1 919.873.2204
www.eosremediation.com

EOS PRO

SAFETY DATA SHEET

Section 1: Identification

Product Name:	**EOS Pro**
Chemical Description:	Mixture; vegetable oil emulsion
Manufacturer:	EOS Remediation PO Box 14266 Research Triangle Park NC 27709 (P): 919-873-2204 www.eosremediation.com
Recommended Use:	Groundwater bioremediation (environmental applications)
Restricted Use:	Not for human consumption.
24-Hour Emergency Contact:	ChemTel: United States (P): 800-255-3924 ChemTel: International (P): 813-248-0585

Section 2: Hazard(s) Identification

Hazard Classification:	Irritant (skin and eye)
Signal Word:	Warning
Hazard Statement(s):	Potential eye and skin irritant.
Pictograms:	
Precautionary Statement(s):	Not for human consumption. Do not store near excessive heat or oxidizers. Avoid contact with eyes and skin. Wear protective gloves and eye protection.

Section 3: Composition/Information on Ingredients

Common Name(s)	**CAS NO.**	**% by Weight**
Soybean Oil	8001-22-7	60
Food Grade Emulsifiers Trade Secret[1,2]	111-03-5	10
Soluble Substrates (glycerol) Trade Secret[1,2]	56-81-5	4
Water	7732-18-5	26

1 – The precise composition of this product is proprietary information. A more complete disclosure will be provided to a physician in the event of a medical emergency.
2 – The soluble substrates and emulsifiers are generally recognized as safe for food contact.

Section 4: First-Aid Measures	
Routes of Exposure	**Emergency First-Aid Procedures**
Inhalation	Remove to fresh air.
Eye Contact	Flush with water for 15 minutes; if irritation persists see a physician.
Skin Contact	Wash with mild soap and water.
Ingestion	Product is non-toxic. If nausea occurs, induce vomiting and seek medical attention.

Section 5: Fire-Fighting Measures	
Extinguishing Media:	CO_2, foam, dry chemical Note: Water, fog and foam may cause frothing and spattering.
Special Fire Fighting Procedures:	Wear self-contained breathing apparatus and chemical resistant clothing. Use water spray to cool fire exposed containers.
Fire Hazard(s):	Burning will cause oxides of carbon.

Section 6: Accidental Release Measures	
Personal Precautions:	Avoid contact with eyes and skin. Do not consume.
Emergency Procedures:	N/A
Methods & Materials used for Containment:	Compatible granular absorbent
Cleanup Procedures:	Spread compatible granular absorbent over spill area and sweep using broom and pan; dispose in appropriate receptacle. Clean area with water.

Section 7: Handling and Storage	
Safe Handling & Storage:	Do not store near excessive heat or oxidizers.
Other Precautions:	Consumption of food and beverages should be prevented in work area where product is being used. After handling product, always wash hands and face thoroughly with soap and water before eating, drinking, or smoking.

Section 8: Exposure Controls/Personal Protection		
Exposure Limits		
OSHA PEL:	NE	
ACGIH TLV:	NE	
NIOSH REL:	NE	
Personal Protective Measures		
Respiratory Protection:	Not normally required. P95 respirator if aerosols might be generated.	
Hand Protection:	Protective gloves are recommended	
Eye Protection:	Recommended	
Engineering Measures:	Local exhaust ventilation if aerosols are generated	
Hygiene Measures:	Wash promptly with soap & water if skin becomes irritated from contact.	
Other Protection:	Wear appropriate clothing to prevent skin contact.	

Section 9: Physical and Chemical Properties

Appearance:	White Liquid	Explosive Limits:	NE
Odor:	Vegetable Oil	Vapor Pressure:	NE
Odor Threshold:	NE	Vapor Density:	Heavier than air
pH:	6.0-7.0 (su)	Relative Density:	0.96-0.98
Melting Point/Freezing Point:	Liquid at room temperature	Solubility:	Dispersible
Boiling Point:	212°F (100°C)	Partition coefficient:	NE
Flash Point:	>300°F (149°C)	Auto-ignition Temperature:	NE
Evaporation Rate:	NE	Decomposition Temperature:	N/A
Flammability (solid, gas):	NE	Viscosity:	500-1500 cP

NE – Not Established

Section 10: Stability and Reactivity

Stability:	Stable
Incompatibility:	Strong acids and oxidizers
Hazardous Decomposition Products:	Thermal decomposition may produce oxides of carbon
Hazardous Reactions/Polymerization:	Will not occur
Conditions to Avoid:	None known

Section 11: Toxicological Information

Likely Routes of Exposure:		Ingestion, dermal and eye contact
Signs and Symptoms of Exposure:		None known
Health Hazards		
	Acute:	Potential eye and skin irritant
	Chronic:	None known
Carcinogenicity		
	NTP:	No
	IARC:	No
	OSHA:	No

Section 12: Ecological Information (non-mandatory)

There is no data on the ecotoxicity of this product.

Section 13: Disposal Considerations (non-mandatory)

Waste Disposal Methods:	Dispose of according to Federal and local regulations for non-hazardous waste. Recycle, if practical.

Section 14: Transport Information (non-mandatory)
The product is not covered by international regulation on the transport of dangerous goods.
No transport warning required.

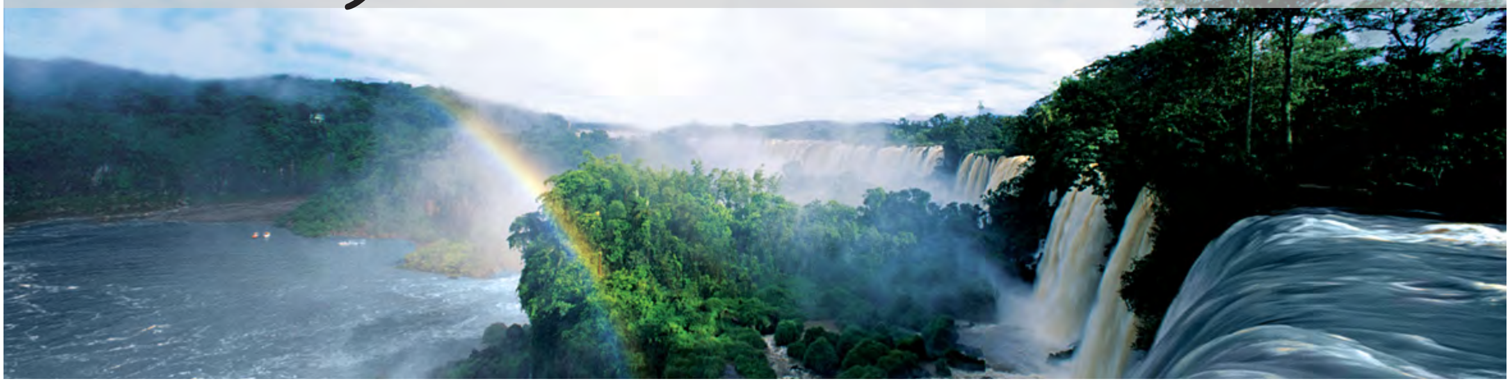
Section 15: Regulatory Information (non-mandatory)
N/A

Section 16: Other Information	
Date of Preparation:	29 May 2014
Last Modified Date:	27 June 2019
The information contained herein is based on available data and is believed to be correct. However, EOS Remediation, LLC makes no warranty, expressed or implied, regarding the accuracy of this data or the results to be obtained thereof. This information and product are furnished on the condition that the person receiving them shall make his/her own determination as to the suitability of the product for his/her particular purpose.	

APPENDIX H BAC-9 PRODUCT INFORMATION

BAC-9

A microbial consortium of *Dehalococcoides mccartyi* enriched to degrade PCE and TCE completely to ethene



Enriched bioaugmentation culture capable of degrading chlorinated solvents to innocuous compounds via halorespiration

Product Advantages

- High cell concentration: 10^{11} Cells/L
- Direct injection for in situ treatment of chlorinated ethenes
- Degrades: PCE, TCE, cis & trans-DCE, VC, Freon 113, mixed plumes containing 1,1,1-TCA & 1,1,2-TCA, dichloroethane isomers, CT, chloroform, and bromine compounds

EOS Remediation

Experience you can rely on, Products you can trust™

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www.eosremediation.com

Brad Elkins
BElkins@eosremediation.com

BAC-9

Description

BAC-9 is an enriched bioaugmentation culture capable of degrading chlorinated solvents to innocuous compounds efficiently via halorespiration.

Applications:

- Direct injection for *in situ* treatment of chlorinated ethenes
- Inoculation of on-site bioreactors
- Degrades: tetrachloroethylene (PCE), trichloroethene, (TCE), dichloroethene isomers (cis & trans-DCE), vinyl chloride (VC), Freon 113, mixed plumes containing trichloroethane (1,1,1-TCA & 1,1,2-TCA), dichloroethane isomers, carbon tetrachloride (CT), chloroform, and bromine compounds (carbon tetrabromide, bromoform, ethylene dibromide (EDB) and bromoethane)

Chemical & Physical Properties

Bioaugmentation Culture: BAC-9	Typical
Microbial consortium including *Dehalococcoides mccartyi* and enzymes in a water-based medium	10^{11} Cells/L

Packaging

Shipped in 19 liter pressurized soda keg. Orders greater than 19 liters are concentrated up to 10-fold to significantly reduce shipping and supply costs for your project. Actual volumes and concentration factor will be written on a hang tag attached with the keg.

See the EOS® website for an instructional video on BAC-9 handling and injection procedure.

Handling & Storage

BAC-9 is shipped overnight direct to your site in a chilled cooler. Your BAC-9 delivery includes: instruction manual, delivery cylinder (request 1, 2 or 3.5 liter) with quick connects and ¼” ID tubing hose barbs. An inert gas (Nitrogen or Argon) cylinder, regulator, and additional tubing to reach the injection point are required but not included.

BAC-9 must be stored at 4°C (40°F) and can remain usable for up-to three weeks from delivery.

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EOS Remediation, LLC

BAC-9

SAFETY DATA SHEET

Section 1: Identification

Product Name:	**BAC-9 aka SDC-9**
Chemical Description:	Non-toxic, naturally occurring, non-pathogenic, non-genetically altered anaerobic microbes in a water-based medium
Manufacturer:	Aptim 17 Princess Road Lawrenceville, NJ 08648 609-895-5340
Recommended Use:	Groundwater bioremediation (environmental applications)
Restricted Use:	Not for human consumption.
24-Hour Emergency Contact:	CHEMTREC (P): 800-424-9300

Section 2: Hazard(s) Identification

Hazard Classification:	Irritant (skin and eye)
Signal Word:	Warning
Hazard Statement(s):	Potential eye and skin irritant in hypersensitive humans.
Pictograms:	
Precautionary Statement(s):	Not for human consumption. Avoid contact with eyes and skin. Wear protective gloves and eye protection.

Section 3: Composition/Information on Ingredients

Common Name(s)	CAS NO.	% by Weight
Microbial consortium in water (comprised of microorganism of the genera *Dehalococcoides)*	N/A	100

Section 4: First-Aid Measures

Routes of Exposure	**Emergency First-Aid Procedures**
Inhalation	Get medical attention if allergic symptoms develop.
Eye Contact	Flush eyes with plenty of water for at least 15 minutes.. Get medical attention if irritation occurs.
Skin Contact	N/A
Ingestion	Thoroughly rinse mouth with water. Do not induce vomiting unless directed to do so by medical personnel. Get immediate medical attention.

Section 5: Fire-Fighting Measures

Extinguishing Media:	CO_2, foam, dry chemical

Special Fire Fighting Procedures:	None
Fire Hazard(s):	None

Section 6: Accidental Release Measures	
Personal Precautions:	Avoid contact with skin or eyes.
Emergency Procedures:	N/A
Methods & Materials used for Containment:	Compatible granular absorbent
Cleanup Procedures:	Spread compatible granular absorbent over spill area and sweep using broom and pan; dispose in appropriate receptacle. Clean area with water.

Section 7: Handling and Storage	
Safe Handling & Storage:	Use personal protective equipment recommended in Section 8. Keep containers tightly closed in a cool, well-ventilated area. The DHC microbial consortium can be supplied in stainless steel kegs designed for maximum working pressure of 130 psi and equipped with pressure relief valves. The kegs are pressurized with Nitrogen up 15 psi. Do not exceed pressure of 15 psi during transfer of DHC microbial consortium from kegs. Do not open keg if content of the keg is under pressure.
Other Precautions:	BAC-9 may be stored for up to 3 weeks at a temperature range of 2-4°C without aeration. Avoid freezing.

Section 8: Exposure Controls/Personal Protection		
Exposure Limits		
OSHA PEL:	NE	
ACGIH TLV:	NE	
NIOSH REL:	NE	
Personal Protective Measures		
Respiratory Protection:	Not normally required. N95 respirator if aerosols might be generated.	
Hand Protection:	Protective gloves are recommended.	
Eye Protection:	Recommended. An eyewash station in the work area is recommended.	
Engineering Measures:	Local exhaust ventilation if aerosols are generated	
Hygiene Measures:	Wash promptly with soap & water following skin contact.	
Other Protection:	Wear appropriate clothing to prevent skin contact.	

Section 9: Physical and Chemical Properties			
Appearance:	Light greenish murky liquid	Explosive Limits:	N/A
Odor:	Musty	Vapor Pressure:	24 mm Hg
Odor Threshold:	N/A	Vapor Density:	N/A
pH:	6.0-8.0	Relative Density:	0.9-1.1
Melting Point/Freezing Point:	0°C	Solubility:	Soluble
Boiling Point:	100°C	Partition coefficient:	NE
Flash Point:	N/A	Auto-ignition Temperature:	N/A
Evaporation Rate:	0.9-1.1	Decomposition Temperature:	N/A
Flammability (solid, gas):	N/A	Viscosity:	NE

Section 10: Stability and Reactivity	
Stability:	Stable
Incompatibility:	Water-reactive materials
Hazardous Decomposition Products:	None
Hazardous Reactions/Polymerization:	None
Conditions to Avoid:	None

Section 11: Toxicological Information		
Routes of Exposure:		Ingestion, Eye Contact
Signs and Symptoms of Exposure:		Ingestion of large quantities may result in abdominal discomfort including nausea, vomiting, cramps, diarrhea, and fever. Skin may become irritated upon prolonged contact. Hypersensitive individuals may experience allergic reactions. May cause eye irritation unless immediately rinsed.
Health Hazards		
	Acute:	Irritation of the skin or eyes. Ingestion may result in abdominal discomfort.
	Chronic:	None
Carcinogenicity		
	NTP:	No
	IARC:	No
	OSHA:	No

Section 12: Ecological Information (non-mandatory)
Ecotoxicity: this material will degrade in the environment

Section 13: Disposal Considerations (non-mandatory)	
Waste Disposal Methods:	Dispose of according to Federal and local regulations for non-hazardous waste. Recycle, if practical.

Section 14: Transport Information (non-mandatory)
The product is not covered by international regulation on the transport of dangerous goods.
No transport warning required.

Section 15: Regulatory Information (non-mandatory)
N/A

Section 16: Other Information	
Date of Preparation:	15 August 2014
Last Modified Date:	12 August 2019
The information contained herein is based on available data and is believed to be correct. However, EOS Remediation, LLC makes no warranty, expressed or implied, regarding the accuracy of this data or the results to be obtained thereof. This information and product are furnished on the condition that the person receiving them shall make his/her own determination as to the suitability of the product for his/her particular purpose.	