Honeywell

Final Site Characterization Field Sampling and Analysis Plan - Phase 1

Oak Materials - River Road 1, 2 and 3 (No. 442008)

Former Oak Materials Fluorglas Division - John Street (No. 442049)

Town of Hoosick and Village of Hoosick Falls, Rensselaer County, New York

20 July 2016

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20 July 2016

Prepared for:

Honeywell

Prepared by:

ERM Consulting and Engineering, Inc.

FINAL SITE CHARACTERIZATION
FIELD SAMPLING AND ANALYSIS PLAN – PHASE 1

OAK MATERIALS - RIVER ROAD 1, 2 AND 3
(No. 442008)

FORMER OAK MATERIALS FLUORGLAS DIVISION
- JOHN STREET (No. 442049)

TOWN OF HOOSICK AND VILLAGE OF HOOSICK FALLS, RENSSELAER COUNTY, NEW YORK

I, Jon S. Fox, certify that I am currently a Qualified Environmental Professional as defined in 6 NYCRR Part 375 and that this Final Site Characterization Field Sampling and Analysis 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).

Jon S. Fox, P.G.
ERM Consulting & Engineering, Inc.

Date: 20 July 2016

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

APS	Advanced Profiling System
ASP	Analytical Services Protocol
°C	Degrees Celsius
CAMP	Community Air Monitoring Plan
COPC	Compound of Potential Concern
DER	Division of Environmental Remediation
DO	Dissolved Oxygen
DQO	Data Quality Objective
DUSR	Data Usability Summary Report
EDS	Electronic Data Summary
ERM	ERM Consulting and Engineering, Inc.
FSAP	Field Sampling and Analysis Plan
GPS	Global Positioning Equipment
HASP	Health and Safety Plan
HDPE	High Density Polyethylene
IDW	Investigation-Derived Waste
IHWDS	Inactive Hazardous Waste Disposal Site
Ik	Inferred hydraulic conductivity
ng/g	Nanograms per gram (parts per billion)
ng/L	Nanograms per liter (parts per trillion)
NJDEP	New Jersey Department of Environmental Protection
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSGS	New York State Geological Survey
ORP	Oxidation-Reduction Potential
OSHA	Occupational Safety and Health Administration
PARCC	Precision, Accuracy, Reproducibility, Completeness, and Comparability
PCBs	Polychlorinated biphenyls
PFCs	Perfluorinated Compounds
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane sulfonic Acid
PPE	Personal Protective Equipment
PTFE	Polytetrafluoroethylene
QA/QC	Quality Assurance / Quality Control
QAPP	Quality Assurance Project Plan
SC	Site Characterization
STARS-#1	Spill Technology and Remediation Series Memorandum Number One
SVOCs	Semivolatile Organic Compounds
SCO	Soil Cleanup Objectives
TAL	Target Analyte List
TCL	Target Compound List

TOGS	Technical Operations Guidance Series
µg/kg	Micrograms per kilogram (parts per billion)
µg/L	Micrograms per liter (parts per billion)
USEPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds

1.0 INTRODUCTION

1.1 PURPOSE AND OBJECTIVES

This Site Characterization (SC) Field Sampling and Analysis Plan (FSAP) describes the field efforts that Honeywell, through its consultant ERM Consulting and Engineering, Inc. (ERM), will undertake to initially evaluate the physical and chemical characteristics of overburden and the bedrock surface at and near these two properties:

- Oak Materials - River Road 1, 2 and 3 (No. 442008)
- Former Oak Materials Fluorglas Division - John Street (No. 442049)

As outlined in the Order on Consent and Administrative Settlement Index Number CO 4-20160415-79 dated 3 June 2016 (the Order) between Honeywell and the New York State Department of Environmental Conservation (NYSDEC), these properties are being considered by the NYSDEC for possible listing on the Inactive Hazardous Waste Disposal Site (IHWDS) Registry. This SC FSAP is being submitted by Honeywell to the NYSDEC to fulfill the requirement for submission of an approvable SC Work Plan as outlined in Section II.A. of the Order.

The Oak Materials - River Road 1, 2 and 3 property is located in the Town of Hoosick. The Former Oak Materials Fluorglas Division – John Street property is located in the Village of Hoosick Falls. Both properties currently have an administrative registry classification of "P" (i.e., a potential IHWDS).

Phase 1 of the SC will employ surface geophysical techniques, soil sampling, sediment sampling, surface water sampling, permeability profiling, and groundwater sampling of overburden geologic units. This approach will expedite and refine the overall investigation of these properties by providing initial data on:

- Subsurface geology;
- Concentrations of perfluorinated compounds (PFCs) in soil, sediment, surface water, and overburden groundwater; and
- Concentrations of Target Compound List (TCL) volatile organic compounds (VOCs), TCL semi-volatile organic compounds (SVOCs), Target Analyte List (TAL) metals, polychlorinated biphenyls (PCBs), and pesticides at select

locations in soil, sediment, surface water, and overburden groundwater.

These data will provide the foundation for developing a conceptual site model, which will inform the selection of locations and depths for a second phase of SC.

Phase 2 of the SC will involve additional sample collection and the installation of fixed groundwater monitoring wells for further evaluation of PFCs and other constituents of potential concern (COPCs). Phase 2 of the SC will be proposed in a separate work plan that will be prepared and submitted to NYSDEC after the results of Phase 1 of the SC have been presented to and discussed with NYSDEC.

1.2 PROJECT ORGANIZATION

Client

Honeywell	John McAuliffe, P.E.	(315) 552-9782
	Mark Sweitzer, P.G.	(215) 292-0519

Counsel

Allen & Desnoyers, LLP	Dale Desnoyers, Esq.	(518) 426-2288

Consultant

ERM	Jim Perazzo, P.G.	(631) 756-8913
	Maureen Leahy, Ph.D.	(860) 466-8523
	Jon Fox, P.G.	(315) 233-3035

1.3 LOCATIONS

Figure 1 shows the location, layout, and current land use of the Oak Materials - River Road 1, 2 and 3 property and surrounding areas. Figure 2 shows the location, layout, and current land use of Former Oak Materials Fluorglas Division - John Street property and surrounding areas.

1.4 DESCRIPTION AND HISTORY

The Oak Materials - River Road 1, 2 and 3 property is comprised of former Plants 1, 2, 3a, and 3b. It is an approximate 11-acre property with buildings located on the northern and southern portions. Perimeter and interior access roads with some paved surfaces and grassy open space are present. This property is shown in Figure 1 (outlined in red).

The Former Oak Materials Fluorglas Division - John Street property is an approximate 0.6-acre property that is currently open and zoned vacant commercial. The former structure was previously demolished in 2012. The property is located in a mixed-use commercial and residential portion of the Village. This property is shown in Figure 2 (outlined in red).

1.5 GEOLOGY

Figure 3 presents surficial geologic units previously mapped by the New York State Geological Survey (NYSGS) in the vicinity of River Road (Cadwell and Dineen, 1987). Most of the surficial geologic units mapped in this area consist of alluvium (predominantly silt and clay) deposited in recent times adjacent to the Hoosick River or lacustrine silts and clays deposited in an ancient lake that formerly existed near the end of the last ice age. Further east of the Oak Materials - River Road 1, 2 and 3 property, the surficial deposits have been mapped by the NYSGS as glacial outwash, which typically consists predominantly of sand and gravel deposited by meltwaters from glaciers during the ice ages.

Figure 4 presents surficial geologic units previously mapped by the NYSGS in the vicinity of Former Oak Materials Fluorglas Division - John Street property (Cadwell and Dineen, 1987). The surficial geologic units mapped in this area consist of alluvium and glacial outwash sand and gravel.

Bedrock beneath these properties consists predominantly of dark gray to black slate of the Walloomsac Formation. The bedrock stratigraphy and structural geology of the Hoosick Falls area is variable and complex and was previously mapped by Potter (1972). Groundwater flow in the bedrock in the area likely occurs predominantly through joints, fractures, faults, foliation, and other partings or separations in the bedrock.

1.6 STANDARDS, CRITERIA AND GUIDANCE

The following standards and criteria may apply to this project.

- 6 NYCRR Part 375 - Environmental Remediation Programs (December 2006)
- 6 NYCRR Part 608 - Use and Protection of Waters
- 6 NYCRR Parts 700-706 - Water Quality Standards
- 29 CFR Part 1910.120 - Hazardous Waste Operations and Emergency Response

The following guidance may apply to this project.

- DER-10 – Technical Guidance for Site Investigation and Remediation (May 2010)
- USEPA Drinking Water Health Advisory for perfluorooctanoic acid (PFOA) dated May 2016 (70 nanograms per liter (ng/l)
- USEPA Drinking Water Health Advisory for perfluorooctane sulfonic acid (PFOS) dated May 2016 (70 ng/l).
- USEPA statement dated January 28, 2016 on "Private Wells in the Town of Hoosick and the Village of Hoosick Falls, NY"
- NYSDEC Division of Spills Management - Sampling Guidelines and Protocols: Technologies Background and Quality Control/Quality Assurance for the NYSDEC Spill Response Program
- Possible future NYSDEC Soil Cleanup Objectives (SCOs) for PFCs, if developed.
- TOGS 1.1.1 - Ambient Water Quality Standards & Guidance Values and Groundwater Effluent Limitations

1.7 RECORDS SEARCH

A Records Search and document review will be performed in conformance with applicable requirements contained in the Order and Appendix 3A of the NYSDEC's Technical Guidance on Site Investigation and Remediation (DER-10; NYSDEC, 2010). In accordance with applicable requirements and guidance, the Records Search will be undertaken to identify and evaluate relevant historical environmental documentation.

1.8 DATA QUALITY OBJECTIVES

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

- Precision is 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.
- 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 field team will collect representative samples. The chemist at the laboratory will analyze samples using accepted protocols resulting in data that meet PARCC standards and in accordance with the Quality Assurance Project Plan (QAPP) in Appendix A.

2.0 SCOPE OF SITE CHARACTERIZATION

Data or other information relevant to well construction and water quality in existing water supply wells in the area will be requested from the NYSDEC, NYSDOH, and/or Rensselaer County Department of Health to provide information that will be useful during characterization of subsurface conditions. The provided data and information will be reviewed and may be used to modify proposed locations for geophysical surveying, permeability profiling, and initial groundwater sample collection.

Currently-proposed geophysical survey lines, permeability profiling locations, and initial groundwater sample collection locations are presented in Figures 1 through 4. Environmental media, sampling methods, rationale, and laboratory analytical parameters are summarized in Table 1 and in the QAPP (Appendix A). Section 2.5 contains a discussion regarding selection of the number and depth of groundwater samples at each profiling location, and indicates that field decisions will be made in concert with NYSDEC field representatives. It is anticipated that the field sampling effort will be dynamic and that some locations may require less or more sampling based on geologic formations encountered, inferred hydraulic conductivity, physiochemical measurements, visual or olfactory evidence of possible contamination, and the discretion of the field geologist in concert with NYSDEC's field representative.

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

2.1 SUBSURFACE CLEARANCE

Dig Safely New York will be notified prior to the initiation of intrusive activities at the properties and requested to identify, locate, and mark member-company utilities in areas proposed for subsurface intrusive investigation. Additionally, an independent underground utility locating

service will be contracted to evaluate and clear proposed profiling locations prior to the commencement of subsurface intrusive activities. A minimum 10-foot diameter around each planned location will be scanned and cleared of subsurface utilities by the utility location subcontractor prior to the initiation of drilling.

Proposed sampling locations will be adjusted in the field as necessary based on the results of the subsurface clearance effort to facilitate the health and safety of personnel, prevent property damage, and/or to avoid or minimize interference with property operations.

2.2 SURFACE GEOPHYSICAL SURVEY

Multiple complimentary surface geophysical methods will be performed as rapid means of preliminary evaluation of subsurface conditions at the properties. Surface geophysical techniques reveal physical properties of the subsurface and can be used to evaluate the hydrogeologic framework of the properties. Surface geophysics will provide useful information regarding the stratigraphic profile (soil or rock type and thicknesses), depth to groundwater, depth to bedrock, areas of differing water chemistry, the location of voids, faults, or fractures, and the potential presence of buried materials, such as steel drums or tanks.

2.2.1 Geologic Setting

Geologic units at the properties will be assessed to develop a conceptual site model for groundwater flow pathways between potential source areas and receptors. Geomorphology and geometry of the Hoosick River valley supplemented by observations of the area suggest that the depth to bedrock is locally shallow and that texture (i.e., grain size) and permeability of unconsolidated glacial deposits is highly variable both laterally and vertically. Overburden and bedrock units may be in hydraulic communication with each other via fracture set contacts at the bedrock-overburden interface. Evaluating subsurface textural and permeability variations and the areas where the fracture sets intersect the overburden deposits may be important to understanding area hydrogeology and potential groundwater flow pathways. Where bedrock is encountered at relatively shallow depths, it may be possible to detect fracture sets at the bedrock-overburden interface.

2.2.2 *Methodology*

Surface geophysical techniques will be performed as site conditions allow along survey lines within and adjacent to the boundaries of the properties as shown in Figures 1 through 4. The lines are proposed with the assumption that property owners allow access to these properties. The proposed lines are also positioned to consider possible obstructing surface cultural features (i.e., roads, buildings, fences, etc.), accessible cleared land, and the need to achieve sufficient survey density. Potential cultural interferences such as buildings, parked cars, overhead electrical lines and buried utilities can create strong electromagnetic fields and possibly affect electrical surface geophysical methods. Although these interferences can be problematic, available information suggests potential interferences will not prohibit acquisition of good information in most areas.

In order to facilitate adaptability and optimize survey results given the known field conditions, the geophysical contractor will be prepared to implement complimentary electromagnetic and acoustic surface geophysical techniques. The geophysical subcontractor will evaluate in the field which methods are working as necessary to accomplish the project goals. Adjustments to the field geophysical survey will be incorporated as required to optimize results.

Electromagnetic methods may include Resistivity (profiling & vertical soundings), Terrain Conductivity, and Very Low Frequency (VLF). Acoustic methods may include Seismic Reflection and Seismic Refraction. Table 2 summarizes information for each of the aforementioned methods including a method overview, key benefits/uses, methodology descriptions and constraints/potential limitations.

2.2.3 *Approach*

Owners of property where geophysical surveying or other investigation activities are proposed will be contacted to request access to their properties and obtain access agreements.

The geophysical survey data will be evaluated in the field using computer software. This real-time evaluation will help facilitate final selection of overburden permeability profile point locations and may also assist with evaluation of potential sample depth intervals (see Section 2.4). Field and subsequent office compilations of survey data, including data tables, geologic cross-sections, profiles, and/or contour maps will be incorporated into the SC Report after the completion of all SC field work.

2.3 SURFACE SOIL SAMPLING

Surface and near-surface soil samples will be collected for laboratory analysis to evaluate concentrations of COPCs.

2.3.1 Methodology

Surface and near-surface soil samples will be collected at the soil boring locations shown in Figures 1 and 2 and as described in Table 1. Surface soil samples will be collected using a stainless steel hand auger or equivalent at a depth of 0 to 2 inches below the surficial vegetative cover, but will include the root mass as requested by NYSDEC. Near-surface soil samples will be collected using the same approach at a depth of 2 to 12 inches below the surficial vegetative cover. Soil will be screened by an ERM geologist using a calibrated photoionization detected (PID) equipped with an 11.7 eV lamp. Soil samples will also be visually examined for physical properties including color, texture, composition, moisture content, odor, and visual evidence of staining, discoloration, or product/sheen. Soil descriptions and other field data/observations will be documented in soil boring logs.

Soil samples will be collected into laboratory-provided sampling containers, which will be labeled and stored in a clean pre-chilled cooler. All samples will be managed under chain-of-custody procedures and submitted to the project laboratory for analysis of parameters indicated in Table 1 and below in Section 2.10.1. Decontamination procedures are presented in Section 2.8.

Special precautions will be used to avoid or minimize the use of sampling equipment and materials that may contain PFCs. PFC-specific sampling considerations for all media are presented in Section 2.7 of this FSAP.

2.3.2 Approach

The results of this effort will be utilized to characterize surface and near-surface soil quality at on-site and off-site locations. Surface and near-surface soil sampling locations will coincide with soil borings to be installed for the collection of subsurface soil samples (see Section 2.4). Soil boring locations will be installed in close proximity to the profiling location (see Section 2.5). The selection of final soil sampling locations will consider visual and other observations at the property during sampling (e.g., disturbed, stained, and/or low-lying areas) and will be discussed with NYSDEC's field representative.

The former facility at John Street was demolished in 2012 and the majority of the surface is now covered with several feet of crushed stone. Therefore, the ability to collect discrete surface or near-surface soil sample may be limited in some locations at that property. The placement of proposed soil sampling locations may be adjusted based on discussions in the field with NYSDEC's representative.

2.4 SUBSURFACE SOIL SAMPLING

Subsurface soil will be examined and screened continuously from the ground surface to each soil boring's completion depth. Selected depth intervals will be sampled for laboratory analysis to evaluate concentrations of COPCs.

2.4.1 Methodology

Subsurface soil samples will be collected at the soil boring locations shown in Figures 1 and 2 and as described in Table 1. Soil borings will be advanced to the top of bedrock or drilling refusal using direct-push or hollow-stem auger drilling methods. Each borehole will be sampled continuously using dedicated sample liners and dual tube or equivalent discrete interval sampling methods. Reusable sampling equipment will be cleaned between each borehole location by washing in a Liquinox® and potable water solution followed by rinsing with distilled water.

Soil will be screened by an ERM geologist using a calibrated photoionization detected (PID) equipped with an 11.7 eV lamp. Soil samples will also be visually examined for physical properties including color, texture, composition, moisture content, odor, and visual evidence of staining, discoloration, or product/sheen. Soil descriptions and other field data/observations will be documented in soil boring logs.

Soil samples for laboratory analysis will be biased towards the 2-foot interval of highest suspected contamination based on the results of field screening, visual examination, and consultation with NYSDEC's field representative. In the absence of apparent contamination, one soil sample will be collected from the 2-foot depth interval above the water table. Additional soil samples for laboratory analysis may be collected if necessary based on:

- Field screening results;

- Visual examination for discoloration, mottling, or other observations suggestive of possible organic-rich zones; and
- Consultation with NYSDEC's field representative.

Soil samples will be placed into laboratory-provided sampling containers, which will be labeled and stored in a clean pre-chilled cooler. All samples will be managed under chain-of-custody procedures and submitted to the project laboratory for analysis of parameters indicated in Table 1 and below in Section 2.10.2. Decontamination procedures are presented in Section 2.8 of this FSAP.

Special precautions will be used to avoid or minimize the use of sampling equipment and materials that may contain PFCs. PFC-specific sampling considerations for all media are presented in Section 2.7 of this FSAP.

2.4.2 Approach

The results from this effort will be utilized to characterize subsurface soil quality at on-site and off-site locations, and to select possible locations for additional soil borings and/or fixed monitoring well installations during a subsequent investigation phase, if necessary.

2.5 OVERBURDEN PERMEABILITY PROFILING AND INITIAL GROUNDWATER SAMPLING

Profiling in the overburden will facilitate targeting and sampling of hydraulically transmissive zones for the collection of discrete groundwater samples. Zones for groundwater sampling will be determined in the field by a geologist in concert with the NYSDEC's field personnel and based on evaluation of surface geophysical data and inferred hydraulic conductivity data and physiochemical measurements collected during the profiling. Hydraulic head measurements and groundwater samples will be collected at selected intervals during the profiling. Samples will be submitted to an approved environmental laboratory for analysis as described in Table 1 and below in Section 2.10.3. The results will inform recommendations for target locations of fixed monitoring wells to be installed during Phase 2 of the SC. This approach will provide an expedited screening of PFCs in overburden groundwater during Phase 1 of the SC and also ensure subsequent fixed monitoring points are located for both follow-up water quality and hydraulic (i.e., groundwater flow) evaluations.

2.5.1 Methodology

Permeability profiling using Waterloo's Advanced Profiling System (APS) tooling will be performed to the top of bedrock or drilling refusal using a direct-push drilling rig. Continuous logging of Ik (inferred hydraulic conductivity) will be performed to identify zones of higher permeability, which may represent preferential groundwater flow paths and identify zones for collection of discrete-interval groundwater samples.

The anticipated top of the saturated zone estimated from surficial geophysics or other available data will be an initial target for groundwater sampling at profiling locations. The sample port will be opened and groundwater purging will be initiated. A calibrated YSI or equivalent electronic field parameter meter will be utilized to collect geochemical data. The field parameter meter will be calibrated at the start of each day and will also have documented calibration checks at the middle and end of each day. All calibration records and checks will be documented in field notes or on sampling records. Select in-situ geochemical parameters including temperature, conductivity, pH, oxidation-reduction potential (ORP), and dissolved oxygen (DO) will be monitored and recorded to provide general geochemical data and evaluate groundwater stabilization criteria prior to sample collection.

It is anticipated that selected additional intervals for groundwater sampling will be determined by the field geologist in concert with NYSDEC field oversight staff based primarily on the following variables:

- Subsurface formations;
- Inferred hydraulic conductivity; and
- Physiochemical measurements.

It is assumed that an average of three groundwater samples per profiling location may be collected; however, the actual number of groundwater samples collected at each profiling location may be lower or higher at the discretion of the field geologist and NYSDEC personnel based on evaluation during profiling. Samples will be collected directly into plastic sampling containers, which will be pre-labeled and stored in a clean pre-chilled cooler. Samples will be stored on ice and transported under chain of custody to the project laboratory for analysis of the parameters indicated in Table 1 and below in Section 2.10.3.

In the event that the identified intervals within a profiled location cannot yield sufficient water volume for all requested analyses, the following

priority will be followed: 1) PFCs, 2) VOCs, 3) metals, 4) SVOCs, and 5) pesticides/PCBs. Electronic data deliverables will be submitted.

Retraction grouting of boreholes will be performed immediately after completion of each borehole to minimize potential vertical migration of COPCs or cross-contamination.

Special precautions will be used to avoid or minimize the use of sampling equipment and materials that may contain PFCs. PFC-specific sampling considerations for all media are presented in Section 2.7 of this FSAP. Decontamination procedures are presented in Section 2.8.

2.5.2 Approach

The results from this effort will be utilized to characterize groundwater quality at on-site and off-site locations and to select possible locations for additional soil borings and/or fixed monitoring well installations during a subsequent investigation phase, if necessary.

2.6 SEDIMENT AND SURFACE WATER

Surface water hydrology at the River Road property, the John Street property, and immediately adjacent properties will be evaluated in the field during implementation of the surface geophysics program in consultation with NYSDEC field personnel. A total of 14 co-located sediment and surface water samples will be collected from the two properties.

The sediment and surface water samples will be collected using the methods described in the USEPA's Sediment Sampling Standard Operating Procedure (SOP) SRC-OGDEN-04 (USEPA, 2001) modified to preclude the use of sample containers with any Teflon components..

Field activities to be conducted by the sampling team include:

- Identify sampling locations using a GPS unit;
- Measure and record the depth to the bottom of the water body at each sampling location using a weighted measuring tape or other;
- Sediment thickness monitoring and deposition/scour monitoring will be conducted at each location;
- A ponar sampler or equivalent sampling device will be utilized to collect the surface sediment samples from 0 to 6

inches in depth and closed to contain the sample. Surface water will be decanted from the core as it is retrieved. The core will then be caped on both ends and labeled. The core will be kept in a vertical position to preserve the stratification until it is ready to be characterized;

- An evaluation, to the extent practicable in the field, of the vertical extent of benthic organism activity (i.e., identification of the most biologically active layers);
- A visual evaluation while in the core sampler of the stratigraphy and physical characteristics (grain size, sediment and detrital material composition, organic matter, mineral content, stratification) of each sediment sample and how those characteristics change with depth; and
- An estimation of the approximate relative percentage of water and solids content of the sediment column and how those values change along the length of the core.

The sampler will be raised to the surface and opened to transfer the sediment to a stainless steel container. The sediment will be screened with a PID with an 11.7 eV lamp and a description will be recorded by an ERM geologist. To the extent practicable, a visual evaluation of the sediment stratigraphy and physical characteristics (benthic zone, grain size, sediment and detrital material composition, organic matter, mineral content, percent solids) will be recorded in the sampling record. Sediment will be removed from the core and segregated into clean, stainless steel bowls for evaluation. The sediment will be formed into a slurry and large debris, sediment clasts, wood fragments, and leaves will be removed and discarded. Sediment will then be placed directly into sample containers provided by the project laboratory and transferred to the laboratory for analysis as described in Table 1 and below in Section 2.10.4. Decontamination procedures are presented in Section 2.8.

Surface water samples will be collected from the same locations prior to collection of the sediment samples to minimize the potential for entrainment of sediments in the surface water samples. The surface water will be placed directly into laboratory-provided glassware and analyzed as indicated in Table 1 and below in Section 2.10.5. Decontamination procedures are presented in Section 2.8.

2.7 PFC SAMPLING CONSIDERATIONS

In order to avoid contamination of environmental samples with PFOA or other PFCs from sampling equipment or other materials, conservative

guidelines have been developed for sampling procedures and equipment decontamination (NJDEP, 2007; USEPA, 2015). These guidelines involve avoiding the use of or contact with materials that might potentially contain PFCs (USEPA, 2009).

- Do not wear new clothing or clothing that has been treated with stain- or water-resistant coatings. All clothing must be washed several times before use (3 to 6 times).
- Do not wear Tyvek® clothing.
- No Post-It-Notes® should be used or brought along during sampling.
- Personnel should not handle pre-wrapped food or snacks before sampling or while working at the properties.
- Do not use any materials or equipment that contains Teflon® (e.g. Teflon® tubing, sample container cap liners, tape, etc.).
- Do not use any materials or equipment that contains polytetrafluoroethylene (PTFE) (e.g. PTFE-coated aluminum foil, Gore-Sorbers™) or any other material containing a fluoropolymer.
- Only use sampling containers and caps/tops that have been supplied by the laboratory that will analyze the samples for PFOA and other PFCs. Polyethylene, high density polyethylene (HDPE) and polypropylene are acceptable.
- Do not store sampling containers and caps/tops for extended periods of time before use.
- Field personal should wash hands with soap and potable water prior to sampling activities, especially after contact with any materials potentially containing PFCs.
- Do not use chemical ice packs ("blue ice") or foil.
- Preserve samples on wet ice only; no "blue ice". Polyethylene bags can be used to store ice.

All potable water used during the sampling effort will be obtained from a source with non-detectable concentrations of PFC based on sampling and laboratory analysis prior to mobilization into the field.

Dedicated potable water containers will be used in the field throughout the duration of the project. The containers will be filled with potable water from a source known to have non-detectable concentrations of PFC prior to mobilization into the field. Aqueous field rinse blank samples will be collected from the containers prior to mobilization and during use in the field for laboratory analysis of PFCs to ensure that the potable water containers are not a potential source of PFCs.

The following NYSDEC special precautions for trace contaminant sampling will also be utilized based on review of Section 5.2.9 of the NYSDEC's Sampling Guidelines and Protocols (NYSDEC, 1992):

- A clean pair of new, disposable nitrile gloves will be worn each time a different point or location is sampled; and
- Sample containers shall be placed into separate re-sealable polyethylene plastic bags immediately after collection and labeling.

2.8 DECONTAMINATION

A temporary decontamination pad will be constructed with two layers of polyethylene sheeting that will be bermed at the sides using lumber or other appropriate material. Re-usable drilling and sampling equipment and tools will be cleaned with a Liquinox® and potable water solution followed by a distilled water rinse between uses. Decontamination water from the pad will be placed into 5-gallon buckets and transferred into pre-labeled waste containers at a secure location.

Decontamination between each sediment sampling location will include the procedures described above but will also include a potable water rinse followed by rinsing with distilled water and air drying (USEPA, 2001). Decontaminated sediment sampling equipment will then be wrapped in aluminum foil until the next use.

2.9 CONTINGENCY PLAN

If unknown containers, drums, underground storage tanks, or other previously unidentified sources of potential contaminants are discovered during subsurface intrusive activities, work activities will be suspended until NYSDEC is notified and properly-trained personnel and sufficient equipment are mobilized to address the condition. An exclusion zone will be set up immediately around the work area to control access to the work area.

Sampling will be performed on product or environmental media as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed for PFCs, TCL VOCs, SVOCs, PCBs, Pesticides, TAL inorganics, ignitability/flammability,

corrosivity, and reactivity unless property history and/or previous sampling results provide a sufficient justification to limit the analyte list.

In this case, a reduced list of analytes will be proposed to NYSDEC for approval prior to sampling.

If grossly-contaminated media is identified by screening during invasive site work, the discovery will be promptly communicated to the NYSDEC's field representative, or if a NYSDEC field representative is not present on site at the time, verbally by phone to the NYSDEC's Project Manager (Richard Mustico, P.E.; 518-402-9676). Reportable quantities of petroleum product will also be reported by ERM to the NYSDEC Spill Hotline (800-457-7362).

2.10 SAMPLE ANALYSIS

Proposed sample locations are presented in Figures 1 through 4. The laboratory analysis of soil, groundwater, surface water, and sediment samples collected during Phase 1 of the SC will be performed by NYSDOH-approved environmental laboratories using analytical methods consistent with the methods outlined in the QAPP (Appendix A). Laboratory analytical reports will contain ASP Category B or equivalent deliverables to facilitate data validation or usability evaluation and review (see Section 2.10). Electronic data deliverables will also be submitted.

2.10.1 Surface Soil

Soil samples collected as part of the SC will be analyzed for the following parameters:

- PFCs by USEPA Method 537-1.1;
- TCL and NYSDEC Spill Technology and Remedial Series Memorandum Number One (STARS-#1) VOCs plus 10 tentatively identified compounds (TICs) by USEPA Method 8260;
- TCL and NYSDEC STARS-#1 SVOCs plus 20 TICs by USEPA Method 8270C;
- Pesticides by USEPA Method 8081;
- PCBs by USEPA Method 8082;
- Target Analyte List (TAL) metals by USEPA Method 6010B;
- Total organic carbon (TOC) by Lloyd Kahn method;
- pH by Standard Method 9045D;
- Mercury by USEPA Method 7471A; and

- Cyanide by USEPA Method 9010.

2.10.2 Subsurface Soil

Subsurface soil samples collected as part of the SC will be analyzed for the following parameters:

- PFCs by USEPA Method 537-1.1;
- TCL and STARS-#1 VOCs plus 10 TICs by USEPA Method 8260;
- TCL and STARS-#1 SVOCs plus 20 TICs by USEPA Method 8270C;
- Pesticides by USEPA Method 8081;
- PCBs by USEPA Method 8082;
- TAL metals by USEPA Method 6010B;
- TOC by Lloyd Kahn method;
- pH by Standard Method 9045D;
- Mercury by USEPA Method 7471A; and
- Cyanide by USEPA Method 9010.

2.10.3 Groundwater

Groundwater samples collected as part of the SC will be analyzed for the following parameters:

- PFCs by USEPA Method 537-1.1;
- TCL and STARS-#1 VOCs plus 10 TICs by USEPA Method 8260;
- TCL and STARS-#1 SVOCs plus 20 TICs by USEPA Method 8270C;
- Pesticides by USEPA Method 8081;
- PCBs by USEPA Method 8082;
- TAL metals by USEPA Method 6010B;
- TOC by Lloyd Kahn Method;
- pH by Standard Method 9045D;
- Mercury by USEPA Method 7470; and
- Cyanide by USEPA Method 9010.

2.10.4 Sediment

Sediment samples collected as part of the SC will be analyzed for the following parameters:

- PFCs by USEPA Method 537-1.1;
- TCL and STARS-#1 VOCs plus 10 TICs by USEPA Method 8260;
- TCL and STARS-#1 SVOCs plus 20 TICs by USEPA Method 8270C;
- Pesticides by USEPA Method 8081;
- PCBs by USEPA Method 8082;
- TAL metals by USEPA Method 6010B;
- TOC by Lloyd Kahn method;
- pH by Standard Method 9045D;
- Mercury by USEPA Method 7471A; and
- Cyanide by USEPA Method 9010.

2.10.5 Surface Water

Surface water samples collected as part of the SC will be analyzed for the following parameters:

- PFCs by USEPA Method 537-1.1;
- TCL and STARS-#1 VOCs plus 10 TICs by USEPA Method 8260;
- TCL and STARS-#1 SVOCs plus 20 TICs by USEPA Method 8270C;
- Pesticides by USEPA Method 8081;
- PCBs by USEPA Method 8082;
- TAL metals by USEPA Method 6010B;
- TOC by Lloyd Kahn method;
- pH by Standard Method 9045D;
- Mercury by USEPA Method 7470; and
- Cyanide by USEPA Method 9010.

2.11 DATA USABILITY

Data usability will be evaluated following procedures for the preparation of a Data Usability Summary Report (DUSR) for all samples collected during the implementation of this FSAP. The usability evaluation will be performed 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 (EDS) consistent with the requirements of DER-10 Section 3.13.

2.12 INVESTIGATION-DERIVED WASTES

Investigation-derived waste (IDW) consisting of cleaning or decontamination fluids from the field sampling effort will be placed in appropriate containers for subsequent waste characterization sampling and analysis, waste determination, and disposal or recycling. The generation of IDW will be minimized to the extent practicable.

All containers of IDW will be labeled with generator name, address, contents, container number, waste determination status, and accumulation start date. The IDW containers will be moved from the field promptly to a designated, secure temporary staging area located at the Oak Materials - River Road 1, 2 and 3 property. IDW will be sampled for waste characterization purposes at the conclusion of the field program to facilitate waste determination and subsequent disposal or recycling as approved by the NYSDEC.

2.13 SURVEY

Geophysical surveying locations and permeability profiling locations will be measured in the field using GPS equipment. The location and elevations of permeability profiling locations (i.e., groundwater sampling locations) will be measured by a New York-licensed surveyor. The location and elevation of other selected features may also be measured if deemed useful during the SC.

2.14 REPORTING

The results of Phase 1 of the SC will be summarized and provided to NYSDEC and a meeting will be held to discuss the results and any potential follow-up actions. Following the meeting, the results of the Phase 1 SC will be summarized in a Supplemental FSAP for Phase 2 of the SC. The Supplemental FSAP for Phase 2 of the SC will be submitted to the NYSDEC for review and approval. A comprehensive SC Report will be prepared after Phase 2 of the SC is completed.

3.0 ASSOCIATED DOCUMENTS

3.1 QUALITY ASSURANCE PROJECT PLAN

The Quality Assurance Project Plan (QAPP) for this project is presented in Appendix A. The QAPP is consistent with the requirements of DER-10 Section 2.4 (NYSDEC, 2010). The QAPP describes sampling and analysis procedures to be used during implementation of the SC along with QA/QC criteria. The QAPP will facilitate generation of data of acceptable PARCC.

3.2 COMMUNITY AIR MONITORING PLAN

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

3.3 HEALTH AND SAFETY PLAN

The project-specific HASP is presented in Appendix C. 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 properties. These procedures generally conform to applicable federal, state and local regulations, including Occupational Safety and Health Administration (OSHA) requirements governing activities at hazardous waste sites and the requirements in 29 CFR 1910.120 (Hazardous Waste Operations). Specific practices and procedures, including the level of personal protective equipment (PPE), are based on a review of currently-available information for the properties.

Every potential safety hazard associated with this SC 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.

3.4 INVESTIGATION PERSONNEL AND QUALIFICATIONS

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

4.0 PROJECT SCHEDULE

An estimated project schedule is presented in Table 2.

5.0 REFERENCES CITED

Cadwell, D.H. and Dineen, R.J., 1987. Surficial Geologic Map of New York: Hudson-Mohawk Sheet. New York State Museum and Science Service, Map and Chart Series Number 40, Albany.

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USEPA, 2009. Perfluorocarboxylic Acid Content in 116 Articles in Commerce. United States Environmental Protection Agency (USEPA), Office of Research and development. EPA/600/R-09/033, March 2009.

USEPA, 2015. Field Equipment Cleaning and Decontamination at the FEC (Field Equipment Center): Operating Procedures. SESDPROC-206-R3, USEPA Science and Ecosystem Support Division, Region 4, Athens (GA), December 2015

Figures

Figure 1: Layout of the
Oak Materials
River Road 1, 2 and 3
Town of Hoosick
New York

ERM

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Legend

- Approximate Property Boundaries
- Proposed Soil Boring and Groundwater Profiling Locations
- Proposed Surface Water / Sediment Locations
- Proposed Off-Site TAL/TCL analysis of Soil
- Proposed Surface Geophysical Survey Line

Hoosick Tax Parcel Type

- Commercial / Vacant / Other
- Residential

NOTES:
Proposed locations are tentative and are subject to revision based on the results of surface geophysics, site inspection, and field discussions.

N

0 25 50 100 150 200
Feet

Figure 2: Layout of the Former Oak Materials Fluorglas Division
John Street
Village of Hoosick Falls
New York

ERM

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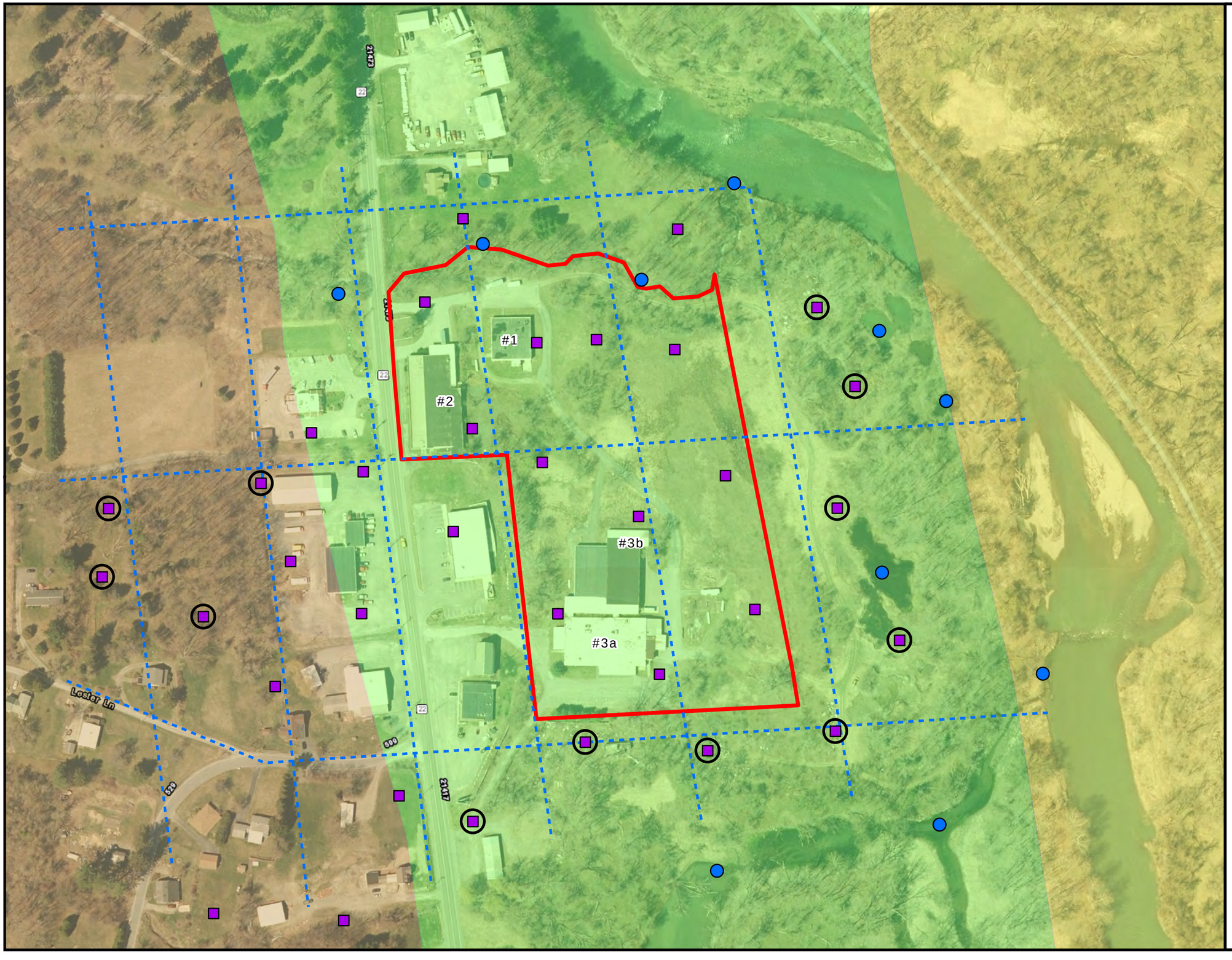

Legend

Approximate Property Boundaries

Proposed Locations

- Proposed Profiling Locations
- Proposed Surface Water / Sediment Locations
- Proposed Off-Site TAL/TCL analysis of Soil
- Proposed Surface Geophysical Survey Line

Surficial Geology (NYSM)

- Aluvium
- Lacustrine Silt and Clay
- Outwash Sand and Gravel

NOTES:
Proposed locations are tentative and are subject to revision based on the results of surface geophysics, site inspection, and field discussions.

N

0 50 100 200 300 400
Feet

Figure 3: Surficial Geology
Oak Materials
River Road 1, 2 and 3
Town of Hoosick
New York

ERM

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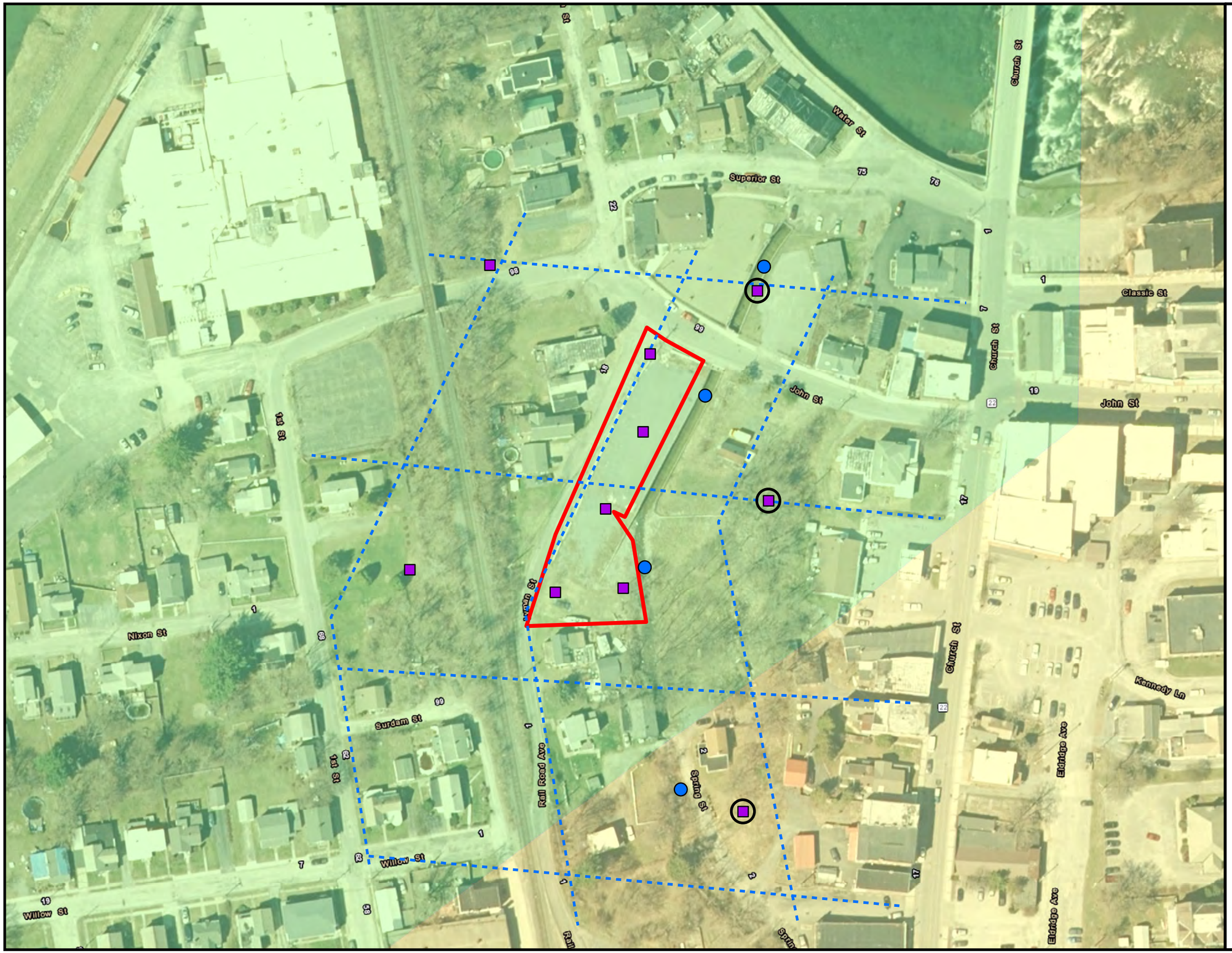

Legend

- Approximate Property Boundaries

Proposed Locations

- Proposed Profiling Locations
- Proposed Surface Water / Sediment Locations
- Proposed Off-Site TAL/TCL analysis of Soil
- Proposed Surface Geophysical Survey Line

Surficial Geology (NYSM)

- Aluvium
- Outwash Sand and Gravel

NOTES:
Proposed locations are tentative and are subject to revision based on the results of surface geophysics, site inspection, and field discussions.

N

0 25 50 100 150 200
Feet

Figure 4: Surficial Geology
Former Oak Materials
Fluorglas Division
John Street
Village of Hoosick Falls
New York

ERM

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Tables

OAK MATERIALS - RIVER ROAD 1, 2, AND 3

Sample Matrix	Sampling Location	Sample Depths for Laboratory Analysis[1]	Number of Samples (Excluding QA/QC)	Analytical Parameter	Sample Type	Sampling Method	Rationale
Surface & Near-Surface Soil	On site (11 locations)	0 to 2" and 2 to 12" (include root mass)	22	PFCs (12), TOC, pH, and TAL/TCL	One grab sample at each depth interval	Hand auger	• Characterize surface and near surface soil quality at both on-site and off-site locations. • DER-10[2] § 3.5 Soil, §3.5.1 Site Characterization; (b) 1 through 3, Surface Soil Sampling. • EPA Work[4] includes two soil samples (surface and near-surface).
	Off site (23 locations)	0 to 2" and 2 to 12" (include root mass)	46	PFCs (12), TOC, and pH at all locations plus TAL/TCL at 12 locations	One grab sample at each depth interval	Hand auger	
Subsurface Soil	On site (11 locations)	One depth interval (2') from the unsaturated zone selected in the field[3]	11	PFCs (12), TOC, pH, and TAL/TCL	Grab sample	Drilling rig	• Characterize subsurface soil quality at on-site and off-site locations as appropriate based on site conditions. • DER-10 § 3.5 Soil, §3.5.1 Site Characterization; (c) 1 through 5, Subsurface Soil Sampling (within the unsaturated zone with selection of the sample interval based on § (c) iv (1 through 4); and (d), encouraging the use of expedited site investigation employing field screening techniques. • EPA Work[4] at the ball fields included collection of soil samples at less than 10% subsurface soil locations and at McCaffrey St and vicinity proposed collection of subsurface soil samples at 33% of locations.
	Off site (23 locations)	One depth interval (2') from the unsaturated zone selected in the field[3]	23	PFCs (12), TOC, pH at all locations plus TAL/TCL at 12 locations	Grab sample	Drilling rig	
Groundwater	On site (11 locations)	Average of three discrete samples per location	33	PFCs (12), TOC, and pH on all samples plus TAL/TCL in the sample collected at the groundwater table at each location	Discrete depth sample	Waterloo APS profiler	• Characterize overburden groundwater quality at the groundwater table and within more permeable saturated zones. • DER-10 § 3.7 Groundwater, §3.7.1 Site Characterization; (a) – Note: the proposed approach provides for 102 groundwater samples and groundwater levels from the overburden at 34 locations {on-site and off-site combined} in lieu of the minimum of three overburden monitoring wells specified in this section. • EPA Work[4] composed for McCaffrey St and vicinity includes collection of groundwater samples at wells.
	Off site (23 locations)	Average of three discrete samples per location	69	PFCs (12), TOC, and pH on all samples plus TAL/TCL in the sample collected at the groundwater table at each location	Discrete depth sample	Waterloo APS profiler	
Surface Water	On site or adjacent to site; 10 locations co-located with sediment samples	NA	10	PFCs (12), TOC, pH, and TAL/TCL	Grab sample	New disposable bailer or directly into containers	• Characterize surface water quality on and immediately adjacent to properties. • DER-10 § 3.8 Surface Water, Sediments and Wetlands, §3.8.1 Site Characterization; (a), 2 (iii), (1), (3) & (4) regarding initial evaluation of surface water determined to be "on or proximate to the site". • EPA Work[4] does not include collection of surface water but does include collection from storm drains, manholes and sewage ejector pit at the McCaffrey St. Facility.
Sediment	On site or adjacent to site; 10 locations co-located with surface water samples	0 to 6"	10	PFCs (12), TOC, pH, and TAL/TCL	Grab sample	Hand auger or macro-core sampler	• Characterize sediment quality at corresponding surface water sample locations on or proximate to the site. • DER-10 § 3.8 Surface Water, Sediments and Wetlands, §3.8.1 Site Characterization; (a), 2 (iii), (1), (3) & (4); §3.8.2 Remedial Investigation; (c)2 regarding sediment sampling locations and §3.9 (d) 3 (I and ii) regarding possible swale drainage. • EPA Work[4] includes collection of sediment/soil samples from a swampy area off site.

Total = 220 samples

FORMER OAK MATERIALS FLUORGLAS DIVISION - JOHN STREET

Sample Matrix	Sampling Location	Sample Depths for Laboratory Analysis[1]	Number of Samples (Excluding QA/QC)	Analytical Parameter	Grab/Sample	Sampling Method	Rationale
Surface & Near-Surface Soil	On site (5 locations)	0 to 2" and 2 to 12" (include root mass)	10	PFCs (12), TOC, pH, and TAL/TCL	One grab sample at each depth interval	Hand auger	• Characterize surface and near surface soil quality at both on-site and off-site locations. • DER-10[2] § 3.5 Soil, §3.5.1 Site Characterization; (b) 1 through 3, Surface Soil Sampling. • EPA Work[4] includes two soil samples (surface and near-surface).
	Off site (5 locations)	0 to 2" and 2 to 12" (include root mass)	10	PFCs (12), TOC, and pH at all locations plus TAL/TCL at 3 locations	One grab sample at each depth interval	Hand auger	
Subsurface Soil	On site (5 locations)	One depth interval (2') from the unsaturated zone selected in the field[3]	5	PFCs (12), TOC, pH, and TAL/TCL	Grab sample	Drilling rig	• Characterize subsurface soil quality at on-site and off-site locations as appropriate based on site conditions. • DER-10 § 3.5 Soil, §3.5.1 Site Characterization; (c) 1 through 5, Subsurface Soil Sampling (within the unsaturated zone with selection of the sample interval based on § (c) iv (1 through 4); and (d), encouraging the use of expedited site investigation employing field screening techniques. • EPA Work[4] at the ball fields included collection of soil samples at less than 10% subsurface soil locations and at McCaffrey St and vicinity proposed collection of subsurface soil samples at 33% of locations.
	Off site (5 locations)	One depth interval (2') within the unsaturated zone selected in the field[3]	5	PFCs (12), TOC, and pH at all locations plus TAL/TCL at 3 locations	Grab sample	Drilling rig	
Groundwater	On site (5 locations)	Average of three discrete samples per location	15	PFCs (12), TOC, and pH on all samples plus TAL/TCL in the sample collected at the groundwater table at each location	Discrete depth sample	Waterloo APS profiler	• Characterize overburden groundwater quality at the groundwater table and within more permeable saturated zones. • DER-10 § 3.7 Groundwater, §3.7.1 Site Characterization; (a) – Note: the proposed approach provides for 102 groundwater samples and groundwater levels from the overburden at 34 locations {on-site and off-site combined} in lieu of the minimum of three overburden monitoring wells specified in this section. • EPA Work[4] composed for McCaffrey St and vicinity includes collection of groundwater samples at wells.
	Off site (5 locations)	Average of three discrete samples per location	15	PFCs (12), TOC, and pH on all samples plus TAL/TCL in the sample collected at the groundwater table at each location	Discrete depth sample	Waterloo APS profiler	
Surface Water	On site or adjacent to site; 4 locations co-located with sediment samples	NA	4	PFCs (12), TOC, pH, and TAL/TCL	Grab sample	New disposable bailer or directly into containers	• Characterize surface water quality on and immediately adjacent to properties. • DER-10 § 3.8 Surface Water, Sediments and Wetlands, §3.8.1 Site Characterization; (a), 2 (iii), (1), (3) & (4) regarding initial evaluation of surface water determined to be "on or proximate to the site". • EPA Work[4] does not include collection of surface water but does include collection from storm drains, manholes and sewage ejector pit at the McCaffrey St. Facility.
Sediment	On site or adjacent to site; 4 locations co-located with surface water samples	0 to 6"	4	PFCs (12), TOC, pH, and TAL/TCL	Grab sample	Hand auger or macro-core sampler	• Characterize sediment quality at corresponding surface water sample locations on or proximate to the site. • DER-10 § 3.8 Surface Water, Sediments and Wetlands, §3.8.1 Site Characterization; (a), 2 (iii), (1), (3) & (4); §3.8.2 Remedial Investigation; (c)2 regarding sediment sampling locations and §3.9 (d) 3 (I and ii) regarding possible swale drainage. • EPA Work[4] includes collection of sediment/soil samples from a swampy area off site.

Total = 72 samples

NOTES:

[1] Soil borings will be advanced continuously to the groundwater table and examined in the field for visual, olfactory, or PID field screening evidence of potential contamination; sample intervals for laboratory analysis will be selected in the field during consultation with NYSDEC's Field Representative.

[2] NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, May 2010

[3] Soil cores will be screened continuously to the top of bedrock or drilling refusal; submit the sample above the water table; additional soil samples may also be submitted for laboratory analysis if needed based on the results of field screening and consultation with NYSDEC's Field Representative.

[4] EPA Work = Work conducted at the ball fields and the work proposed and/or ongoing at the McCaffrey St facility and vicinity.

Soil pH will be determined by laboratory analysis.

TAL = USEPA Target Analyte List inorganic elements and compounds.

TCL = USEPA Target Compound List VOCs, SVOCs, PCBs, and Pesticides, including Tentatively Identified Compounds.

TOC = Total Organic Carbon by the Lloyd Kahn method.

TABLE 2
SUMMARY OF POTENTIAL SURFACE GEOPHYSICAL METHODS
SC FSAP - INITIAL PHASE

Method	Key Benefits/Project-Specific Uses	Methodology	Constraints/Potential Limitations
Seismic Refraction	• Determine depth to groundwater table, unconsolidated units (clay, silt, sand, gravel), depth to bedrock surface, & bedrock units • Identify fracture zones in bedrock • Map bedrock contours	Utilizes acoustic waves which travel at different velocities through different materials and are refracted at layer interfaces. A seismic wave is usually generated using a sledge hammer or a seismic weight drop tool. The wave's travel time from the sound source to refracting layers, along those layers and back to detectors (called geophones) is precisely measured. Subsurface layer velocities and thicknesses are calculated from the time-distance relationships. Typical geophones spacing is 10 to 50 feet apart. Shorter spacings or radial patterns are sometimes used in fracture zone detection studies.	• Layer density must increase with depth • Layers must be of sufficient thickness to be detectable. • Cultural "noise" may interfere with results. • Single narrow fractures may be too small to be detected.
Seismic Reflection	• Graphically visualize unconsolidated and bedrock units • Differentiate and map unconsolidated units and bedrock surface.	Uses acoustic waves reflected directly from underground surfaces with density contrasts and are used to map unconsolidated and bedrock units. Ground coverage is usually slower than with a refraction survey. It is less suseptable to some of the potential problems encountered in refraction surveys.	• Highly site-specific. • Shallow groundwater table required. Useful for exploration depths of 50 feet to several hundred feet.
Resistivity	• Characterize vertical and lateral changes in subsurface electrical properties (typically due to changes in type of unconsolidated or bedrock units) • Location of water-filled fractures • Location of gravel aquifers • Vertical electrical soundings for stratigraphic information • Lateral and vertical mapping of groundwater	Used to map spatial changes in subsurface electrical properties and commonly used to map groundwater. An electrical current is introduced directly into the ground through small electrodes. In the resistivity profiling method, four electrodes are positioned at a fixed distance from each other. A current is introduced between two of the electrodes and a voltage potential is measured between the other two electrodes. The electrode pairs are moved along a surveyed line and the electrical measurements result in a horizontal profile of apparent resistivity. Different electrode spacings can be used to yield a cross-section of resistivity changes with depth. Applications of a resistivity survey are similar to those of terrain conductivity surveys. The vertical electrical sounding (VES) method measures vertical changes in the resistivity of the geologic units and are typically used to laterally trace clay layers, and in conjunction with borehole data, to characterize electrically-distinct layers. In the field, a series of resistivity measurements are made at various electrode spacings centered on a common point. Sampling depth is increased by increasing electrode spacing.	Profiling: Resistivity profiling can be slower than EM surveying. VES: Soundings are affected by changes in surface relief and lateral changes in resistivity. The electrode array length is about 10 times the depth of investigation.
Terrain Conductivity & VLF	• Non-invasive • Compliments resistivity surveys • Locating bedrock fractures • Locating buried metal objects • Lateral and vertical conductivity mapping • Locating groundwater	Common Inductive electromagnetic (EM) applications include terrain conductivity measurements, metal detection, and bedrock fracture detection. Terrain conductivity is a walk-over EM induction method that works by inducing current into the ground from a transmitter coil. The resulting secondary EM field is then measured at a receiver coil. The presence of metals, ions, or clays increases the ground conductivity. Detection depth of EM instruments is a function of the transmitter-to-receiver coil separation and the coil orientation (horizontal or vertical). Bedrock fracture detection can be accomplished using very low frequency EM (VLF-EM) which is an inductive technique that measures very low frequency horizontal EM signals from remote military transmitters. Localized conductors, such as water-filled fractures, cause angular disturbances in this signal which are measured in degrees from horizontal with the VLF-EM instrument. VLF-EM can best detect linear, steeply dipping conductors oriented in the direction of the transmitter. Detection depth depends largely upon overall ground conductivity, but is commonly over 100 feet.	Constraints: Measurements can be affected by power lines, metal fences, metal debris, and utilities. Fracture detection can be affected by overburden thickness, soil conductivity, and orientation and dip of the fractures.

TABLE 3
ESTIMATED PROJECT SCHEDULE
FINAL SC FSAP – PHASE 1

Task/Milestone	Estimated Duration *	Estimated Completion Date**
Attainment of required access agreements	15 days	
Mobilization, procurement of supplies, and field office set-up	5 days	
Subsurface utility clearances – River Road	5 days	
Surface geophysical surveys – River Road	15 days	
Surface soil sampling – River Road	2 days	
Soil borings, permeability profiling, groundwater sampling, borehole abandonments – River Road	15 days	
Sediment and Surface Water Sampling – River Road	2 days	
Subsurface utility clearances – John Street	2 days	
Surface geophysical surveys – John Street	5 days	
Surface Soil Sampling – John Street	1 day	
Soil borings, permeability profiling, groundwater sampling, borehole abandonments – John Street	7 days	
Sediment and Surface Water Sampling – John Street	1 day	
Demobilization	3 days	

NOTES:

- * Estimated durations are reported in business days and are tentative and are subject to modification based on site work progress, delays, and other considerations.
- ** Estimated completion dates after access agreements have been obtained and a firm start date for the field work is scheduled. Tasks may be performed concurrently as much as possible to expedite overall project schedule.

Appendix A
Quality Assurance Project Plan

Final Quality Assurance Project Plan for Site Characterization Field Sampling and Analysis Plan – Phase 1

Oak Materials - River Road 1, 2 and 3 (No. 442008) and

Former Oak Materials Fluorglas Division - John Street (No. 442049)

July 2016

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

TABLE OF CONTENTS

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

ALS	Australian Laboratory Services
ASP	Analytical Services Protocol
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFCs	Chlorofluorocarbons
CLP	Contract Laboratory Protocols
COPC	Constituent of Potential Concern
DQOs	Data Quality Objectives
DUP	Duplicate
DUSR	Data Usability Summary Report
ELLE	Eurofins Lancaster Laboratory Environmental
ERM	ERM Consulting and Engineering, Inc.
FB	Field Blank
FSAP	Field Sampling and Analysis Plan
HCFCs	Hydrochlorofluorocarbons
LFB	Laboratory Fortified Blank
LFSM	Laboratory Fortified Sample Matrix
LFSMD	Laboratory Fortified Sample Matrix Duplicate
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NA	Not applicable
NJDEP	New Jersey Department of Environmental Protection
NYSDEC	New York State Department of Environmental Conservation
OSHA	Occupational Safety and Health Administration
PARCC	Precision, Accuracy, Representativeness, Completeness, and Comparability
PCBs	Polychlorinated Biphenyls
PIC	Partner In Charge
PFOA	Perfluorooctanoic Acid
QAOs	Quality Assurance Objectives

QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/ Quality Control
QL	Qualitative Limit
RCRA	Resource Conservation and Recovery Act
RPD	Relative Percent Difference
SC	Site Characterization
SOPs	Standard Operating Procedures
SVOCs	Semi-volatile Organic Compounds
TB	Trip Blank
TBD	To Be Determined
TOC	Total Organic Compounds
TSCA	Toxic Substances Control Act
USEPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds

1.0 INTRODUCTION

ERM Consulting and Engineering, Inc. (ERM) has prepared this Quality Assurance Project Plan (QAPP) as part of the Site Characterization (SC) Field Sampling and Analysis Plan (FSAP) for the Oak Materials – River Road 1, 2, and 3 property (No. 442008) and the Former Oak Materials Fluorglas Division – John Street property (No. 442049). These properties are respectively located in the Town of Hoosick and the Village of Hoosick Falls, Rensselaer County, New York.

1.1 PURPOSE AND OBJECTIVES

The objective of this project is to evaluate overburden characteristics including permeability and concentration of constituents of potential concern (COPCs) to evaluate whether or not additional investigation is required at the properties, and if so, to help select appropriate locations and depths for the installation of sampling points and fixed monitoring wells. A summary of project sampling tasks are included in Table 1.

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.

2.0 QUALITY ASSURANCE OBJECTIVES

Quality objectives ensure that collected data 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, representativeness, 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 prior to sample collection and continues throughout the analytical and data validation 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

Eurofins Lancaster Laboratory Environmental (ELLE) and Australian Laboratory Services (ALS) are the selected project laboratories. These laboratories 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. This evaluation is outlined in Tables 2 & 3.

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 SC FSAP.

These quality control procedures are to be implemented as follows:

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

Further detail regarding QA/QC samples and procedures can be found in Table 4.

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, regarding collection frequency are described in Table 1. Sampling procedures are described Section 2 of the SC FSAP. The six types of field QC samples that will be generated during the project are defined below.

- Trip blanks – Trip blank samples monitor for contamination due to handling, transport, cross contamination from other samples during storage, or laboratory contamination.
- Temperature blank – Temperature blanks are used to monitor temperature within a sample cooler. Temperature blank results that are outside of acceptable limits (1° to 10° C) indicate possible sample preservation issues and may require qualification of data or the recollection of samples.
- Field duplicates – Field duplicates are used to monitor field and laboratory precision, as well as matrix heterogeneity.

- Field Blank – Field blanks are prepared using laboratory-provided water and poured into sample containers at the sampling location. Used to provide information that samples have not been contaminated during field sampling and during transport of containers from and to the laboratory.

- Matrix Spikes – Matrix Spikes (MS) are used to monitor precision and accuracy of the analytical method on various matrices.

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 Fortified Blank (LFB) – A volume of reagent water or other blank matrix to which known quantities of the method analytes and all the preservation compounds are added in the laboratory. The LFB is analyzed exactly like a sample, and its purpose is to determine whether the methodology is in control, and whether the laboratory is capable of making accurate and precise measurements.

- Laboratory Fortified Sample Matrix (LFSM) – A preserved field sample to which known quantities of the method analytes are added in the laboratory. The LFSM is processed and analyzed exactly like a sample, and its purpose is to determine whether the sample matrix contributes bias to the analytical results. The background concentrations of the analytes in the sample matrix must be determined in a separate sample extraction and the measured values in the LFSM corrected for background concentrations.

- Laboratory Fortified Sample Matrix Duplicate (LFSMD) – A duplicate of the Field Sample used to prepare the LFSM. The LFSMD is fortified, extracted, and analyzed identically to the

LFSM. The LFSMD is used instead of the Field Duplicate to assess method precision when the occurrence of method analytes is low..

- Surrogate Spikes - Surrogate Spikes are utilized to monitor potential interferences from the sample matrix. Surrogate spikes are required for organic analyses only.

Further detail regarding measurement performance criteria can be found in Table 5.

4.0 ANALYTICAL PROCEDURES AND DATA EVALUATION

Overburden groundwater, soil, surface water, and sediment samples will be collected and submitted to the selected project laboratory for analysis of COPCs to facilitate the NYSDEC's SC process. The COPCs are:

- Perfluorooctanoic acid (PFOA)
- Perfluoroheptanoic acid (PFHpA)
- Perfluorononanoic acid (PFNA)
- Perfluorooctane sulfonic acid (PFOS)
- Perfluorobutane sulfonic acid (PFBS)
- Perfluorohexane sulfonic acid (PFhxS)
- Perfluorodecanoic acid (PFDA)
- Perfluorododecanoic acid (PFDoA)
- Perfluorohexanoic acid (PFHxA)
- Perfluorotetradecanoic acid (PFTA)
- Perfluorotridecanoic acid (PFTrDA)
- Perfluoroundecanoic acid (PFUnA)
- Volatile organic compounds (VOCs)
- Semi-volatile organic compounds (SVOCs)
- Polychlorinated biphenyls (PCBs)
- Pesticides
- Inorganic compounds (e.g., metals)

Laboratory analytical procedures will adhere to the methodology and/or the selected project laboratory Standard Operating Procedures (SOPs) outlined in Table 6.

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 deliverables in NYSDEC Analytical Services Protocol (ASP) Category B format.

The Project Quality Assurance 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 (see Table 8 for requirements);
- date sampled/date analyzed;
- sample temperature at check-in;
- 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.

5.0 PROJECT PERSONNEL

ERM will staff this project with persons having expertise in the tasks to be performed and experience working on NYSDEC-regulated sites. The Project Personnel Sign-Off Sheet is located in Table 9 and key project personnel that will be involved with this project are summarized below.

James A. Perazzo P.G. will be the Partner--in-Charge for this project. Mr. Perazzo has over 25 years of experience dealing with legacy environmental problems under CERCLA, RCRA, TSCA and related brownfield environmental programs. As part of the Sustainable Watershed integrated Management practice, Mr. Perazzo works with clients, regulators and national organizations on assessing impacts in urban waterways and facilitating risk management decisions to address impacts. Aligns technical approaches with business objectives and works with regulators, when necessary. Mr. Perazzo 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.

Elena Ponce will be the project manager for this project. Ms. Ponce has 14 years of diversified experience in environmental consulting, project engineering, and project management. Experience includes industrial and domestic wastewater treatment, pilot plant design and modeling, field sampling, construction oversight, waste management, Brownfield clean-up programs and insurance engineering support. Ms. Ponce has also assisted in the development and implementation of work plans and associated documents for various state agencies including the New York State Department of Environmental Conservation (NYSDEC) and New Jersey Department of Environmental Protection (NJDEP).

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.

Maureen C. Leahy, Ph.D. has more than 30 years of experience in chemistry, biochemistry and environmental remediation technologies and has served clients in over 30 States in the USA, Canada, Latin America, Europe, Middle East and Asia Pacific. Dr. Leahy's primary areas of expertise are biological and chemical treatment processes and the fate and transport of chemicals in the environment. Dr. Leahy also provides expertise in metal chemistry, emerging and/or persistent contaminants (perchlorate, pharmaceuticals, surfactants, polychlorinated biphenyls, chlorofluorocarbons (CFCs and HCFCs), perfluorinated alkyl substances (PFAS), perfluorooctanoic acid (PFOA) and has served as QA officer responsible for data quality.

Jon Fox P.G. will be the Principal Geologist for this project. Mr. Fox is a Qualified Environmental Professional and licensed Professional Geologist and has more than 28 years of diversified professional scientific and environmental consulting experience including contaminated site investigation and remediation; site management; program and project management; Brownfields program management; regulatory negotiations; geologic and hydrogeologic evaluation; private water well system inspection, sampling, and corrective action; inspection and corrective action of storage tank systems; operations management; expert witness and litigation support; immunoassay field screening; petrographic analyses; geochemistry and geophysics; statistical analysis of geologic data; wetlands evaluation; petroleum exploration geology and development; and professional geologic instruction.

Tables

Table 1
Summary of Project Tasks

Sampling Tasks: ▪ Collection of samples of potable water, potential sampling equipment, and sampling supplies that may be used in field activities ▪ Collection of soil samples ▪ Collection of groundwater samples utilizing Waterloo APS. ▪ Collection of surface water and sediment samples ▪ Recording groundwater field parameters with field instruments during sampling (i.e. pH, conductivity, temperature, ORP, etc.)
Analysis Tasks: Eurofins Lancaster Laboratories Environmental and Australian Laboratory Services (ALS) will perform laboratory analyses. The specific criteria for project sampling are detailed in the FSAP.
Quality Control Tasks: QA/QC sampling requirements are outlined in the QAPP. All project personnel are expected to review and comply with the QA/QC protocol and guidance presented within the QAPP.
Secondary Data: Not applicable.
Data Management Tasks: After appropriate QA/QC review data will be compiled in an electronic database.
Documentation and Records: All documents will be managed and retained by the ERM project manager or their designee in the central project file.
Assessment/Audit Tasks: QA/QC audits will be performed by Project Manager, ERM Principal In Charge and ERM QA Officer.
Data Review Tasks: QA/QC review and validation of data will be managed by ERM QA officer.

Table 2
Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Timeframe for Response
Field Sampling Protocol	Electronic mail that documents the results of the audit will be submitted to the project manager.	ERM Project Manager	24 hours after audit	Electronic mail	All ERM project personnel listed in Table 9	24 hours after notification
Handling and Custody of Samples	Electronic mail that documents the results of the audit will be submitted to the project manager.	ERM Project Manager	24 hours after audit	Electronic mail	All ERM project personnel listed in Table 9	24 hours after notification
Analytical Laboratory Performance	Electronic mail that documents the results of the audit will be submitted to the project manager.	ERM Project Manager	24 hours after audit	Electronic mail	All ERM project personnel listed in Table 9	24 hours after notification

Table 3
Verification Process

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
Chain of Custody Forms	Chain of Custody (COC) Forms and FedEx shipping papers will be reviewed after the forms have been completed by the ERM sampler but prior to shipping any laboratory samples off-Site. All elements of the COC (requested analysis, bottle qty., project information, etc.) will be compared to the analytical criteria specified in the QAPP and to confirm that the labels and qty. of bottles in the cooler match the information specified on the COC. The FedEx shipping form will be reviewed to certify that the address information is correct, all requested information is provided and that the appropriate shipping method (e.g., priority overnight, Saturday delivery, etc.) has been marked so that the samples arrive at the lab according to holding time and temperature preservation requirements specified in the QAPP.	Internal	ERM Field Team Leader
Audit Reports	The results of the audit reports and project assessments presented in Table 2 will be retained in the project file. As specified, the results and findings will be reviewed with the appropriate members of the project team and confirmation that all corrective measures have been completed will be the responsibility of the project manager. Reference Table 2 for further details.	Internal	ERM Project Manager
Field Notes	It is imperative that detailed field notes are recorded real-time in the field to document project field activities.	Internal	ERM Field Team Leader ERM Project Manager
Laboratory Data	All laboratory data will be reviewed internally by the analytical laboratory prior to reporting analytical results to ERM. All analytical laboratory data packages will comply with the 2005 NYSDEC ASP Category B reporting and deliverable requirements presented in Attachment E. Data generated from the Groundwater Monitoring samples will be validated. A Data Usability Assessment will be prepared at the end of the project.	External Internal	Laboratories Project Manager ERM Laboratory QA Officer

Table 4A
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Perfluorinated Compounds (PFCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solids	All Compounds			≤ 50	≤ RL			
	Perfluorooctane sulfonic acid	1763-23-1				70-130	30	70-130
	Perfluorobutane sulfonic acid	375-73-5				70-130	30	70-130
	Perfluorodecanoic acid	335-76-2				70-130	30	70-130
	Perfluorododecanoic acid	307-55-1				70-130	30	70-130
	Perfluoroheptanoic acid	375-85-9				70-130	30	70-130
	Perfluorohexane sulfonic acid	355-46-4				70-130	30	70-130
	Perfluorohexanoic acid	307-24-4				70-130	30	70-130
	Perfluorononanoic acid	375-95-1				70-130	30	70-130
	Perfluorooctanoic acid	335-67-1				70-130	30	70-130
	Perfluorotetradecanoic acid	376-06-7				70-130	30	70-130
	Perfluorotridecanoic acid	72629-94-8				70-130	30	70-130
	Perfluoroundecanoic acid	2058-94-8				70-130	30	70-130

Notes:
1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Eurofins for USEPA Method 537-1.1. Subject to change.

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

Table 4B
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Perfluorinated Compounds (PFCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	Perfluorooctane sulfonic acid	1763-23-1				70-130	30	70-130
	Perfluorobutane sulfonic acid	375-73-5				70-130	30	70-130
	Perfluorodecanoic acid	335-76-2				70-130	30	70-130
	Perfluorododecanoic acid	307-55-1				70-130	30	70-130
	Perfluoroheptanoic acid	375-85-9				70-130	30	70-130
	Perfluorohexane sulfonic acid	355-46-4				70-130	30	70-130
	Perfluorohexanoic acid	307-24-4				70-130	30	70-130
	Perfluorononanoic acid	375-95-1				70-130	30	70-130
	Perfluorooctanoic acid	335-67-1				70-130	30	70-130
	Perfluorotetradecanoic acid	376-06-7				70-130	30	70-130
	Perfluorotridecanoic acid	72629-94-8				70-130	30	70-130
	Perfluoroundecanoic acid	2058-94-8				70-130	30	70-130

Notes:

3. Chemical Abstracts Service (CAS) Registry Number.
4. QC limits as established by Eurofins for USEPA Method 537-1.1. Subject to change.

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

Table 5A
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Volatile Organic Compounds (VOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solids	All compounds			≤ 50	≤ RL			
	1,1,1-Trichloroethane	71-55-6				66-128	30	66-128
	1,1,2,2-Tetrachloroethane	79-34-5				67-121	30	67-121
	1,1,2-Trichloroethane	79-00-5				80-120	30	80-120
	1,1-Dichloroethane	75-34-3				77-120	30	77-120
	1,1-Dichloroethene	75-35-4				73-129	30	73-129
	1,2,4-Trichlorobenzene	120-82-1				55-120	30	55-120
	1,2-Dibromo-3-chloropropane	96-12-8				54-120	30	54-120
	1,2-Dibromoethane	106-93-4				80-120	30	80-120
	1,2-Dichlorobenzene	95-50-1				80-120	30	80-120
	1,2-Dichloroethane	107-06-2				77-130	30	77-130
	1,2-Dichloropropane	78-87-5				76-120	30	76-120
	1,3-Dichlorobenzene	541-73-1				80-120	30	80-120
	1,4-Dichlorobenzene	106-46-7				80-120	30	80-120
	2-Butanone	78-93-3				54-129	30	54-129
	2-Hexanone	591-78-6				39-120	30	39-120
	4-Methyl-2-pentanone	108-10-1				50-120	30	50-120
	Acetone	67-64-1				46-139	30	46-139
	Benzene	71-43-2				80-120	30	80-120
	Bromodichloromethane	75-27-4				75-120	30	75-120
	Bromoform	75-25-2				64-120	30	64-120
	Bromomethane	74-83-9				16-200	30	16-200
	Carbon Disulfide	75-15-0				60-120	30	60-120
	Carbon Tetrachloride	56-23-5				69-130	30	69-130
	Chlorobenzene	108-90-7				80-120	30	80-120
	Chloroethane	75-00-3				11-200	30	11-200
	Chloroform	67-66-3				80-120	30	80-120
	Chloromethane	74-87-3				56-120	30	56-120
	Cyclohexane	110-82-7				58-120	30	58-120
	Dibromochloromethane	124-48-1				77-120	30	77-120
	Dichlorodifluoromethane	75-71-8				28-131	30	28-131
	Ethylbenzene	100-41-4				80-120	30	80-120

Table 5A (continued)
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Volatile Analysis (VOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solids	All compounds			≤ 50	≤ RL			
	Freon 113	76-13-1				57-141	30	57-141
	Isopropylbenzene	98-82-8				70-120	30	70-120
	Methyl Acetate	79-20-9				52-146	30	52-146
	Methyl Tertiary Butyl Ether	1634-04-4				72-120	30	72-120
	Methylcyclohexane	108-87-2				52-128	30	52-128
	Methylene Chloride	75-09-2				76-122	30	76-122
	Styrene	100-42-5				76-120	30	76-120
	Tetrachloroethene	127-18-4				78-120	30	78-120
	Toluene	108-88-3				80-120	30	80-120
	Trichloroethene	79-01-6				80-120	30	80-120
	Trichlorofluoromethane	75-69-4				54-140	30	54-140
	Vinyl Chloride	75-01-4				59-120	30	59-120
	Xylenes (Total)	1330-20-7				80-120	30	80-120
	cis-1,2-Dichloroethene	156-59-2				80-120	30	80-120
	cis-1,3-Dichloropropene	10061-01-5				74-120	30	74-120
	trans-1,2-Dichloroethene	156-60-5				80-125	30	80-125
	trans-1,3-Dichloropropene	10061-02-6				76-120	30	76-120
	Dibromofluoromethane	1868-53-7	50 - 141					
	1,2-Dichloroethane-d4	17060-07-0	54 - 135					
	Toluene-d8	2037-26-5	52 - 141					
	4-Bromofluorobenzene	460-00-4	50 - 131					

Notes:
1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Eurofins for USEPA Method SW-846 8260C. Subject to change.

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

Table 5B
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Volatile Organic Compounds (VOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	1,1,1-Trichloroethane	71-55-6				66-126	30	66-126
	1,1,2,2-Tetrachloroethane	79-34-5				72-120	30	72-120
	1,1,2-Trichloroethane	79-00-5				80-120	30	80-120
	1,1-Dichloroethane	75-34-3				80-120	30	80-120
	1,1-Dichloroethene	75-35-4				76-124	30	76-124
	1,2-Dichloroethane	107-06-2				72-127	30	72-127
	1,2-Dichloropropane	78-87-5				80-120	30	80-120
	2-Butanone	78-93-3				62-131	30	62-131
	2-Hexanone	591-78-6				35-138	30	35-138
	4-Methyl-2-pentanone	108-10-1				47-133	30	47-133
	Acetone	67-64-1				58-138	30	58-138
	Benzene	71-43-2				78-120	30	78-120
	Bromodichloromethane	75-27-4				80-120	30	80-120
	Bromoform	75-25-2				67-120	30	67-120
	Bromomethane	74-83-9				53-130	30	53-130
	Carbon Disulfide	75-15-0				58-120	30	58-120
	Carbon Tetrachloride	56-23-5				74-130	30	74-130
	Chlorobenzene	108-90-7				80-120	30	80-120
	Chloroethane	75-00-3				56-120	30	56-120
	Chloroform	67-66-3				80-120	30	80-120
	Chloromethane	74-87-3				65-129	30	65-129
	Dibromochloromethane	124-48-1				78-120	30	78-120
	Ethylbenzene	100-41-4				78-120	30	78-120
	Methylene Chloride	75-09-2				77-121	30	77-121
	Styrene	100-42-5				80-120	30	80-120
	Tetrachloroethene	127-18-4				80-129	30	80-129
	Toluene	108-88-3				80-120	30	80-120
	Trichloroethene	79-01-6				80-120	30	80-120
	Vinyl Chloride	75-01-4				69-120	30	69-120
	cis-1,2-Dichloroethene	156-59-2				80-120	30	80-120
	cis-1,3-Dichloropropene	10061-01-5				80-120	30	80-120

Table 5B (continued)
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Volatile Organic Compounds (VOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	m+p-Xylenes	179601-23-1				80-120	30	80-120
	o-Xylene	95-47-6				80-120	30	80-120
	trans-1,2-Dichloroethene	156-60-5				80-120	30	80-120
	trans-1,3-Dichloropropene	10061-02-6				76-120	30	76-120
	Dibromofluoromethane	1868-53-7						
	1,2-Dichloroethane-d4	17060-07-0						
	Toluene-d8	2037-26-5						
	4-Bromofluorobenzene	460-00-4						

Notes:

3. Chemical Abstracts Service (CAS) Registry Number.
4. QC limits as established by Eurofins for USEPA Method SW-846 8260C. Subject to change.

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

Table 6A
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Semi-Volatile Organic Compounds (SVOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solids	All compounds			≤ 50	≤ RL			
	1,1'-Biphenyl	92-52-4				76-111	30	76-111
	2,2'-oxybis(1-Chloropropane)	108-60-1				61-134	30	61-134
	2,4,5-Trichlorophenol	95-95-4				86-123	30	86-123
	2,4,6-Trichlorophenol	88-06-2				81-123	30	81-123
	2,4-Dichlorophenol	120-83-2				86-125	30	86-125
	2,4-Dimethylphenol	105-67-9				83-120	30	83-120
	2,4-Dinitrophenol	51-28-5				16-132	30	16-132
	2,4-Dinitrotoluene	121-14-2				81-122	30	81-122
	2,6-Dinitrotoluene	606-20-2				86-125	30	86-125
	2-Chloronaphthalene	91-58-7				63-146	30	63-146
	2-Chlorophenol	95-57-8				85-123	30	85-123
	2-Methylnaphthalene	91-57-6				83-109	30	83-109
	2-Methylphenol	95-48-7				80-133	30	80-133
	2-Nitroaniline	88-74-4				84-126	30	84-126
	2-Nitrophenol	88-75-5				83-120	30	83-120
	3,3'-Dichlorobenzidine	91-94-1				10-116	30	10-116
	3-Nitroaniline	99-09-2				66-119	30	66-119
	4,6-Dinitro-2-methylphenol	534-52-1				46-134	30	46-134
	4-Bromophenyl-phenylether	101-55-3				84-120	30	84-120
	4-Chloro-3-methylphenol	59-50-7				79-127	30	79-127
	4-Chloroaniline	106-47-8				10-100	30	10-100
	4-Chlorophenyl-phenylether	7005-72-3				81-120	30	81-120
	4-Methylphenol	65794-96-9				73-125	30	73-125
	4-Nitroaniline	100-01-6				44-110	30	44-110
	4-Nitrophenol	100-02-7				52-133	30	52-133
	Acenaphthene	83-32-9				83-116	30	83-116
	Acenaphthylene	208-96-8				83-119	30	83-119
	Acetophenone	98-86-2				74-116	30	74-116
	Anthracene	120-12-7				82-118	30	82-118
	Atrazine	1912-24-9				62-143	30	62-143
	Benzaldehyde	100-52-7				10-93	30	10-93
	Benzo(a)anthracene	56-55-3				76-119	30	76-119

Table 6A (continued)
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Semi-Volatile Organic Compounds (SVOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solids	All compounds			≤ 50	≤ RL			
	Benzo(a)pyrene	50-32-8				85-117	30	85-117
	Benzo(b)fluoranthene	205-99-2				78-129	30	78-129
	Benzo(g,h,i)perylene	191-24-2				77-118	30	77-118
	Benzo(k)fluoranthene	207-08-9				79-120	30	79-120
	Butylbenzylphthalate	85-68-7				80-118	30	80-118
	Caprolactam	105-60-2				73-119	30	73-119
	Carbazole	86-74-8				78-117	30	78-117
	Chrysene	218-01-9				80-121	30	80-121
	Di-n-butylphthalate	84-74-2				84-120	30	84-120
	Di-n-octylphthalate	117-84-0				80-140	30	80-140
	Dibenz(a,h)anthracene	53-70-3				81-123	30	81-123
	Dibenzofuran	132-64-9				85-115	30	85-115
	Diethylphthalate	84-66-2				81-118	30	81-118
	Dimethylphthalate	131-11-3				82-113	30	82-113
	Fluoranthene	206-44-0				81-117	30	81-117
	Fluorene	86-73-7				86-118	30	86-118
	Hexachlorobenzene	118-74-1				79-116	30	79-116
	Hexachlorobutadiene	87-68-3				72-120	30	72-120
	Hexachlorocyclopentadiene	77-47-4				64-137	30	64-137
	Hexachloroethane	67-72-1				78-114	30	78-114
	Indeno(1,2,3-cd)pyrene	193-39-5				81-118	30	81-118
	Isophorone	78-59-1				77-118	30	77-118
	N-Nitroso-di-n-propylamine	621-64-7				67-121	30	67-121
	N-Nitrosodiphenylamine	86-30-6				83-118	30	83-118
	Naphthalene	91-20-3				82-112	30	82-112
	Nitrobenzene	98-95-3				70-122	30	70-122
	Pentachlorophenol	87-86-5				57-126	30	57-126
	Phenanthrene	85-01-8				80-114	30	80-114
	Phenol	108-95-2				73-122	30	73-122
	Pyrene	129-00-0				81-114	30	81-114
	bis(2-Chloroethoxy)methane	111-91-1				77-116	30	77-116
	bis(2-Chloroethyl)ether	111-44-4				77-115	30	77-115

Table 6A (continued)
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Semi-Volatile Organic Compounds (SVOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solids	All compounds			≤ 50	≤ RL			
	bis(2-Ethylhexyl)phthalate	117-81-7				81-121	30	81-121
	Phenol-d6	13127-88-3	58 - 122					
	2-Fluorophenol	367-12-4	57 - 126					
	2,4,6-Tribromophenol	118-79-6	35 - 136					
	Nitrobenzene-d5	4165-60-0	54 - 123					
	2-Fluorobiphenyl	321-60-8	63 - 117					
	Terphenyl-d14	1718-51-0	59 - 129					

Notes:
1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Eurofins for USEPA Method SW-846 8270D. Subject to change.

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

Table 6B
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Semi-Volatile Organic Compounds (SVOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	1,1'-Biphenyl	92-52-4				59-124	30	59-124
	2,2'-oxybis(1-Chloropropane)	108-60-1				56-128	30	56-128
	2,4,5-Trichlorophenol	95-95-4				68-126	30	68-126
	2,4,6-Trichlorophenol	88-06-2				71-130	30	71-130
	2,4-Dichlorophenol	120-83-2				66-126	30	66-126
	2,4-Dimethylphenol	105-67-9				63-117	30	63-117
	2,4-Dinitrophenol	51-28-5				42-129	30	42-129
	2,4-Dinitrotoluene	121-14-2				71-131	30	71-131
	2,6-Dinitrotoluene	606-20-2				71-133	30	71-133
	2-Chloronaphthalene	91-58-7				57-126	30	57-126
	2-Chlorophenol	95-57-8				59-120	30	59-120
	2-Methylnaphthalene	91-57-6				61-117	30	61-117
	2-Methylphenol	95-48-7				54-122	30	54-122
	2-Nitroaniline	88-74-4				68-130	30	68-130
	2-Nitrophenol	88-75-5				67-131	30	67-131
	3,3'-Dichlorobenzidine	91-94-1				39-111	30	39-111
	3-Nitroaniline	99-09-2				58-122	30	58-122
	4,6-Dinitro-2-methylphenol	534-52-1				64-124	30	64-124
	4-Bromophenyl-phenylether	101-55-3				64-129	30	64-129
	4-Chloro-3-methylphenol	59-50-7				65-125	30	65-125
	4-Chloroaniline	106-47-8				45-115	30	45-115
	4-Chlorophenyl-phenylether	7005-72-3				67-125	30	67-125
	4-Methylphenol	65794-96-9				56-109	30	56-109
	4-Nitroaniline	100-01-6				61-111	30	61-111
	4-Nitrophenol	100-02-7				20-89	30	20-89
	Acenaphthene	83-32-9				69-123	30	69-123
	Acenaphthylene	208-96-8				67-125	30	67-125
	Acetophenone	98-86-2				61-124	30	61-124
	Anthracene	120-12-7				68-126	30	68-126
	Atrazine	1912-24-9				62-140	30	62-140
	Benzaldehyde	100-52-7				10-123	30	10-123
	Benzo(a)anthracene	56-55-3				69-133	30	69-133

Table 6B (continued)
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Semi-Volatile Organic Compounds (SVOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	Benzo(a)pyrene	50-32-8				68-126	30	68-126
	Benzo(b)fluoranthene	205-99-2				71-131	30	71-131
	Benzo(g,h,i)perylene	191-24-2				62-132	30	62-132
	Benzo(k)fluoranthene	207-08-9				72-128	30	72-128
	Butylbenzylphthalate	85-68-7				68-119	30	68-119
	Caprolactam	105-60-2				11-51	30	11-51
	Carbazole	86-74-8				64-126	30	64-126
	Chrysene	218-01-9				71-136	30	71-136
	Di-n-butylphthalate	84-74-2				61-125	30	61-125
	Di-n-octylphthalate	117-84-0				73-131	30	73-131
	Dibenz(a,h)anthracene	53-70-3				64-133	30	64-133
	Dibenzofuran	132-64-9				67-120	30	67-120
	Diethylphthalate	84-66-2				55-124	30	55-124
	Dimethylphthalate	131-11-3				26-133	30	26-133
	Fluoranthene	206-44-0				68-129	30	68-129
	Fluorene	86-73-7				71-127	30	71-127
	Hexachlorobenzene	118-74-1				64-128	30	64-128
	Hexachlorobutadiene	87-68-3				23-129	30	23-129
	Hexachlorocyclopentadiene	77-47-4				10-101	30	10-101
	Hexachloroethane	67-72-1				23-121	30	23-121
	Indeno(1,2,3-cd)pyrene	193-39-5				62-128	30	62-128
	Isophorone	78-59-1				68-125	30	68-125
	N-Nitroso-di-n-propylamine	621-64-7				63-121	30	63-121
	N-Nitrosodiphenylamine	86-30-6				80-115	30	80-115
	Naphthalene	91-20-3				62-121	30	62-121
	Nitrobenzene	98-95-3				77-119	30	77-119
	Pentachlorophenol	87-86-5				53-133	30	53-133
	Phenanthrene	85-01-8				65-120	30	65-120
	Phenol	108-95-2				19-82	30	19-82
	Pyrene	129-00-0				68-118	30	68-118
	bis(2-Chloroethoxy)methane	111-91-1				67-124	30	67-124
	bis(2-Chloroethyl)ether	111-44-4				65-120	30	65-120

Table 6B (continued)
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Semi-Volatile Organic Compounds (SVOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	bis(2-Ethylhexyl)phthalate	117-81-7				66-130	30	66-130
	Phenol-d6	13127-88-3	10-85					
	2-Fluorophenol	367-12-4	10-103					
	2,4,6-Tribromophenol	118-79-6	22-150					
	Nitrobenzene-d5	4165-60-0	46-128					
	2-Fluorobiphenyl	321-60-8	61-112					
	Terphenyl-d14	1718-51-0	41-125					

Notes:
1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Eurofins for USEPA Method SW-846 8270D. Subject to change.

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

Table 7A
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Polychlorinated Biphenyls (PCBs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Soil	All compounds			≤ 50	≤ RL			
	Aroclor-1016	12674-11-2				76-121	50	76-121
	Aroclor -1221	11104-28-2				NA	NA	NA
	Aroclor -1232	11141-16-5				NA	NA	NA
	Aroclor -1242	53469-21-9				NA	NA	NA
	Aroclor -1248	12672-29-6				NA	NA	NA
	Aroclor -1254	11097-69-1				50-130	50	50-130
	Aroclor -1260	11096-82-5				79-130	50	79-130
	Tetrachloro-m-xylene	877-09-8	53 - 140					
	Decachlorobiphenyl	2051-24-3	45 - 143					

Notes:
1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Eurofins for USEPA Method SW-846 8082A. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit; NA = Not Available.

Table 7B
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Polychlorinated Biphenyls (PCBs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	Aroclor-1016	12674-11-2				60-117	30	60-117
	Aroclor -1221	11104-28-2				80-120	30	NA
	Aroclor -1232	11141-16-5				80-120	30	NA
	Aroclor -1242	53469-21-9				75-125	30	75-125
	Aroclor -1248	12672-29-6				68-149	30	58-112
	Aroclor -1254	11097-69-1				50-130	30	NA
	Aroclor -1260	11096-82-5				57-134	30	57-134
	Tetrachloro-m-xylene	877-09-8	33-137					
	Decachlorobiphenyl	2051-24-3	10-148					

Notes:

3. Chemical Abstracts Service (CAS) Registry Number.
4. QC limits as established by Eurofins for USEPA Method SW-846 8082A. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit; NA = Not Available.

Table 8A
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Pesticides

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)*[1]	*LCS Accuracy (% Rec.)* [2]
Solids	All compounds			< 50	≤ RL			
	Aldrin	309-00-2				60-117	50	60-117
	Alpha BHC	319-84-6				65-124	50	65-124
	Alpha Chlordane	5103-71-9				73-131	50	73-131
	Beta BHC	319-85-7				68-129	50	68-129
	Delta BHC	319-86-8				45-151	50	45-151
	Dieldrin	60-57-1				63-126	50	63-126
	Endosulfan I	959-98-8				62-119	50	62-119
	Endosulfan II	33213-65-9				65-126	50	65-126
	Endosulfan Sulfate	1031-07-8				71-132	50	71-132
	Endrin	72-20-8				65-125	50	65-125
	Endrin Aldehyde	7421-93-4				59-122	50	59-122
	Endrin Ketone	53494-70-5				64-121	50	64-121
	Gamma BHC - Lindane	58-89-9				47-140	50	47-140
	Gamma Chlordane	5103-74-2				76-134	50	76-134
	Heptachlor	76-44-8				66-118	50	66-118
	Heptachlor Epoxide	1024-57-3				74-128	50	74-128
	Methoxychlor	72-43-5				65-131	50	65-131
	Toxaphene	8001-35-2				70-120	50	75-125
	p,p'-DDD	72-54-8				69-138	50	69-138
	p,p'-DDE	72-55-9				68-146	50	68-146
	p,p'-DDT	50-29-3				67-135	50	67-135
	Tetrachloro-m-xylene	877-09-8	26 - 145					
	Decachlorobiphenyl	2051-24-3	39 - 152					

Notes:
1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Eurofins for USEPA Method SW-846 8081B. Subject to change.

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

Table 8B
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Pesticides

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	Aldrin	309-00-2				28-119	30	28-119
	Alpha BHC	319-84-6				47-132	30	47-132
	Alpha Chlordane	5103-71-9				53-126	30	53-126
	Beta BHC	319-85-7				56-125	30	56-125
	Delta BHC	319-86-8				76-126	30	76-126
	Dieldrin	60-57-1				54-126	30	54-126
	Endosulfan I	959-98-8				51-118	30	51-118
	Endosulfan II	33213-65-9				54-124	30	54-124
	Endosulfan Sulfate	1031-07-8				41-133	30	41-133
	Endrin	72-20-8				35-143	30	35-143
	Endrin Aldehyde	7421-93-4				40-135	20	40-135
	Endrin Ketone	53494-70-5				44-136	30	44-136
	Gamma BHC - Lindane	58-89-9				51-132	30	51-132
	Gamma Chlordane	5103-74-2				53-130	30	53-130
	Heptachlor	76-44-8				38-135	30	38-135
	Heptachlor Epoxide	1024-57-3				56-132	30	56-132
	Methoxychlor	72-43-5				39-143	30	39-143
	Toxaphene	8001-35-2				48-148	30	48-148
	p,p-DDD	72-54-8				67-123	30	67-123
	p,p-DDE	72-55-9				51-129	30	51-129
	p,p-DDT	50-29-3				66-119	30	66-119
	Tetrachloro-m-xylene	877-09-8	29-129					
	Decachlorobiphenyl	2051-24-3	32-149					

Notes:

3. Chemical Abstracts Service (CAS) Registry Number.
4. QC limits as established by Eurofins for USEPA Method SW-846 8081B. Subject to change.

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

Table 9
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Inorganic Constituents

QC Analytes	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS Accuracy (% Rec.) [1] Water*	*MS Accuracy (% Rec.) [1] Soil*	*LCS Accuracy (% Rec.) Water*	*LCS Accuracy (% Rec.) Soil*
All analytes	≤ 50 % for	≤ RL				
Aluminum	Soil and		75-125	75-125	80-120	80-120
Antimony	Sediment		75-125	75-125	80-120	80-120
Arsenic	Samples		75-125	75-125	80-120	80-120
Barium			75-125	75-125	80-120	80-120
Beryllium	≤ 20 % for		75-125	75-125	80-120	80-120
Cadmium	Aqueous		75-125	75-125	80-120	80-120
Calcium	Samples		75-125	75-125	80-120	80-120
Chromium			75-125	75-125	80-120	80-120
Cobalt			75-125	75-125	80-120	80-120
Copper			75-125	75-125	80-120	80-120
Cyanide			72-114	45-145	90-110	90-110
Iron			75-125	75-125	80-120	80-120
Lead			75-125	75-125	80-120	80-120
Magnesium			75-125	75-125	80-120	80-120
Manganese			75-125	75-125	80-120	80-120
Mercury			80-120	80-120	80-120	80-120
Nickel			75-125	75-125	80-120	80-120
Potassium			75-125	75-125	80-120	80-120
Selenium			75-125	75-125	80-120	80-120
Silver			75-125	75-125	80-120	80-120
Sodium			75-125	75-125	80-120	80-120
Thallium			75-125	75-125	80-120	80-120
Vanadium			75-125	75-125	80-120	80-120
Zinc			75-125	75-125	80-120	80-120

Notes:

1. QC limits as established by Eurofins for USEPA Method SW-846 6010C/7471B. Subject to change.

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

Table 10
Analytical Method/SOP References

Analytical Group	*Matrix*	*Analytical Method/SOP Title*	*Analytical SOP Document Number*	*Analytical SOP Revision Number*	*Analytical SOP Revision Date*	*Organization Performing Analysis*	*Definitive or Screening Data*	*Modified for Project Work?*
PFCs	Soil/ Aqueous	USEPA Method 537-1.1	1-P-QM-WI -9035864 1-P-QM-WI -9012802	2 5	2/10/2016 4/14/2016	ELLE/ALS	Definitive	No
VOCs	Soil/ Aqueous	USEPA Method SW-846 8260C	1-P-QM-WI -9012764 1-P-QM-WI -9015141	3 23	4/28/2014 3/26/2016	ELLE/ ALS	Definitive	No
SVOCs	Soil/ Aqueous	USEPA Method SW-846 8270C	1-P-QM-WI -9015087	15	5/28/2015	ELLE/ ALS	Definitive	No
PCBs	Soil/ Aqueous	USEPA Method SW-846 8082A	1-P-QM-WI -9015126 1-P-QM-WI -9015164	19 15	9/24/2015 6/27/2015	ELLE/ALS	Definitive	No
Pesticides	Soil/ Aqueous	USEPA Method SW-846 8081B	1-P-QM-WI -9015128 1-P-QM-WI -9015066	11 12	3/20/2015 8/4/2014	ELLE/ALS	Definitive	No
Inorganics	Soil/ Aqueous	USEPA Method SW-846 6010C/7471B	1-P-QM-WI -9018442 1-P-QM-WI -9015067 1-P-QM-WI -9011646	9 16 17	11/20/2015 11/27/2015 4/28/2014	ELLE/ALS	Definitive	No

Table 11a Oak Materials – River Road 1, 2, and 3
Field Sampling and Analysis Plan

Analytical Parameters	*Matrix*	*Number of Samples*	*Analytical Method/SOP Title*	*Sample Preservation*	*Holding Time*	*Minimum Sample Volume*
PFCs	Soil/ Aqueous	220	USEPA Method 537-1.1	Soil – None Aqueous - Trizma®	14 days	200 g/ 100 mL
VOCs	Soil/ Aqueous	111	USEPA Method SW-846 8260	4ºC	14 days	15 g/ 40 mL
SVOCs	Soil/ Aqueous	111	USEPA Method SW-846 8270	4ºC	7 days (aqueous) 14 days (solid)	20 g/ 1000 mL
PCBs	Soil/ Aqueous	111	USEPA Method SW-846 8082	4ºC	14 days	20 g (solid)
Pesticides	Soil/ Aqueous	111	USEPA Method SW-846 8081	4ºC	14 days	20 g (solid)
Metals	Soil/ Aqueous	111	USEPA Method SW-846 6010	None	180 days	1 g/ 100 mL
Mercury	Soil/ Aqueous	111	USEPA Method SW-846 7471	None	28 days	2 g/ 100 mL
Cyanide	Soil/ Aqueous	111	USEPA Method 9010	4ºC	14 days	10 g/ 500 mL
TOC	Soil/ Aqueous	220	USEPA Method 9060	4ºC	28 days	2 g/ 150 mL
pH	Soil/ Aqueous	220	USEPA Method 9045	4ºC	< 24 hours	20 g/ 50 mL

Notes:

1. Total analytical samples not including QA/QC samples
2. Blind Field Duplicates will be collected at a minimum frequency of five percent (1 per 20 field samples). More frequent collection may be warranted based on field conditions/observations and/or at the discretion of the Field Leader.
3. Field Blanks will be collected at a minimum frequency of five percent (1 per 20 field samples). More frequent collection may be warranted based on field conditions/observations and/or at the discretion of the Field Leader.

4. MS/MSD Pairs (two samples) will be collected at a minimum frequency of five percent (1 per 20 field samples). More frequent collection may be warranted based on field conditions/observations and/or at the discretion of the Field Leader.

5. Trip Blank and Temperature Blank one per cooler.
6. Samples must be < 10°C, greater than 0°C (not frozen) upon lab receipt.
7. Holding time in days from sample collection to extraction

Table 11b Former Oak Materials Fluorglas Division – John Street
Field Sampling and Analysis Plan

Analytical Parameters	*Matrix*	*Number of Samples*	*Analytical Method/SOP Title*	*Sample Preservation*	*Holding Time*	*Minimum Sample Volume*
PFCs	Soil/ Aqueous	68	USEPA Method 537-1.1	Soil – None Aqueous - Trizma®	14 days	200 g/ 100 mL
VOCs	Soil/ Aqueous	42	USEPA Method SW-846 8260	4ºC	14 days	15 g/ 40 mL
SVOCs	Soil/ Aqueous	42	USEPA Method SW-846 8270	4ºC	7 days (aqueous) 14 days (solid)	20 g/ 1000 mL
PCBs	Soil/ Aqueous	42	USEPA Method SW-846 8082	4ºC	14 days	20 g (solid)
Pesticides	Soil/ Aqueous	42	USEPA Method SW-846 8081	4ºC	14 days	20 g (solid)
Metals	Soil/ Aqueous	42	USEPA Method SW-846 6010	None	180 days	1 g/ 100 mL
Mercury	Soil/ Aqueous	42	USEPA Method SW-846 7471	None	28 days	2 g/ 100 mL
Cyanide	Soil/ Aqueous	42	USEPA Method 9010	4ºC	14 days	10 g/ 500 mL
TOC	Soil/ Aqueous	68	USEPA Method 9060	4ºC	28 days	2 g/ 150 mL
pH	Soil/ Aqueous	68	USEPA Method 9045	4ºC	< 24 hours	20 g/ 50 mL

Notes:

1. Total analytical samples not including QA/QC samples
2. Blind Field Duplicates will be collected at a minimum frequency of five percent (1 per 20 field samples). More frequent collection may be warranted based on field conditions/observations and/or at the discretion of the Field Leader.
3. Field Blanks will be collected at a minimum frequency of five percent (1 per 20 field samples). More frequent collection may be warranted based on field conditions/observations and/or at the discretion of the Field Leader.

4. MS/MSD Pairs (two samples) will be collected at a minimum frequency of five percent (1 per 20 field samples). More frequent collection may be warranted based on field conditions/observations and/or at the discretion of the Field Leader.

5. Trip Blank and Temperature Blank one per cooler.
6. Samples must be < 10°C, greater than 0°C (not frozen) upon lab receipt.
7. Holding time in days from sample collection to extraction

Table 12
Sample Custody Requirements

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory):

The following documentation procedures will be used during sampling and analysis to provide custody control during transfer of samples from collection through storage. A sample is defined as being under a person's custody if any of the following conditions exist: 1) it is in their possession, 2) it is in their view, after being in their possession, 3) it was in their possession and they locked it up, or 4) it is in a designated secure area. Recordkeeping documentation will include the use of the following:

- a field logbook (bound, with dated pages) to document sampling activities in the field,
- labels to identify individual samples,
- and- chain-of-custody forms to document the analyses to be performed

In the field the sampler will record in the field logbook the following information for each sample collected:

- sample identification,
- sample matrix,
- name of the sampler,
- sample location,
- sample time and date,
- additional pertinent data,
- analysis to be conducted,
- sampling method,
- sample appearance (e.g., color, turbidity),
- preservative (if required),
- number of sample bottles an types, and- weather conditions

Samples will be packaged in a manner to prevent breakage of sample containers in a pre-chilled cooler. Custody of the samples and cooler will be the responsibility of the sampling personnel. Samples will be picked up by an Eurofin courier or shipped via Federal Express Priority Overnight service to the analytical laboratory the same day samples are collected.

Laboratory Sample Custody Procedures (receipt of samples, archiving, and disposal): Each sample or group of samples shipped to the laboratory for analysis will be given a unique identification number. The laboratory sample custodian will record the client name, number of samples and date of receipt of the samples. The remaining sample aliquots not used by the laboratory for analysis will be archived for a period of 30 days. After the archive period has passed the sample will be disposed of by the laboratory unless a request to hold the sample is made by ERM.

Table 12
Sample Custody Requirements (Continued)

Sample Identification Procedures: Each sample collected will be designated by an alpha-numeric code that will identify the sampling location and depth. Sample designations will be assigned as indicated in the following example:

LOC-01 (25)= Location ID (Collection Depth)

Additionally, eight digits will follow all sample designations to represent the date; therefore, LOC-01 (25)(04012016) would represent a groundwater sample collected at Location 01 at a depth of 25 feet on 01 April 2016.

In the case of QC samples such as field blanks, trip blanks and blind field duplicate samples, FB, TB and DUP respectively will be followed by the eight-digit date. For matrix spike/matrix spike duplicate samples, MS/MSD will be added following the applicable sample identification.

Chain-of-custody Procedures: The sampling crew shall maintain chain-of-custody records for all field and field QC samples.

The following information concerning the sample shall be documented on the chain of custody form:

- Unique sample identification for each container,
- Date and time of sample collection,
- Source of sample (including name, location, and sample type),
- Designation of MS/MSD;
- Preservative used;
- Analyses required;
- Name of collector(s);
- Serial numbers of custody seals and transportation cases (if used);
- Custody transfer signatures and dates and times of sample transfer from the field to transporters and to the laboratory or laboratories; and
- Bill of lading or transporter tracking number (if applicable).

Table 13
Project Personnel Sign-Off Sheet

Organization:

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read

Organization: ERM

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Jim Perazzo	Partner in Charge (PIC)	631-756-8913		
Elena Ponce	Project Manager	631-756-8905		
Andrew Coenen	QA/QC Officer	631-756-8959		
Jon Fox	Principal Geologist	315-233-3035		
Maureen C. Leahy	Principal Chemist	860-466-8523		
Matthew Botzler	ERM Health and Safety Officer	484-913-0339		

Organization: Eurofins Lancaster Laboratories Environmental LLC

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Kay Hower	Laboratory Project Manager	717-556-7364		

Organization: Australian Laboratories Services (ALS)

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Howard Boorse	Laboratory Project Manager	360-430-7733		

Appendix B

Community Air Monitoring Plan

COMMUNITY AIR MONITORING PLAN
OAK MATERIALS – RIVER ROAD 1, 2, AND 3 (442008) AND
FORMER OAK MATERIAS FLUORGLAS DIVISION - JOHN STREET (442049)
TOWN OF HOOSICK AND VILLAGE OF HOOSICK FALLS
RENSSELAER COUNTY, 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 include soil or waste excavation, grading, staging, movement, or handling; test pitting or trenching; and/or the installation of soil borings. The CAMP provides a measure of protection for on-Site workers and the downwind community (i.e., 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 equipment, operations and maintenance, 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 that does not require factory calibration will be calibrated at least once a day. 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 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 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 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

Health and Safety Plan

This Level 2 health and safety plan (HASP) is intended to provide 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;
- Work meets the definition of being "high hazard", which 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.);
    - Air or boat transport via charter or non-commercial carrier/vendor;
    - Confined space entry;
    - Construction;
    - Demolition, Decontamination and Demolition (DDD) operations;
    - Diving;
    - Excavations, trenching, drilling, or other ground disturbance activities (i.e., activities requiring subsurface clearance [SSC] operations);
    - Hazardous energy control operations;
    - Hot work (e.g., welding, flame cutting, or other spark-producing activities);
    - Injection well operations;
    - Off-shore or over water work (including oil platform visits);
    - Rigging and lifting operations; and
    - Work at heights in excess of four feet.

The HASP should be developed with input from the project team and reviewed with all ERM project personnel, including subcontractors. 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 (ERMNASafetyLeads@erm.com). 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 has been developed for the sole use of ERM staff. Subcontractors and other project participants must develop their own HASP.

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: SC FSAP - Oak Materials - River Road 1, 2 and 3 & Former Oak Materials Fluorglas Division - John Street	Site Name & Location: Hoosick Falls, NY
Client Contact and Phone: Edward McTiernan	GMS Project #: 0357439
Health & Safety Plan Date: 6/30/2016	Revision Number and Date: Click here to enter text.
Field Work Start Date: TBD	Anticipated Field Work End Date: TBD
Project Manager: Elena Ponce	Partner In Charge: Jim Perazzo
Field Safety Officer: Jason Reynolds/Tim Daniluk	Additional ERM Personnel on site: Jon Fox, TBD

H&S Team Review

Reviewer Name: Review Date:	Signature File:

Site Description and Scope of Work

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.

Include a description of work to be completed during the project. From this, develop a list of tasks to be completed by ERM personnel, as well as a list of tasks to be completed by subcontractor personnel.

Site Description: The site includes residential, commercial/industrial and undeveloped areas within the Village of Hoosick Falls, NY and the Town of Hoosick, NY. Tasks will include driving to/from locations, oversight of geophysical surveys, surface soil sampling, subsurface soil sampling, permeability profiling, groundwater sampling, surface water sampling and sediment sampling.

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 contractors at the site. A site-specific Job Hazard Analysis (JHA; ERM Form S1-ERM-002-FM4) must be completed for each task to be performed. Contractors must provide their own HASP and a JHA for each task they will perform for ERM review.

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

ERM Scope of Work: Tasks will include driving to/from locations, oversight of geophysical surveys, surface soil sampling, subsurface soil sampling, permeability profiling, groundwater sampling, surface water sampling and sediment sampling.

ERM Task 1: Oversight of geophysical surveys/ SSC	☐ JHA Attached?
ERM Task 2: Surface soil sampling	☐ JHA Attached?
ERM Task 3: Oversight of permeability profiling	☐ JHA Attached?
ERM Task 4: Groundwater sampling	☐ JHA Attached?
ERM Task 5: Surface water sampling	☐ JHA Attached?
ERM Task 6: Sediment sampling	☐ JHA Attached?
ERM Task 7: Click here to enter text.	☐ JHA Attached?

Contractor Scope of Work: Geophysical surveys, permeability profiling, and boring installations. A laboratory subcontractor will also analyze water, soil, and sediment samples for parameters outlined in the QAPP.

Contractor Task 1: Geophysical survey/ SSC	☐ JHA Reviewed?
Contractor Task 2: Permeability profiling	☐ JHA Reviewed?
Contractor Task 3: Boring installations	☐ JHA Reviewed?
Contractor Task 4: Laboratory analytical services	☐ JHA Reviewed?
Contractor Task 5: Click here to enter text.	☐ JHA Reviewed?
Contractor Task 6: Click here to enter text.	☐ JHA Reviewed?
Contractor Task 7: Click here to enter text.	☐ JHA Reviewed?

Contractor(s) to be used:	Approved under Contractor Management Program?
1. Geophysical Survey provider to be selected	☐ Yes ☐ No
2. Driller to be selected	☐ Yes ☐ No
3. Analytical Laboratory to be selected	☐ Yes ☐ No
4. Click here to enter text.	☐ Yes ☐ No
5. Click here to enter text.	☐ Yes ☐ No

Site/Project General Information

Site Type (check all applicable boxes)

☒	Industrial	☐	Hazardous waste release (Hazwoper)
☒	Residential	☒	Remote or Inactive Facility*
☒	Unsecured	☐	Other (specify): Click here to enter text.
☐	Coastal/offshore (on or near water)	☐	Other (specify): Click here to enter text.

*ERM Form S3-NAM-029-FM6 (*Undeveloped, Remote, or Inactive Sites*) must be completed and attached to this document.

Main Project Hazards (check all applicable boxes)

☐	Aerial Lift Use (e.g., Scissor Lifts, Cherry Pickers)[1]	☐	Helicopter/Fixed Wing Aircraft Transportation[3]
☐	All-Terrain Vehicle Use[1]	☒	High Noise (>85 dBA)
☐	ASTs/USTs	☐	Hot Work (Welding, Cutting, Brazing)[2]
☒	Biological Hazards	☐	International Travel[4]
☒	Chemical Exposure Potential (including asbestos)	☐	Long Distance/Duration Driving[5]
☐	Chemical Mixing/Injection	☐	Mining (Surface/Underground)
☐	Compressed Gas	☒	Natural Hazards (Plants, Animals, Insects)
☐	Confined Space Entry[2]	☐	Off-Shore Platform Work[6]
☐	Construction[1]	☒	Overhead Power Lines
☐	Control of Hazardous Energy (i.e., Lockout/Tagout)[2]	☐	Portable/Fixed Ladders
☐	DDD Operations[1]	☐	Radiation (Ionizing/Non-ionizing)
☐	Diving[1]	☐	Rigging/Lifting[2]
☒	Ergonomics/Material Handling	☐	Scaffold Use
☒	Excavation/Trenching/Drilling[2]	☐	Shift Work (e.g., night work)
☐	Extended or Nonstandard Work Shifts (>14 hours)	☐	Short Service Employees
☐	Extreme Weather	☒	Slips/Trips
☐	Explosives Use[1]	☒	Subsurface Clearance (Buried Utilities)[2]
☐	Falls from height (>4 feet)[1]	☐	Working on/over Water (including transport)[1]
☐	Forklift/Industrial Truck Use[1]	☐	Unexploded Ordnance/Munitions and Explosives of Concern (UXO/MEC)[1]
☐	Hand/Power Tool Use		
☒	Heavy Equipment Use	☐	Other (specify): Click here to enter text.

1 High hazard work requiring H&S team coordination. Additional control measures may be required beyond JHA.

2 Permit-required high hazard work requiring H&S Team coordination and ERM or equivalent client-required permit to be completed.

3 If traveling using a helicopter or fixed wing aircraft, ERM employees are required to follow the provisions of ERM Standard S1-ERM-009-ST (*Fixed Wing Aircraft and Helicopter Safety*).

4 A Travel Risk Assessment (TRA) is required for all international travel (with the sole exception of travel to a Low Risk country where ERM has a permanent office). Consult ERM Standard S1-ERM-005-ST.

5 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 location, a Journey Management Plan (see ERM Standard S1-ERM-008-PR) is required and should be appended to this HASP.

6 If traveling to/from and working on an off shore platform, ERM employees are required to follow the provisions of ERM Standard S1-ERM-006-ST (*Offshore Platform Safety*).

Chemical Products Used or Stored On-Site

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

☒	Alconox or Liquinox	☐	Household bleach (NaOCl)
☐	Hydrocholoric acid (HCl)	☐	Calibration gas
☐	Nitric acid (HNO_3)	☒	Other (specify): Trizma Base (bottle preservative)
☐	Sulfuric acid (H_2SO_4)	☐	Other (specify): Click here to enter text.
☐	Sodium hydroxide (NaOH)	☐	Other (specify): Click here to enter text.
☐	Isopropyl alcohol	☐	Other (specify): Click here to enter text.

Note: 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 eyewash unit, whether stationary or portable, must be large enough to provide at least 15 minutes of eye flushing.

Regulated Chemicals of Concern

Check any chemicals known or suspected to be present on the site to which the ERM team may be exposed. These chemicals include OSHA-regulated potential carcinogens (29 CFR 1910.1003 through 1016) as well as those chemicals for which OSHA has established specific respiratory protection requirements (29 CFR 1910.134). If any of these chemicals are present on site, contact your H&S team member for guidance and describe any additional protective measures to be taken, as necessary.

☐	Friable asbestos	☐	Hexavalent chromium
☐	3,3'-Dichlorobenzidine	☐	Coke oven emissions
☐	Benzidine	☐	Ethylene oxide
☐	Beta-Propiolactone	☐	1,2-Butadiene
☐	N-Nitrosomethylamine	☐	Methyl chromoethyl ether
☐	Lead	☐	Beta-Napthylamine
☐	Benzene	☐	Ethyleneimine
☐	Acrylonitrile	☐	4-Dimethylaminoazobenzene
☐	Methylenedianiline	☐	Inorganic arsenic
☐	4-Nitrobiphenyl	☐	Cadmium
☐	alpha-Napthylamine	☐	1,2-Dibromo-3-chloropropane
☐	bis-Chloromethyl ether	☐	Formaldehyde
☐	4-Aminodiphenyl	☐	Methylene chloride
☐	2-Acetyaminoflourene	☒	**No ERM exposure to these compounds**
☐	Vinyl chloride		

Known or Suspected Chemicals of Concern

The following section must be filled out for all confirmed or suspected chemicals present on the site to which the ERM team may reasonably be exposed. Information on each chemical must be provided to all team members.

Material name: Perfluorooctanoic Acid (PFOA)		Highest reported concentration*: 8.6 ng/L - 412 ng/L	
Primary hazards: AS A POWDER Fire - Not Combistible - Gives off irritating or toxic fumes (or gases) in a fire		Exposure symptoms: AS A POWDER Inhalation - cough, sore throat; Skin - redness, pain; Eyes - redness, bain, blurred vision; Ingestion - abdominal pain, nausea, vomiting	
OSHA Exposure Limits**	NIOSH Exposure Limits**	ACGIH Exposure Limits**	IDLH Level**: Not Established
PEL: Not Established	REL: Not Established	TLV: Not Established	
STEL: Not Established	STEL: Not Established	STEL: Not Established	Ionization Potential (in eV): Not Established
Other: Not Established	Other: Click here to enter text.	Other: Click here to enter text.	

Material name: Click here to enter text.		Highest reported concentration*: Click here to enter text.	
Primary hazards: Click here to enter text.		Exposure symptoms: Click here to enter text.	
OSHA Exposure Limits**	NIOSH Exposure Limits**	ACGIH Exposure Limits**	IDLH Level**: Click here to enter text.
PEL: Click here to enter text.	REL: Click here to enter text.	TLV: Click here to enter text.	
STEL: Click here to enter text.	STEL: Click here to enter text.	STEL: Click here to enter text.	Ionization Potential (in eV): Click here to enter text.
Other: Click here to enter text.	Other: Click here to enter text.	Other: Click here to enter text.	

Material name: Click here to enter text.		Highest reported concentration*: Click here to enter text.	
Primary hazards: Click here to enter text.		Exposure symptoms: Click here to enter text.	
OSHA Exposure Limits**	NIOSH Exposure Limits**	ACGIH Exposure Limits**	IDLH Level**: Click here to enter text.
PEL: Click here to enter text.	REL: Click here to enter text.	TLV: Click here to enter text.	
STEL: Click here to enter text.	STEL: Click here to enter text.	STEL: Click here to enter text.	Ionization Potential (in eV): Click here to enter text.
Other: Click here to enter text.	Other: Click here to enter text.	Other: Click here to enter text.	

Material name: Click here to enter text.		Highest reported concentration*: Click here to enter text.	
Primary hazards: Click here to enter text.		Exposure symptoms: Click here to enter text.	
OSHA Exposure Limits**	NIOSH Exposure Limits**	ACGIH Exposure Limits**	IDLH Level**: Click here to enter text.
PEL: Click here to enter text.	REL: Click here to enter text.	TLV: Click here to enter text.	
STEL: Click here to enter text.	STEL: Click here to enter text.	STEL: Click here to enter text.	Ionization Potential (in eV): Click here to enter text.
Other: Click here to enter text.	Other: Click here to enter text.	Other: Click here to enter text.	

For additional chemicals, refer to S3-NAM-029-FM9 (Additional Known or Suspected Chemicals of Concern).
*Specify units and sample medium; **Specify units
OSHA Permissible Exposure Limits (PEL) and Short Term Exposure Limits (STEL); https://www.osha.gov/dsg/annotated-pels/
NIOSH Recommended Exposure Limits (REL), STELs, and Immediately Dangerous to Life and Health (IDLH); http://www.cdc.gov/niosh/npg/
ACGIH Threshold Limit Values (TLV) and STELs; contact your Division H&S Leader for additional information on these values.

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	☒	☐	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): Nitrile Gloves ONLY	☐	☐			

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 Division H&S Leader 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 S3-NAM-026-PR (*Respiratory Protection*) for additional information.

Training, Medical Surveillance, and Safety Supplies

Req = Required; requirements are based on the specific tasks performed in the field and the type of environments, chemicals, or hazards encountered. NA = Not applicable to this project.

Training	Req	NA	Medical Surveillance**	Req	NA
40-Hour Hazwoper	☒	☐	Medical Clearance	☒	☐
Current 8-hour Hazwoper Refresher	☒	☐	Respirator Clearance and Fit Test	☐	☒
8-Hour Hazwoper Supervisor*	☐	☒	Blood Lead and ZPP	☐	☒
Current First Aid/CPR	☒	☐	Other (specify): Click here to enter text.	☐	☐
40-Hour MSHA New Miner	☐	☒	Other (specify): Click here to enter text.	☐	☐
Current 8-hour MSHA Refresher	☐	☒	**Safety Supplies**	**Req**	**NA**
ERM Field Safety Officer (FSO)	☒	☐	First Aid Kit	☒	☐
DDD Practice FSO/DM	☐	☒	Eyewash Solution (15 minute flush)	☒	☐
Subsurface Clearance (SSC)	☒	☐	Air Horn	☐	☒
EPA Hazardous Waste	☐	☒	Decontamination Supplies	☐	☒
Hazmat/Dangerous Goods Shipping	☐	☒	Fire Extinguisher	☒	☐
International Traveler	☐	☒	Potable Water	☐	☒
Other (specify): Click here to enter text.	☐	☐	Toilets	☐	☒
Other (specify): Click here to enter text.	☐	☐	Other (specify): 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.

**Physical examination requirements should be discussed with Workcare well in advance of project to allow adequate time to schedule exams.

Monitoring Equipment

All monitoring equipment on site must be calibrated per manufacturer specifications (including daily bump tests) and results recorded. Under stable conditions, measurements must be made in the breathing zone at least once every 30 minutes.

Combustible Gas Indicator	Reading	Action Guideline	Comments
Check if required: ☐	0 to 10% LEL	Monitor. Evacuate if confined space.	Click here to enter text.
Model: Click here to enter text.	10 to 25% LEL	Potential fire or explosion hazard.	
Task number(s): Click here to enter text.	>25% LEL	Fire/explosion hazard. Evacuate.	

Oxygen Meter	Reading	Action Guideline	Comments
Check if required: ☐	>23.5%	Fire hazard. Evacuate.	Click here to enter text.
Model: Click here to enter text.	23.5 to 19.5%	Normal oxygen levels.	
Task number(s): Click here to enter text.	<19.5%	Oxygen deficient conditions. Evacuate.	

Radiation Survey Meter	Reading	Action Guideline	Comments
Check if required: ☐	Normal background	Proceed with normal operations.	Annual exposure not to exceed 1250 mrem per quarter. Background reading must be taken in an area known to be free of radiation sources.
Model: Click here to enter text.	3x background	Notify Radiation Safety Officer.	
Task number(s): Click here to enter text.	>3x background	Radiological hazard. Evacuate.	

Photoionization Detector	Reading	Action Guideline	Comments
Check if required: ☐	Any response below Click here to enter text. ppm, sustained for 1 minute	Level "D" PPE is acceptable up to the action level. For response above established background level(s), appropriate level PPE requirements must be met.	The action level for upgrading the level of protection is typically ½ the lowest published exposure limit for the potential COCs at the site. For COCs with extremely low exposure limits (e.g., <5 ppm), contact your Division H&S Leader for guidance on action levels.
Model: Click here to enter text.	Click here to enter text. ppm to Click here to enter text. ppm, sustained for 1 minute	Level "C" is acceptable as appropriate.	
Task number(s): Click here to enter text.	Greater than Click here to enter text. ppm above background, sustained for 1 minute	Stop work. Tasks requiring Level B or Level A PPE are not anticipated during this project. If Level B or Level A PPE is needed, as determined by the FSO and/or the PM, the Division H&S Leader will be notified and the HASP will be revised.	See end of this section for additional information on respirator selection.

Flame Ionization Detector	Reading	Action Guideline	Comments
Check if required: ☐	Any response below Click here to enter text. ppm, sustained for 1 minute	Level "D" PPE is acceptable up to the action level. For response above established background level(s), appropriate level PPE requirements must be met.	The action level for upgrading the level of protection is typically ½ the lowest published exposure limit for the potential COCs at the site. For COCs with extremely low exposure limits (e.g., <5 ppm), contact your Division H&S Leader for guidance on action levels. See end of this section for additional information on respirator selection.
Model: Click here to enter text.	Click here to enter text. ppm to Click here to enter text. ppm, sustained for 1 minute	Level "C" is acceptable as appropriate.	
Task number(s): Click here to enter text.	Greater than Click here to enter text. ppm above background, sustained for 1 minute	Stop work. Tasks requiring Level B or Level A PPE are not anticipated during this project. If Level B or Level A PPE is needed, as determined by the FSO and/or the PM, the Division H&S Leader will be notified and the HASP will be revised.	
Colorimetric Detector Tubes	**Reading**	**Action Guideline**	**Comments**
Check if required: ☐	Specify: Click here to enter text.	Specify: Click here to enter text.	Click here to enter text.
Model: Click here to enter text.			
Task number(s): Click here to enter text.			
Other (specify): Click here to enter text.	**Reading**	**Action Guideline**	**Comments**
Check if required: ☐	Specify: Click here to enter text.	Specify: Click here to enter text.	Click here to enter text.
Model: Click here to enter text.			
Task number(s): Click here to enter text.			

Work Zones

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

Exclusion Zone: Not applicable for this scope of work

Contamination Reduction Zone: Not applicable for this scope of work

Support Zone: Not applicable for this scope of work

Site Access/Control

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

Access Control Procedures: Keep unauthorized personnel a safe distance from GeoProbe

Decontamination Procedures

Describe procedures for the decontamination of personnel and equipment.

Personnel: Not applicable for this scope of work

Equipment: Not applicable for this scope of work

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 contractors possess containerized chemicals on the project site? ☒ Yes ☐ No

Will container size be greater than or equal to one gallon? ☐ Yes ☒ No

If the answer to both of these questions is Yes, follow the requirements outlined in ERM Procedure S3-NAM-042-PR (*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 answer to either of these questions is Yes, follow the requirements outlined in ERM Procedure S3-NAM-038-PR (*Waste Management Planning*).

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

Client-Specific Emergency Response

In the event of an emergency, client-specific emergency response procedures may take precedence over ERM established procedures.

While engaging in field-related activities on an active client 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, contractors, and others subject to HASP review upon site visit.

Contributing factor initiating emergency response (process, material, weather): Not applicable for this scope of work

Lights and/or sounds associated with evacuation: Not applicable for this scope of work

Drill requirements for contractors on-site: Not applicable for this scope of work

Initial and alternative muster points: To be decided by FSO

Specific evacuation procedures: To be decided by FSO

Method for accounting for site visitors: To be decided by FSO

PPE and spill kit requirements (if emergency response is spill related): Not applicable for this scope of work

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. All work-related safety events should be shared with the project team and promptly entered into the Event Communication System (ECS).

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 which we may need to follow.*

For all incidents (injuries, illnesses, spills, fires, property damage, etc.) and significant near misses, enter the event into ECS within 24 hours.

Contact	Name	Location	Phone
Hospital (attach map)	South Vermont Medical Center	100 Hospital Drive Bennington, VT 05201	800-543-1624
Police	911	911	911
Fire	911	911	911
Incident Intervention	WorkCare	NA	888-449-7787
Partner-in-Charge	Jim Perazzo	Melville, NY	Work: 631-756-8913 Cell: 516-353-8849
Project Manager	Elena Ponce	Melville, NY	Work: 631-756-8905 Cell: 516-250-1125
Field Manager (if not PM)	Jon Fox	Syracuse, NY	Work: 315-233-3035 Cell: 315-256-5352
Field Safety Officer (if not PM)	Tim Daniluk	Syracuse, NY	Work: 315-445-2554 Cell: 315-317-2044
SSC Experienced Person	Tim Daniluk	Syracuse, NY	Work: 315-445-2554 Cell: 315-317-2044
Division H&S Contact	Matthew Botzler	Malvern, PA	Work: 484-913-0339 Cell: 484-885-5188
Region H&S Director	Matthew Boardman	Rolling Meadows, IL	Work: 847-258-8900 Cell: 616-283-5863
Subcontractor Contact	Click here to enter text.	Click here to enter text.	Work: Click here to enter text. Cell: Click here to enter text.

Client Contact	Edward McTiernan	New York, NY	Work: 212-715-1024 Cell: 518-937-3410
Additional Contact	Click here to enter text.	Click here to enter text.	Work: Click here to enter text. Cell: Click here to enter text.

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. Contractors, 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 S3-NAM-030-PR (Contractor Management).

Project Manager	Date
Typed Name: Click here to enter text. Signature File:	Click here to enter a date.
Partner-in-Charge	**Date**

S3-NAM-030-PR (Contractor Management).	**Partner-in-Charge**	**Date**
	Typed Name: Jim Perazzo Signature File:	Click here to enter a date.

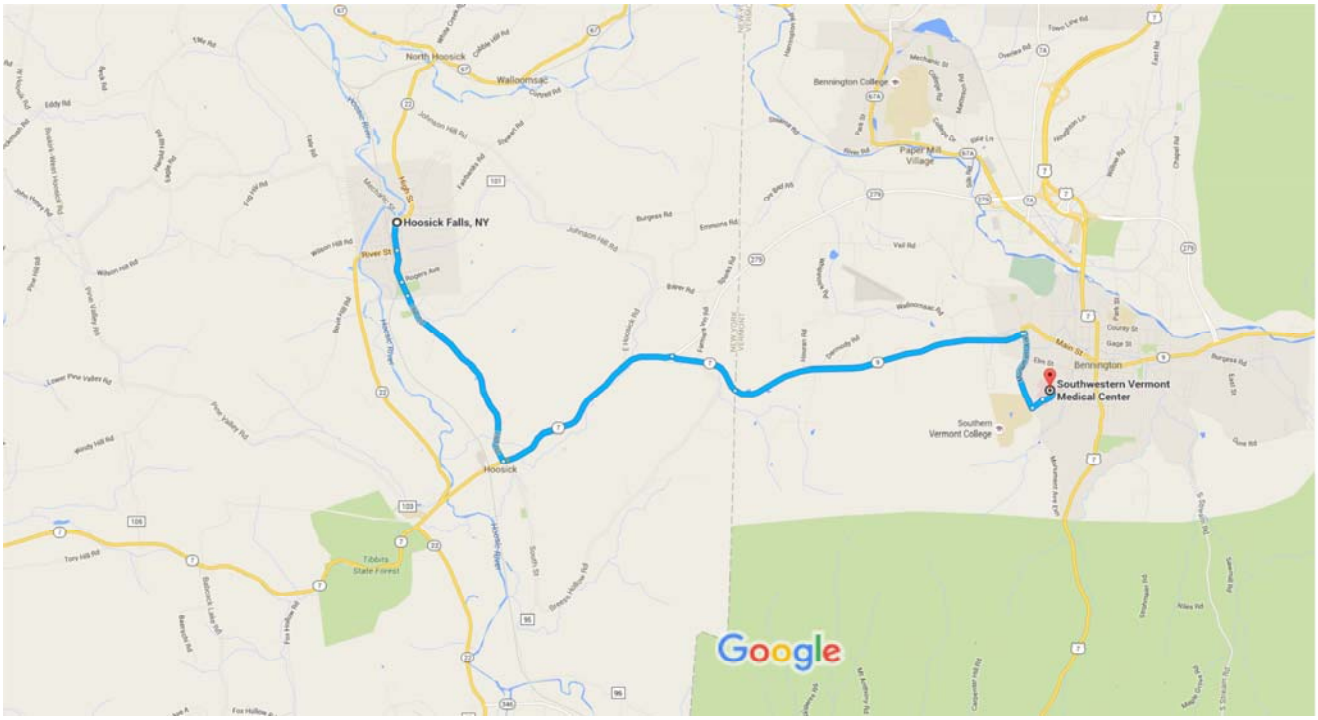
Attachments ***Check all appropriate documents to be attached to this HASP.***	
☒ Site-specific JHAs for all tasks (including contractors)	☒ Map of route to hospital with turn-by-turn instructions
☒ Subsurface Clearance (SSC) Project Plan	☐ Facility site map(s)
☒ Site Safety Meeting Form (S3-NAM-029-FM5)	☒ SNAP Cards
☒ Vehicle Inspection Forms (S1-ERM-008-FM2)	☐ Project/Field Audit Checklist (M1-ERM-016-FM3)
☒ Journey Management Plans (S1-ERM-008-FM1)	☐ Industrial Hygiene Sample Data (S3-NAM-005-FM1)
☒ Safety Data Sheets (SDS) for chemicals brought to site	☐ Ambient Air Monitoring Form (S3-NAM-005-FM2)
☐ Information on chemicals of concern (ICSC cards or like)	☐ Client-specific requirements
☐ PLAN Risk Assessment	☐ Other: Click here to enter text.
Applicable ERM Safety Standards/Procedures ***Check all that procedures/standards that are applicable to this project. Refer to the standards/procedures for guidance and, where applicable, use forms, work instructions, and guideline documents associated with these standards/procedures in the completion of site work. Copies of all standards/procedures must be procured from ERM's Document Control System.***	
Global (Tier I) Standards/Procedures	
☐ Short Service Employees (S1-ERM-003-PR)	☒ Travel Risk Assessment (S1-ERM-005-ST)
☐ Offshore Platform Safety (S1-ERM-006-ST)	☒ Subsurface Clearance Standard (S1-ERM-007-ST)
☒ Driver and Vehicle Safety (S1-ERM-008-PR)	☐ Fixed Wing Aircraft/Helicopter Travel (S1-ERM-009-ST)
Local (Tier III) Standards/Procedures	
☐ Demolition (S3-NAM-004-PR)	☐ Excavation and Trenching (S3-NAM-008-PR)
☐ Fall Protection (S3-NAM-009-PR)	☐ Setting Occ. Exposure Guidelines (S3-NAM-010-PR)
☒ Hazard Communication (S3-NAM-011-PR)	☐ Ladder Safety (S3-NAM-012-PR)
☐ Cold Stress (S3-NAM-013-PR)	☐ Hearing Conservation (S3-NAM-014-PR)
☐ Heat Stress (S3-NAM-015-PR)	☒ Incident Reporting and Investigation (S3-NAM-016-PR)
☐ Medical Services (S3-NAM-019-PR)	☒ Medical Surveillance (S3-NAM-020-PR)
☒ Personal Protective Equipment (S3-NAM-021-PR)	☐ Hot Work (S3-NAM-023-PR)
☐ Regulatory Inspection (S3-NAM-024-PR)	☐ Respiratory Protection (S3-NAM-026-PR)
☒ Contractor Management (S3-NAM-030-PR)	☒ Contractor Management (S3-NAM-030-PR)
☐ High Risk Activity Driving (S3-NAM-031-PR)	☒ Hand Tools/Portable Power Equipment (S3-NAM-033-PR)
☐ Electrical Safety (S3-NAM-035-PR)	☒ Incident/Illness Management (S3-NAM-037-PR)
☐ Waste Management Planning (S3-NAM-038-PR)	☐ Energy Isolation (S3-NAM-039-PR)
☐ Working Over Water (S3-NAM-041-PR)	☒ Spill Prevention and Response (S3-NAM-042-PR)
☐ Fatigue Management (S3-NAM-044-PR)	☒ Cutting Tools and Hand Safety (S3-NAM-047-PR)
☐ Lone Worker (S3-NAM-048-PR)	☐ Compressed Gas Cylinders (S3-NAM-049-PR)

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're 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 Contractor 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.**

Google Maps

Hoosick Falls, NY to Southwestern Vermont Medical Center

Drive 10.9 miles, 18 min

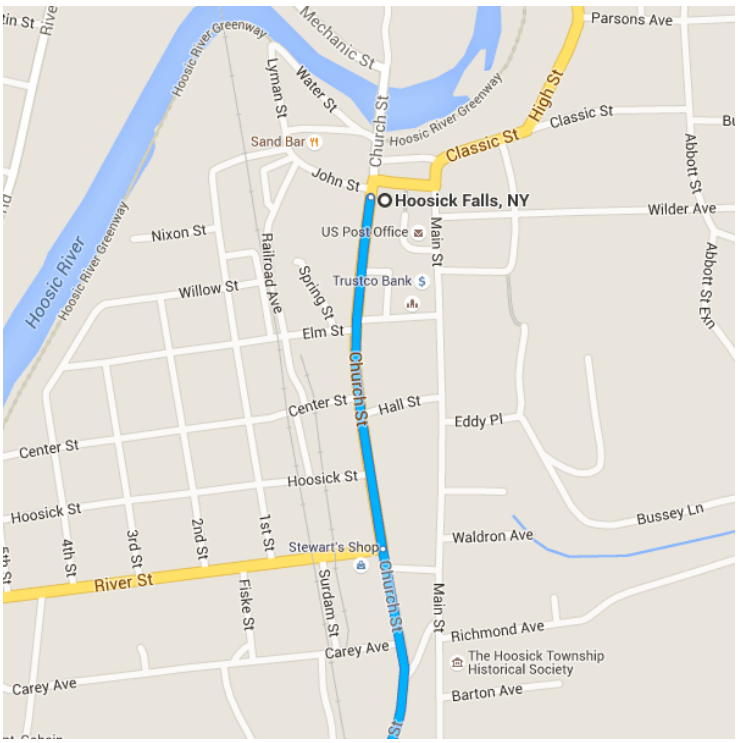


Map data ©2016 Google 1 mi

Hoosick Falls, NY

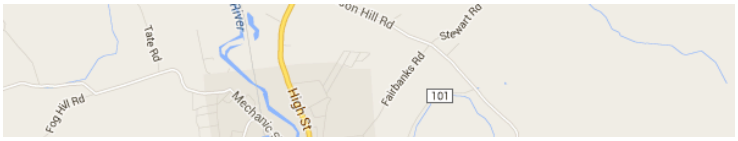
1. Head south on Church St toward Elm St

1 min (0.3 mi)



Take Hill Rd to NY-7 E in Hoosick

5 min (2.8 mi)



2. Continue straight to stay on Church St

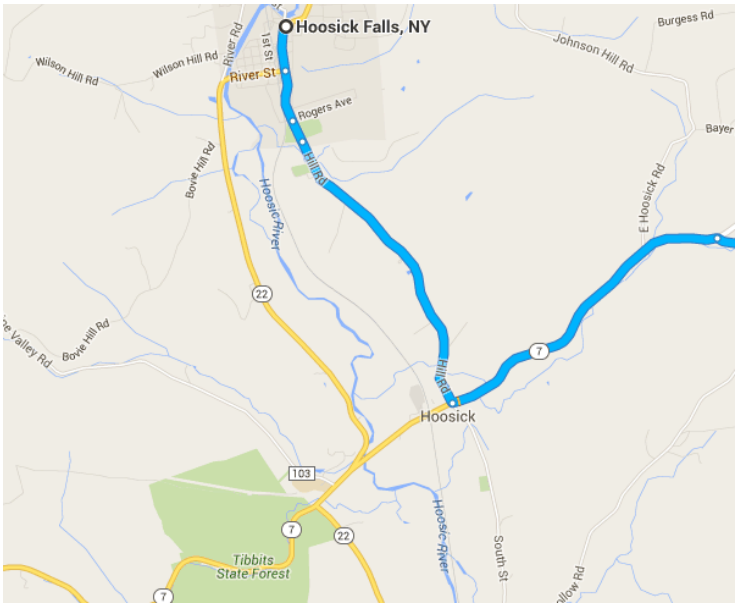
0.4 mi

3. Continue onto Main St

0.2 mi

4. Continue onto Hill Rd

2.3 mi



Follow NY-7 E and VT-9 E to W Rd in Bennington

9 min (6.6 mi)

5. Turn left onto NY-7 E

2.4 mi

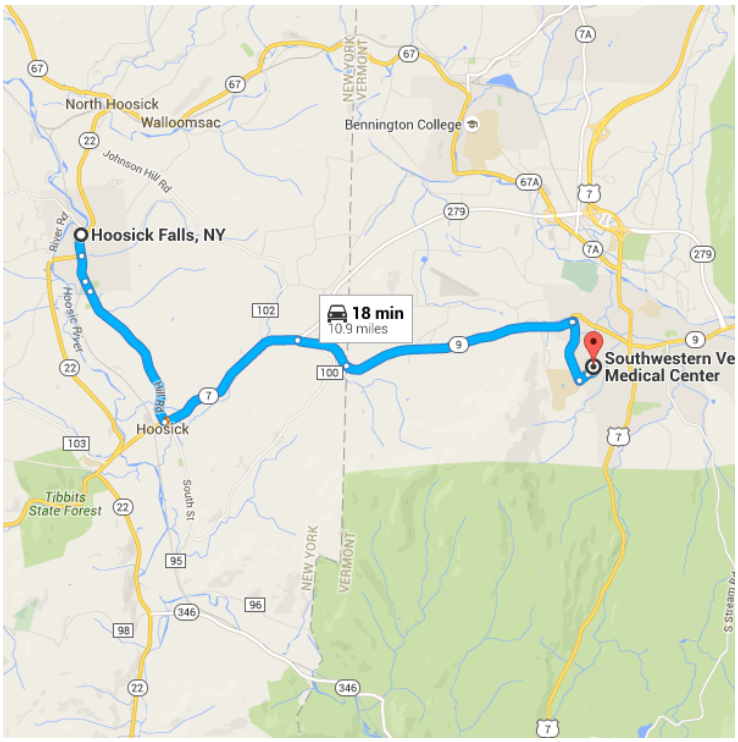
6. Turn right to stay on NY-7 E

Entering Vermont

0.9 mi

7. Continue onto VT-9 E/W Rd

3.4 mi



Take Monument Ave to Hospital Dr in Bennington

3 min (1.2 mi)

8. Turn right onto W Rd

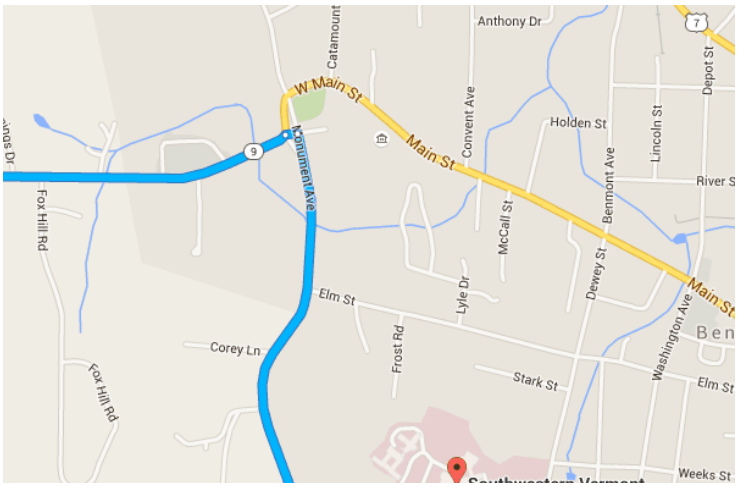
118 ft

9. Turn right at the 1st cross street onto Monument Ave

0.9 mi

10. Turn left toward Hospital Dr

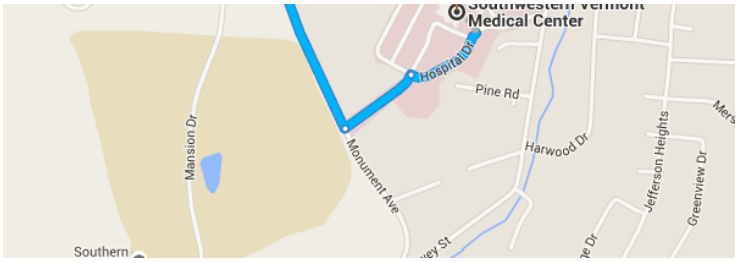
0.2 mi



11. Turn right at the 1st cross street onto Hospital Dr

Destination will be on the left

0.2 mi



Southwestern Vermont Medical Center

100 Hospital Drive, Bennington, VT 05201

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.

ERM

Subsurface Clearance

SUBSURFACE CLEARANCE PROJECT PLAN
Addendum to HASP
GMS Project No: 0334662

This Subsurface Clearance (SSC) Project Plan should be completed for each phase of ground disturbance activities at a project location, and included as an addendum to the Project-Specific Health & Safety Plan (HASP).

Ground disturbance activities that fall under this SSC Project Plan include ALL activities which require penetration of the ground surface (regardless of 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 decommissioning by over-drilling
- Excavation (by hand or with mechanical equipment)
- Trenching
- Grading
- Concrete coring
- Driving of posts, stakes, rods, poles, or sheet pile.

This SSC Project Plan summarizes the types and sources of SSC information obtained, describes the Site Services Model, and documents any waivers to ERM's Global SSC Process. The ERM Partner-in-Charge (PIC), Project Manager (PM), and SSC Experienced Person (EP)[1] must review and approve this SSC Project Plan, and maintain a copy (1) at the project location for the duration of ground disturbance activities and (2) in the project files.
All waivers must be approved by BOTH: (1) the ERM PIC and (2) the Business Unit Managing Partner (BU MP) or the BU MP's designee (cannot be the same person as the PIC).

Administrative Information		
	Project Name and Location: Privileged and Confidential	
	Scope of Ground Disturbance Activities: *Check all that apply:* ☐ Point disturbances ☐ Excavation / trenching ☐ Removal of engineered surfaces ☐ Other - Describe:	*Use field documentation to document SSC:* • *Process Checklist – broadly across the site* • *Remote/Greenfield Site Process Checklist – broadly across the site for those projects that meet these criteria and where ONLY hand digging will occur (refer to SSC Process Document Section 1.2)* • *Location Disturbance Permit – for each location inside a Critical Zone*
	SSC Project Plan Date:	Field Work Start Date:
	Project Manager: Signature:	Partner In Charge: Signature:
	SSC EP: Signature:	BU MP (req'd for waivers): Signature:
	List any SSC General Employees (GEs) working on this project:	

[1] SSC EP not required for project sites determined to be Remote/Greenfield sites (as defined in the ERM Global SSC Process), where ONLY hand digging will occur.

Subsurface Clearance Information Sources Summary **Document the information sources that ERM used or will use to locate Subsurface Structures on site.**	**Information Sources**	**Yes**	**No**	**N/A**	**Comments**
	Facility-provided as-built drawings, maps, site plans showing subsurface structures / utilities	☐	☐	☐	Date(s):
	Other information obtained (e.g., 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	☐	☐	☐	List (including dates):
	Knowledgeable Contact Person	☐	☐	☐	Who: Time in Job: Time at Site:
	Utility Markouts	**Yes**	**No**	**N/A**	**Comments**
	Site is Remote/Greenfield site AND only hand digging will occur	☐	☐	☐	*If "YES", utility markouts are not required by ERM process (Note that public markouts may be legally required based on jurisdiction of project site – it is the responsibility of the PIC and PM to determine these requirements and comply)*
	Public Utility Markouts (where they are available)	☐	☐	☐	*Required where available – if not available check "N/A". If available and checked "NO", a Waiver is required (if legally able to do so).* Who:
	Private Utility Markouts	☐	☐	☐	*If checked "NO" and site is not a Remote/Greenfield site, a Waiver is required* ERM employee ☐ or Subcontractor ☐ Who: List methods / equipment used:

For Remote/Greenfield Sites where ONLY hand digging will occur – the remaining sections of this SSC Project Plan do not apply and can be left blank.

Site Services Model **List the utilities or other below ground services present on site.** **Do we know the locations of these services, their conveyance on site (to the site boundary, as appropriate) and the location of isolation switches or valves?** **If "Present" and not located or "Unknown", comment on how those gaps will be addressed.** **Attach a site plan / drawing (to scale) showing planned ground disturbance location(s), the locations/routes of all identified or suspected subsurface structures and services, and associated critical zones.**	**Utility / Service**	**Present**	**Anticipated Depth (note units)**	**Located?** Yes	**Located?** No	**Absent**	**Unknown**	**Status (active/ inactive/ abandoned)**	**Comment** *(how located? Lines of evidence – types and quality. How will gaps be addressed?)*
	Electricity	☐		☐	☐	☐	☐		Voltage:
	Gas	☐		☐	☐	☐	☐		
	Petroleum Pipeline	☐		☐	☐	☐	☐		
	Other Pressurized Lines	☐		☐	☐	☐	☐		Type:
	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:	☐		☐	☐	☐	☐		

Subsurface Clearance Process Waivers **Document any waivers to the process approved by BOTH the PIC and BU MP.** **Legally required steps cannot be waived.**	**Process Component Being Waived:**	**Waived By (PIC)**	**Waived by (BU MP)**	**Date**	**Reason**
	Performance of Public Utility Markouts (where they are available)				
	Performance of Private Utility Markouts				
	No ground disturbance inside a Critical Zone				
	Physical Clearance to required depth(s) and diameters(s) at Point Disturbance Location(s). Indicate specific location(s):				
	Requirement for SSC EP to be present on site, when ONLY hand digging/hand augering will occur in the uppermost 1 foot (0.3 meters)				

Subsurface and Overhead Utility Clearance Map	**Attach a site plan / drawing (to scale) showing planned ground disturbance location(s), the locations/routes of all identified or suspected subsurface structures and services, associated critical zones, and location of all isolation devices and/or shutoff valves.**

Project Information Utilized for Field SSC Activities	Yes	No	N/A	Comments
Knowledgeable Contact Person(s) requested and identified				
Contractors prequalified and approved				
ERM / client SSC requirements have been communicated to all field personnel (including contractors)				
As-built drawings, site plans, aerial photographs, and/or other information sources available and reviewed				
Site plan(s) / drawing(s) developed showing subsurface lines/structures, Critical Zones, and planned ground disturbance locations				
SSC Experienced Person (EP) with current SSC certification assigned				
Project staff with current SSC certification assigned				
UXO / MEC risks assessed: UXO / MEC is present or potentially present				If Yes, stop work and contact PIC

General Field Activity & Site Walk	Yes	No	N/A	Comments
HASP available, reviewed, and signed by project team				
Site walk visual clues / site features (below) integrated into Site Services Model				

Identified Visual Clue	Yes	No		Identified Visual Clue	Yes	No
Lights				Heated floors (in-floor radiant heating)		
Signage				Fire hydrants		
Sewer drains / cleanouts				Sprinkler systems		
Cable / pipeline markers				Water meters		
Utility poles with conduit leading to the ground				Natural gas meters		
Utility boxes				UST fill ports and vent pipes		
Manholes				Equipment / manifold locations		
Pavement scarring				Steam lines		
Distressed vegetation or vegetation in linear pattern				Remote buildings with no visible utilities		

Comments / Others:

Contact Person Approval of Ground Disturbance at All Locations (indicate verbal approval by printing "Verbal" in the signature space)

Name (Print)	Company	Name (Sign)	Date / Time

Utility Markouts	Yes	No	N/A	Comments
Public Utility Markouts completed (where available; waiver required if "NO")				
List utilities notified:				
Responses received from ALL companies notified?				
Private Utility Markout completed (waiver required if "NO");				

NOTE: Private utility markouts must be performed by competent, trained personnel. Contractors must be overseen directly by SSC EP with "eyes on" supervision".

Performed by:

Type of equipment / methods used:

Note any issues or limitations (e.g., sources of interference, geology, etc.):

Final Critical Zone determinations made by the SSC EP				

Critical Zones		
Are there any ground disturbance locations <u>known</u> or <u>suspected</u> to be inside Critical Zones?	☐	**Yes.** PIC and BU MP (or designee) must BOTH grant waiver for work within the Critical Zone. The SSC Location Disturbance Permit or equivalent is required for those locations.
	☐	**No.** Physical Clearance will proceed to the deeper of: 0.6 m / 2 feet below the frost line or 1.5 m / 5 feet below ground level, whichever is deeper.

Overhead Clearance	**Yes**	**No**	**N/A**	**Comments**
Overhead utility lines in the general vicinity of ERM work onsite?				
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? (The minimum horizontal distance from any point on the equipment to the nearest overhead electrical power line should adhere to the minimum clearance requirements stipulated by regulation, utility companies, client requirements, and/or industry best practice.)				Clearance distance(s):
Proximity alarms and /or spotters necessary to ensure safe clearances?				
If the equipment is to be closer than the minimum clearance distance to the overhead utility, can utility be de-energized via formal lockout/tagout (LOTO) program?				
If utility cannot be de-energized, alternate plan developed with approval from the PIC, H&S Team, and client/site owner?				

Clearance for Point Disturbances	**Yes**	**No**	**N/A**	**Comments**
Physical Clearance technique used: (waiver required if no Physical clearance performed)				Specify:
Diameter of physical clearance at least 125% of outside diameter of largest downhole tool (150% is best practice)				
Physical Clearance successfully completed at all locations				

Clearance for Excavations	**Yes**	**No**	**N/A**	**Comments**
Communicate excavation plan and Excavation Buffer location(s) to contractor. Delineate excavation buffers.				
There are disturbance locations known or suspected to be inside Critical Zones (waiver required if yes)				
De-energize subsurface services via formal LOTO program prior to beginning excavation				

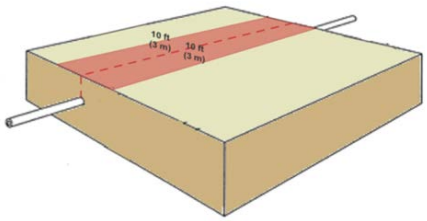
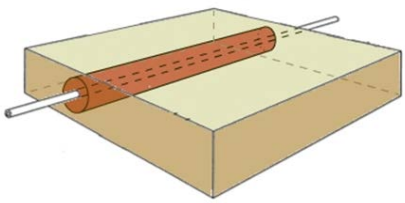
Additional Notes:

SSC Process Completed By (SSC Experienced Person)		
Name (Print)	Name (Sign)	Date / Time

Subsurface Clearance (SSC)
Field Review Checklist for Contractors

Site Name:	Privileged and Confidential
Client:	Privileged and Confidential
ERM Project No.:	0334662
Contractor activities to be performed on Site:	

Use this form to conduct and document review with contractor field personnel, to ensure they have been properly briefed on the applicable components of ERM's SSC Process.

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 jobsite conditions change, work should be stopped and the potential H&S effect of the change discussed.	☐	☐	
Ground disturbance activities may NOT be performed at any location without authorization by the ERM SSC Experienced Person (EP). Clearance activities may NOT be performed at any location unless the ERM EP is physically present.	☐	☐	
Unless explicitly authorized by ERM's Partner-in-Charge and Business Unit Managing Partner, ground disturbance may NOT be performed within 10 feet (3 meters) distance (referred to as the "Critical Zone") of the surface projection of: • Any known or suspected underground pipes, cables, conduits, drains, galleries, edges of tanks, or any other useful property; or • Aboveground structures with associated subsurface pipes and/or cables, including but not limited to pump islands, pump galleries, manifolds, electrical transformers, compressors, production wells, loading racks, or other process equipment.	☐	☐	**"The Critical Zone"** 
Unless authorized by the ERM 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 Business Unit Managing Partner, all borehole and small test pit locations must be physically cleared prior to use of mechanized equipment. Required physical clearance depths and diameters for point disturbances are as follows: • Physically clear to a diameter at least 125% of the largest downhole tool to be used. • Physically clear to the deeper of: o 2 feet (0.6 meters) beyond the bottom of the frost line at the site, or: o Outside Critical Zones to 5 feet (1.5 meters), or o Inside Critical Zones to the deeper of: 8 feet (2.4 meters), or 2 feet (0.6 meters) deeper than the expected invert elevation of the subsurface structure.	☐	☐	**"The Excavation Buffer"** 

TOPIC			
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 using non-conductive tools.	☐	☐	
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.	☐	☐	
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.	☐	☐	
Contractor 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 be immediately reported to the ERM EP or field supervisor. Contractor personnel must participate, as requested, in investigations of near misses and incidents.	☐	☐	
Other topics discussed:	☐	☐	

N/A = Not applicable to this project.

REQUIREMENTS FOR TOOLS AND EQUIPMENT:

- Hand digging tools must have a non-conductive handle (e.g., fiberglass, wood, composite) AND / OR fully insulated handles and upper shaft. It is a best practice to also wear insulated electrical gloves certified to appropriate standards.
- Blades on shovels and post-hole diggers must have rounded or blunt edges.
- Pick axes or pointed spades are not to be used for physical clearance.
- Electric-powered equipment must have ground fault protection. If this is not feasible, fully insulated electrical gloves certified to appropriate standards must be worn at all times during equipment use/operation.
- Equipment must be inspected prior to use, maintained according to manufacturer recommendations, and operated only by trained personnel.
- Rig- or stand-mounted concrete coring equipment must be anchored to the ground/floor using proper anchors.

Checklist Completed By: (SSC Experienced Person)		
Name (Print)	Name (Sign)	Date / Time

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

Subsurface Clearance (SSC) Field Audit Form

Site Name:	Privileged and Confidential
Client:	Privileged and Confidential
ERM Project No.:	0334662
Activities Observed on Site:	

1.0	OFFICE / PRE-MOBILIZATION	YES	NO	N/A	N/O	COMMENTS (Refer to Follow-Up Items if needed)
1.1	Have subcontractor(s) working at the project site been pre-qualified and approved by ERM?	☐	☐	☐	☐	
1.2	Has an SSC "Experienced Person" been assigned to manage SSC activities and identified in the site HASP?	☐	☐	☐	☐	
1.3	Have all ERM staff at project site received SSC training? (record names & dates)	☐	☐	☐	☐	
1.4	Are "SSC mentee(s)" working at the site and identified in the site HASP?	☐	☐	☐	☐	
1.5	Have the Level 2 HASP and SSC Project Plan been completed?	☐	☐	☐	☐	
1.6	Has a knowledgeable site contact person been identified? Are they present to participate in site walk and approve disturbance locations?	☐	☐	☐	☐	
1.7	Have available as-builts, maps, aerial photos, etc. been obtained and reviewed?	☐	☐	☐	☐	
1.8	Other:	☐	☐	☐	☐	

2.0	FIELD ACTIVITIES: PRE-CLEARANCE	YES	NO	N/A	N/O	COMMENTS (Refer to Follow-Up Items if needed)
2.1	Are ground disturbance locations/points clearly marked?	☐	☐	☐	☐	
2.2	Have public and private utility locate and markout have been conducted? By who? When?	☐	☐	☐	☐	
2.3	If utility locate/markout was conducted by ERM staff, how is employee qualified to execute locate service? Provide details of training/qualifications.	☐	☐	☐	☐	
2.4	If utility locate/markout was conducted by ERM staff, has location equipment been adequately maintained and calibrated? Provide date of last calibration.	☐	☐	☐	☐	
2.5	Has the ERM *SSC Checklist & Disturbance Permit* been utilized to assess **each** ground disturbance location?	☐	☐	☐	☐	
2.6	Have Critical Zones been identified on the *Site Services Model* and marked?	☐	☐	☐	☐	
2.7	If UXO/MEC are known or suspected to be present, has the site been assessed by a UXO/MEC specialist?	☐	☐	☐	☐	
2.8	Are any Process Waivers being applied? If so, is PIC and BU MP approval documented?	☐	☐	☐	☐	
2.9	Other:	☐	☐	☐	☐	

3.0	FIELD ACTIVITIES: PYSICAL CLEARANCE	YES	NO	N/A	N/O	COMMENTS (Refer to Follow-Up Items if needed)
3.1	Has Critical Zone (CZ) distance* has been effectively maintained during project?	☐	☐	☐	☐	
3.2	Was physical subsurface clearance to minimum requirements** executed? What methods/equipment were used?	☐	☐	☐	☐	
3.3	If project is a trench or excavation, was the minimum 2-foot (0.6 meters) buffer zone maintained around exposed lines?	☐	☐	☐	☐	
3.4	Was mechanical equipment used within 2-foot (0.6 meters) buffer zones?	☐	☐	☐	☐	
3.5	Have SSC-related safety events been reported per ERM *Subsurface Clearance Procedure*?	☐	☐	☐	☐	
3.6	Were any changes from HASP / SSC Plan observed? If so, were Management of Change procedures implemented per ERM *Subsurface Clearance Procedure*?	☐	☐	☐	☐	
3.7	Other:	☐	☐	☐	☐	

N/A = Not applicable to this project.

N/O = Not observed during audit.

* *Critical Zone - 10 feet (3 meters) distance from all known or suspected underground lines, edge of tanks, pump islands, pump gallery, manifold, electrical transformer, compressor, production well, loading rack, or other process equipment with associated underground lines.*

** *Clearance must meet or exceed 125% the outside diameter of the largest downhole tool. In Critical Zones, physical clearance to 2 feet (0.6 meters) below frost line; OR 2 feet (0.6 meters) deeper than expected invert depth of service or 8 feet (2.4 meters). In Non-Critical Zones, physical clearance to 2 feet (0.6 meters) below frost line; OR 5 feet (1.5 meters)*

FOLLOW UP ITEMS:

- If a checklist item was corrected in the field, please mark as YES and note in the COMMENT area how the correction was implemented.
- If a checklist item was unable to be corrected in the field, please list below the follow-up items for ERM/Client/Sub-Contractor to implement to correct the deficiency or improve the process.

Follow Up Items:

Attach additional comments, as necessary, to a new page.

Prepared By: _____
(print)

Reviewed By: _____
(print)

_____
(print)

Contact Person Approval of Ground Disturbance Locations (indicate verbal approval by printing "Verbal" in the signature space)

Name (Print)	Company	Name (Sign)	Date / Time

Critical Zone Determination and Clearance Depth (It is not preferred to initiate ground disturbance activities within a Critical Zone)

If the Disturbance Location is known or suspected to fall within a Critical Zone, then a sketch (see reverse) or other map **must be** developed showing the location of all potential utilities within 10 feet (3 m) of the disturbance location. Sketch / map must be to scale.

This Location Is:

☐ Inside a Critical Zone. Partner-in-Charge (PIC) and Business Unit Managing Partner (BU MP) must BOTH grant waiver for disturbance at this location. Ensure documentation in the SSC Project Plan addendum to the HASP. Physical Clearance for point disturbances will proceed to the deeper of: **0.6 m / 2 feet below the frost line, 0.6 m / 2 feet deeper than the expected invert elevation of the service, OR 2.4 m / 8 feet below ground level.**

☐ Outside a Critical Zone.
Physical Clearance for point disturbances will proceed to the deeper of: **0.6 m / 2 feet below the frost line or 1.5 m / 5 feet below ground level.**

Utility Markouts

Has this location been cleared through both public and private utility locates?	Y ☐	N ☐	*"N" requires waiver*

Physical Clearance Technique at This Location

☐ Cleared using the following techniques / equipment:

Clearance depth and diameter (specify units):

☐ None – or not completed to required depth or diameter. For point disturbances, this must be waived by PIC and BU MP. (Ensure documentation in the SSC Project Plan addendum to HASP.)

Reason: Date / Time:

Physical Clearance Executed & Observed By:

Company	Representative(s)	Date / Time Complete	Notes

Was any Subsurface Structure discovered (damaged or undamaged) during Clearance?

☐ No (Proceed) ☐ Yes If Yes: Work stopped and discussed with PIC (Date / Time):

Agreed Action:

SSC Process Complete

Name of SSC Experienced Person (Print)	Name (Sign)	Date / Time

Critical Zone Determination Sketch (use this or other map to confirm proximal Critical Zones).

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. Critical landmarks and Subsurface Structures (tanks, transformers, wells, racks, etc.)
   d. Underground services:
      i. Identified in the Site Service Model
      ii. Marked by Public and Private utility markouts
      iii. As relayed by the Contact Person
      iv. Nearest shutoff / isolation mechanism for each
   e. Any surface clues as to potential underground services (junction boxes, drains, disturbed concrete, signage, etc.)
   f. The site property boundary
2. Use your sketch to mark Critical Zones (3m or 10 feet) around critical landmarks and underground structures / services.
3. For Excavations, use your sketch to mark Excavation Buffers (0.6m or 2 feet) from Subsurface Structures.
4. If the disturbance location falls inside the Critical Zone, the preferred course of action is step out to a safe location outside a Critical Zone.
5. Disturbance within a Critical Zone can only proceed with both PIC and BU MP (or designee) approval.

ERM

Job Hazard Analyses

JHA
Job Hazard Analysis

Project Number:	0334662	Project / Client Name:	Privileged and Confidential
Project Manager:	Randy Shuler	Location:	Hoosick Falls, NY
Partner-in-Charge:	Jim Perazzo	Date and Revision Number:	2/3/2016

SPECIFIC TASK:	**Motor Vehicle Operation (excluding commercial vehicles and heavy equipment)**

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 ☐ PPE clothing <enter type here (eg, Tyvek, FRC, long sleeves)> <enter additional PPE here>		
Additional Task-Step Specific PPE: (as indicated below under Controls)	Reflective safety vests	Equipment / Tools Required:	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
Training Required for this Task:	Valid Drivers License, Alert Driving Training	Permits Required for this Task:	None
Associated Forms:	S1-ERM-008-FM2 - Vehicle Inspection Checklist S1-ERM-008-FM1 - Journey Management Plan S1-ERM-008-FM3 - Taxi Card	Associated Procedures:	S1-ERM-008-PR - Driver and Vehicle Safety

JHA Developed / Reviewed By:			JHA Review In Field
Name / Job Title:	Name / Job Title:	Name / Job Title:	Field Safety Officer (FSO) 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. **FSO Signature/Date:**
Brian Stoudt / Project Manager			

Task Steps[1]		Potential Hazards & Consequences[2]		select	Likelihood	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
1	Inspect vehicle (walk-around exterior and interior)	1a	Broken or malfunctioning equipment resulting in unsafe operation/accidents, break-downs, or spill of engine fluids to ground	multiple	2	5	10	1a	For ERM owned or leased vehicles, rental vehicles and personal vehicles used for field operations: document regular inspections of the vehicle (S1-ERM-008-FM2 - Vehicle Inspection Checklist). Do not operate any vehicle if its safety is in question and report any vehicle safety issues to ERM Fleet Manager or Project Manager/Supervisor.
		1b	Loose articles inside the vehicle and carried in truck beds or on trailers can shift and cause distractions, property damage, and accidents	multiple	2	5	10	1b	During vehicle inspection make sure any loose articles either inside the vehicle or in truck beds/on trailers are well-secured. For trailers, ensure trailers are properly and securely attached to hitch. Do not tow a trailer unless you have received training and the vehicle is rated for the load.
2	Loading / unloading vehicle	2a	Loose articles inside the vehicle and carried in truck beds or on trailers can shift and cause distractions, property damage, and accidents	multiple	2	5	10	2a	See above, 1b
		2b	Muscle strain from lifting and carrying heavy or awkwardly-shaped objects	**H&S**	2	3	6	2b	Use a dolly/cart to transport items, or get assistance from another person. Only carry what can safely be transported to/from the vehicle. Make as many trips as necessary. While lifting and carrying, keep materials close to your core - do not bend at waist, reach above your head, twist, or extend weight out away from your core. If materials slip, just let them drop rather than try to catch them and risk getting hurt.
		2c	Slip / trip / fall resulting in injury	**H&S**	2	3	6	2c	Inspect area for potential slip/trip/fall obstructions prior to loading / unloading, and remove or avoid these. Obtain additional lighting and use clear safety glasses in areas with low/unclear visibility. Keep work area organized and free of surface obstructions. Immediately dry wet areas or restrict access. 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. Ensure steps, walkways and shoes are not slippery or loose prior to 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. Wear footwear with nonslip soles and good tread.

Task Steps[1]		Potential Hazards & Consequences[2]		select	Likelihood	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
		2d	Property damage from dropping equipment or improper loading	PL	2	2	4	2d	Use a dolly/cart to transport items, or get assistance from another person. Only carry what can safely be transported to/from the vehicle. Make as many trips as necessary. Secure equipment in the vehicle using tie-down straps (avoid bungee cables as they can slip and cause injury!). Ensure equipment will not move or shift during transport. Don't stack equipment such that equipment on bottom could be crushed by the weight.
3	Entering and exiting the vehicle.	3a	Caught in doors, trunk covers, and other vehicle equipment, causing injury	**H&S**	2	3	6	3a	Keep hands, feet, head, and loose articles of clothing or equipment out of the line of fire. Check before opening or closing any door to ensure you and others are not in line of fire.
		3b	Slip / trip / fall resulting in injury	**H&S**	1	3	3	3b	Use three points of contact when entering and exiting, and keep hands and feet placement and body posture in balance.
		3c	Property damage / theft from unattended vehicles	PL	2	3	6	3c	Unattended vehicles (even for a short period of time) must 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 of the vehicle.
4	Driving to and from work locations	4a	Distraction resulting in accident	multiple	2	5	10	4a	Do not talk or text on phone while driving. Ensure all loose items and equipment inside the vehicle or in truck beds/on trailers are secured. Program electronics like GPS and radio before driving, or have passenger do this. Know how AC / heater / windshield wiper controls work before driving. Any activity that takes your eyes away from the road is dangerous - if you must read a map, make detailed adjustments to mirrors or other controls, or other related tasks - pull over to a safe area. Avoid drinking hot beverages or eating while driving. Avoid conversations with passengers that will distract your mental focus from driving.
		4b	Fatigue resulting in accident	multiple	2	5	10	4b	Take a 15 minute break after every two hours of driving. Don't drive more than 8 hours/day, or after doing more than 12 hours of work-related activities. Avoid driving between 10 p.m. and 5 a.m. Share driving with others, if possible. Avoid driving after consecutive work days of 14 hours. Avoid driving after a flight of six hours or more without appropriate rest. 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 in a remote location (including off-road driving) • Driving in any location/region identified as “High Risk” by Control Risk Group (CRG) and/or Regional H&S Lead The JMP shall be completed using S1-ERM-008-FM1.
		4c	Broken or malfunctioning equipment resulting in unsafe operation/accidents, break-downs	multiple	2	5	10	4c	See above, 1a. If vehicle malfunctions during driving, pull safely off the road before exiting. ERM vehicles and vehicles used for field operations should be equipped with spare tire and jack; warning triangles (reflective), road flares (flares may not be stored in the passenger compartment of the vehicle), or LED road flares/emergency lighting; and reflective safety vests.
		4d	Actions of driver (or other drivers / pedestrians / cyclists) resulting in accident	multiple	3	5	15	4d	Follow designated vehicle travel routes only. 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. All drivers must hold a current driver's license valid in the location where they will be driving. Follow all posted signs and speed limits, all applicable laws and regulations, ERM safe driving policies, and any client-specific or site specific vehicle safety policies. ERM drivers must complete regular safe driver training through Alert Driving. Practice defensive driving techniques as learned during these trainings. Do not drive 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).
		4e	Becoming lost or stranded, resulting in accident or exposure to elements / crime	multiple	2	3	6	4e	Prepare a JMP as required. Program GPS prior to driving. Inspect vehicle before driving - see above 1a. Check weather forecasts and adjust trip accordingly to avoid inclement weather.

Task Steps[1]		Potential Hazards & Consequences[2]		select	Likelihood	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
5	Towing	5	Accident resulting in injury or property damage	multiple	2	5	10	5	No ERM employee shall tow a trailer or equipment without having first received documented training on safe towing methods. 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. Ensure trailer is attached securely to the main vehicle and the safety chain or other backup attachment device is in-place. Use a spotter when driving in reverse. The use of straps or chains for towing purposes is prohibited.
6	Backing up	6	Accident resulting in injury or property damage	multiple	2	4	8	6	Use spotter when maneuvering in/out of tight spaces and backing up. Make all backing maneuvers slowly and cautiously. Check mirrors and over shoulders. When parking, look for pull-through parking or back into parking spot when safe to do so.
7	Parking	7a	Accident resulting in injury or property damage	multiple	2	3	6	7a	Always set parking brake. Park only in designated areas. Park away from other cars when possible. Back into parking spot when safe to do so. Do not exit cab of vehicle with ignition running except in emergency. Maintain cushion of safety from fixed objects. Park so that driver and all passengers have enough room to open doors fully and enter/exit vehicle without obstructions or slip/trip/fall hazards. Look for pull-through parking to avoid backing. When parking on an incline, turn the wheels away from the curb and allow the vehicle to roll back until the wheels touch the curb. On a decline, turn the wheels toward the curb and allow the vehicle to roll forward until the wheels touch the curb. If parking on a hill without a curb, park with the wheels turned away from the roadway.
8	Driving on dirt roads or off road, or in remote areas	8a	Accident resulting in injury or property damage	multiple	2	3	6	8a	Only drivers trained on specific hazards of off-road driving may do so. Vehicles must be suitable for off-road use, including the use of 10-ply tires. Scan travel path for obstructions, debris. Do not drive through areas overgrown with vegetation where a clear view of the ground surface is obscured.
		8b	Property damage from rough terrain, sharp objects, uneven terrain	PL	3	2	6	8b	See above 8a. ERM has negotiated a separate contract with Enterprise for rental trucks for use on non-maintained, unpaved roads.
		8c	Getting stuck / stranded in soft / muddy / standing water conditions	multiple	3	3	9	8c	Where possible, carry a second spare tire if travelling off paved roads, and an emergency tire patch kit (these are usually a foam that is injected into the flat tire and can be used to temporarily seal a leak). Use of the buddy system is mandatory for remote site work – if for some reason this is not feasible then project teams must engage the H&S Leads and the Business Unit Managing Partner to discuss options. A communications plan must be established in advance and documented, to include: - Equipment suitable for the part of the world you're in (satellite GPS messenger, sat phone, etc.) – assume a cell phone will not work - Regular check-ins with office and client - Process to follow if no check-in occurs at scheduled time Be prepared for overnight conditions, including suitable clothing, water and survival items (this applies to any remote work, not just off-road travel).
9	Renting a vehicle	9a	Accident resulting in injury or property damage	multiple	2	5	10	9a	See above, 1a. Try to reserve a vehicle that is about the same size as your personal vehicle, so you are familiar with how it maneuvers. When renting a vehicle, proof of inspection must be available to the driver.
		9b	Renting a vehicle from an agency for which no negotiated contract is in place, resulting in unnecessary liability and risk.	PL	1	2	2	9b	Only rent from companies with which ERM has negotiated rates and contract terms. If employees cannot rent from a preferred provider with negotiated contract terms, the employee should purchase the collision damage waiver and personal accident insurance.
10	Reporting and documenting vehicular accidents and property damage.	10	Inadequate response / documentation resulting in increased liability (personal or ERM)	PL	1	2	2	10	No matter how minor a vehicle accident or property damage event is, report it as a safety event. If involved in a vehicular accident, always call the police, so a report will be available. In addition, reporting will protect your liability and ERM liability. Take as many pictures as you can of the accident scene if you can do so without placing yourself in further danger.
11	Driving the vehicle near and across railroad tracks.	11	Passing trains cannot stop quickly, and there is a risk for collisions resulting in property damage, injury, and death.	multiple	1	5	5	11	Use caution when crossing any railroad track in a vehicle and do so only on designated crossing roads. Never come to a stop on RR tracks.
12	Minor Vehicle Maintenance - topping off fluids, cleaning windows, changing wiper blades, fuses	12a	Tool hazards, sharp edges	**H&S**	2	2	4	12a	Inspect all tools and equipment prior to use; if faulty or inappropriate, do not proceed until repaired or replaced. Use only the proper tool for the job, and only tools that you are trained / qualified to use. Position hands/fingers away from contact/striking/pinch points. Do not position any part of body such that it is in "line of fire". Use stable/neutral body position and do not reach, stretch, or twist when using tools. Wear heavy duty work gloves. For sharp edges and punture hazards, wear cut-resistant gloves.

Task Steps[1]		Potential Hazards & Consequences[2]		select	Likelihood	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
		12b	Electrical hazards from jump-starting dead battery	multiple	1	2	2	12b	Line both cars up so the batteries are as close as can be. Make sure the cars are in park, parking brake is set, and the engine is turned off. Make sure all headlights, blinkers, radios, and ACs are off. If the battery is cracked and liquid is leaking out, DO NOT go further! Inspect jumper cables for worn insulation. Ensure the red clamp is on (+) terminal and the black clamp is on (-) terminal. If unsure, refer to owner's manual.

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).

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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 likelihood of occurrence and severity of each hazard, AFTER implementation of the planned control measures (use the Risk Matrix as a guide). The corresponding risk rating will then be automatically calculated [RISK = Likelihood x Severity].

A risk rating shaded red indicates that work cannot continue without additional control measures and approval of Partner-in-Charge.

WAYS TO ELIMINATE OR REDUCE RISKS (IN ORDER OF PREFERENCE):

ELIMINATE / AVOID --> SUBSTITUTE / MODIFY --> ISOLATE --> ENGINEER / SAFEGUARD --> TRAINING AND PROCEDURES --> WARNING AND ALERT MECHANISMS --> PPE

JHA
Job Hazard Analysis

Project Number:	0334662	Project / Client Name:	Privileged and Confidential
Project Manager:	Randy Shuler	Location:	Hoosick Falls, NY
Partner-in-Charge:	Jim Perazzo	Date and Revision Number:	2/3/2016

SPECIFIC TASK:	**Traffic Hazards, Work in Road**

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 chemical resistant ☐ PPE clothing		
Additional Task-Step Specific PPE: (as indicated below under Controls)	None	Equipment / Tools Required:	Field book, marking paint, subcontractor equipment
Training Required for this Task:	OSHA 40hr/current 8hr, Subsurface Clearance Training EP	Permits Required for this Task:	SSC Waivers and Local Disturbance Permits as needed
Forms Associated with This Task:	Subsurface clearance forms, SSC Project Plan		

JHA Developed / Reviewed By:			JHA Review In Field
Name / Job Title:	Name / Job Title:	Name / Job Title:	Field Safety Officer (FSO) 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. **FSO Signature/Date:**
Brian Stoudt / Project Manager			

Task Steps[1]		Potential Hazards & Consequences[2]		select	Likelihood	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
1	Travel to and from Site - Vehicle Operation	1a	Vehicular Accident	multiple	2	4	8	1a	Use defensive driving techniques to minimize hazards. Allow sufficient time to travel to and from site.
2	Block Traffic Lane - Set up work zone	2a	Impact with vehicles in roadway or outside of work zone.	H&S	3	4	12	2a	Police traffic control should block roadway prior to subcontractor/ERM vehicles crossing into work zone. Police should direct traffic to assist subcontractor vehicle to work zone, and then remainder of work zone should be cordoned off.
		2b	Heavy Equipment roll over causing damage to vehicles or injury to employees	multiple	1	4	4	2b	Stay clear of heavy equipment while in operation or while moving. Wear hard hat and steel toed boots to prevent head and foot injuries. Be aware of and avoid pinch points.
		2c	Vehiclular Traffic impacting staff, vehicles, or entering work zone	multiple	2	4	8	2c	Wear high-visibility reflective vest when working in parking lot, ROW or street to increase visibility. Advise traffic control officer to have lights on police car running (red-blue lights) for increased visibility. Be aware of traffic and do not assume that vehicles can see you. Use appropriate traffic barricades to delineate work zone.
		2d	Equipment or matierials overflows work zone and impacts neighboring travel lanes.	multiple	1	3	3	2d	Minimize extraneous materials in work zone. Allow one subcontractor vehicle in work zone at a time (eg.: vac truck OR drill rig). Park ERM vehicle outside of work zone in secure location. Only bring materials and supplies necessary to current task into work zone. Practice good housekeeping to keep equipment and supplies contained.
3	Equipment Moving	3a	Impact with vehicles in roadway or outside of work zone.	H&S	1	1	1	2a	Uniformed police should direct traffic whenever equipment needs to be moved in our out of the work zone, ie: drums, well supplies, etc. High-visibility clothing should be worn by all parties
		3b	Heavy Equipment rollover resulting in injury or property damage	multiple	1	4	4	2b	Stay clear of heavy equipment while in operation or while moving. Wear hard hat and steel toed boots to prevent head and foot injuries. Be aware of and avoid pinch points.
		3c	Vehiclular Traffic impacting staff, vehicles, or entering work zone	multiple	2	2	4	2c	Wear high-visibility reflective vest when working in or near parking lot to increase visibility. Be aware of vehicular traffic and do not assume that vehicles can see you. Use appropriate traffic barricades to delineate work zone.
4	Work Oversight	4a	High Noise Level leading to hearing damage	H&S	2	2	4	3a	Wear hearing protection during air knife & vac or geoprobe operation
		4b	Work zone or near work zone distractions leading to poor sample collection or to hazard blindness.	H&S	1	2	2	3b	Use good situational awareness habits to monitor task in work zone, such as sampling, and to be vigilant for hazards coming from outside the work zone, such as vehicles or pedestrians.

Task Steps[1]		Potential Hazards & Consequences[2]		select	Likelihood	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
5	Break down work zone - Release Lane	5a	Impact with vehicles in roadway or outside of work zone.	H&S	1	1	1	5a	Police traffic control should block roadway prior to subcontractor/ERM vehicles crossing into work zone. Police should direct traffic to assist subcontractor vehicle to work zone, and then remainder of work zone should be cordoned off.
		5b	Heavy Equipment roll over causing damage to vehicles or injury to employees	multiple	1	4	4	5b	Stay clear of heavy equipment while in operation or while moving. Wear hard hat and steel toed boots to prevent head and foot injuries. Be aware of and avoid pinch points.
		5c	Vehiclular Traffic impacting staff, vehicles, or entering work zone	multiple	2	4	8	5c	Wear high-visibility reflective vest when working in parking lot, ROW or street to increase visibility. Advise traffic control officer to have lights on police car running (red-blue lights) for increased visibility. Be aware of traffic and do not assume that vehicles can see you. Use appropriate traffic barricades to delineate work zone.

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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 likelihood of occurrence and severity of each hazard, AFTER implementation of the planned control measures (use the Risk Matrix as a guide). The corresponding risk rating will then be automatically calculated [RISK = Likelihood x Severity].

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WAYS TO ELIMINATE OR REDUCE RISKS (IN ORDER OF PREFERENCE):

ELIMINATE / AVOID --> SUBSTITUTE / MODIFY --> ISOLATE --> ENGINEER / SAFEGUARD --> TRAINING AND PROCEDURES --> WARNING AND ALERT MECHANISMS --> PPE

JHA
Job Hazard Analysis

Project Number:	0334662	Project / Client Name:	Privileged and Confidential
Project Manager:	Randy Shuler	Location:	Hoosick Falls, NY
Partner-in-Charge:	Jim Perazzo	Date and Revision Number:	2/3/2016

SPECIFIC TASK:	**Subsurface Clearance**

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 chemical resistant ☐ PPE clothing		
Additional Task-Step Specific PPE: (as indicated below under Controls)	None	Equipment / Tools Required:	Field book, marking paint, subcontractor equipment
Training Required for this Task:	OSHA 40hr/current 8hr, Subsurface Clearance Training EP	Permits Required for this Task:	SSC Waivers and Local Disturbance Permits as needed
Forms Associated with This Task:	Subsurface clearance forms, SSC Project Plan		

JHA Developed / Reviewed By:			JHA Review In Field
Name / Job Title:	Name / Job Title:	Name / Job Title:	Field Safety Officer (FSO) 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. **FSO Signature/Date:**
Brian Stoudt / Project Manager			

Task Steps[1]		Potential Hazards & Consequences[2]		select	Likelihood	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
1	Travel to and from Site - Vehicle Operation	1a	Vehicular Accident	multiple	2	4	8	1a	Use defensive driving techniques to minimize hazards. Allow sufficient time to travel to and from site.
2	Oversight of Utility Clearance and Soft-Dig Activities	2a	High Noise Level leading to hearing damage	H&S	2	2	4	2a	Wear hearing protection when using the concrete core machine and/or hackhammer.
		2b	Heavy Equipment roll over causing damage to building or injury to employees	multiple	1	4	4	2b	Stay clear of heavy equipment while in operation or while moving. Wear hard hat and steel toed boots to prevent head and foot injuries. Be aware of and avoid pinch points.
		2c	Vehiclular Traffic impacting staff, vehicles, or entering work zone	multiple	1	4	4	2c	Wear high-visibility reflective vest when working in parking lot, ROW or street to increase visibility. Be aware of traffic and do not assume that vehicles can see you.
		2d	Hazardous Atmosphere - especially while working indoors, resulting in injury or illness to employees	multiple	1	3	3	2d	Conduct continous air monitoring while drilling inside the building.
		2e	Subsurface utility strike resulting in injury to employees or damage to utility.	multiple	2	3	6	2e	Contact public and private utility markout sercices 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. Use cable avoidance tools and ground penetrating radar (GPR) at each location that must be physically cleared (OSHA requirement). If using a hand-auger, ensure insulated handles are in-place before their use.
		2f	Exposure to chemicals resulting in injury or illness to employees	H&S	1	3	3	2f	Wear nitrile gloves and safety glasses to prevent exposure to contaminated soil. Wash hands after work is complete and before injesting food or beverages. Follow proper spill containment and clean-up procedures if spills occur.

Task Steps[1]		Potential Hazards & Consequences[2]		select	Likelihood	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
2	Oversight of Geoprobe or hand auger advancement	2a	High noise level resulting in hearing damage	H&S	1	1	1	2a	Wear hearing protection during geoprobe operation
		2b	Heavy Equipment rollover resulting in injury or property damage	multiple	1	2	2	2b	Stay clear of heavy equipment while in operation or while moving. Wear hard hat and steel toed boots to prevent head and foot injuries. Be aware of and avoid pinch points.
		2c	Vehiclular Traffic impacting staff, vehicles, or entering work zone	multiple	2	2	4	2c	Wear high-visibility reflective vest when working in or near parking lot to increase visibility. Be aware of vehicular traffic and do not assume that vehicles can see you. Use cones and caution tape to demarcate work zone.
		2d	Subsurface utility strike resulting in injury to employees or damage to utility.	multiple	3	3	9	2d	Contact public and private utility markout sercices 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. Use cable avoidance tools and ground penetrating radar (GPR) at each location that must be physically cleared (OSHA requirement). If using a hand-auger, ensure insulated handles are in-place before their use.
3	Examine soil from macrocore or hand auger bucket	3a	Exposure to chemicals resulting in injury or illness to employees	H&S	2	2	4	3a	Wear nitrile gloves and safety glasses when examining soil. Wash hands after work is complete and before injesting food or beverages. Follow proper spill containment and clean-up procedures if spills occur.
		3b	Cuts from macrocore resulting in injury	H&S	1	2	2	3b	Advise sub-contractors to wear cut resistant gloves when opening the macro core. Wear nitrile gloves when screening soil; do not remove soil from macrocore with hands - use trowel or sampling spatula.
4	Place soil in appropriate glassware	4	Cuts from glass or plastic containers resulting in injury	H&S	1	2	2	4	Inspect glassware for damage prior to handling. Wear cut resistant gloves underneath chemicla resistant gloves. Ensure that glassware is placed in cooler in a way that does not allow the samples to move too much and potentially break. Use packing material or bubble wrap.

Task Steps[1]		Potential Hazards & Consequences[2]		select	Likelihood	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
5	Site Restoration	5	None, to be completed by subcontractors	H&S	1	1	1	5	General site hazards, such as slip, trip, and fall, apply but risk is considered minimal as all site restoration will be completed by subcontractor personnel.

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4. Select the likelihood of occurrence and severity of each hazard, AFTER implementation of the planned control measures (use the Risk Matrix as a guide). The corresponding risk rating will then be automatically calculated [RISK = Likelihood x Severity].

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JHA
Job Hazard Analysis

Project Number:	0334662	Project / Client Name:	Privileged and Confidential
Project Manager:	Randy Shuler	Location:	Hoosick Falls, NY
Partner-in-Charge:	Jim Perazzo	Date and Revision Number:	2/3/2016

SPECIFIC TASK:	**Using hand tools**

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 cut resistant ☐ PPE clothing <enter type here (eg, Tyvek, FRC, long sleeves)> Sleeves, Hard hat when equipment or overhead hazards present		
Additional Task-Step Specific PPE: (as indicated below under Controls)	cut-resistant gloves	Equipment / Tools Required:	Miscellaneous hand tools (screwdrivers, hammers, cutting tools, etc.)
Training Required for this Task:	Tool Specific	Permits Required for this Task:	
Associated Forms:		Associated Procedures:	S3-NAM-046-PR - Safe Use of Cutting Tools

JHA Developed / Reviewed By:			JHA Review In Field
Name / Job Title:	Name / Job Title:	Name / Job Title:	Field Safety Officer (FSO) 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. **FSO Signature/Date:**
Brian Stoudt / Project Manager			

Update Tasks and hazards in the field

Task Steps[1]		Potential Hazards & Consequences[2]		select	Likelihood	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	3	6	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	3	2	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	3	4	12	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	3	4	12	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.
4a	Using hammers / sledgehammers	4a	Creation of sparks which can cause bodily harm or damage to property or fire	multiple	3	4	12	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.

Task Steps[1]		Potential Hazards & Consequences[2]		select	Likelihood	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
		4c	Loose handles may create a projectile hazard - causing bodily injury or property damage	multiple	3	3	9	4c	Replace any hammer with a loose handle so the hammer-head does not detach and cause injuries.
		4d	Smashed fingers	H&S	3	3	9	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.

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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 likelihood of occurrence and severity of each hazard, AFTER implementation of the planned control measures (use the Risk Matrix as a guide). The corresponding risk rating will then be automatically calculated [RISK = Likelihood x Severity].

A risk rating shaded red indicates that work cannot continue without additional control measures and approval of Partner-in-Charge.

WAYS TO ELIMINATE OR REDUCE RISKS (IN ORDER OF PREFERENCE):

ELIMINATE / AVOID --> SUBSTITUTE / MODIFY --> ISOLATE --> ENGINEER / SAFEGUARD --> TRAINING AND PROCEDURES --> WARNING AND ALERT MECHANISMS --> PPE

JHA
Job Hazard Analysis

Project Number:	0334662	Project / Client Name:	Privileged and Confidential
Project Manager:	Randy Shuler	Location:	Hoosick Falls, NY
Partner-in-Charge:	Jim Perazzo	Date and Revision Number:	2/3/2016

SPECIFIC TASK:	**Drilling and Temporary Well Point Installation**

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 leather, cut resistent, nitrile ☐ PPE clothing <enter type here (eg, Tyvek, FRC, long sleeves)> <enter additional PPE here>		
Additional Task-Step Specific PPE: (as indicated below under Controls)		Equipment / Tools Required:	Include monitoring equipment, hand tools, powered equipment, etc.
Training Required for this Task:	HAZWOPER	Permits Required for this Task:	Include both safety permits (e.g., Hot Work) and environmental permits (eg, drilling permit)
Forms Associated with This Task:	SSC Documents		

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:**
Brian Stoudt / Project Manager			

Task Steps[1]		Potential Hazards & Consequences[2]		select	Probability	Consequence	RISK	Controls to Eliminate or Reduce Risks[3]	
1	Moving equiment to and from each sample location	1a	Location hazards, vehicular and pedestrian traffic, security.	multiple	2	4	8	1a	Wear long pants, hard hat, high-visibility reflective vest. Demarcate work area with cones and caution tape in high traffic areas. Obtain police traffic control prior to accessing wells in sidewalks and streets. Park vehicles between oncoming traffic and work area. Work in teams.
		1b	Slips, trips, and Falls	H&S	2	3	6	1b	Wear ankle high boots to support ankles. Arrange equipment and supplies to keep a tidy work area, free of tripping hazards.
		1c	Back Strain/Sprain from lifting/moving equipment	H&S	3	3	9	1c	Ensure proper lifting technique is used (bend at the legs, keeping the back and the load close to the body). Also, obtain assistance with any heavy items or items that are awkward or bulky.
2	Oversee setup of drilling equipment	2a	Bodily injury or equipment damage	H&S	3	3	9	2a	Fully inspect drill rig and support vehicles before movement. Ensure heavy eqiupment is equipped with back-up alarm or use horn when backing. Wear proper PPE including high visibility refelctive vest, hard hat, gloves, and long pants. When appropching heavy equipment, approach from the front and within view of the operator.
		2b	Contact with electric lines and other overhead obstacles	multiple	3	4	12	2b	Fully inspect the area aroudn drill rig and other equipment. Use a spotter when raising any parts or moving the drill rig.
		2c	Boidly injury due to heavy lifting	H&S	3	3	9	2c	Use powered equipment, lift truck, drum cart, or some other mechanical means to move heavy items. Wear proper PPE including leather cut-resistant gloves, hard hat, high visibility refelctive vest. Bend and lift with legs and arms, not with back. Do not reach, stretch, or twist to lift. Position hands from pinch points or areas where fingers may be crushed.
		2d	Injury due to sharp/ rough equipment and tools	H&S	3	3	9	2d	Wear leather cut resistant gloves and steel-toed boots. Keep hands 6" away from cutting edge of tool.
		2e	Boidly injury due to pinch points	H&S	3	3	9	2e	Wear PPE including leather, ANSI Blade Cut Resistant Level 2 work gloves, long sleeves and pants, and steel-toed boots; keep hands away from cutting edge of tools.
3	Physically Cleear all Ground Disturbance Areas	3	Contacting and damaging underground utility/ service lines	multiple	3	4	12	3	Ensure all Sub-Surface clearance requirements are followed. Inspect area for all possible underground utilities (private mark-out). Mechanical ground penetration should not commence until a ground disturbance location is physically cleared.
4	Drilling operations: Well Installation and Isolation Casing Installation	4a	Slips, trips, and Falls	H&S	3	3	9	4a	See above
		4b	Damage to hearing from sustained elevated noise or intermittent impact noise	H&S	3	3	9	4b	Wear hearing protection such as ear plugs, or ear muffs to protect hearing. Have hand signs to help with communicating when nosie levels are high.

Task Steps[1]		Potential Hazards & Consequences[2]		select	Probability	Consequence	RISK	Controls to Eliminate or Reduce Risks[3]	
		4c	Faulty or Inappropriate Equipment	H&S	2	2	4	4c	Qualified driller must inspect drill rig and support vehicle(s) prior to use, if faulty or inappropriate, do not proceed until repaired or replaced. Inspect all hand tools prior to use, if faulty or inappropriate, do not proceed until repaired or replaced.
		4d	Suspended load and/or Elevated Equipment	H&S	2	3	6	4d	Do not walk under suspended loads and if possible remove promptly. Where loads are free to swing, use a guide chaing or tagline to govern movement. Ensure to stay in site of equipment operator at all times and establish a communication system. Wear proper PPE (hard hat, steel-toed boots, high visibility vest)
		4e	Injury or illness due to exposure to vaport and airborne particles	H&S	2	4	8	4e	Approach and stay upwind of potential sources of vapors. If prescribed by the HASP, monitor air concentration in the breathing zone using directed reading instruments warranged in the HASP. Wear appropriate PPE including safety glasses, nitrile gloves, long sleeves, and if necessary respirator. Use water to control dust when necessary.
		4f	Injury due to pinch points	H&S	3	3	9	4f	see above
		4g	Injury due to sharp/ rough equipment and tools	H&S	3	3	9	4g	see above
		4h	Cross-Contamination	E	2	4	8	4h	Decontaminate or dispose of down hole development equipment between well locations.
		4i	Dermal Contact with Contaminated Materials	H&S	2	3	6	4i	Wear proper PPE including nitrile gloves, safety glasses, etc. Refer to HASP for appropriate PPE. If clothing becomes wet or saturated, remove clothing immediately, wash affected areas, and change into dry clothing before completing the work. When drilling with augers, construct a primary containment structure around the borehole.
		4j	Injury or fire while cutting/welding metal casing	H&S	4	3	12	4j	Fill out necessary hot work permits and verify the area is safe using vapor monitoring equipment for operating blow torch or welder. Where proper PPE for cutting including leather gloves, safety glasses or face shield.
5	Well Surface Features Construction	5a	Moving Eqiupment	H&S	2	4	8	5a	See above
		5b	Faulty or Inappropriate Equipment	H&S	2	2	4	5b	See above
		5c	High Noise Levels	H&S	3	3	9	5c	See above
		5d	Vapors and Airborne Particles	H&S	2	4	8	5d	See above
		5e	Sharp/Rough Materials	H&S	3	3	9	5e	See above
		5f	Heavy Lifting	H&S	3	3	9	5f	See above
6	Decontaminate Equipment	6a	Dermal Contact with Contaminated Materials	H&S	2	3	6	6a	See above
		6b	Vapors and Airborne Particles	H&S	2	4	8	6b	See above
		6c	Bodily injury due to improper use of Equipment	H&S	2	3	6	6c	Inspect all tools before use and ensure to properly use them. Wear correct PPE including leater cut resistant gloves and safety glasses. When cleaning a hand auger, keep hands away from sharp edges of auger.
7	Waste containerization	7	General Hazards	H&S	2	4	8	7	Ensure all waste and used supplies/PPE are containerized properly.

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

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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 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].

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JHA
Job Hazard Analysis

Project Number:	0334662	Project / Client Name:	Privileged and Confidential
Project Manager:	Randy Shuler	Location:	Hoosick Falls, NY
Partner-in-Charge:	Jim Perazzo	Date and Revision Number:	2/3/2016

SPECIFIC TASK:	**Groundwater Sampling**

Minimum Required PPE for Entire Task:	☐ Hard Hat ☑ Safety-Toe Shoes ☐ Hearing Protection ☐ Goggles ☐ Face Shield ☐ Respirator None ☑ Other (specify): ☑ Safety Glasses ☑ Reflective Vest ☑ Gloves Nitrile ☑ PPE clothing Modified Level D Hard hat when equipment or overhead hazards are present		
Additional Task-Step Specific PPE: (as indicated below under Controls)	see below	Equipment / Tools Required:	YSI, depth to water meter, air compressor, hand tools, electric cords (GFI), PID, pumps and controllers
Training Required for this Task:	OSHA 40HR HAZWOPER, Field Safety Officer	Permits Required for this Task:	Police Detail Required for locations on sidewalks and streets.
Forms Associated with This Task:	Daily Safety Meeting, low flow sampling forms, calibration forms		

JHA Developed / Reviewed By:			JHA Review In Field
Name / Job Title:	Name / Job Title:	Name / Job Title:	Field Safety Officer (FSO) 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. **FSO Signature/Date:**
Brian Stoudt / Project Manager			

Task Steps[1]		Potential Hazards & Consequences[2]		select	Likelihood	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
1	Gather Cooler and sample container and take to jobsite	1	Back Strain/Sprain	H&S	3	3	9	1	Ensure proper lifting technique is used (bend at the legs, keeping the back and the load close to the body). Also, obtain assistance with any heavy items or items that are awkward or bulky.
2	Moving equiment to and from each sample location	2a	Location hazards, vehicular and pedestrian traffic, security.	multiple	3	4	12	2a	Wear long pants, hard hat, high-visibility reflective vest. Demarcate work area with cones and caution tape in high traffic areas. Obtain police traffic control prior to accessing wells in sidewalks and streets. Park vehicles between oncoming traffic and work area. Work in teams.
		2b	Slips, trips, and Falls	H&S	2	3	6	2b	Wear ankle high boots to support ankles. Arrange equipment and supplies to keep a tidy work area, free of tripping hazards.
		2c	Back Strain/Sprain from lifting/moving equipment	H&S	3	3	9	2c	Ensure proper lifting technique is used (bend at the legs, keeping the back and the load close to the body). Also, obtain assistance with any heavy items or items that are awkward or bulky.
3	Accessing well to be sampled	3	Location hazards, vehicular and pedestrian traffic, security.	multiple	3	4	12	3	Wear long pants, hard hat, high-visibility reflective vest. Demarcate work area with cones and caution tape in high traffic areas. Obtain police traffic control prior to accessing wells in sidewalks and streets. Park vehicles between oncoming traffic and work area. Work in teams.
4	Water Meter Calibration	4	Minimal from handling calibration solutions	H&S	1	1	1	4	Use nitrile gloves and wear safety glasses
5	Opening and closing the well	5	Hand injuries could occur; insect bites and stings are possible.	H&S	3	2	6	5	Wear appropriate gloves for the task. Bring appropriate tools to open well. Take your time to assess the situation, and consult the Site HSO or the project manager with questions.
6	Pump assembly, placement, retrieval	6	Pinch, minor skin injury from tool, muscle strain during placement or retrieval	H&S	3	2	6	6	Use proper tools and practice proper lifting techniques.
7	Filling glassware with ground water samples	7	Sharp Edges	H&S	2	2	4	7	Do not use glassware that contains cracks or chips. Cut-resistant gloves may be worn while filling containers (under nitrile gloves) as an added precaution to prevent cuts.

Task Steps[1]		Potential Hazards & Consequences[2]		select	Likelihood	Severity	RISK	Controls to Eliminate or Reduce Risks[3]	
8	Moving equiment to and from each sample location	8a	Location hazards, vehicular and pedestrian traffic, security.	multiple	3	4	12	8a	Wear long pants, hard hat, high-visibility reflective vest. Demarcate work area with cones and caution tape in high traffic areas. Obtain police traffic control prior to accessing wells in sidewalks and streets. Park vehicles between oncoming traffic and work area. Work in teams.
		8b	Slips, trips, and Falls	H&S	2	3	6	8b	Wear ankle high boots to support ankles. Arrange equipment and supplies to keep a tidy work area, free of tripping hazards.
		8c	Back Strain/Sprain from lifting/moving equipment	H&S	3	3	9	8c	Ensure proper lifting technique is used (bend at the legs, keeping the back and the load close to the body). Also, obtain assistance with any heavy items or items that are awkward or bulky.
9	Packing cooler and shipping to lab	9	Back Strain/Sprain	H&S	3	3	9	9	Ensure proper lifting technique is used (bend at the legs, keeping the back and the load close to the body). Also, obtain assistance with any heavy items or items that are awkward or bulky.

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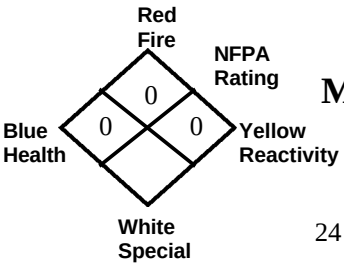
Safety Data Sheets



Liqui-Nox ®

MATERIAL SAFETY DATA SHEET

Alconox, Inc.
30 Glenn Street
White Plains, NY 10603
24 Hour Emergency Number – Chem-Tel (800) 255-3924

I. IDENTIFICATION

Product Name (as appears on label)	LIQUI-NOX
CAS Registry Number:	Not Applicable
Effective Date:	January 1, 2001
Chemical Family:	Anionic Liquid Detergent
Manufacturer Catalog Numbers for sizes	1232, 1201, 1215 and 1255

II. HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

There are no hazardous ingredients in LIQUI-NOX¨ as defined by the OSHA Standard and Hazardous Substance List 29 CFR 1910 Subpart Z.

III. PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point (F):	214°F
Vapor Pressure (mm Hg):	No Data
Vapor Density (AIR=1):	No Data
Specific Gravity (Water=1):	1.075
Melting Point:	Not Applicable
Evaporation Rate (Butyl Acetate=1):	Slower
Solubility in Water:	Completely soluble in all proportions.
Appearance:	Yellow liquid, nearly odorless
pH:	8.5 (1%)

IV. FIRE AND EXPLOSION DATA

Flash Point:	None (Cleveland Open Cup)
Flammable Limits:	LEL: No Data UEL: No Data
Extinguishing Media:	Water, dry chemical, CO_2, foam
Special Fire fighting Procedures:	Self-contained positive pressure breathing apparatus and protective clothing should be worn when fighting fires involving chemicals.
Unusual Fire and Explosion Hazards:	None

V. REACTIVITY DATA

Stability:	Stable
Conditions To Avoid:	None
Incompatibility (Materials To Avoid):	Oxidizing agents.
Hazardous Decomposition or Byproducts:	May release SO_2 on burning

VI. HEALTH HAZARD DATA

Route(s) of Entry:	Inhalation? No Skin? Yes Ingestion? Yes
Health Hazards (Acute and Chronic):	Skin contact may prove locally irritating, causing drying and/or chapping. Ingestion may cause discomfort and/or diarrhea.
Carcinogenicity:	NTP? No IARC Monographs? No OSHA Regulated? No
Signs and Symptoms of Exposure:	Prolonged skin contact may cause drying and/or chapping.
Medical Conditions Generally Aggravated by Exposure:	Not established. Unnecessary exposure to this product or any industrial chemical should be avoided.
Emergency and First Aid Procedures:	Eyes: Immediately flush eyes with water for at least 15 minutes. Call a physician. Skin: Flush with plenty of water. Ingestion: Drink large quantities of water or milk. Do not induce vomiting. If vomiting occurs administer fluids. See a physician for discomfort.

VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken if Material is Released or Spilled:	Material foams profusely. For small spills recover as much as possible with absorbent material and flush remainder to sewer. Material is biodegradable.
Waste Disposal Method:	Small quantities may be disposed of in sewer. Large quantities should be disposed of in accordance with local ordinances for detergent products.
Precautions to be Taken in Storing and Handling:	No special precautions in storing. Use protective equipment when handling undiluted material.
Other Precautions:	No special requirements other than the good industrial hygiene and safety practices employed with any industrial chemical.

VIII. CONTROL MEASURES

Respiratory Protection (Specify Type):	Not Required
Ventilation:	Local Exhaust-Normal Special-Not Required Mechanical-Not Required Other-Not Required
Protective Gloves:	Impervious gloves are recommended.
Eye Protection:	Goggles and/or splash shields are recommended.
Other Protective Clothing or Equipment:	Not required
Work/Hygienic Practices:	No special practices required

SAFETY DATA SHEET

Version 4.19
Revision Date 10/09/2014
Print Date 02/03/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Trizma® base

Product Number : T1503
Brand : Sigma

CAS-No. : 77-86-1

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

Not a hazardous substance or mixture.

2.2 GHS Label elements, including precautionary statements

Not a hazardous substance or mixture.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS

This substance is not considered to be persistent, bioaccumulating and toxic (PBT).

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms : 2-Amino-2-(hydroxymethyl)-1,3-propanediol
THAM
Trometamol
Tris base
Tris(hydroxymethyl)aminomethane

Formula : $C_4H_{11}NO_3$
Molecular weight : 121.14 g/mol
CAS-No. : 77-86-1
EC-No. : 201-064-4
Registration number : 01-2119957659-16-XXXX

No components need to be disclosed according to the applicable regulations.

4. FIRST AID MEASURES

4.1 Description of first aid measures

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration.

In case of skin contact
Wash off with soap and plenty of water.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides, Nitrogen oxides (NOx)

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Avoid dust formation. Avoid breathing vapours, mist or gas.
For personal protection see section 8.

6.2 Environmental precautions
Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.

Hygroscopic. Store under inert gas.
Storage class (TRGS 510): Non Combustible Solids

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls
General industrial hygiene practice.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Respiratory protection is not required. Where protection from nuisance levels of dusts are desired, use type N95 (US) or type P1 (EN 143) dust masks. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: crystalline Colour: colourlesswhite
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	10.5 - 12
e)	Melting point/freezing	Melting point/range: 169 °C (336 °F)

	point	
f)	Initial boiling point and boiling range	288 °C (550 °F) at 1,013 hPa (760 mmHg) - Decomposes below the boiling point.
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	No data available
n)	Water solubility	678 g/l at 20 °C (68 °F)
o)	Partition coefficient: n-octanol/water	log Pow: -2.31 at 20 °C (68 °F)
p)	Auto-ignition temperature	The substance or mixture is not classified as self heating.
q)	Decomposition temperature	No data available
r)	Viscosity	Not applicable
s)	Explosive properties	Not explosive
t)	Oxidizing properties	The substance or mixture is not classified as oxidizing.

9.2 Other safety information

Bulk density	800 kg/m3
Dissociation constant	8.22 at 25 °C (77 °F)

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
hygroscopic

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - > 3,000 mg/kg

Inhalation: No data available

LD50 Dermal - Rat - > 5,000 mg/kg
(OECD Test Guideline 402)

No data available

Skin corrosion/irritation
Skin - Rabbit
Result: No skin irritation
(OECD Test Guideline 404)

Serious eye damage/eye irritation
Eyes - Rabbit
Result: No eye irritation
(OECD Test Guideline 405)

Respiratory or skin sensitisation
Buehler Test - Guinea pig
Does not cause skin sensitisation.
(OECD Test Guideline 406)

Germ cell mutagenicity
Result: Not mutagenic in Ames Test.

in vitro assay
Result: negative
In vitro tests did not show mutagenic effects

Result: In vivo tests did not show any chromosomal changes.

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information

Repeated dose toxicity - Rat - Oral - No observed adverse effect level - 1,000 mg/kg
RTECS: TY2900000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia (water flea) - > 980 mg/l - 48 h
Toxicity to algae	EC50 - Algae - 397 mg/l - 72 h
	NOEC - Algae - 100 mg/l - 72 h

12.2 Persistence and degradability

Biodegradability	Result: - Readily biodegradable. (OECD Test Guideline 301F)

12.3 Bioaccumulative potential

No bioaccumulation is to be expected (log Pow <= 4).

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

This substance is not considered to be persistent, bioaccumulating and toxic (PBT).

12.6 Other adverse effects

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

Not dangerous goods

IMDG

Not dangerous goods

IATA

Not dangerous goods

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

No SARA Hazards

Massachusetts Right To Know Components

No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Tris (hydroxymethyl) aminomethane	77-86-1	

New Jersey Right To Know Components

	CAS-No.	Revision Date
Tris (hydroxymethyl) aminomethane	77-86-1	

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

HMIS Rating

Health hazard:	0
Chronic Health Hazard:	
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	0
Fire Hazard:	0
Reactivity Hazard:	0

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.19 Revision Date: 10/09/2014 Print Date: 02/03/2016

ERM
Standard Operating Procedures

1. Purpose and Scope

This document describes the methodology for using ERM's Management of Change reminder tool: the SNAP Card.

2. Using the SNAP Card

There are four steps to performing a SNAP analysis:

- **Scan** – take two minutes to see the hazards
- **Notice** – take note of existing (or lacking) hazard controls
- **Analyze** – assess the remaining risk associated with the activity
- **Perform** – take appropriate action before work proceeds

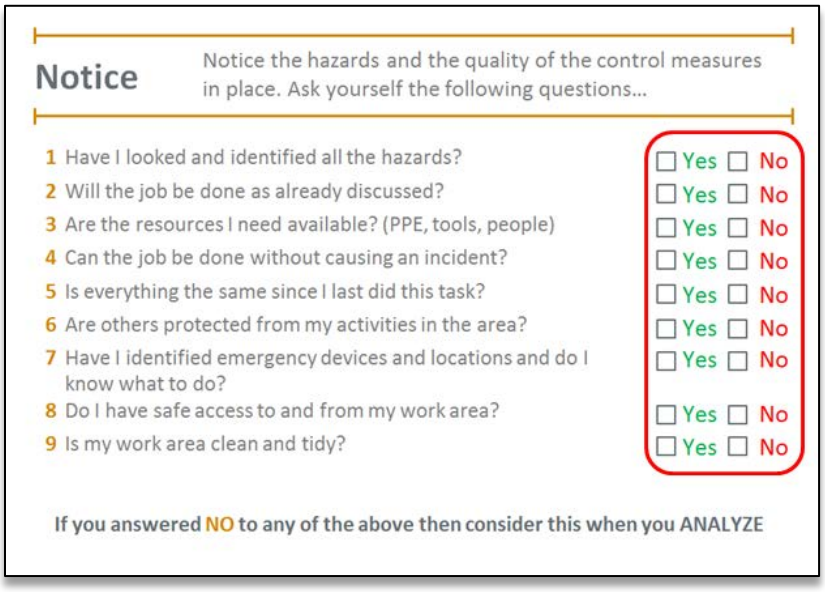
Each of these elements are included as components on the SNAP card, and are discussed below.

2.1 SCAN the Area

The front of the SNAP card reminds you to always be looking for new or changed conditions. Take two minutes to scan your work area: look high, look mid-level, look low. Remember the techniques you learned and practiced in your Observation and Feedback program (OFP) training.

2.2 NOTICE Situational Changes

The second page of the SNAP card (inside the card, above the fold) provides guidance on how to systematically notice change. Reviewing these nine questions will aid you in determining if the situation has changed from what was expected. Of course, you should not rely only on these questions when identifying change … anything 'out of the ordinary' is reason enough to pause and analyze the situation.



A 'No' answer to one of these questions is a good indicator that further analysis is required.

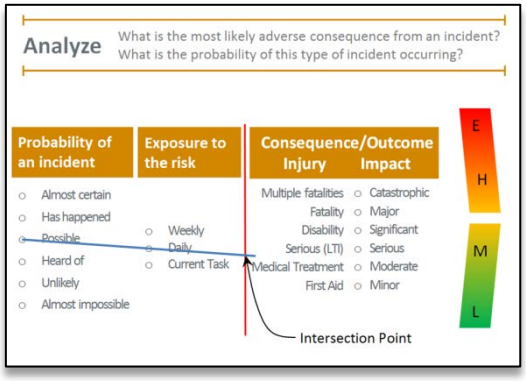
2.3 ANALYZE the Risk

"Risk" can be subjective concept, and may mean different things to different people. The third page of the SNAP card (inside the card, below the fold) provides guidance on how we can each consistently evaluate risk associated with an identified hazard.

Think about the hazardous situation / condition you noticed:

- What is the **Probability** that the condition could cause an incident (an injury, illness or environmental release)?
- What is someone's potential **Exposure** to the potential risk (this is sometimes called 'frequency')?
- What is the most realistic **Consequence**, if the incident were to occur? Only realistic (sometimes called single-failure) consequences should be considered. The goal here is not to image a string of unexpected events that leads to dire results. Rather, try to evaluate the realistic outcome if something were to go wrong.

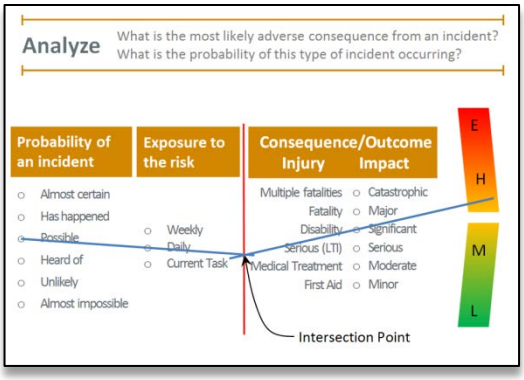
If a project team is working together, all team members should discuss these parameters.



Once you've considered the probability, exposure and consequence of the condition, use the Analyze nomograph to determine risk. This analysis will determine if the risk level is Extreme (E), High (H), Medium (M) or Low (L).

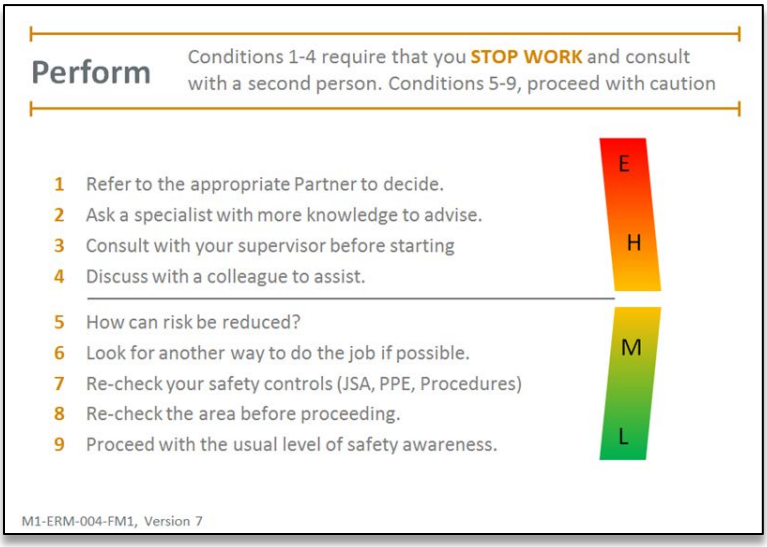
First: draw a straight line through the identified probability and exposure conditions; extend this line until it hits the vertical red line. For example, a 'Possible' situation with a 'Daily' exposure is presented to the left.

Second, draw a line from the intersection point with the vertical red line, through the identified consequence. Extend this line until it hits the risk level description on the right side of the card. Continuing the above example, consider a situation where the realistic consequence is a 'Disability'. As seen on the right, this results in a risk level between Medium and High.



2.4 PERFORM an Action to Mitigate Risk

Finally, take action! The back of the SNAP card provides suggested steps to take prior to proceeding with the activity to ensure that the identified condition has been adequately addressed. When in doubt: err on the side of caution and discuss the situation with a member of the project team.



Case Management Flow Chart

If an Employee is HURT or SICK Follow These Steps:

Step 1 — Call 911
for emergencies, such as heart attack, stroke, severe shortness of breath, sudden and severe pain, major injury (such as trauma), severe bleeding, or unconsciousness.

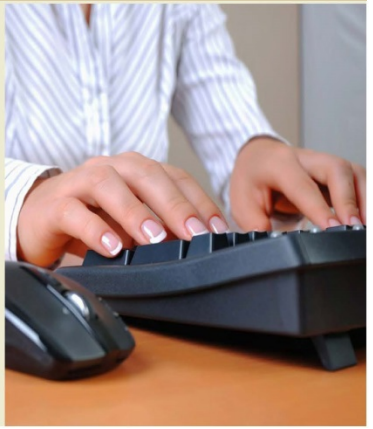
Step 2
For non-emergencies, give any necessary first aid care for the employee and secure the scene.

Step 3
Immediately after giving care, contact your PM (if in the field) or Supervisor (if in the office) to report the event. Also notify the safety team.

Step 4
As directed by the safety team, contact ERM's Incident Intervention service at 1-888-449-7787 to obtain professional medical advice.

WorkCare® Making Health Count

Step 5
Within 24 hours, enter the event into the Event Communication System (ECS).



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 Division Health, Safety, Security, and Environment (HSSE) Leader.

Project Manager (PM)/Supervisor/Branch Manager (BM): 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 Division HSSE Leader, any observed deficiencies in the implementation of the procedure.

Division HSSE Leader: Responsible for the following elements:

- Evaluate implementation of the procedure by Division personnel during ECS reviews; and
- Communicate identified deficiencies to the PIC and Divisional management teams.

Employee: Responsible for the following elements:

- Report work-related injuries/illnesses as soon as possible to their PM/Supervisor/BM;
- Comply with the requirements of the procedure during response to injury/illness events;
- Work with the ERM management, HSSE, and Human Resources (HR) teams to ensure the best outcome for the employee; and
- Notify the ERM management, HSSE, 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

- Work-related injury/illness – An injury or illness that arises out of and in the course of employment.
- 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.
- Illness – Systemic infections, exposure to hazardous materials, repeated stress and 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.

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 Work Activity Risk Assessment (WARN) 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 S3-NAM-019-PR (*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 S3-NAM-019-PR (*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 used, 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 Post-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 urgent care facility via ambulance or similar method (if a critical condition) or ERM vehicle. Employees should not be permitted to drive themselves unless safe to do so.

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 medical consultant, 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 injury or illness, employees must call Workcare's Incident Intervention service (available 24 hours per day, 7 days per week). When contacted, an occupational nurse or physician provides medical advice to the injured or ill employee, which may include a referral to a medical clinic. If referral is required, Workcare's occupational physicians will provide peer-to-peer interaction with medical clinic physicians to ensure the level of care and treatment is appropriate to the symptoms presented. The employee is also responsible for maintaining contact with appropriate ERM management and H&S team members to alert them to issues relating to their condition.

4.2.4 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.

4.2.5 Return to Work

Employee supervisors, after consultation with the Division HSSE Leader and the HR team, 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.

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 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.

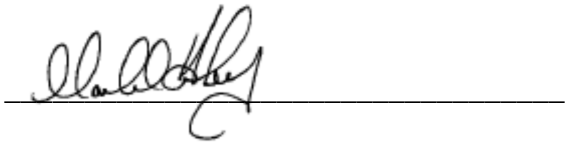
5. References

- ERM Work Instruction S3-NAM-037-WI1 (*Injury/Illness Management Flow Chart*)

Document Control Information

Original Effective Date: 8/5/14

Policy Approval by: Mark Hickey

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

1. Purpose and Scope

This document establishes the criteria for consistent reporting and recording for work-related injuries and illnesses, and the methodology for calculating injury/illness related reporting metrics. **Figure 1** summarizes the Recordability Decision process.

In certain circumstances, ERM employees and entities may have a duty to record and report data on injuries and illnesses of certain ERM Agents or Contractors if the work of an Agent or Contractor is directly supervised by an ERM employee on a daily basis.

2. Roles and Responsibilities

Global H&S Director (GHSD). Issue a final determination on whether an injury/illness is ERM Recordable in the event of disagreement, in consultation with the responsible Regional H&S Lead, Regional CEO, ERM Legal Department and Executive Committee.

Regional Health and Safety (H&S) Lead. Determine Recordability within 3 days of receiving notice of an injury or illness via ERM's Event Communication System (ECS); update the record as required until the event is complete and the employee has returned to normal duties; communicate with regulatory authorities regarding Regulatory Reportable or Recordable Injuries/Illnesses (in consultation with the GHSD and the Legal Department, and following approval by a member of the Executive Committee).

All employees. Immediately notify the PIC (for project-related events) or Office Head (for non-project related events), and the BU H&S Lead of a suspected work-related injury or illness, and enter the event into ECS within 24 hours.

3. Definitions

Agent. Any member of any ERM entity board, any officer of any ERM entity, hired personnel, consultants, intermediaries, lobbyists, agents, representatives, independent contractors, subcontractors, and any others who act on ERM's behalf.

Aggravated Pre-existing Condition. When an event or exposure in the work environment results in any of the following:

- Death provided that the pre-existing injury or illness would likely not have resulted in death but for the occupational event or exposure.
- Loss of consciousness provided that the pre-existing injury or illness would likely not have resulted in loss of consciousness but for the occupational event or exposure.
- One or more days away from work, or days of restricted work, or days of job transfer that otherwise would not have occurred but for the occupational event or exposure.

- Medical treatment in a case where no previous medical treatment was needed for the pre-existing injury or illness before the workplace event or exposure, or a change in medical treatment was necessitated by the workplace event or exposure.

Employee. Any personnel hired directly by ERM (regardless of status classification of full-time, part-time, temporary, contract, etc.); interns (even if an intern does not receive payment by ERM); employees of other companies seconded into ERM, and any ERM employee seconded to a non-ERM company.

ERM Recordable Incident: A Medical Treatment Incident (MTI), Restricted Work Incident (RWI), Lost Time Incident (LTI), or fatality that meets the requirements in this procedure and which is used in establishing our externally reported Total Recordable Incident Rate (TRIR)..

First aid. First Aid Incident is any injury or illness that does not require medical treatment, require work restrictions or result in Lost Time away from work as defined below. The following are examples of this definition (but not limited to):

- Using a non-prescription medication at non-prescription strength (for medications available in both prescription and non-prescription form, a recommendation by a physician or other licensed health care professional to use a non-prescription medication at prescription strength is considered medical treatment);
- Administering routine preventative tetanus immunizations;
- Cleaning, flushing or soaking wounds on the surface of the skin;
- Using wound coverings such as bandages, Band-Aids™, gauze pads, etc.; or using butterfly bandages or Steri-Strips™ (other wound closing devices such as sutures, staples, etc., are considered medical treatment);
- Using hot or cold therapy;
- Using any non-rigid means of support, such as elastic bandages, wraps, non-rigid back belts, etc. (devices with rigid stays or other systems designed to immobilize parts of the body are considered medical treatment);
- Using temporary immobilization devices while transporting an accident victim (e.g., splints, slings, neck collars, back boards, etc.);
- Drilling of a fingernail or toenail to relieve pressure, or draining fluid from a blister;
- Using eye patches;
- Removing foreign bodies from the eye using only irrigation or a cotton swab;
- Removing splinters or foreign material from areas other than the eye by irrigation, tweezers, cotton swabs or other simple means;
- Using finger guards;
- Using massages (physical therapy or chiropractic treatment are considered medical treatment for recordkeeping purposes); or
- Drinking fluids for relief of heat stress.

Note: The above are considered first aid, whether or not treatment is accepted

Lost Time Incident (LTI – Days Away from Work Recordable): A work-related injury or illness that results in the affected party being unable to report to work for one or more days, excluding the day of injury or onset of illness.

Medical Treatment Incident (MTI – Other Recordable): A work-related injury or illness that requires professional medical treatment, not defined as first aid above, that should be administered by a physician. The following are examples of this definition (but not limited to):

- Sutures,
- Broken bones
- Recommendation of prescription medication
- Loss of consciousness
- Other injury or illness that is not considered first aid

Note: Observation, counselling and scans (xrays, MRI's etc) are not medical treatment.

Near Miss: An unplanned event that did NOT result in injury, illness, or damage – but had the potential to do so. Only a fortunate break in the chain of events prevented an injury, illness, property damage or environmental impact. For example, slipping on a staircase and falling to the ground that results in no injury, visible bruising and/or lasting impacts (i.e. pain/discomfort). If the same event were to result in visible bruising and/or lasting impacts with no medical treatment, the event would be classified as first-aid.

Regulatory Recordable Incident: An injury or illness that is considered recordable within the jurisdiction of the affected employee. These requirements may be more or less stringent than the ERM Recordable definition.

Reportable Injury: Any injury or illness that must be reported to a governmental authority within the jurisdiction of the affected employee.

Restricted Work Incident (RWI). A work-related injury or illness where:

- The employee is restricted by an ERM manager from performing one or more of the routine functions of his or her job, or from working the full workday that he or she would otherwise have been scheduled to work; or
- A physician or other licensed health care professional recommends that the employee not perform one or more of the routine functions of his or her job, or not work the full workday that he or she would otherwise have been scheduled to work.

Routine functions. For recordkeeping purposes, an employee's "routine functions" are those work activities the employee regularly performs at least once per week.

Workplace: Any location where one or more employees are directly engaged in activities related to the performance of their work assignment, or are present as a condition of their employment.

The workplace includes not only physical locations, but also the equipment or materials used by the employee during the course of work.

Work Related: An injury or illness is considered work-related if an event or exposure in the workplace either:

- caused or contributed to the resulting condition; or
- significantly aggravated a pre-existing injury or illness.

The following exceptions to "work-related" apply:

- At the time of the injury or illness, the employee was present in the work environment as a member of the general public rather than as an employee.
- The injury or illness involves signs or symptoms that surface at work but result solely from a non-work-related event or exposure that occurs outside the work environment.
- The injury or illness results solely from voluntary participation in a wellness program or in a medical, fitness, or recreational activity such as blood donation, physical examination, flu shot, exercise class, racquetball, or baseball.
- The injury or illness is solely the result of an employee eating, drinking, or preparing food or drink for personal consumption (whether bought on the employer's premises or brought in).
- The injury or illness is solely the result of an employee doing personal tasks (unrelated to their employment) at the establishment outside of the employee's assigned working hours.
- The injury or illness is solely the result of personal grooming, self medication for a non-work-related condition, or is intentionally self-inflicted.
- The injury or illness is caused by a motor vehicle accident and occurs on a company parking lot or company access road while the employee is commuting to or from work.
- The illness is the common cold or flu (note: other contagious diseases such as tuberculosis, brucellosis, hepatitis A, or plague may be considered work-related if the employee is confirmed as having been infected at work).
- The illness is a mental illness.

4. Procedure

4.1 Mandatory Notification

All Employees shall immediately notify their supervisor of any injury and/or illness suspected to be work-related.

Any injury or illness known or suspected to be work related shall also be verbally disclosed as quickly as possible following the occurrence, and no later than the end of the current work shift, to the PIC (for project-related events) or Office Head (for non-project related events), and the

BU H&S Lead. In addition, the employee shall enter the event into ECS within 24 hours (if able; otherwise, the employee's Line Manager shall enter the event).

4.2 ERM Recordable Injury

Within three (3) days of receiving notification of an injury or illness, the Regional H&S Lead, or designee, shall document whether an event is Recordable within ECS. If information relevant to the injury or illness becomes available after the initial submittal of the event into ECS, the Regional H&S Lead shall update the record as soon as practical.

A separate ECS entry shall be completed for each ERM employee with an injury/illness.

In the event of dispute/disagreement, the GHSD, in consultation with the responsible Regional H&S Lead, RCEO, ERM Legal Department and Executive Committee leadership, will make final case determinations regarding ERM Recording of work-related injury and illness cases. Interpretation of the recording rationale will be documented and maintained by the GHSD, The final determination will be documented by the GHSD within 90 days of the incident, to the extent practicable based on the availability of necessary information.

4.2.1 Determination of Work Related

The Regional H&S Lead shall determine if an injury is Work Related, based on the definitions and exceptions in Section 3. Two special conditions are discussed below.

Injury/illness while traveling. An injury/illness that occurs while an employee is travelling for business is work-related if, at the time of the injury or illness, the employee was engaged in work activities "in the interest of the employer" (e.g., travel to and from clients, conducting job tasks, site visits, and business entertaining). Exceptions to this requirement include:

- Home away from home. When a travelling employee checks into a hotel, motel, or into another temporary residence, he or she establishes a "home away from home." The employee's activities after he or she checks into the hotel, motel, or other temporary residence must be evaluated for their work-relatedness in the same manner as the activities of a non-travelling employee. When the employee checks into the temporary residence, he or she is considered to have left the work environment. When the employee begins work each day, he or she re-enters the work environment. If the employee has established a "home away from home" and is reporting to a fixed worksite each day, injuries/illnesses are not work-related if they occur while the employee is commuting between the temporary residence and the job location.
- Injuries that occur during a Personal Detour. Injuries or illnesses are not considered work-related if they occur while the employee is on a personal detour from a reasonably direct route of travel (e.g, has taken a side trip for personal reasons).

Injury/illness while working at home. An injury/illness that occurs while an employee is working at home, including work in a home office, is work-related if the injury/illness occurs while the

employee is performing work for pay or compensation in the home, and the injury or illness is directly related to the performance of work rather than to the general home environment or setting.

4.2.2 Determination of ERM Recordable

A work-related injury or illness incurred by an ERM employee is considered ERM Recordable if it results in one or more of the following:

- Death;
- Days away from work;
- Restricted work or transfer to another job;
- Medical treatment beyond first aid;
- Loss of consciousness;
- Constitutes a needle stick or sharp injury; or
- A significant injury or illness diagnosed by a physician or other licensed health care professional as work related

The following medical activities are specifically excluded from the definition of "medical treatment" and do not trigger a recording requirement:

- Visits to a physician or other licensed health care professional solely for observation or counselling; and
- The conduct of diagnostic procedures, such as x-rays and blood tests, including the administration of prescription medications (as defined by local jurisdictions) used solely for diagnostic purposes (e.g., eye drops to dilate pupils)
- First aid.
- If medical prophylaxis is used for the prevention of malaria or other diseases while travelling.
- If herbal or natural supplements are used.
- If oxygen is used while working at elevations as used a part of a normal work practice, not for the treatment of altitude sickness of other working at higher elevation illnesses.
- If medications for the prevention of seasickness or motion sickness are used.

4.2.3 Determining Duration of Hospitalization, Lost Time and Restricted Work

Within 3 days of receiving notice of an injury/illness from ECS, the Regional H&S Lead shall make a general estimate of the number of days that the employee may experience:

- Hospitalization: time spent within a hospital or other in-patient medical facility.
- Lost time: time spent away from work as designated by a physician or other licensed health care professional.

- Restricted work: time when an employee cannot perform their routine duties, at the direction of a physician or other licensed health care professional, or their ERM Line Manager.

If the estimated duration has elapsed without the condition being resolved, the Regional H&S Lead shall update ECS with a revised estimate. Once the actual duration of these conditions is known, the Regional H&S Lead shall update ECS with the actual duration.

When determining duration, the following considerations apply:

- Do not count the day that the injury/illness occurred.
- Count calendar days from day following the occurrence of the injury/illness.
- If the injury/illness occurs prior to a day that the employee was not scheduled to work (e.g., holiday or weekend), these unscheduled days are only counted if you receive information from the physician or other licensed health care professional that the employee should not have worked, or should have performed restricted work, during the unscheduled period.
- The maximum total days of lost time plus restricted work that shall be recorded is 180 days (the 180-day cap).

4.3 Regulatory Recordable Injury and Reporting

Local regulatory recording and reporting requirements may be different from ERM recording requirements.

As appropriate following a proper review of the conditions/circumstances associated with the injury or illness, and in accordance with promulgated time expectations for reporting by the appropriate regulatory authorities, ERM will submit the required information to the respective entity(ies) [such as U.S. OSHA, U.S. Mine Safety and Health Administration (MSHA), UK Health and Safety Executive (HSE), etc.]. Communications with regulatory authorities will be conducted by the Business Unit Managing Partner (or designee), in consultation with the Regional H&S Lead, GHSD and the Legal Department.

4.4 Record Keeping

ERM maintains statistics associated with Injury and Illness Reporting that are submitted to the Senior Leadership Team on a monthly basis. The reports document, among other things, the Total Recordable Incident Rate (TRIR) and the number of Restricted Work Days and Lost Time Days.

4.4.1 Calculating TRIR

TRIR is calculated as:

$$TRIR = \frac{(Number\ of\ ERM\ Recordable\ Injuries\ \&\ Illnesses) * 200{,}000}{Number\ of\ Hours\ Worked\ by\ ERM}$$

Where:

- "Number of ERM Recordable Injuries & Illnesses" is as defined in Section 4.2. The calculation shall be based upon the rational identified within the completed "Recordability Review Form." If further investigation of the event results in a modification to the information on the form, the TRIR number will be modified accordingly.
- "200,000" is a standard normalization factor based on the typical number of hours worked by 100 employees
- "Number of Hours Worked by ERM" is based on info obtained from GMS for full- or part-time employees, and does not include recorded sick time, vacation time or holidays.

4.4.2 Calculating Restricted Work Day and Lost Time Days

Restricted Work Days and Lost Time Days shall be calculated as follows:

- The number of days reported on a monthly basis will be either:
    - For completed (or "Closed") events, where the employee has returned to full duty, the actual number of restricted or lost time days shall be reported.
    - For ongoing (or "Open") events, where the employee remains on restricted duty or off work, the number of total days reported shall be estimated.

- The number of days reported on annual reports will be either:
    - For completed (or "Closed") events, where the employee has returned to full duty, the actual number of restricted or lost time days shall be reported.
    - For ongoing (or "Open") events, where the employee remains on restricted duty or off work, the number of days reported shall be estimated, unless otherwise indicated. In this case, when the actual number of days becomes known, the subsequent annual report shall, if appropriate, report the revised "Final" data for the previous reporting year.

5. References

None

Document Control Information

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Approved by: Gary Beswick on 29 December 2014

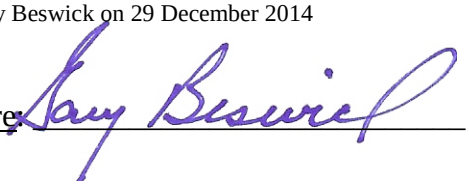
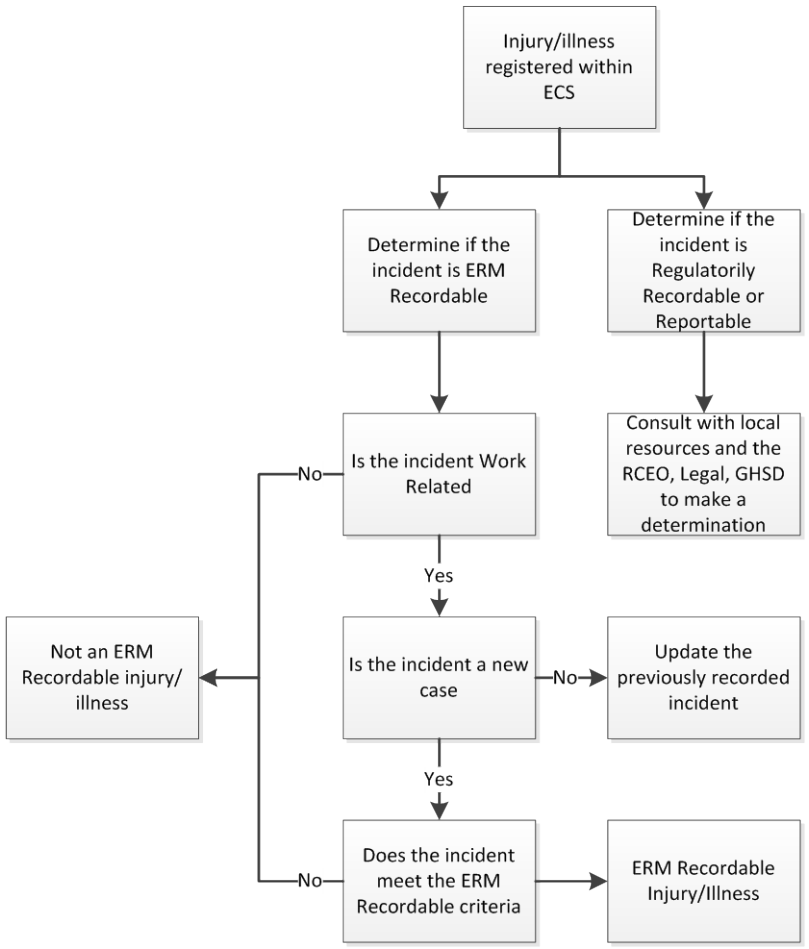
Approval Signature: 

Figure 1 – Recordability Decision Process



Revision History

Section	Version: Reason for Revision	Date
All	1.0: New document.	29 Dec 2014

1 PURPOSE AND SCOPE

This document describes how employees recognize, re-assess and properly address changed conditions. The main focus of this document pertains to management of change with respect to health, safety and the environment (HSE). ERM has other procedures to address change management related to project management (scope, schedule and budget management of change).

2 ROLES AND RESPONSIBILITIES

Partner in Charge (PIC). Own and set the tone for the management of change (MOC) process on projects; approve changes within their authority level.

Project Manager (PM). Encourage and demonstrate the MOC process; work with employees and contractors to understand the changed conditions, assess the hazards, and mitigate the risk.

Employees. Implement the MOC process on all activities, every day; notify the appropriate person as soon as a changed condition occurs; continually assess conditions and implement procedures to address any identified hazards.

Health and Safety (H&S) Professionals. Support and advise on the MOC process; develop and communicate 'lessons learned'.

Global Health and Safety Director (GHSD). Own the overall Management of Change process as it relates to implementing the Safety Management System.

3 DEFINITIONS

Baseline Condition. The expected situation or setting that provided the basis for project planning, specifically HSE planning. The baseline condition can be adjusted during the activity through the MOC process.

Change. Situations that differ from the expected baseline conditions. Change could result from:

- Actions or expectations of stakeholders
- Alternate equipment
- Contractor performance
- Modifications to the scope of work
- Project design
- Procedure revisions
- Regulations and regulatory visits
- Schedule modifications
- Staff
- Third party actions
- Updates to legal requirements or client requirements
- Weather conditions
- Office modifications

Management of Change (MOC). Addressing changed conditions in a systematic, safe manner to assess new hazards and minimize the risks associated with the change(s). MOC includes assessing the impact of the change(s) and integrating all approved steps and precautions to minimize the risks.

4 PROCEDURE

4.1 Managing Change

Effective change management involves identifying, discussing, addressing and learning from changes. To support this process, all employees have access to "SNAP" cards: Scan, Notice, Analyze, and Perform; see ***M1-ERM-004-FM1***. The SNAP cards summarize a systematic approach to looking for and evaluating changed conditions.

4.1.1 Identifying Change (Scan, Notice)

All employees are responsible for understanding the baseline conditions of an activity, prior to implementation. With regard to H&S, the baseline conditions document the anticipated hazards and risk mitigation tools that apply to the activity. The baseline conditions may be defined in a variety of documents:

- Scope of work for the project;
- Hazard profile;
- Job Hazard Analysis (JHA);
- Health & Safety Plan (HASP);
- Daily tailgate safety briefings; and
- Applicable Operational Controls

Change occurs when the actual conditions differ from the baseline conditions. Employees must look for changes before performing any task.

When an employee identifies a change, they are expected to apply the concepts of ERM's Observation and Feedback Program (OFP) to See, Own, and Share potential hazards:

- **Seeing**: Being able to identify hazards and the degree to which they are or are not controlled.
- **Owning**: Taking action – from immediate abatement to development of corrective actions – to address the hazard.
- **Sharing**: Working inside a zero blame culture to share lessons learned from both big and small things that are "Seen" and "Owned" every day.

Additional information on the OFP program can be found on Minerva.

4.1.2 Assessing the Impact of Change (Analyze)

Employees who identify a changed condition shall assess the potential risks associated with the change, and communicate that change commensurate with the potential risk.

Risk is best understood when discussed among the project or office team. This discussion may be part of:

- Ad hoc project or office meetings / discussions, in the field or on the phone, to brainstorm about the identified change.
- Daily Tailgate Meetings offer the opportunity every day to restate the scope and to remind all participants to identify, assess and address changes.
- Contractor Meetings to discuss the scope and note that any changes need to be raised promptly and addressed.

When in doubt, notify the PIC and/or PM, Line Manager, and H&S professional staff to discuss the change and the potential risk.

4.1.3 Addressing Change (Perform)

The most effective means of addressing change is to take the time to stop/pause the activity and think about the implications of the change.

All employees have Stop or Pause Work Authority to consider changed conditions.

Depending upon the nature of the change, it may be easily addressed by the individual discovering the change, or it may require input and approval by the PM, PIC, or Client.

Risk associated with identified change must be mitigated prior to continuing with activities. This may involve a review and revision to the baseline condition and the associated project documentation. Revisions to the Project JHAs and/or HASP may be required, depending on the severity of the change. Revisions need not be "formal." Hand-written notes on field documentation may be sufficient in lower potential risk situations. Input from a H&S Professional and documented PIC/PM approval may be warranted for higher potential risk situations (or if required by other procedures, e.g., Subsurface Clearance).

Managing Change is not a project unto itself, but rather the identification of the need to pause/stop and go back through the hazard recognition process and modify the health & safety planning documents and activities as needed.

4.1.4 Learning from Change

Effective change management should be communicated to the organization. PICs, PMs or employees who participate in a 'high learning value' MOC should communicate the lessons learned to the Business Unit (BU) H&S Lead. The BU H&S Lead will work with the PIC/PM to develop a lessons-learned bulletin, which can be communicated to the organization in accordance with the ***Communication, Participation and Consultation*** Procedure.

4.2 Management of Change Training

ERM has a MOC training module built into our OFP training curriculum that is required for all personnel. The training identifies and discusses proactive steps to address barriers to effectively managing change, and presents role playing examples for dealing with identified changes.

5 REFERENCES

- M1-ERM-004-FM1 – SNAP Card
- M1-ERM-002-PR – Hazard Identification and Risk Assessment Procedure
- M1-ERM-010-PR – Communication, Participation and Consultation Procedure

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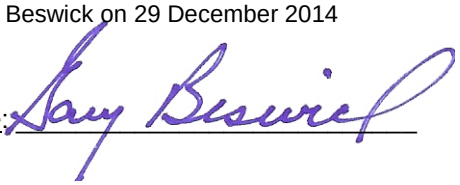
Approval Signature: 

Revision History

Section	Version: Reason for Revision	Date
All	1.0: New document.	29 Dec 2014

1. Purpose and Scope

This procedure is designed to ensure that information necessary for the safe use, handling, and storage of hazardous chemicals is provided and made available to all ERM employees. This document applies to all ERM employees and covers all ERM work activities.

2. Roles and Responsibilities

Regional Health and Safety (H&S) Director: Responsible for ensuring that a written hazard communication program is prepared, implemented, and regularly evaluated for applicability.

Partner in Charge (PIC): Responsible for the following elements:

- Ensure this program is implemented, understood, and followed by employees under their charge and working on their projects;
- Ensure, in conjunction with the Branch Manager/Project Manager, that employees are properly trained in accordance with this procedure;
- Ensure that any site-specific health and safety plans (HASP) address hazard communication elements as described herein; and
- Correct any deficiencies in the implementation of this program as identified by the Division H&S Leader.

Branch Manager/Project Manager: Responsible for the following elements:

- 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 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.

Division H&S Leader: Responsible for the following elements:

- Monitor new employees for completion of appropriate training;
- Assist PICs, Branch 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 Branch 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

Labels on all containers of chemicals, whether used, handled, or stored in the field or on ERM property, 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.

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 do not have to be labeled providing:

- The person who transferred the chemical into the portable container is the only person who will use the chemical; 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 S3-NAM-011-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 minimum data which must appear on an SDS is provided in S3-NAM-011-WI2 (*Safety Data Sheet Composition*).

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 Division H&S Leader 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, Branch 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 Branch Manager will work with the Division H&S Leader 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 will be made available, upon request, to any ERM employee, contractor, or client. Upon receipt of an SDS, the Project Manager/Branch Manager shall review the SDS to ensure it is written in English, is legible, appears to be complete (in accordance with the requirements outlined in S3-NAM-011-WI2), and is current, with an effective date of less than five years. Older SDS will be replaced with updated sheets when they are received.

4.4 Contractors

The Project Manager will provide the following information to contractors 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 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 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;
- 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 work/handling practices, use of PPE, and emergency response procedures;
- How to read and use SDS and labels; 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, etc. will be documented as part of daily safety meetings at the project site using S3-NAM-029-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 Form S3-NAM-011-FM1 (Chemical Inventory Sheet)
- ERM Work Instruction S3-NAM-011-WI1 (Examples of Common Labeling Systems)
- ERM Procedure S3-NAM-029-PR (Project Health and Safety)
- ERM Procedure S3-NAM-006-PR (Emergency Action Plans)

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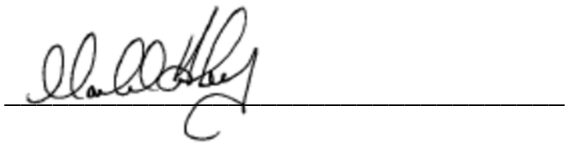
Approval Signature: 

Revision History

Section	Reason for Revision	Date
All	Changed format; updated to meet state and federal regulations	6/2/15

Safety data sheets (SDS) acquired for use at ERM offices and project sites should contain the following information.

Section 1: Identification

This section identifies the chemical on the SDS as well as the recommended uses. It also provides the essential contact information of the supplier. The required information consists of:

- Product identifier used on the label and any other common names or synonyms by which the substance is known.
- Name, address, phone number of the manufacturer, importer, or other responsible party, and emergency phone number.
- Recommended use of the chemical (e.g., a brief description of what it actually does, such as flame retardant) and any restrictions on use (including recommendations given by the supplier).

Section 2: Hazard Identification

This section identifies the hazards of the chemical presented on the SDS and the appropriate warning information associated with those hazards. The required information consists of:

- The hazard classification of the chemical (e.g., flammable liquid, category1).
- Signal word.
- Hazard statement(s).
- Pictograms (the pictograms or hazard symbols may be presented as graphical reproductions of the symbols in black and white or be a description of the name of the symbol (e.g., skull and crossbones, flame).
- Precautionary statement(s).
- Description of any hazards not otherwise classified.
- For a mixture that contains an ingredient(s) with unknown toxicity, a statement describing how much (percentage) of the mixture consists of ingredient(s) with unknown acute toxicity. Please note that this is a total percentage of the mixture and not tied to the individual ingredient(s).

Section 3: Composition/Information on Ingredients

This section identifies the ingredient(s) contained in the product indicated on the SDS, including impurities and stabilizing additives. This section includes information on substances, mixtures, and all chemicals where a trade secret is claimed. The required information consists of:

Substances

- Chemical name.
- Common name and synonyms.
- Chemical Abstracts Service (CAS) number and other unique identifiers.
- Impurities and stabilizing additives, which are themselves classified and which contribute to the classification of the chemical.

Mixtures

- Same information required for substances.
- The chemical name and concentration (i.e., exact percentage) of all ingredients which are classified as health hazards and are:
    - Present above their cut-off/concentration limits or
    - Present a health risk below the cut-off/concentration limits.
- The concentration (exact percentages) of each ingredient must be specified except concentration ranges may be used in the following situations:
    - A trade secret claim is made,
    - There is batch-to-batch variation, or
    - The SDS is used for a group of substantially similar mixtures.

Chemicals where a trade secret is claimed

- A statement that the specific chemical identity and/or exact percentage (concentration) of composition has been withheld as a trade secret is required.

Section 4: First-Aid Measures

This section describes the initial care that should be given by untrained responders to an individual who has been exposed to the chemical. The required information consists of:

- Necessary first-aid instructions by relevant routes of exposure (inhalation, skin and eye contact, and ingestion).
- Description of the most important symptoms or effects, and any symptoms that are acute or delayed.
- Recommendations for immediate medical care and special treatment needed, when necessary.

Section 5: Fire-Fighting Measures

This section provides recommendations for fighting a fire caused by the chemical. The required information consists of:

- Recommendations of suitable extinguishing equipment, and information about extinguishing equipment that is not appropriate for a particular situation.
- Advice on specific hazards that develop from the chemical during the fire, such as any hazardous combustion products created when the chemical burns.
- Recommendations on special protective equipment or precautions for firefighters.

Section 6: Accidental Release Measures

This section provides recommendations on the appropriate response to spills, leaks, or releases, including containment and cleanup practices to prevent or minimize exposure to people, properties, or the environment. It may also include recommendations distinguishing between responses for large and small spills where the spill volume has a significant impact on the hazard. The required information may consist of recommendations for:

- Use of personal precautions (such as removal of ignition sources or providing sufficient ventilation) and protective equipment to prevent the contamination of skin, eyes, and clothing.
- Emergency procedures, including instructions for evacuations, consulting experts when needed, and appropriate protective clothing.
- Methods and materials used for containment (e.g., covering the drains and capping procedures).
- Cleanup procedures (e.g., appropriate techniques for neutralization, decontamination, cleaning or vacuuming; adsorbent materials; and/or equipment required for containment/clean up).

Section 7: Handling and Storage

This section provides guidance on the safe handling practices and conditions for safe storage of chemicals. The required information consists of:

- Precautions for safe handling, including recommendations for handling incompatible chemicals, minimizing the release of the chemical into the environment, and providing advice on general hygiene practices (e.g., eating, drinking, and smoking in work areas is prohibited).
- Recommendations on the conditions for safe storage, including any incompatibilities. Provide advice on specific storage requirements (e.g., ventilation requirements).

Section 8: Exposure Controls/Personal Protection

This section indicates the exposure limits, engineering controls, and personal protective measures that can be used to minimize worker exposure. The required information consists of:

- OSHA Permissible Exposure Limits (PELs), American Conference of Governmental Industrial
- Hygienists (ACGIH) Threshold Limit Values (TLVs), and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the safety data sheet, where available.
- Appropriate engineering controls (e.g., use local exhaust ventilation, or use only in an enclosed system).
- Recommendations for personal protective measures to prevent illness or injury from exposure to chemicals, such as personal protective equipment (PPE) (e.g., appropriate types of eye, face, skin or respiratory protection needed based on hazards and potential exposure).
- Any special requirements for PPE, protective clothing or respirators (e.g., type of glove material, such as PVC or nitrile rubber gloves; and breakthrough time of the glove material).

Section 9: Physical and Chemical Properties

This section identifies physical and chemical properties associated with the substance or mixture. The minimum required information consists of:

- Appearance (physical state, color, etc.);
- Odor and odor threshold;
- pH;
- Melting point/freezing point;
- Initial boiling point and boiling range;
- Flash point;
- Evaporation rate;
- Flammability (solid, gas);
- Upper/lower flammability or explosive limits;
- Vapor pressure;
- Vapor density;
- Relative density;
- Solubility(ies);
- Partition coefficient: n-octanol/water;
- Auto-ignition temperature;
- Decomposition temperature; and
- Viscosity.

The SDS may not contain every item on the above list because information may not be relevant or is not available. When this occurs, a notation to that effect must be made for that chemical property. Manufacturers may also add other relevant properties, such as the dust deflagration index (Kst) for combustible dust, used to evaluate a dust's explosive potential.

Section 10: Stability and Reactivity

This section describes the reactivity hazards of the chemical and the chemical stability information. This section is broken into three parts: reactivity, chemical stability, and other. The required information consists of:

Reactivity

- Description of the specific test data for the chemical(s). This data can be for a class or family of the chemical if such data adequately represent the anticipated hazard of the chemical(s), where available.

Chemical stability

- Indication of whether the chemical is stable or unstable under normal ambient temperature and conditions while in storage and being handled.
- Description of any stabilizers that may be needed to maintain chemical stability.
- Indication of any safety issues that may arise should the product change in physical appearance.

Other

- Indication of the possibility of hazardous reactions, including a statement whether the chemical will react or polymerize, which could release excess pressure or heat, or create other hazardous conditions. Also, a description of the conditions under which hazardous reactions may occur.
- List of all conditions that should be avoided (e.g., static discharge, shock, vibrations, or environmental conditions that may lead to hazardous conditions).
- List of all classes of incompatible materials (e.g., classes of chemicals or specific substances) with which the chemical could react to produce a hazardous situation.
- List of any known or anticipated hazardous decomposition products that could be produced because of use, storage, or heating. (Hazardous combustion products should also be included in Section 5 (Fire-Fighting Measures) of the SDS.)

Section 11: Toxicological Information

This section identifies toxicological and health effects information or indicates that such data are not available. The required information consists of:

- Information on the likely routes of exposure (inhalation, ingestion, skin and eye contact). The SDS should indicate if the information is unknown.
- Description of the delayed, immediate, or chronic effects from short- and long-term exposure. The numerical measures of toxicity (e.g., acute toxicity estimates such as the LD50 (median lethal dose)) - the estimated amount [of a substance] expected to kill 50% of test animals in a single dose.
- Description of the symptoms. This description includes the symptoms associated with exposure to the chemical including symptoms from the lowest to the most severe exposure.
- Indication of whether the chemical is listed in the National Toxicology Program (NTP)
- Report on Carcinogens (latest edition) or has been found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs (latest editions) or found to be a potential carcinogen by OSHA.

Section 12: Ecological Information (non-mandatory)

This section provides information to evaluate the environmental impact of the chemical(s) if it were released to the environment. The information may include:

- Data from toxicity tests performed on aquatic and/or terrestrial organisms, where available (e.g., acute or chronic aquatic toxicity data for fish, algae, crustaceans, and other plants; toxicity data on birds, bees, plants).
- Whether there is a potential for the chemical to persist and degrade in the environment either through biodegradation or other processes, such as oxidation or hydrolysis.
- Results of tests of bioaccumulation potential, making reference to the octanol-water partition coefficient (Kow) and the bioconcentration factor (BCF), where available.
- The potential for a substance to move from the soil to the groundwater (indicate results from adsorption studies or leaching studies).
- Other adverse effects (e.g., environmental fate, ozone layer depletion potential, photochemical ozone creation potential, endocrine disrupting potential, and/or global warming potential).

Section 13: Disposal Considerations (non-mandatory)

This section provides guidance on proper disposal practices, recycling or reclamation of the chemical(s) or its container, and safe handling practices. To minimize exposure, this section should also refer the reader to Section 8 (Exposure Controls/Personal Protection) of the SDS.

The information may include:

- Description of appropriate disposal containers to use.
- Recommendations of appropriate disposal methods to employ.
- Description of the physical and chemical properties that may affect disposal activities.
- Language discouraging sewage disposal.
- Any special precautions for landfills or incineration activities.

Section 14: Transport Information (non-mandatory)

This section provides guidance on classification information for shipping and transporting of hazardous chemical(s) by road, air, rail, or sea. The information may include:

- UN number (i.e., four-figure identification number of the substance).
- UN proper shipping name.
- Transport hazard class(es).
- Packing group number, if applicable, based on the degree of hazard.
- Environmental hazards (e.g., identify if it is a marine pollutant according to the International Maritime Dangerous Goods Code (IMDG Code)).
- Guidance on transport in bulk (according to Annex II of MARPOL 73/783 and the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (International Bulk Chemical Code (IBC Code)).
- Any special precautions which an employee should be aware of or needs to comply with, in connection with transport or conveyance either within or outside their premises (indicate when information is not available).

Section 15: Regulatory Information (non-mandatory)

This section identifies the safety, health, and environmental regulations specific for the product that is not indicated anywhere else on the SDS. The information may include any national and/or regional regulatory information of the chemical or mixtures (including any OSHA, Department of Transportation, Environmental Protection Agency, or Consumer Product Safety Commission regulations).

Section 16: Other Information

This section indicates when the SDS was prepared or when the last known revision was made. The SDS may also state where the changes have been made to the previous version. You may wish to contact the supplier for an explanation of the changes. Other useful information also may be included here

1. Purpose and Scope

This document establishes safe work 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 operations. Note that respiratory protection (*S3-NAM-026-PR*) and hearing protection (*S3-NAM-014-PR*) 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 Division Health and Safety (H&S) Leader.

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 Division H&S Leader, any observed deficiencies in the implementation of this procedure.

Division H&S Leader: 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 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 multiple basic types of hazards which may be able 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.

4.2 PPE Selection

Once hazards have been identified and evaluated though the hazard assessment process, 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;
- Adequacy of 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, S3-NAM-021-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 in the field. 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. S3-NAM-021-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, and other hand injuries. S3-NAM-047-PR (*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) must be worn whenever a hazard exists from falling objects or other impact/bump hazards. The inner suspension of the hard hat must be inspected regularly 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.

4.3 Training

Employees shall receive training on PPE. 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 *S3-NAM-021-WI1* and *S3-NAM-021-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 Division HSSE Leader will observe the condition of employee PPE.

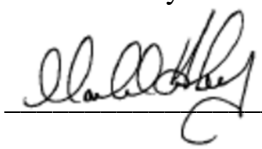
5. References

- ERM Work Instruction S3-NAM-021-WI1 (*Prescription Protective Eyewear*)
- ERM Work Instruction S3-NAM-021-WI2 (*Protective Footwear*)
- ERM Work Instruction S3-NAM-021-WI3 (*Selection, Care, and Use of Flame-Resistant Clothing*)
- ERM Procedure S3-NAM-047-PR (*Safe Use of Cutting Tools*)

Document Control Information

Original Effective Date: 2/10/15

Policy Approval by: Mark Hickey

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

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 Division Health and Safety (H&S) Leader 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 Division H&S Leader, any observed deficiencies in the implementation of this procedure.

Regional H&S Director: Responsible for the development and implementation of this procedure.

Division H&S Leader: 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 wither 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 whoever 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 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 int heir 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 of noisy operations (e.g., drilling).

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 is responsible for making this determination.

4.6 Training

Hazard recognition and general awareness training on hearing conservation is provided to all ERM employees during the new hire orientation process which occurs during the first week 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. 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); and

- Purpose of audiometric testing program including an explanation of the test procedure.

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.

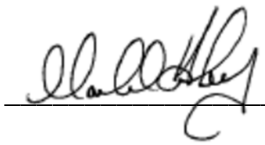
5. References

- US Occupational Safety and Health Administration (OSHA) regulations – 29 CFR 1910.95; *Occupational Noise Exposure*

Document Control Information

Original Effective Date: 3/17/14

Policy Approval by: Mark Hickey

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

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 Division Health and Safety (H&S) Leader 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 Division H&S Leader, any observed deficiencies in the implementation of this procedure.

Division H&S Leader: Responsible for the following elements:

- Evaluate implementation of this procedure during project audits; and
- Communicate identified deficiencies to the PIC..

3. Definitions

Portable Power Equipment: Electric, pneumatic, gasoline or explosive-actuated hand tools.

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.

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.

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.

4.2 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.

5. References

- Occupational Health and Safety Adminsitration (OSHA) Regulation 29 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)

Document Control Information

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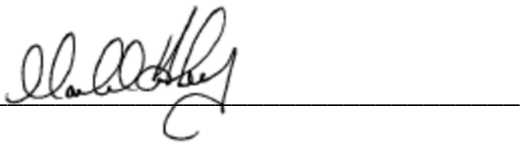
Approval Signature: 

Revision History

Section	Reason for Revision	Date
All	New document.	6/29/2015

No.	Issue	Considered?	Additional Actions Necessary Before Beginning Work?
Personnel Management			
1	Has an effort been made to secure at least a two-person team for this field work?	☒ Y ☐ N ☐ NA	Click here to enter text.
2	If only one person is making the site visit, has that decision been reviewed and approved by the Partner-in-Charge (PIC), in consultation with the H&S Team?	☐ Y ☐ N ☒ NA	Click here to enter text.
3	Has someone been designated as the team leader to supervise the site activities?	☒ Y ☐ N ☐ NA	Click here to enter text.
4	Does the team have instructions on where to park safely?	☒ Y ☐ N ☐ NA	Click here to enter text.
5	Has the most appropriate location for site entry been determined?	☒ Y ☐ N ☐ NA	Click here to enter text.
6	Has the client/site been notified that an ERM representative will be on site so that entry and security issues are addressed?	☒ Y ☐ N ☐ NA	Click here to enter text.
7	Has a site map been provided, if available?	☒ Y ☐ N ☐ NA	Click here to enter text.
8	Has ERM been informed of any hazards unique to this site?	☒ Y ☐ N ☐ NA	Click here to enter text.
9	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 location, a Journey Management Plan is required and should be appended to the HASP. Consult ERM H&S Standard #S1-ERM-005-ST (*Travel Risk Assessment*) for requirements.	☒ Y ☐ N ☐ NA	Click here to enter text.
Field Communications			
1	Do team members have a reliable means of communicating with other ERM team members in event of an emergency (e.g., mobile phone, two-way radio, satellite phone or beacon, etc.)?	☒ Y ☐ N ☐ NA	Click here to enter text.
2	Is there a plan in place to ensure that the Project Manager or PIC communicates with the field team members during the day and when all team members have safely left the site at the end of the day and arrived back at their evening destination?	☒ Y ☐ N ☐ NA	Click here to enter text.
3	Has a plan been developed on how to address or deal with unauthorized people encountered on or near the site?	☒ Y ☐ N ☐ NA	Click here to enter text.

No.	Issue	Considered?	Additional Actions Necessary Before Beginning Work?
Field Safety			
1	Have PPE requirements been evaluated and the following minimum issues been considered?	☐ Y ☐ N ☐ NA	Click here to enter text.
	• Sturdy work boots (steel-toed/steel shank if crushing or puncture hazards are present)	☒ Y ☐ N ☐ NA	Click here to enter text.
	• Long pants/long-sleeved shirt (protection against poisonous plants, insects, and sunburn)	☒ Y ☐ N ☐ NA	Click here to enter text.
	• Safety glasses (if potential for flying particulates is present)	☒ Y ☐ N ☐ NA	Click here to enter text.
	• Gloves (leather or Kevlar for exposure to cut, pinch, or abrasion hazards; chemical resistant gloves as needed)	☒ Y ☐ N ☐ NA	Nitrile Gloves ONLY
	• Hi-visibility vest (potential exposure to vehicle traffic)	☒ Y ☐ N ☐ NA	Click here to enter text.
	• Hard hat (falling objects, struck against, or contact between head and electrical shock hazard is present)	☒ Y ☐ N ☐ NA	Click here to enter text.
2	Is there a process in place to monitor weather forecasts?	☒ Y ☐ N ☐ NA	Click here to enter text.
3	Is there a sheltering plan in the event of inclement weather?	☒ Y ☐ N ☐ NA	Click here to enter text.
4	Is there access to potable water on the site or have plans been made to bring water with the team members?	☒ Y ☐ N ☐ NA	Click here to enter text.
5	Is an ERM-approved first aid kit immediately available?	☒ Y ☐ N ☐ NA	Click here to enter text.
6	Is there at least on first aid trained person on site?	☒ Y ☐ N ☐ NA	Click here to enter text.
7	Is the team aware of any local plants, insects, arachnids, or animals that could carry disease or cause harm?	☒ Y ☐ N ☐ NA	Click here to enter text.
8	If so, have appropriate repellents, clothing, or other protective measures been considered and acquired?	☒ Y ☐ N ☐ NA	Click here to enter text.
9	If a team member is allergic to any natural agents, do they have the appropriate medications with them?	☒ Y ☐ N ☐ NA	Click here to enter text.
10	If a team member is allergic to any natural agents, are other team members aware of the allergy and knowledgeable about the location and application of appropriate medications?	☒ Y ☐ N ☐ NA	Click here to enter text.
11	Has the team addressed the need for periodic clothing and body inspection to note the presence of disease-bearing insects/arachnids?	☒ Y ☐ N ☐ NA	Click here to enter text.

Your care provider may recommend changes in your work schedule if your work involves the following:

- Stooping or bending over more than ten times each hour
- Climbing a ladder more than three times during an eight-hour shift
- Standing for more than four hours at one time
- Climbing stairs more than three times per shift
- Working more than 40 hours per week
- Shift work
- Lifting more than 50 pounds (23 kg) after the 20th week of pregnancy
- Lifting more than 24 pounds (11 kg) after the 24th week
- Stooping, bending, or climbing ladders after the 28th week
- Needing to lift heavy items after the 30th week
- Needing to stand still for more than 30 minutes of every hour after the 32nd week
- Working with chemicals, solvents, fumes, or radiation

Chemical	Female Affected?	Male Affected?
Anesthetic gases	X	X
Aniline	X	
Benzene	X	
Carbon disulfide	X	X
Chlordecone (Kepone)		X
Dibromochloropropane		X
Ethanol	X	X
Ethylene dibromide		X
Ethylene oxide	X	X
Formaldehyde	X	
Glycol ethers	X	X
Hexane		X
Inorganic lead	X	X
Organic lead	X	X
Methyl mercury	X	
Pesticides	X	X
Phthalic acid esters	X	
Polychlorinated biphenyls (PCBs)	X	
Styrene	X	
Toluene	X	
Vinyl chloride	X	X

Hazard	Gender Exposed	Effects
Inorganic lead	Female	Menstrual disorders, decreased fertility, spontaneous abortion, behavioral or developmental disabilities, breast milk contamination
	Male	Decreased fertility, premature birth, spontaneous abortion, perinatal mortality of fetus
Dibromochloropropane	Male	Decreased fertility
Ethylene oxide	Female	Spontaneous abortion and mutagenesis
Infectious agents (rubella, cytomegalovirus, Hepatitis B, and varicella)	Female	Birth defects
Heat	Male	Decreased fertility
Carbaryl (insecticide)	Female	Birth defects
	Male	Decreased fertility
Organic solvents	Female	Menstrual disorders, spontaneous abortions, toxemia of pregnancy, birth defects
	Male	Decreased fertility, spontaneous abortions, birth defects of fetus
Anesthetic agents	Female	Spontaneous abortions and birth defects
	Male	Infertility and birth defects of fetus
Ionizing radiation	Female	Reproductive disorders in offspring, cancer in offspring, birth defects
	Male	Decreased libido, infertility, mutagenesis

1. Purpose and Scope

The purpose of this procedure is to provide guidance to staff on workplace reproductive hazards and their management. This procedure applies to all ERM North American employees.

2. Roles and Responsibilities

Regional Health and Safety (H&S) Director: Responsible for the following elements:

- Direct implementation of this procedure throughout ERM's North American operations;
- Provide a copy of any state, provincial, or federal regulations related to reproductive hazards upon request by the employee; and
- Facilitate delivery of exposure records to employees upon written request by the employee.

Division H&S Leader: Responsible for the following elements:

- Assist Regional H&S Director in the implementation of this procedure; and
- Assist employees in acquiring medical and exposure records, as needed.

3. Definitions

Reproductive hazard: Any foreign agent that may cause reproductive impairment in female workers, productive dysfunction in male workers, or developmental impairments or death in an embryo, fetus, or child. Other adverse outcomes of exposure may include infertility, decreased libido, altered menses, early fetal loss, spontaneous abortion, premature birth, low birth weight, birth defects, abnormal growth and development, difficulty with milk production, and a variety of childhood cancers.

4. Procedure

It is the goal of ERM to provide a workplace adequately protected from reproductive hazards. With sufficient information, education, work procedures, and appropriate personal protective equipment (PPE), occupational exposure can be managed to limit not only exposure to the reproductive and productive systems of female and male workers, but to protect the overall health and well-being of all employees. S3-NAM-025-WI1 (*Known and Suspected Reproductive Hazards*) and S3-NAM-025-WI2 (*Environmental Chemicals with Known Reproductive Effects*) provide additional information.

4.1 Female Reproductive Hazards

Human and animal studies have identified at least 500 known or suspected reproductive hazards in the workplace. In the US, only four of these are currently regulated: ionizing radiation. Lead, dibromochloropropane, and ethylene oxide. Regulation is based on the potential effects of hazards of reproductive dysfunction in females.

Exposure to reproductive hazards occurring before, during, and after pregnancy may cause adverse outcomes. Exposure to some toxic agents may affect the fetus adversely, even though exposure predates conception. Female exposure before conception can also affect fetal development if the toxin persists in the mother's body, as in the case of polychlorinated biphenyls (PCB) in fat cells and lead in bones. Exposure to physical or chemical mutagens (agents that cause adverse genetic changes) can lead to spontaneous abortion of the fetus or birth defects in the offspring. The following subsections discuss prenatal exposure, postnatal exposure, and work continuance.

4.1.1 Prenatal Exposure

During pregnancy, the time of exposure is a significant factor in determining its effect. In general, exposure occurring during the first 3 weeks of embryonic development may lead to severe damage or death of the embryo. Exposures during the fourth through seventh weeks of gestation, which is when organ development occurs, may produce birth defects. Subsequent exposures may cause postnatal growth or functional abnormalities or damage to the central nervous, immune, or endocrine systems that continue to develop throughout gestation. An agent may be harmful to the embryo or fetus but have no effect on the mother.

4.1.2 Postnatal Exposure

Postnatal parental exposure may affect the growth and development of the offspring. Poor decontamination and hygiene may lead to contaminated work clothes brought into the home by either parent, which can expose offspring to the contaminants. Also, breast milk can be contaminated by exposure to workplace toxins such as PCBs, lead, and mercury, which may be transmitted to the nursing child.

4.1.3 Work Continuance

Birth weights of full-term infants have been shown to be lower when mothers continued work outside the house during the third trimester. Growth retardation has been shown to be most severe when mothers (1) held jobs requiring standing, (2) continued working until near term, (3) were hypertensive, or (4) had other children to care for at home. Third-trimester employment does not appear to shorten the length of gestation regardless of postural requirements. Shift work, night work, and work extending beyond 8 hours a day and 5 days per week (40 hours per week) have been associated with premature birth. However, little evidence indicates that working while pregnant presents a risk of adverse pregnancy outcome.

In general, a pregnant woman may be able to continue regular work until the onset of labor. The determination of whether a pregnant employee can work at a particular job or work site and the modifications necessary, if any, are to be made in conjunction with the pregnant employee, her health care provider, the Divisional H&S Leader, and the Regional H&S Director. Factors affecting this decision-making process include posture, exertion, and other job requirements; potential workplace exposures and their effects; the woman's general physical condition and health status; and her past pregnancy experience.

The Society of Obstetricians and Gynecologists of Canada (SOGC) has published information on working during pregnancy and various work activities to discuss with your care provider. S3-NAM-025-WI3 summarizes these discussion points.

4.2 Male Reproductive Dysfunctions

Scientific research indicates that it is difficult to draw a correlation between direct human exposure to occupational chemicals and other factors that may alter the male reproductive system. Moreover, most research and regulatory policies disregard the male role in procreation, the vulnerability of the male reproductive system to toxic agents, and the potential for adverse effects on reproduction.

ERM follows OSHA requirements to monitor and limit exposures when possible and provides PPE appropriate for the work. With these preventive and protective measures in place, exposure and subsequent effects on reproductive dysfunction can be minimized. Tables 1 and 2 provide a brief overview of factors and chemicals known to cause reproductive dysfunction in male workers.

The primary factors influencing reproductive dysfunction in males are heat stress, alcohol consumption, and ionizing radiation. These factors are discussed in the following sections.

4.2.1 Heat Stress

Among men, frequent or prolonged exposure to heat can result in elevated intra- scrotal temperatures, causing a substantial decrease in sperm count. Occupational exposure to excessive heat has been associated with delayed conception. A decrease in fetal brain weight and other adverse neurological effects on the fetus have been observed in laboratory studies as a result of male exposure to heat stress

4.2.2 Alcohol Consumption

Alcohol consumption can lead to depressed testicular function. At best, alcoholic consumption should be moderate.

4.2.3 Ionizing Radiation

The two most notable genetic effects of ionizing radiation to the male reproductive system are decrease in fertility (low sperm count) and production of mutant genes and aberrations in chromosomes. Mutation, associated with exposure to ionizing radiation, is non-repairable and almost always harmful. Mutations caused by manmade radiation are similar to those that occur naturally. The OSHA exposure limit for whole body ionizing radiation exposure is 5 rems per year.

5. References

- ERM Work Instruction S3-NAM-025-WI1 (Known and Suspected Reproductive Hazards)
- ERM Work Instruction S3-NAM-025-WI2 (Environmental Chemicals with Known Reproductive Effects)
- ERM Work Instruction S3-NAM-025-WI3 (Work Activities to Discuss with Your Care Provider)
- ERM Procedure S3-NAM-003-PR (Access to Medical and Exposure Records)

Document Control Information

Original Effective Date: 1/23/15

Policy Approval by: Mark Hickey

Approval Signature: 

Revision History

Section	Reason for Revision	Date
All	New procedure.	1/23/15
All	Updated format of procedure; minor language revisions.	6/3/15

Perform

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

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.

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

M1-ERM-004-FM1, Version 6

Scan

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

Safety AT ERM
Risk Management

SNAP Assessment
Scan
Notice
Analyze
Perform

Activity Level Risk Review

ERM

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

- Almost certain
- Has happened
- Possible
- Heard of
- Unlikely
- Almost impossible

Exposure to the risk

- Weekly
- Daily
- Current Task

Consequence/Outcome

Injury	Impact
Multiple fatalities	Catastrophic
Fatality	Major
Disability	Significant
Serious (LTI)	Serious
Medical Treatment	Moderate
First Aid	Minor

Project Introduction and Background	
GMS No:0334662	PIC: Jim Perazzo
PM: Randy Shuler	Staff:
Date of audit:	Auditor(s):
Project information (Client / Site / Type of services/ Name and Number of contractors/Current project activities):	
Brief summary of audit results (list best practices observed, repeat findings, etc.):	

Instructions:
The audit should include observations, spot-checks of pertinent documentation (such as training or inspection records) and interviews with site staff. Auditors should ensure that interviewees understand that the goal of the audit is to improve on site safety and should encourage interviewees to speak openly. It is an opportunity for leaders to communicate their expectations.

This checklist has been developed for all types of field projects and therefore includes open questions. For field work including (i) travelling abroad or (ii) secondments, please use the relevant section in addition to the project audit checklist.

Please use the Audit Finding Action Plan at the end of this document to describe the finding for each item that has not been marked “Yes” or “N/A”.

In exceptional cases, use the auditor’s notes section to explain why an element that is marked “No” does not require an Action Item.

Corrective action measures should be developed by the PIC for the project with support by the PM and local H&S advisers. This completed form and associated action plan should be sent to the BU H&S Lead. Where a corrective action has been implemented immediately on site, this should also be noted.

Scoring the Audit – Score the audit by following the instructions provided on the scoring page of this document. The resulting score is a relative guide for the project leadership on how well their project performed during the audit.

☆ This symbol indicates situations or actions that are of high risk or relate to 5 For Life (driver and vehicle safety, travel safety and security, subsurface clearance, short-service employees, and marine/offshore activities), and are weighted more heavily during scoring the project.

	Field Visit Review Questions		Insert "X" or similar, below		
			Yes	No	N/A
	1	**Planning and Risk Assessment**			
☆	1.1	Is the appropriate level ERM HASP available / complete / up-to-date / signed by field staff?			
	1.2	Is the information included in the HASP (e.g., safety measures, job hazard analyses, emergency procedures, etc.) appropriate to the project risks?			
	1.3	Is the PPE identified in the HASP appropriate to risks?			
	1.4	Does the HASP include a requirement to report accidents and near misses?			
	1.5	If work permits are required (client, regulatory, or procedural), have they been full completed (including date and signature, if required)?			
	1.6	If work permits are required, are all personnel on the site aware of and following the requirements?			
☆	1.7	Do ERM personnel have the appropriate H&S training? Verify training in the Academy for onsite employees upon your return to the office.			
	2	**Site Access, Registration and Induction**			
	2.1	Are all site workers accessing the work site familiar with scope of work and associated risks?			
☆	2.2	Did all site workers attend a site orientation/client specific training and sign off on the HASP?			
	2.3	Have all persons temporarily accessing the work site received a safety induction and are unauthorized persons prevented from entering the work site?			
	2.4	Are daily tailgate meetings conducted at the beginning of each day?			
	3	**Layout and Condition of Work Area**			
	3.1	Is the work site appropriately delineated (cones / fencing / tape)?			
	3.2	Is the size and location of delineated work site adequate?			
☆	3.3	If working on or near roadways, is the work area appropriately marked and secured against traffic impact? (i.e. adequate safety zone, appropriate barriers, traffic controls signage)			
	3.4	Have obstacles or other hazards (such as holes or excavations) within the work area been removed or secured and are warning signs in place and appropriate for hazards which cannot be mitigated?			
	3.5	Are materials stored /stacked safely and orderly to prevent hazards from falling, rolling or collapsing materials and trip hazards? Are storage areas appropriate for the items being stored?			
	3.6	Is the storage of hazardous materials on work site acceptable and labelled?			
	3.7	Have areas with specific fire risks within or close to the work site been identified (flammables or fuel storage areas etc.) and are minimum distances kept?			
☆	3.8	Are emergency precautions in the work area (including emergency escape routes, hydrants, fire extinguishers) accessible / unblocked?			
	3.9	Is the appropriate fire extinguishing equipment in place?			
	3.10	Are worker hygiene facilities, toilets, hand-wash stations, and/or lunch areas present and in good/clean condition?			
	3.11	Are first aid kits / facilities available?			
	3.12	Are emergency phone numbers displayed / available?			
	3.13	Is a map to the local hospital/clinic prominently posted/available?			
	3.14	Is ERM staff and contractors familiar with site-specific emergency procedures, escape routes, and assembly points?			
	3.15	Are specific site procedures being adhered to (such as speed limits, smoking, eating, cell phone use)?			
	3.16	Is the work site appropriately lighted?			
	3.17	Is the general housekeeping at the work site appropriate?			
	3.18	Are wastes appropriately collected and disposed of?			

	Field Visit Review Questions		Insert "X" or similar, below		
			Yes	No	N/A
	4	**Subsurface Clearance (SSC)**			
	4.1	Has an Experienced Person (EP) responsible for the supervision of SSC activities been appointed?			
☆	4.2	Has a Subsurface Clearance Project Plan (SCPP) been completed as part of the project HASP?			
	4.2.1	Have all parts of the SCPP been sufficiently completed (information sources, site service model, and any clearance waivers)?			
☆	4.3	Has a Location Disturbance Permit been completed for each drilling location?			
	4.4	Have all planned areas of disturbance been cleared (unless waived) by a public and private utility marking contractor using a Cable Avoidance Tool, Ground Penetrating Radar (GPR), or other suitable means?			
	4.5	Are utilities present within a 10 foot or 3 meter radius of drilling or excavation location? (if “no” or “N/A” move to Question 4.6)			
	4.5.1	Have the appropriate waivers been completed for performing intrusive work within a critical zone?			
	4.6	Have the appropriate tools been brought by the contractor to perform physical clearance, and equipped with the appropriate electrical insulation?			
	4.7	Has physical clearance been performed down to the following for each borehole? (If soft clearing was waived, moved to 4.9)			
☆		· 2 ft/60 cm beyond bottom of local frost line, or			
		· 5 ft/150 cm below ground surface (outside of critical zone), or			
		· 2 ft/60 cm deeper than the expected invert elevation or 8 ft/240 cm below ground surface (inside of critical zone).			
	4.8	Has the point disturbance been physically cleared to a diameter of at least 125% larger than the largest downhole tool?			
	4.9	If excavating, has the 2 ft/60 cm “no mechanical digging” buffer around subsurface structure or utility been adhered to?			
	4.9.1	Has hand digging been waived? If “yes”, has a similar safety level been achieved (describe below)?			
	5	**Contractors**			
☆	5.1	Are all contractors being used approved per the local Contractor Pre-qualification process?			
	5.2	Does the contractor have the work specifications and understand the scope, and all HASP requirements/risks?			
	5.3	Is the contractor performance (housekeeping, adherence to rules, PPE) in accordance with the project HASP?			
	6	**Personal Protective Equipment**			
☆	6.1	Do onsite staff correctly wear the appropriate task specific PPE in accordance with the site HASP?			
	6.1.1	Is the PPE in use still effective/in good condition and within their designed lifespan? (i.e. clean high visible vest, worn respirators, old hard hats, etc.)			
	6.1.2	Is there a source/procedure for staff to replace/resupply worn or used PPE?			
	6.2	Through discussions with field personnel, are staff aware of the proper/storage/disposal of PPE?			
	7	**Chemical Exposure**			
☆	7.1	Has the potential for exposure to hazardous substances been identified, including exposure limits for chemicals and explosive atmosphere? (should be included in HASP)			
	7.2	Is monitoring equipment (such as PID, gas detectors, explosion meters) present, well-maintained, calibrated, and used as required by HASP?			
	7.3	Are emergency showers or eyewash facilities available if identified in the HASP?			
	7.4	Do field staff know the chemical exposure limits, as well as PPE requirements, and potential emergency procedures after accidental contact with chemicals?			
	7.5	Are worker and equipment decontamination procedures followed as required?			

7.6	Is appropriate safety information (Safety Data Sheets) available for chemicals used on site or hazardous substances likely to be present in the soil/groundwater?			

	Field Visit Review Questions		Insert "X" or similar, below		
			Yes	No	N/A
	8	**Machinery, Equipment and Vehicles**			
☆	8.1	Do ERM staff and contractors have the required training and authorizations to operate equipment and vehicles (such as driving or operating licenses)?			
	8.2	Are ERM and contractor machinery, equipment, and vehicles in good condition?			
	8.2.1	Have vehicle inspection checklists been completed for ERM-owned vehicles onsite?			
	8.3	Are vehicles/rigs regularly maintained and inspected as required (last inspection report available)?			
☆	8.4	Have risks from moving equipment and/or parts been addressed (e.g. being struck or hit by vehicles, caught by augers, etc.)?			
	8.4.1	Is machinery appropriately guarded, a work area/safety zone established, and are only the appropriate personnel allowed around the equipment in operation?			
	8.4.2	Are the emergency switch off devices present, in working order, and accessible from the work area?			
	8.5	Are electrical tools and connections in good condition and appropriate for the site conditions and their intended use?			
	8.6	Is portable electrical equipment electrically isolated (e.g., equipped with Ground Fault Circuit Interrupters - GFCI-, or double insulated) and are all electrical cords/plugs in good condition?			
	9	**Specific High Risk Hazards and Safety Procedures**			
☆	9.1	Is the “buddy system” being followed while onsite? (if “yes” move to Question 9.2)			
	9.1.1	Has a lone working procedure been established and being followed?			
☆	9.2	Are procedures for work at or near water required / established / followed?			
☆	9.3	Are lockout / tagout / de-energize procedures required / established / followed?			
☆	9.4	Is entering of confined spaces by contractors required? Have all permits and procedures established and followed?			
☆	9.5	If hot work is being performed, have all permits been obtained from site contact?			
☆	9.6	If work in explosion-protected areas required, have are all procedures established and being followed?			
☆	9.7	If work at heights are performed, is fall prevention measures in place? Are collective measures (scaffolding) preferred to individual measures (harnesses)?			
☆	9.8	If lifting / hoisting is required, is a Hoisting plan in place, including a pre-hoist equipment check?			
☆	9.9	Have all overhead risks been addressed (i.e. trees and power lines)?			

	Field Visit Review Questions		Insert "X" or similar, below		
			Yes	No	N/A
	1	**Travel Planning and Travel Risk Assessment**			
	1.1	Travellers, PMs and PIC with TRA training? Verify training in the Academy for onsite employees upon your return to the office.			
	1.2	Travellers, PMs and PIC with malaria awareness training? Verify training in the Academy for onsite employees upon your return to the office.			
☆	1.3	Has a Travel Risk Assessment (TRA) been prepared, and is the approved version onsite?			
	1.4	Has the TRA been reviewed and approved by required parties?			
	1.5	Has any Control Risk Group (CRG) advice been taken into account and appropriate prevention measures included in TRA, including standing travel advice?			
☆	1.6	Has experience and information from other ERM staff, client, and local embassies obtained and taken into account?			
	1.7	Are travellers comfortable with all planned travel arrangements?			
	1.8	Have the travel arrangements been discussed within project team prior to departure?			
	2	**Travel to and In Country Travel – Accommodation & Safety**			
	2.1	Has whole itinerary been considered, including intermediate locations in different destinations (customs/visas issues)?			
	2.2	Have arrangements been made to be met at airport by contact for High Risk Countries?			
☆	2.3	Have in-country travel risks been assessed and information obtained with regard to reliability of transportation plans?			
	2.4	If vehicle or driver services are to be used, are vehicles in good condition and are the drivers deemed reliable?			
	2.5	Are the accommodations and living premises during travel appropriate?			
☆	2.6	Have natural / environment hazards been assessed for travel and destination and have prevention measures been implemented (insects, animals, plants, climate, etc.)?			
	3	**Health / Medical**			
	3.1	Have hygiene and health risks been assessed and suitable arrangements implemented?			
☆	3.2	Have vaccination, medical prophylaxis and expert medical advice obtained and implemented?			
	3.3	Are food and drink provided of appropriate standards?			
	3.4	Are project specific medical exams required and being performed as scheduled?			
	4	**Emergency Preparedness, Security and Terrorism**			
	4.1	Has insurance limitations and/or needs for additional insurance coverage been verified (e.g. additional insurance premium for disturbed or remote locations)?			
☆	4.2	Has means and schedule of communication been established, verified and described in TRA?			
	4.3	Has registration for country-specific CRG or International SOS alerts – CRG consulted prior to departure for high risk locations?			
	4.4	Has registration to local embassy been completed?			
☆	4.5	Have security and terrorism risks assessed and prevention measures implemented?			
	4.6	Has an evacuation plan established?			

Secondment Additional Questions		Insert "X" or similar, below		
		Yes	No	N/A
1	**Project Planning**			
1.1	Is the HASP prepared, including health, safety and security risks appropriate to ERM tasks, client facilities, project environment and travel/accommodation?			
1.2	Has workload and work/rest distribution been considered (including travel time to and from the site)? (travel and work hours should be below 12 total)			
1.3	Are the contact people defined, responsibilities defined and communication schedule established with the ERM team (definition of relationships/responsibilities and communication/reports)?			
1.4	Are consultants in secondment with appropriate qualification and training?			
1.5	Are specific project-related medical exams implemented?			
1.6	Has any client-specific training received by consultants?			
1.7	Has any client-specific standards communicated and understood?			
2	**Project Implementation**			
2.1	Is confirmation of both parties understanding the expectations/deliverables of the project available?			
2.2	Are the appropriate arrangements in place as planned?			
2.2.1	- systems & utilities			
2.2.2	- equipment			
2.2.3	- PPE			
2.2.4	- accommodations			
2.2.5	- travel means			
2.2.6	- emergency instructions, facilities and equipment			
2.3	Conflicting or redundant ERM / Client policies identified and managed?			

Project Field Audit Scoring
(To be completed upon return to office, within excel file)

The audit score should be provided to the project leadership on the basis that the score indicates the relative condition of their project's health and safety compliance. Additionally, it should be communicated that no matter how well or poorly the project performed, the goal for all projects are 100% compliance and any corrective actions should be performed as quickly as able, and to the fullest extent.

Each audit item was given a weighted score based on its importance/level of risk associated with the hazard/impact to the project or staff/relation to the 5 For Life (driver and vehicle safety, travel safety and security, subsurface clearance, short-service employees, and marine/offshore activities).

		Project Score Percent
Project Score	254	100%
Total Score Possible	254	

Audit Findings Action Plan (attach a separate sheet if needed)			
Finding *(Please provide checklist ref.)*	**Corrective Action** *(be specific)*	**Person/Party Responsible**	**Target Date**

Other observations / Auditor's Notes / Photos / Additional comments from interviewees, including positive observations: (use separate sheets as needed)

Purpose of Journey:		**Is this trip necessary?**	☒ Yes ☐ No
Client Name:	**Privileged and Confidential**	**GMS number:**	0334662
Project Name:	**Privileged and Confidential**	**Journey Date:**	
Originating From: Address/Location		**Destination:** Address/Location	

Driver and Vehicle Details

Journey Leader		**Contact Number:**	

Passenger Details

Name	Contact Number	Name	Contact Number

Route to be Taken (Detail Journey legs / stages, destinations, route to be taken and speed limits)

Date	Start Location and Estimated Time	Finish Location and Estimated Time	Anticipated Check-in Call Time	Journey Point of Contact

Identified Risks and Mitigation Plan

Identified Risks	Mitigation Techniques
Anticipated call in not received	

Pre-Departure Checklist	Yes	No
Has the PIC (or the Journey Leader's supervisor if the Journey Leader is the PIC or there is no PIC associated with the travel) approved the journey?	☐	☐
Pre-trip briefing conducted with Journey Leader and Journey Point of Contact including call in requirements and response if call is not received	☐	☐
Driver has a current driver's license for the class of vehicle and has completed relevant driving safety training	☐	☐
Immediately Before Journey Commences	**Yes**	**No**
Driver is physically and mentally fit to perform task (Sufficient rest based on past work hours, time of the day etc.)	☐	☐
Vehicle selected is suitable for the trip and cargo/loads are separated from vehicle occupants	☐	☐
Vehicle inspected by driver	☐	☐
Correct Safety Equipment in vehicle for task - Emergency Triangles, Water, First Aid kit, Fire Extinguisher (recommended)	☐	☐
Suitable (checked and operational) communication devices (i.e. mobile telephone, satellite phone, 2 way radio)	☐	☐
Operational In-Vehicle Monitoring System (IVMS), if required	☐	☐
Weather and Road conditions checked	☐	☐

Journey Approved by PIC / Line Manager	Pre-Trip Briefing Completed with Journey Point of Contact
Name: _____	**Name:** _____
Signature: _____ **Date:** _____	**Signature:** _____ **Date:** _____

Include a Map and/or Directions for the Proposed Journey:

Project Name:	Privileged and Confidential
Project Manager:	Randy Shuler
Start/End Date:	
Project PIC:	Jim Perazzo
Project Field Safety Officer:	Jon Fox

This document can be used by the Project Manager to identify project health and safety requirements for project planning, project site work, and project closeout. It can also serve as guideline to give to project team members to inform the team of health and safety planning undertaken and team efforts required.

Project Planning		
Applicable?	**Description**	**Details**
☐ Y ☐ N	Level of health and safety plan (HASP) has been determined (Email, Level 1, Level 2, or Level 3 HASP)	Click here to enter text.
☐ Y ☐ N	Risks of travel have been identified (Travel Risk Assessment or Journey Management Plan)?	Click here to enter text.
☐ Y ☐ N	H&S team has reviewed Level 2 or Level 3 HASPs	Click here to enter text.
☐ Y ☐ N	For all levels of HASP, the project PIC has given written approval	Click here to enter text.
☐ Y ☐ N	For projects that must undergo PLAN analysis, risk review is provided to H&S team during HASP review	Click here to enter text.
☐ Y ☐ N	Job Hazard Analyses (JHAs) s obtained from contractors and provided to H&S team during HASP review	Click here to enter text.
☐ Y ☐ N	Personal protective equipment (PPE) requirements have been determined for each task	Click here to enter text.
☐ Y ☐ N	Real-time/industrial hygiene/noise monitoring requirements have been determined based on chemical exposure potential at the site	Click here to enter text.
☐ Y ☐ N	Contractors utilized for the project are green-flagged in PICS	Click here to enter text.
☐ Y ☐ N	Medical surveillance requirements for ERM and contractor employees have been determined	Click here to enter text.
☐ Y ☐ N	Training requirement, including client-specific HS requirements, for ERM and subcontractor employees have been determined	Click here to enter text.
☐ Y ☐ N	Applicable permits, notifications, and registrations have been identified	Click here to enter text.
☐ Y ☐ N	ERM personnel identified and assigned to the project meet training/medical requirements	Click here to enter text.
☐ Y ☐ N	Trained and qualified ERM Field Safety Officer (FSO) has been identified and assigned to the project (as applicable)	Click here to enter text.
☐ Y ☐ N	SNAP Cards (M1-ERM-004-FM1) will be used on the project and procedures for using have been explained to ERM and contractors employees	Click here to enter text.

☐ Y ☐ N	ERM HASP provided to each contractor firm involved in the project along with minimum health and safety requirements each firm must meet	Click here to enter text.
Project Work		
Applicable?	**Description**	**Details**
☐ Y ☐ N	ERM personnel and FSO have not changed since project planning phase, or new personnel meet training and medical surveillance requirements?	Click here to enter text.
☐ Y ☐ N	Health and safety included in initial project kickoff meeting or separate health and safety kickoff meeting has been planned	Click here to enter text.
☐ Y ☐ N	Site Safety Meeting Form (*S3-NAM-029-FM5*) is at the project site and used to discuss safety each day with ERM and contractor employees onsite	Click here to enter text.
☐ Y ☐ N	Everyone on site informed that any change to work scope (weather conditions, personnel, timing, etc.) require short meeting to determine if the change compromises personnel safety	Click here to enter text.
☐ Y ☐ N	All PPE and emergency equipment identified in the HASP and JHAs is present at the project site	Click here to enter text.
☐ Y ☐ N	Emergency contact information, emergency evacuation/assembly point and route to nearest medical facility are included in HASP and posted at the site	Click here to enter text.
☐ Y ☐ N	Guidance on how to handle a regulatory inspection (*S3-NAM-024-PR*) is at the project site	Click here to enter text.
☐ Y ☐ N	Training/medical surveillance documents are collected by PM for each contractor employee	Click here to enter text.
☐ Y ☐ N	Safety Data Sheets (SDS) are located at the project site for each chemical ERM or contractor brings to the site	Click here to enter text.
☐ Y ☐ N	Method to keep site visitors out of ERM work areas has been determined and managed by FSO	Click here to enter text.
☐ Y ☐ N	For project work lasting longer than one week, a Field Safety Audit will be conducted, kept with project files, and forwarded to the Division H&S Leader	Click here to enter text.
Project Closeout		
Applicable?	**Description**	**Details**
☐ Y ☐ N	Project HASP, JHAs, PM H&S Checklist, subcontractor training/medical documentation, daily Site Safety Meeting Forms, work permits, air and/or noise monitoring and calibration results are placed in project file	Click here to enter text.
☐ Y ☐ N	Project team has performed a post-project brainstorming session to close any ECS events and determine any lessons learned	Click here to enter text.

Project Name:	Privileged and Confidential
Project Manager:	Randy Shuler
Partner-in-Charge (PIC):	Jim Perazzo
Start/End Date:	Click here to enter text.

Part I: Project Scope and Team

1. What is the general scope of work for this project?

Click here to enter text.

2. Who are the key ERM members of the envisioned project team?

Role	Assigned
Partner-in-Charge	Jim Perazzo
Project Manager	Randy Shuler
Field Safety Officer	Jon Fox
Construction Manager	Click here to enter text.
Subject Matter Expert	Click here to enter text.
Other: Click here to enter text.	Click here to enter text.
Other: Click here to enter text.	Click here to enter text.

3. Who are ERM's direct contractors for this project? Ensure that all contractors are green-flagged in PICS prior to work start.

Contractor	Task
Click here to enter text.	Click here to enter text.
Click here to enter text.	Click here to enter text.
Click here to enter text.	Click here to enter text.
Click here to enter text.	Click here to enter text.
Click here to enter text.	Click here to enter text.
Click here to enter text.	Click here to enter text.

Part I Completed: *PM Initials:* Click here to enter text. *Date:* Click here to enter a date.

Part II: Project Security Issues

4. Is full-time security needed/required?

Click here to enter text.

5. Who controls site access?

Click here to enter text.

6. How is site access controlled?

Click here to enter text.

7. What site constituents pose special security risks (e.g., highly toxic chemicals or very valuable materials)?

Click here to enter text.

8. Are there hazardous materials (e.g., drill cuttings or other wastes) that will be shipped from the site?

Click here to enter text.

9. Are there community issues that may impact safety?

Click here to enter text.

10. If work will affect local traffic patterns, are plans in place to contact authorities for specific local requirements?

Click here to enter text.

Part II Completed: *PM Initials:* Click here to enter text. *Date:* Click here to enter a date.

Part III: Project Environmental Issues

11. Where is the site located (provide address)?

Click here to enter text.

12. What regulations will apply to the work (e.g., EPA, State or local regulations, building codes, etc.)?

Click here to enter text.

13. What aspects of the work will require specific professional training, certification, or licenses (e.g., State contractor's license, Professional Engineer seal, etc.)?

Click here to enter text.

Part III Completed: *PM Initials:* Click here to enter text. *Date:* Click here to enter a date.

Part IV: Client-Specific Requirements

14. What general, client-specific HSSE requirements (i.e., those above and beyond what would normally be specified in the ERM health and safety plan (HASP) will impact the work? Examples may include site-specific training, use of client-specific incident reporting procedures, loss prevention training, and permit-to-work policies.

Click here to enter text.

Part IV Completed: *PM Initials:* Click here to enter text. *Date:* Click here to enter a date.

PART V: Project Health and Safety Planning/Execution Checklist		
Item	**PM Initials**	**Date Complete**
Draft HASP Preparation		
Applicable HASP documents completed.	Click here to enter text.	Click here to enter a date.
Approximate scope of work and tasks developed.	Click here to enter text.	Click here to enter a date.
Applicable procedures from the Global Safety Management System (SMS) identified.	Click here to enter text.	Click here to enter a date.
Site constituents identified; appropriate informational sheets on each collected.	Click here to enter text.	Click here to enter a date.
Safety Data Sheets (SDS) acquired for chemicals/materials that will be used to help complete the work.	Click here to enter text.	Click here to enter a date.
Personal protective equipment (PPE) and respiratory protection assessment has been performed.	Click here to enter text.	Click here to enter a date.
Medical surveillance requirements have been determined.	Click here to enter text.	Click here to enter a date.
Draft Job Hazard Analyses (JHAs) have been prepared for envisioned work tasks.	Click here to enter text.	Click here to enter a date.
Client approval prior to issuing draft HASP for bid.	Click here to enter text.	Click here to enter a date.
HASP Finalization and Pre-mobilization		
Contractors' means and methods understood.	Click here to enter text.	Click here to enter a date.
Final JHAs prepared with input of contractors.	Click here to enter text.	Click here to enter a date.
HASP reviewed by member of ERM North America HASP review team.	Click here to enter text.	Click here to enter a date.
HASP signed by ERM Project Team.	Click here to enter text.	Click here to enter a date.
Project FSO appointed and made familiar with the HASP.	Click here to enter text.	Click here to enter a date.
Subcontractor personnel training documentation received and verified.	Click here to enter text.	Click here to enter a date.
First Day on Site		
All site personnel read and sign the HASP. Note that subsequently arriving site personnel must also read and sign the HASP prior to initiating site work.	Click here to enter text.	Click here to enter a date.
All site personnel training requirements verified. Note that subsequently arriving site personnel must also provide ERM with appropriate training documentation.	Click here to enter text.	Click here to enter a date.
All "first day" HASP review and training completed at the site.	Click here to enter text.	Click here to enter a date.
Project Close Out		
Ensure that all medical monitoring requirements have been met.	Click here to enter text.	Click here to enter a date.
Ensure that all ECS entries have been finalized.	Click here to enter text.	Click here to enter a date.
Ensure that all action items, if any, from any incident, near miss, unsafe act, or unsafe condition ECS reports have been completed.	Click here to enter text.	Click here to enter a date.
Ensure that all subcontractor safety performance information has been obtained and the performance evaluation has been conducted.	Click here to enter text.	Click here to enter a date.
Transfer site health and safety files to the office.	Click here to enter text.	Click here to enter a date.
Consolidate project health and safety files.	Click here to enter text.	Click here to enter a date.

	Applicability:	Form	Document Number:	Version:
	North America		S3-NAM-038-FM1	2
	Title: **Pre-Mobilization Activities**		**Last Revision Date:**	6/25/15

		Date Completed	Completed By	Applicable Regulatory References
General				
1	Estimate the expected quantities of each different waste type that may be generated during the job.			
2	Evaluate the potential for recycling/reuse of any wastes generated, as well as any requirements for such.			
3	Determine containment/cover/storage requirements for each type of waste.			
4	Verify which wastes will be placed in client-provided containers for management by the client and which waste ERM will need to containerize.			
5	Develop plan for segregating wastes as needed to facilitate proper handling and ultimate disposal or recycling.			
6	Instruct members of the project team that will be responsible for waste management activities on the requirements for proper waste handling and disposal as established in the project-specific waste management plan.			
Transport				
1	Verify if the waste material is hazardous or nonhazardous. If you are unsure how to make this determination, consult an ERM waste characterization expert.			
2	Verify that all analytical data needed to properly characterize each waste type has been collected.			
3	Verify waste shipment origin, destination, and transit route are within the country of origin only.			
4	Verify proposed disposal facility is on client-approved waste site list (if applicable) and qualified for type of waste.			
5	Verify transporter is licensed to haul the waste and that they have the correct State and Federal numbers.			
6	Verify who will sign the waste profiles and manifest prior to submittal to disposal facility.			
7	If client is not signing profiles or manifest, verify that a "Letter of Authorization" from the client has been completed and signed, identifying ERM as the authorized entity for the manifesting.			
8	If ERM is authorized to sign manifests for the project, and any of the waste are classified as hazardous, identify specific personnel with proper DOT (or other) training.			

	Applicability:	Form	Document Number:	Version:
ERM	North America		S3-NAM-038-FM2	2
	Title: **Project Execution Activities**		**Last Revision Date:**	6/25/15

		Date Completed	Completed By	Applicable Regulatory References
Profile: To be completed when a new waste profile is prepared.				
1	Verify waste profile exists and proposed disposal facility has accepted profile. If not, prepare profile as indicated.			
2	Obtain waste profile form from selected waste disposal facility.			
3	Determine/obtain waste code(s).			
4	If requested by disposal facility, assemble analytical and/or TCLP data characterizing the constituent makeup of the waste (to be submitted with final profile).			
5	Verify waste profile will be signed by a DOT HM 126-trained and client-authorized employee or representative.			
6	If client is not signing profile, verify "Authorized Agent on behalf of" is written on the signature line on the profile.			
7	ERM Project Manager has reviewed the profile.			
8	ERM Partner-In-Charge has reviewed the profile.			
9	Submit profile to disposal facility for review and approval.			
Transport: To be completed in the field at the time of transport for disposal or recycling.				
1	Verify waste manifest is prepared correctly:			
	• Use Federal Uniform Hazardous Waste Manifest for hazardous waste and the disposal facilities' approved manifest for nonhazardous waste.			
	• Verify manifest will be signed by a DOT HM 126 trained and client-authorized employee representative.			
	• Verify "Authorized Agent on behalf of" is written on the signature line of the manifest.			
2	Verify that appropriate labels have been placed on the waste containers prior to transport.			
3	Verify correct quantity for disposal is written on manifest.			
4	Verify transporter signed and dated manifest.			
5	Verify that an authorized signature and current dates are on the manifest.			
6	Verify you have the generator's copy of the manifest with the transporter's signature.			

Date	Operator	Project# 0334662	Mileage
Vehicle Make/Model License#			Company Vehicle? ☐ Y ☐ N

I. Inspection	**Before Driving:**			**Comments**
	OK	**Deficient**	**N/A**	
Prior to Use, and Weekly Thereafter 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.
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***.

Project Name/ Location:	Privileged and Confidential			**Phone:**	
Project Number:	0334662	**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?
☐ Who do you contact if you have questions or before deviating from written procedures?
☐ What happens and who 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? Is everyone aware that the use of fixed open-blade knives is not permitted?
☐ What natural hazards are present (including plants, animals, and insects)?
☐ What areas of the site have slip/trip/fall hazards? Can these be avoided? Are everyone's work boots in good shape?
☐ Other items:

Meeting Attendees (including employees, contractors, and visitors)			
Name	**Company**	**Sign-In***	**Sign-Out****

* Signature/initials in this space verify that the employee is fit for performing work.

** Signature/initials in this space verify that the employee was uninjured during the workday.

Appendix D

Investigation Personnel and Qualifications

James A. Perazzo, P.G.

Principal-In-Charge

Mr. Perazzo has over 25 years of experience dealing with legacy environmental problems under CERCLA, RCRA, TSCA and related brownfield environmental programs. Combines both technical and financial analysis of environmental impacts to assess costs of liabilities to establish environmental reserves for financial reporting and/or provide expert testimony in cost recovery actions. Assist clients in making business decisions involving acquisition, divestiture and strategic management of environmental impacts, including evaluation of practical realistic cash flows and exit strategies. As part of the Sustainable Watershed integrated Management practice, Mr. Perazzo works with clients, regulators and national organizations on assessing impacts in urban waterways and facilitating risk management decisions to address impacts. Aligns technical approaches with business objectives and works with regulators, when necessary, ensure clients goals are achieved. Provide expert support cost recovery claims under CERCLA, navigation law and other environmental statues in arbitrations, mediations and litigation.

Registrations & Professional Affiliations

- Professional Geologist in Pennsylvania

Fields of Competence

- CERCLA RI/FS and removal actions
- RCRA (RFA, RFI CMS and CMI)
- TSCA (PCBs & lead)
- UST assessment and hydrocarbon remediation
- Indirect/direct investigative techniques
- Soil and ground water investigations
- Hydrogeological assessments
- Regulatory negotiation and strategic guidance
- Financial analysis (legacy environmental and compliance costs)
- Expert witness (CERCLA cost recovery, Navigation Law claims)

Education

- M.B.A. , Long Island University (C.W. Post), New York, 2006
- M.S. Earth Science, Adelphi University, New York, 1981
- B.S. Geology, The State University of New York at Stony Brook, 1978

Publications/Presentations

"The Intersection of Governance, Performance, Assurance and Reporting in Asset Retirement Obligations Related to Mine Reclamation & Closure" Perazzo, James, A. & Eddy, Stuart , SME Conference, Seattle, WA February 22, 2012

"Financial Reporting of Environmental Matters & the Influence on a Company's Sustainable Business Strategy" AWMA/NYEWA Seminar, Rochester Institute of Technology Conference Center, February 12, 2009.

"Real Estate Transactions & Brownfield's" NYSBA CLE Program, May 24, 2004

"CERCLA - The Technical Perspective," Environmental Regulations Course, Executive Enterprises, Inc., June '95, October '95, and February '96.

"Remedial Investigation and Feasibility Study Process," New York Hazardous Regulation Course, Executive Enterprises, Inc., November 16-17, 1990.

"Groundwater Remediation; Performance Goals," Haztech International, Cleveland, Ohio, September 20-22, 1988.

"Remedial Design Needs to Consider in Planning Hazardous Waste Site Investigations," with J. Iannone and J. Mack; Haztech International, St. Louis, Missouri, August 26-27, 1987.

"Long Term Confidence in Ground Water Monitoring Systems," Groundwater Monitoring Review, Vol. 4, No. 4, all 1984.

Sample Projects

Principal-in-Charge involving a major urban waterbody project in the Superfund program in USEPA Region 2. Coordinates a diverse staff of environmental professionals in support of a contributing PRP. Also, liaison with common consultant, USEPA and NYC to advance PRP group objectives and initiatives with the intent of assuring a comprehensive, technically supported and protective and practical RI/FS and eventual RA.

Project Director to develop environmental liability estimates for the purpose of financial re-statement to facilitate registrant's filing of an S-1 with the SEC. The portfolio involved review and assessment of over 2500 properties (historic and current) with projected environmental liabilities and asset retirement obligations in excess of $700MM. Financial estimates were developed in accordance with US GAAP.

Project Director for federal superfund site involving PCE impacts to regional aquifer and allegations of public supply well impacts. Developed technical strategy and coordinated implementation of a RI/FS leading to a ROD that narrowly defined impacts from client site versus regional impacts from other sources of similar contamination. Direct RD/RA effort to implement the selected remedy and, together with post-ROD information and support from local municipality, resulted in EPA issuing a modified ROD.

Part of a multi-disciplined team providing technical consultation to a city planning board to ensure development of a comprehensive draft and final environmental impact assessment. Ensured that residual environmental impacts at properties within a project area in both federal and state Superfund programs were addressed and/or incorporated into a 50+ acre regional waterfront redevelopment in the northeast with significant public amenities. The effort led to a successful adoption of a FEIS and issuance of Findings that ensured the integrity of future site plans.

Project Principal for responsible for a former industrial facility requiring completion of an RI/FS at a NYS Superfund site. Secured a ROD that was used to facilitate transfer of the property into the NYS Brownfield Cleanup Program and, combined with a finite risk insurance policy enabled the responsible party to cap environmental liabilities.

Project Principal assisting client with 3rd party claim related to an urban water body designated a CERCLA site. Provide strategic consultation and assessment of site-specific and regional data to assess liability and potential contribution. Matter resulted in settlement.

Project Director for Chapter 11 bankruptcy settlement and re-organization involving major mining company. Lead team to develop environmental liability and asset retirement estimates for a portfolio of formerly owed, non-operating sites. Provided proffer and testimony in support of debtor's settlement of outstanding liabilities that was affirmed by the court.

Project Manager for large Superfund site impacted from former lead and copper recovery operations. Project responsibilities included work plan preparation, RI implementation, coordination of human health risk and ecological assessments, a feasibility study, and remedial design and construction of the remediation action.

Provided expert testimony in matter involving the origin and subsequent migration of petroleum contamination as it related to on-site and off-site impacts.
Completed cleanup obligations at NYC manufacturing site under the Voluntary Cleanup Program as part of its conversion to a multi-tenant commercial space. The project involved disassembly of manufacturing lines, and soil/ground water remediation (combined ex-situ and in-situ) beneath an existing facility adjacent the East River.

Developed a tank management program for 36 locations in New York and Connecticut. Planned site assessments and remedial programs. Formulated monitoring programs for early warning of potential environmental problems. Negotiated financial estimates and justification for outstanding environmental liability allowing owner to divest with protection against future liabilities.

Served as a technical expert for one airline in litigation with multiple airlines over a claim of $100 MM in environmental cleanup costs at JFK airport. Engaged in mediation on behalf of client setting out technical positions to apply to cost allocation in pursuit of settlement.

Completed cleanup obligations at NYC manufacturing site under the Voluntary Cleanup Program as part of its conversion to a multi-tenant commercial space. The project involved disassembly of manufacturing lines, and soil/ground water remediation (combined ex-situ and in-situ) beneath an existing facility adjacent the East River.

Project Director for three removal actions pursuant to an ACO under 106 provisions at two separate Superfund sites that were in receivership. Performed removal of anhydrous ammonia vessel, ASTs, laboratory chemicals, drums, PCB oils, transformers, and closure of USTs. Also directed a radiological survey with a health physicist to locate and remove materials exhibiting anomalous levels of radiation. These efforts were done on behalf of a savings and loan in receivership.

Project Director for development and implementation of remedial system to extract chlorinated VOCs from soil and ground water from a source area at a Superfund site. Coordinated program involving dewatering and vacuum extraction. Established basis for performance analysis and effectiveness evaluation to determine proper time for system termination.

Assessed alleged environmental liabilities at a commercial resort built on a former shipyard to facilitate a Chapter 11 bankruptcy work-out on Long Island, NY.

Conducted reviews and critiques of RI and RODs, the latter in support of petitions to amend. These efforts resulted in modifications to remedies that were consistent with the NCP.

Assisted clients in securing approval for reimbursement of response costs from the Superfund

Planned and implemented activities to secure abandoned manufacturing facilities and negotiated with NYS DOL on behalf of financial institutions to allow assets to be removed as part of a Chapter 7 bankruptcy.

Developed technical approach to ongoing cases for the New York Sate Environmental Protection Bureau of the Attorney General's office. Prepared scientific reports and represented the Attorney General in adversarial discussions, public meetings, and court hearings.

As part of a multi-disciplined technical team, developed a comprehensive remedial program at a dioxin-contaminated landfill in western New York. The program involved collection and treatment of dissolved and non-aqueous phase liquids (NAPLs) in overburden and bedrock.

Technical representative for the government in developing a comprehensive soil and aquifer remediation project in Nassau County, New York. The project involved a soil and ground water remediation program including installation of a slurry wall via the vibrating beam technique, soil flushing system and staged ground water recovery from a shallow and deep aquifer. Maintained a key role in establishing performance criteria for cleanup and effectiveness monitoring.

Maureen C. Leahy, Ph.D.

Dr. Leahy has more than 25 years of experience in chemistry, biochemistry and environmental remediation technologies and has served clients in over 30 States in the USA, Canada, Latin America, Europe, Middle East and Asia Pacific. Dr. Leahy provides technical support in the application of biological, chemical, and physical treatments for contaminated soil and groundwater and her primary areas of expertise are biological and chemical treatment processes.

Dr. Leahy has conducted feasibility studies, designed pilot tests and provided oversight for multiple projects involving aerobic and anaerobic bioremediation, soil vapor extraction, air sparging, dual phase extraction, chemical oxidation/reduction, natural attenuation and other technologies. She had also provided expertise in metal chemistry, emerging and/or persistent contaminants (perchlorate, pharmaceuticals, surfactants, PCBs, chlorofluoro-hydrocarbons (CFCs, HCFCs), PFOA, etc.) and has served as QA officer responsible for data quality.

Dr. Leahy has served as an expert witness in the field of bioremediation and fate of chemicals in the environment, as well as a consultant for litigation support in the areas of petroleum fingerprint identification, natural attenuation, chemical forensics, isotopic ratio analyses, chemical processes, remediation technology selection, and the fate of petroleum and chlorinated hydrocarbons in the environment.

Dr. Leahy has also directed laboratory support services for the remediation of contaminated soil and ground water. Her responsibilities included design of lab treatability studies, supervision of laboratory personnel, and data quality review (QA/QC). In addition, Dr. Leahy served as project manager for several government-sponsored research projects for the development of technology for the biodegradation of hazardous substances including chlorinated solvents, petroleum hydrocarbons, and coal tar. Dr. Leahy holds a patent for a bioreactor process using methanotrophic cometabolism for degradation of chlorinated solvents.

Fields of Competence

- Anaerobic and aerobic biological remediation
- Cometabolic biological processes
- Natural attenuation evaluations
- Environmental chemistry
- Feasibility studies and technology selection

Education

- Ph.D. Molecular Biophysics and Biochemistry, Yale University, USA
- M. Phil. Molecular Biophysics and Biochemistry, Yale University, USA
- B.S. Chemistry, Fordham University, USA

Key Industry Sectors

- Petroleum
- Pharmaceutical
- Manufacturing
- Utilities

Patent

Moore, A., M.C. Leahy, M. Findlay and S. Fogel. Decomposition of Halogenated Aliphatic Hydrocarbons in a Bioreactor. 23 Mar 1993. U.S. Patent No. 5,196,121

Publications and Presentations

Morris, K., D. Ross, M. Leahy, and W. Butler. 2012. Biobarrier Combined with Source Area Bioremediation to Expedite Site Closure of a Large TCE Plume. Presented at the International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, CA, May.

Byrd, J. E. Hollifield, B. Hodge, M. Leahy and J. Haselow. 2012. Comparison of Bioremediation Pilot Test Data for Chlorinated Ethenes at Three Sites within the Southeast. Presented at the International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, CA, May.

Key Projects

Former Automotive Parts Manufacturer, Toronto, Canada. Technical oversight for remediation, indoor air monitoring, risk assessment and development of property-specific standards for soil and groundwater impacted with TCA and other chlorinated solvents.

Technical Review of 3 Remediation Sites, Canada. Participated in a "red team" review of the technical, strategical, and financial aspects of three remediation projects using chemical oxidation to treat chlorinated solvents in groundwater.

Technical Lead for CVOC Source Differentiation with CSIA in Groundwater and Soil Vapor, Germany. Compound specific isotope analyses were used to provide evidence of the contribution of an off-site source to a groundwater plume, which was being remediated by groundwater extraction with soil vapor extraction for unsaturated zone soils.

Air National Guard, 174th FW, Syracuse, New York Developed a focused feasibility study and injection pilot study for the petroleum impacts at Site 15. After the IRAC for source area soil removal of approximately 2,890-tons of soil, treatment of the residual contamination, including the 7 sampling locations above cleanup levels, involved the application of approximately 4,000 pounds of PermeOx® Plus was applied within the floor of the excavation areas.

Senior Technical Advisor, Manufacturing Facility, MA. Oversight of anaerobic bioremediation for treatment of TCA, TCE and other chlorinated solvents using lactate as a carbon source.

Chemist, Perchlorate Method Evaluation, OR. Evaluated analytical methods available for the analysis of perchlorate in groundwater containing high concentrations of potentially interfering substances. Developed a laboratory testing program to evaluate two analytical methods relative to this potential matrix interference. The result of the study provided assurance that the common less expensive method would be sufficient for most site samples.

Technical Support, Assessment and Preliminary Evaluation of Chemical, Physical and Thermal Technologies for Oil-Impacted Shoreline, Saudi Arabia. Conducted literature study to evaluate soil vapor extraction, chemical oxidation, thermal desorption, soil washing, and other chemical and physical treatment technologies applicable to oil-impacted sands and sediments (PAH and TPH) under desert conditions; developed treatability protocols for chemical oxidation and thermal treatment.

Project Manager, Former Chemical Plants Impacted with Mixed Solvents, Argentina. Wrote work plan for SVE and chemical oxidation pilot testing in support of technology selection. Developed remediation alternatives (incorporating the results of pilot testing) for soil and groundwater impacted with multiple solvents including toluene, xylenes, vinyl chloride, 1,2-DCA, trichloroethene, chloroform, and methylene chloride to meet either Argentine standards or site-specific risk-based closure goals.

QA Officer for Industrial Site Impacted with Chlorinated Organics, NY. Data quality review of soil and groundwater analyses conducted for the remedial investigation; preparation of data usability reports; review of field sampling quality and adherence to the QAPP and RI/FS work plan.

Uptake of Metals from Composted Sludges into Plants and Cattle, CA. Researched literature to estimate metal uptake by cattle fed plants grown on land treated with composted sludges, in support of a risk analysis.

Project Scientist, Soil Vapor Extraction to Support Bioventing of Diesel At a Rail Yard, CT. Designed laboratory treatability and field pilot testing for using SVE to introduce oxygen into the subsurface to treat diesel contamination in shallow soil. Provided conceptual design and oversight of full-scale remediation system.

Expert Witness for Applicability of Bioremediation, KY. Served as an expert witness and testified in court to support client's choice of bioremediation as the remediation technology for mineral spirits.

Litigation Support, Estimation of Timing of Petroleum Release, Iowa. Estimated timing and/or source(s) of petroleum releases at over twenty sites for a major petroleum company based on site data including occurrence of separate phase hydrocarbon, ratios of BTEX constituents, natural attenuation rates, chromatographic fingerprint data and presence of various gasoline additives (MTBE, TBA and alkyl leads).

Jon S. Fox, P.G.

Jon Fox has more than 27 years of diversified professional scientific and environmental consulting experience including contaminated site investigation and remediation; site management; program and project management; Brownfields program management; regulatory negotiations; geologic and hydrogeologic evaluation; private water well system inspection, sampling, and corrective action; inspection and corrective action of storage tank systems; operations management; expert witness and litigation support; immunoassay field screening; petrographic analyses; geochemistry and geophysics; statistical analysis of geologic data; wetlands evaluation; petroleum exploration geology and development; and professional geologic instruction.

Jon stays current on topics useful to clients with resolution of environmental problems in a manner consistent with the client's business goals and objectives through participation in relevant and timely conferences, seminars, and continuing professional education courses. Recent examples include:

- Technical Guidance on Site Investigation and Remediation
- Private Water Well Systems
- Brownfield Opportunity Areas and Tax Credits
- Remote Sensing Techniques
- Structural and Hydro-Structural Geology
- Surface Geophysics for Hydrogeological and Geotechnical Applications
- Hydrogeology and Management of Karst Ground Water Resources
- Erosion and Sediment Control Workshops

Registrations & Professional Affiliations

- Qualified Environmental Professional (New York)
- Licensed Professional Geologist (Pennsylvania)
- Certified in Underground Storage Tank Decommissioning (International Code Council)
- Geological Society of America
- International Society of Environmental Forensics
- National Ground Water Association
- New York State Council of Professional Geologists
- New York State Geological Association
- Central New York Association of Professional Geologists
- Pennsylvania Council of Professional Geologists
- New England Interstate Water Pollution Control Commission
- Air & Waste Management Association
- Manufacturer's Association

Fields of Competence

- Geological Sciences and Hydrogeology
- Environmental Investigation & Remediation
- Private Water Well Systems
- Petroleum Storage Tank Systems
- Environmental Forensic Analysis
- Geochemistry and Geophysics
- Environmental Regulations
- Wetland Hydrology
- Statistical Analysis
- Radioactivity
- Petroleum Exploration and Development

Education

- M.A., Geology and Geochemistry, University of North Dakota, 1993
- B.S., Geology, State University of New York at Oswego, 1988 (Honors: Outstanding Geology Graduate)

Publications and Presentations

Fox, J.S., 2015. New York State Brownfield Cleanup Program Technical Changes in 2015. *Air & Waste Management Association - CNY Chapter Meeting*, Syracuse (NY), 21 April 2015.

Fox, J.S., Mohlin, J.P., and Kuhn, J., 2014. The effects of TENORM discovery on remedial action scope, schedule, and budget. *Air & Waste Management Association - Genesee/Finger Lakes Chaper Annual Technical Seminar,* Rochester (NY), 12 February 2014.

Misra, G., Sartain, H., and Fox, J.S., 2008. Contaminated soil cleanup objective assessment through statistical analyses: selected case studies (abstract). *Proceedings, 6th International Conference on the Remediation of Chlorinated and Recalcitrant Compounds;* Battelle Institute, Monterey, CA, 19-22 May 2008.

Otz, M.H., Sents, R.C., Fox, J.S., Myers, D.W., and Wells, J., 2008. Effective delineation of jet fuel-contaminated ground water using background fluorescence analysis (abstract). *Proceedings, 6th International Conference on the Remediation of Chlorinated and Recalcitrant Compounds;* Battelle Institute, Monterey, CA, 19-22 May 2008.

Sents, R.C., Otz, M.H., Fox, J.S., and Wunderlich, C.D., 2007. Fluorescent dye-tracing used to investigate fast flowing preferential flow paths in a heavily DNAPL-contaminated aquifer (abstract). *2nd International Conference on DNAPL: Characterization and Remediation*. Niagara Falls, New York, September 2007.

Otz, M. H., Hinchey, E.J., Fox, J.S., Wunderlich, C.D., and Perritt, K., 2005. Intrinsic background fluorescence analysis as an easy tool to delineate organic contaminant plumes (abstract). *Geological Society of America Abstracts with Programs*, Vol. 37, No.1, p. 80, February 2005.

Fox, J.D. and Fox, J.S., 2002. Metrological considerations in Flame AA analyses versus certified reference materials of soils from Onondaga County, New York State (USA) for background trace metals content. *Accreditation and Quality Assurance*, Vol. 7., pp. 520-528.

Fox, J.S. and Fox, J.D., 2001. Variation in background concentrations of selected metals in soil based on parent geologic material. *Geological Society of America Abstracts with Programs*, Vol. 33, No. 6, p. A-187.

Hinchey, E.H., Fox, J.S., and Tayeh, H.C., 2001. Evaluation of MTBE in middle distillate petroleum products in the northeastern United States (abs.). National Ground Water Association, National FOCUS Conference, Baltimore, Maryland - June 2001, *Conference Proceedings* pp. 130-131.

Fox, J.S. and Videtich, P.E., 1997. Revised estimate of $\delta^{34}S$ for marine sulfates from the Upper Ordovician: data from the Williston basin, North Dakota, U.S.A.: *Applied Geochemistry*, v. 12, no. 1, p. 97-103.

Fox, J.S., 1996. Accuracy and comparability of immunoassay field screening for PCBs at two Superfund sites in New York State: in A. Scott Weber (editor), Hazardous and Industrial Wastes: *Proceedings of the 28th Mid-Atlantic Industrial and Hazardous Waste Conference*. Technonic Publishing Cp., Lancaster (PA), p. 804.

Fox, J.S. and Videtich, P.E., 1992. Subaqueous deposition of the "C" zone, Red River Formation (Upper Ordovician), Williston basin (abs.): *American Association of Petroleum Geologists Bulletin*, v. 76, p. 1259.

Pees, S.T. and Fox, J.S., 1990. Northwest Pennsylvania should have more Cambrian potential: *Oil and Gas Journal*, Oct. 8, pp. 129-134.

Fox, J.S., 1988. Some geological aspects of the Oil Creek Valley Region: in C. Burgchardt (editor), *AAPG History of the Oil Industry Symposium Guidebook*: American Association of Petroleum Geologists, Tulsa, pp. 37-44.

Key Projects

Brownfields Program Management
New York State
Senior Consultant and Project Manager for the successful completion of a large Brownfields project at a complex industrial property in western New York State (USA) through the State's Brownfield Cleanup Program (BCP). Performed regulatory negotiations and managed environmental aspects of the decommissioning and decontamination of an abandoned paper mill and the concurrent construction of a new state-of-the-art fiberboard recycling facility in its place. Total project cost = $450 Million, Environmental project cost = $18 Million. The Site contained multiple areas of concern affected by multiple contaminants. Assembled and managed the project team that performed Site investigation and remediation activities in an expedited manner concurrent with site demolition and construction activities (2 years from start to finish). Ensured compliance with applicable environmental regulations and technical requirements for site investigation and remediation. The successful completion of the BCP at the Site resulted in issuance of a regulatory Certificate of Completion, liability release, and the securing of approximately $40 Million in state tax credits for the client.

Industrial Remediation Management
New York State
Senior Project Manager for the investigation and remediation of a complex industrial property in western New York State (USA) through the State's Voluntary Cleanup Program. The site contained multiple areas of concern affected by releases of chlorinated solvents and/or varnish. Site investigation and remediation activities are being performed in distinct phases including a baseline investigation, data gap investigation, interim remedial measures, feasibility study, remedial design, and remedial implementation.

Ground Water Remediation
Implemented remediation of petroleum-affected soil and ground water through use of various remedial strategies, including natural attenuation strategies, with the approval of the State Regulatory Agency.

Private Water Well Sampling and Corrective Action
Directed the inspection and sampling of private water supply wells at numerous residential properties in New York, New Jersey, Pennsylvania, and Connecticut in association with the investigation and remediation of petroleum or chemical spills. Worked with engineers and water treatment vendors to evaluate and implement effective point-of-entry water treatment systems at numerous residential properties under the oversight of the applicable State Regulatory Agencies.

Commercial Remediation Management
Western New York State
Senior Project Manager for the investigation and remediation of a commercial property in western New York State (USA) through the State's Voluntary Cleanup Program. The site contained two areas of concern affected by releases of a chlorinated solvent and metals. Site investigation and remediation activities are being performed in distinct phases including a baseline investigation, data gap investigation, remedial work plan development, remedial design investigation, and remedial implementation.

Environmental Investigation and Remediation Coordination
New England Region
Coordinated, supervised, and managed environmental investigation and remediation efforts associated with releases of petroleum, solvents, and/or metals at numerous properties in New York, New Jersey, Connecticut, Pennsylvania, and Massachusetts. Projects typically involve soil and ground water investigation, remediation, and regulatory negotiations. Obtained regulatory closure for numerous projects.

Military Remediation Property Management
Central New York State
Senior Project Manager for the remediation of a military property in central New York State (USA) through a Record of Decision with the State Regulatory Agency. The area of concern involves ground water that was affected by releases of aviation fuel (JP-4 and JP-8). The remediation involves development of a work plan, full-scale design phase, construction of the remedial system, and operations and maintenance. The selected

technology involves a combination of air sparging, soil vapor extraction, and enhanced microbiological degradation of petroleum residuals in ground water.

Underground Storage Tank Inspection
Performed inspections of hundreds of underground storage tank and aboveground storage tank systems (including associated piping) for the purpose of confirming proper tank decommissioning procedures and to evaluate whether or not the tank system released petroleum or other chemicals into the environment.

Geological Services
New York State
Provided expert geological services, including attendance and presentations at public and governmental meetings, to assist a global energy company with the State Environmental Quality Review Act process for planning, siting, construction, and operation and maintenance of a 140-turbine wind energy farm in northern New York State.

Environmental Investigation
New England
Performed document reviews and managed environmental investigation and remediation efforts in New York, New Jersey, Connecticut, Pennsylvania, and Massachusetts for numerous insurance carriers. Projects typically involve environmental investigation to assist the client's coverage determination and/or preparation of reports used by client's counsel in successful motions for Summary Judgment, inter-company arbitration, or other litigation support scenarios.

Litigation Support
Upstate New York
Provided litigation support services on numerous projects including expert testimony at trial in a civil action associated with a petroleum release at a residential property in upstate New York.

Litigation Support
Western New York
Provided litigation support services associated with a CERCLA action against a former owner of a Site in western New York State (USA). Services were focused on objective evaluation of the consistency of the investigation and remediation to date with the National Contingency Plan. Services provided helped the client secure a very favorable decision by the Court regarding cost recovery and apportionment of ongoing and future remedial costs.

Property Remediation Management
Managed a project involving investigation and remediation of residential and commercial properties with landscaped areas affected by boron allegedly derived from mulch produced by a commercial operation. The mulch was accidentally contaminated by scraps derived from wood treated with a wood preservative compound. Directed and mitigated negotiations between affected and potentially-affected parties, the client, the insured, counsel, and the State Regulatory Agency.

Site Investigation
Employed innovative site investigation methodologies focused on three-dimensional delineation of ground water affected by the gasoline oxygenate methyl-tert-butyl ether (MTBE) and other volatile organic compounds.

Contractor Oversight
Provided oversight of environmental contractors engaged in investigative or remedial efforts at numerous petroleum spill sites; in many cases, ERM's oversight resulted in significant cost savings through reduction in scope of work and/or negotiated reductions of environmental contractor invoices.

Surface and Subsurface Hydrogeological Investigations
New York State
Performed surface and subsurface hydrogeologic investigations at an unpermitted industrial landfill in northern New York State as part of remedial investigation/feasibility studies and remedial design investigations.

Site Delineation
Delineated areas affected by PCBs from a transformer fluid release at an industrial site through the application of immunoassay field screening technology; also provided oversight and documentation of remedial efforts associated with the implementation of the site remediation plan and regulatory negotiations.

Ground Water Remediation
Central New York State
Managed a project involving investigation and remediation of a petroleum release and ground water/facility issues regarding an unknown chlorinated solvent release at an industrial property in central New York State (USA).

Soil Remediation
Northern New York State
Coordinated efforts with state and local government officials related to the remediation of gasoline-affected soil through the planned construction and operation of an ex-situ treatment cell utilizing soil vapor extraction at a project site in northern New York State (USA).

Bedrock Sampling
Various States
Developed analytical protocol and sampling methodologies for investigation of porosity and permeability characteristics in numerous bedrock formations in New York, Pennsylvania, Ohio, and North Dakota (USA).

Regional Subsurface Structural Investigations
Various States
Developed and performed extensive regional subsurface structural investigations in portions of New York, Pennsylvania, Ohio, North Dakota (USA), and Ontario (Canada).

Andrew Coenen

Mr. Coenen has 19 years of general analytical chemistry experience, 6 years of analytical laboratory experience, and 13 years of environmental consulting experience, including analytical data validation, sampling and analysis programs, quality assurance programs, technical support, laboratory audits, 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, NYSDEC ASP, and NJDEP protocols. He is proficient with GIS/Key environmental management software and has operated a mobile gas chromatograph laboratory used to test soil and water samples for quick-turn volatile analysis.

Mr. Coenen is an expert in GIS Solutions GIS\Key software, and has implemented the system's cutting edge data management protocols and processes for numerous large and small scale site investigation and remediation projects throughout the Uniteed States.

GIS\Key is a comprehensive, environmental data management and reporting tool. The software suite includes specific modules for storing and presenting Chemistry, Geology, Hydrology, NPDES, and Radiology data.

Fields of Competence

- Analytical data review and validation
- Environmental Database Management (GIS/Key)
- Laboratory Subcontractor Management
- Analytical protocols for pollutants by USEPA methodologies
- Methods of analysis of organic and inorganic parameters
- Review and preparation of QA/QC plans
- Field analytical techniques
- Multi-Media Sampling

Education

- 8-Hour OSHA Annual Refresher Training, 1999 - current
- 40-Hour OSHA [29 CFR 1910.120 (e) (2)] Health and Safety Training, 1998
- Rutgers University/Cook College - NJDEP Using GIS for Environmental Evaluations, October 1999
- Computer Aided Drafting, 50-Hour Course, Island Drafting and Technical Institute, 1998
- Immunoassay Testing Training Program, Strategic Diagnostics Inc., 1998
- B.S. Chemistry, University of Michigan, 1991

Languages

- English, native speaker
- Knowledge of German and Spanish

Key Projects

Environmental Data Management: Contaminated Site Management

Data validation for numerous projects located in New York, New Jersey, California, Connecticut, Illinois, Iowa, Indiana, Maryland, Massachusetts, Michigan, Pennsylvania, Rhode Island, and Wisconsin, involving evaluation of aqueous, soil, sediment, leachate, and air samples analyzed by USEPA Contract Laboratory Protocols, State Protocols and numerous methodologies for organic, inorganic, wet chemistry parameters, TPH, and various other analyses.

Reviewed sampling and laboratory chemical data for adherence to New Jersey Department of Environmental Protection protocols and New York State Department of Environmental Conservation on numerous projects. Also constructed electronic deliverables for submission to NJDEP and NYSDEC in required electronic formats.

Database construction & management for numerous investigations utilizing GIS/Key software. Compiled field and laboratory data and generated result summary tables, contours, isopleths, contaminant plume maps, cross-sections, and boring logs.

Prepared numerous Sampling and Analysis Plans (SAPs) and Quality Assurance Project Plans (QAPPs) for adherence to state and federal guidelines.

Project Manager responsible for the coordination and performance of a major hydrogeologic investigation for an ISRA site (NJDEP Site Remediation) in East Rutherford, NJ. Conducted an extensive volatile organic compound plume delineation, a vapoer intrusion investigation, installation of an extensive ground water monitoring well network, ground water sampling.

Quality Assurance Officer responsible for review of all data collected at several sites including the former Brooklyn Navy Yard Industrial Park, several NYSDEC Standby Contract Projects, Sherwin Williams Superfund Site, Hydrite Chemical Company in Waterloo, Iowa.

Project management and technical support for Special Analytical Services required to delineate low-level PAH contamination at a Superfund Site. This included method development and validation of a Selected Ion Monitoring (SIM) GC/MS technique.

Utilized Immunoassay test kits for field measurement of PCB contamination at the former Brooklyn Navy Yard, Brooklyn, New York. Performed data validation of all field analytical samples and off-site laboratory samples and compared off-site results to test kits.

Conducted subsurface investigations with a Geoprobe. Performed various field tests.

Supervision of tank removal and subsequent soils evaluation for contamination.

Matthew W. Botzler, PG, OHST

Mr. Botzler is a project manager based in ERM's Malvern, Pennsylvania office. He has more than 8 years of experience as a geologist in the field of environmental consulting. His primary focus has been in the practice of site investigation and remediation and has taken active roles in assisting with the management of contaminated sites for a wide range of industries including chemical, Oil and Gas, and light and heavy manufacturing. Matthew is also a practicing Health and Safety professional and currently serves as the Mid-Atlantic Business Unit's Health and Safety Coordinator, which consists of the New York, New Jersey, and Pennsylvania offices.

Mr. Botzler's project experience includes the organization, implementation and management of soil, sediment, soil gas, sub-slab, air, groundwater, and surface water sampling events. Mr. Botzler also has experience with subcontractor management, construction and drilling oversight, Geosynthetic liner installation and QA/QC processes, groundwater remediation design, and technical report writing.

As a Health and Safety professional, Mr. Botzler's responsibilities include support of employee training, implementation of health and safety programs and initiatives, risk assessment and mitigation, and management of incidents within the business unit. He is the point of contact for concerns and questions regarding ERM policies and best work practices both internal and external to ERM. Additionally, Mr. Botzler performs document and on-site project audits for compliance with ERM and regulatory Health and Safety requirements and has experience in providing project related implementation of Client specific programs and developing, evaluating, coordinating, and revising written management systems, including various elements of corporate health and safety programs.

Fields of Competence

- Geological logging and sampling of soil, hard rock, and river sediments
- Groundwater sampling and remediation
- Hydrologic testing
- Construction management and oversight
- Soil erosion and sediment control practices
- Geosynthetic Liner Installation and QA/QC
- Technical report preparation and data analysis
- Health and Safety program development and instruction
- Ergonomics
- Construction and Workplace Health & Safety
- Safety Compliance

Key Industry Sectors

- Telecommunication
- Transportation
- Construction and Engineering
- Industrial

Education

- MS, Ocean, Earth and Atmospheric Sciences, Old Dominion University, VA, USA, 2007
- BS, Geology, Old Dominion University, VA, USA, 2004
- Pennsylvania Professional Geologist No: PG005066
- Occupational Health and Safety Technologist No: 5537
- Safety Trained Supervisor No: IEX10056
- Occupational Safety and Health Administration (OSHA) 40-hour Hazardous Waste Site Operations (HAZWOPER)
- Certified as an inspector for Geosynthetic material and compacted clay liners, "GCI-ICP Certified Inspector"

Publications

"Condensed and Expanded Sections in the lower Mesaverde Clastic Wedge, Campanian of Wyoming: Evidence for Tectonic Rectification of Sea Level" A Thesis Submitted to the Faculty of Old Dominion University in Partial Fulfillment of the Requirement for the Degree of Master of Science in Ocean and Earth Sciences, 2007.

Health and Safety Experience

- Northern Region H&S Communications and Training Lead - responsible for developing, evaluating, and coordinating corporate Health and Safety programs and management systems.
- Mid-Atlantic Business Unit H&S Coordinator - responsible for the completion of risk assessments, implementation of risk management and control, and performance assurance within the Philadelphia, New Jersey, and New York City offices.
- Manager of behavior based communication system and ensures the development and completion of any corrective actions, as well as leading incident investigations and incident root cause analyses.
- Manages Health and Safety statistical data, performs subsequent trend analysis, and has developed multiple, hazard specific, awareness and mitigation trainings within the Northern Region.
- Performs internal project safety document reviews and onsite safety audits.
- Experienced in the provision of Health and Safety programs to employees and the implementation of new Health and Safety initiatives and practices, including OHSAS 18001 and ISO 14001 management system.
- Experienced in onsite Health and Safety program oversight and compliance.

Key Projects

IPC, Wilmington, DE
Project manager at an active petroleum recycling facility. The site was characterized by significant hydrocarbon contamination, which threatened an adjacent wetland and river. Site impacts are being addressed through on-going free-product recovery, implementation of phytoremediation through the installation of an engineered wetland and arbor groundwater barrier, and deed restrictions.

Harbor Point Development Group, Baltimore, MD
Project Health and Safety Consultant for a former chromium ore processing facility with related impacts to soil and groundwater. Worked with project team to develop and maintain compliance with management programs that addressed the exposure pathways of concern for potential airborne dust from intrusive activities resulting in incidental inhalation, ingestion or dermal contact, including contact with contaminated materials and liquids while handling during construction. Performed multiple onsite audits of the ongoing Health and Safety management system, working with general contractors, third party subcontractors, and regulatory agencies.

Avtex, Front Royal, VA.
Lead QC Inspector during the Geosynthetic capping project. Responsibilities included health and safety oversite, cap installation, and cover soil placement. Directly responsible for liner quality control testing and reporting to site contractor and EPA site representative. Led and managed field personnel during the installation of multiple deep bedrock extraction and monitoring wells, several long-term pumping tests, multiple geophysical investigations of hazardous waste depositional basins, and multiple well installation for PCB sampling and remediation. Additionally, an engineering team member for the design and construction of long-term, multi-well, groundwater and leachate extraction system. Monitoring programs and operations and maintenance manuals were also developed for this project.

AMERCO Real Estate, Langhorne, PA
Project manager of Act 2 investigation and remediation efforts at a site in southeastern Pennsylvania.
The site was historically operated as a fueling station, which subsequently had a release of unknown amount of fuel. The project involved the investigation and remediation of impacted soil, ground water, and potential sensitive receptors. Release of liability was achieved under Statewide Health Standards.

EDM, Hometown, PA.
On-site consultant during wetland excavation, remediation, and stream restoration. Monitored and delegated construction processes and minimized ecological impact. ERM representative for long term construction and geosynthetic capping processes. Managed time and materials and field construction. QC officer for Geosynthetic liner installation for the in-place

capping closure of a 250,000-cubic yard pile of wire chop fluff at a northeastern Pennsylvania Superfund site. Conducted numerous soil and groundwater sampling events. Communicated with contractor, sub-contractor, federal, and state regulatory agencies during the process.

Boeing, Pleasantville, NJ
On-going remedial activities completed under NJDEP Bureau of Underground Storage Tanks (BUST) and NJDEP Industrial Site Recovery Act (ISRA) programs. Responsible for monthly separate phase liquid recovery and liquid level data collection events at a truck services facility. Conducted semi-annual ground water sampling events using peristaltic and whale pumps, bailers, and three-volume purge methodology. Assisted in writing semi-annual Remedial Action Progress Reports. Created ground water contour maps, data tables, and various figures. Provided oversight of quarterly waste pick-up events. Prepared electronic data submittals to the NJDEP.

Crompton Colors, Inc., Chemtura, Newark, NJ.
Task manager and Health and Safety technician, provided oversight and direction for the installation of a multi-channel HDPE groundwater recovery system, conveyance piping, and associated pumping components.

Dublin NPL Site, Dublin, PA.
Deepened existing hardrock monitoring wells by managing and monitoring drilling subcontractor. Collected drill cuttings and sampled for trace VOC and lithology changes. Collected multiple ground water samples using QED micro-purge sampling equipment. Conducted a multiple interval Packer test in existing wells while collecting ground water for characteristic testing.

North Penn Area 2 Superfund Site, PA
Task manager for the design and implementation of a large scale groundwater sampling field effort to support the active ground water recovery system. Assisted in the development of the site's Remedial Design Work Plan, Sampling and Analysis Plan, and Health and Safety Plan.

CSG Commodore, Norristown, PA.
Managed and oversaw the delineation and characterization of "source area" using both a low clearance hollow stem auger and hard rock drilling techniques inside of the facility. Installed monitoring wells and conducted performance monitoring of a previous multi-staged chemical oxidation to treat impacted bedrock. Logged and classified soil overburden and rock cores retrieved from multiple drilling locations. Monitored headspace of samples using a PID and breathing zones using a PID and Drager tubes for vinyl chloride and benzene.

Solvey Solexis Inc., West Deptford, NJ.
Lead field technician during a low flow sampling event of approximately 100 shallow and deep wells using a Teflon bladder pump. Compiled and constructed data tables and narrative for submitted sampling report.

Chesapeake Energy, PA.
Conducted multiple composite sampling events of flow back water used in rock fracturing of the Marcellus Shale formation. Portable peristaltic pumps and mixing apparatuses were used during sampling. All samples were taken from within a roll-off frac tanks onsite at the active production well.

Hercules Research Center, DE.
Oversaw sub-surface utility investigation and soil excavation of contaminated soils. Managed the removal, transportation, and deposition, of the excavation. Collected soil samples before and after excavation. Prepared tables, figures, and photographs for report.

BROS Superfund site, NJ
Assisted in LNAPL extraction system construction and operation. Field team leader for the installation of more than 60 shallow extraction wells. Other responsibilities included data acquisition, soil and groundwater sampling, and waste management of PCB contaminated product.