FIELD ACTIVITIES PLAN
DATA GAP INVESTIGATION

MOHONK ROAD INDUSTRIAL
(356023)

WORK ASSIGNMENT NO. D007619-34

Prepared for:

New York State Department of Environmental Conservation
Albany, New York

Prepared by:

MACTEC Engineering and Consulting, P.C.
Portland, Maine

MACTEC: 3617157346

July 2015

FINAL
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TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES

Tables

LIST OF FIGURES

Figures

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

1,1-DCA	1,1-dichloroethane
1,1-DCE	1,1-dichloroethene
1,1,1-TCA	1,1,1-trichloroethane
AOC	area of concern
CAMP	Community Air Monitoring Plan
COCs	contaminants of concern
CSM	conceptual site model
bgs	below ground surface
DPT	Direct-Push Technology
EC	electrical conductivity
ºF	degrees Fahrenheit
FAP	Field Activity Plan
FDR	Field Data Record
FS	feasibility study
ft	foot or feet
HASP	Health and Safety Plan
HPT	Hydrophysical Tool
IDW	investigation-derived waste
K	hydraulic conductivity
LMS	Lawler, Matusky & Skelly Engineers
MACTEC	MACTEC Engineering and Consulting, P.C.

GLOSSARY OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

MIP	membrane interface probe
MIPS	membrane interface probe sampling
MRIP	Mohonk Road Industrial Plant
msl	mean sea level
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PDF	portable data file
PID	photoionization detector
ppb	parts per billion
ppm	parts per million
QAPP	Quality Assurance Program Plan
RI	remedial investigation
ROD	Record of Decision
Site	Mohonk Road Industrial Plant
SVE	soil vapor extraction
µg/L	microgram(s) per liter
$\mu g/m^3$	microgram(s) per cubic meter
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USDOT	United States Department of Transportation
VOC	volatile organic compound
WA	Work Assignment
XSD	Halogen Specific Detector

1.0 INTRODUCTION

MACTEC Engineering and Consulting, P.C. (MACTEC), is submitting this Field Activities Plan (FAP) to the New York State Department of Environmental Conservation (NYSDEC) for the Data Gap Investigation at the Mohonk Road Industrial Plant (MRIP) Site (Site) in the Hamlet of High Falls, Ulster County, New York (Figure 1.1). This FAP was prepared in response to Work Assignment (WA) No. D007619-34 (NYSDEC, 2015), and in accordance with the April 2011 Superfund Standby Contract No. D007619 between the NYSDEC and MACTEC.

The Site has been identified as a source of volatile organic compounds (VOCs), primarily 1,1,1-trichloroethane (1,1,1-TCA), which have been detected in soil, groundwater, and soil vapor. This FAP presents a technical scope of work to conduct data gap investigation activities to evaluate the remedy and options for remedial system optimization, including membrane interface probe (MIP) sampling, soil sampling, test pitting, downhole geophysics, groundwater level measurement, and packer groundwater sampling to determine whether the chosen technology will be effective at the Site. Work will be conducted in accordance with the NYSDEC Department of Environmental Remediation-10 Guidance (NYSDEC, 2010).

This FAP is organized into six sections as follows:

- *Section 1.0* – Introduction, WA Objectives, and Site background
- *Section 2.0* –Site Physical Setting – Describes the physical, geological, and hydrogeological setting of the Site.
- *Section 3.0* – Conceptual Site Model (CSM) – Presents a working conceptual model describing how contaminants may have been released into the environment, how the chemicals may migrate, and the receptors that may be affected.
- *Section 4.0* – Scope of Work - Describes the sampling and analysis that will be performed to assess contaminant distribution in groundwater, soil, and soil vapor.
- *Section 5.0* – References.

The FAP is supplemented by the following attached documents:

- *Appendix A – Cross Section*
- *Appendix B – Historical Soil Gas Data*
- *Appendix C* – MACTEC Short Form Site-Specific Health and Safety Plan (HASP)

1.1 DATA GAP INVESTIGATION OBJECTIVES

Based on an updated CSM for the Site and identified data gaps (MACTEC, 2015), additional information is needed to assess and/or modify the existing remedial measures in order to effectively remediate the contamination at the Site. The following objectives for the field program have been developed to address the uncertainty as to whether the apparent residual contamination resides in the overburden, at the bedrock interface, or within shallow bedrock fractures:

1) Evaluate the potential presence of residual VOC contamination (primarily 1,1,1-TCA) within the overburden and in the bedrock matrix in the interpreted source area (i.e. in the previously excavated former septic tank area, the area between the former septic tank and the MRIP building, the septic piping termini, and beneath the Site building).
2) Evaluate the hydrostratigraphic migration pathways on-site and contaminant concentrations in the source area groundwater zones.
3) Evaluate the hydraulic properties of the deeper overburden and shallow bedrock within the source area to aid in determining if the existing system can be modified to control or mitigate contaminate mass and mobility, or if other remedial options should be considered.

This FAP is prepared to provide the technical scope of work associated with the data gap investigation.

1.2 SITE BACKGROUND

The Site background is discussed in the following sub-sections.

1.2.1 Site Description

The Site is located in the Hamlet of High Falls, Ulster County, New York, approximately seven miles north-northwest of the Village of New Paltz (Figure 1.1). The Site includes the original MRIP property at 186 Mohonk Road and surrounding properties impacted by the contaminated groundwater plume emanating from the Site.

1.2.2 Site Background

Industrial activities have taken place at the Site since the early 1960s, which included metal finishing, wet spray painting and the manufacturing of store display fixtures, card punch machines and computer frames. The property currently contains a 43,000-square foot (ft), single-story building. A septic field serving this building was used to dispose of hazardous substance-containing wastes, such as solvents and wastes from paint and metal-working operations. Drums, paint sludge and other wastes were also buried in several locations on the MRIP Property.

In April 1994 a residential well near the MRIP property was sampled and was found to contain elevated levels of VOCs above the NYS Class GA drinking water standards. An Immediate Investigation Work Assignment was implemented in 1994, and groundwater sampling results demonstrated on-site interface and bedrock wells, and the in-service production wells, had 1,1,1-TCA and other compounds above groundwater standards, with the highest levels found in the overburden/bedrock interface wells directly downgradient of the underground septic tank area (i.e. MW-4; 82,000 micrograms per liter [µg/L]).

Groundwater sampling results collected during a Remedial Investigation/Feasibility Study (RI/FS), indicated that downgradient private water supplies contained 1,1,1-TCA concentrations ranging from non-detectable to 880 parts per billion (ppb), and total VOC concentrations ranging from 1.6 ppb to 1,077 ppb (Lawler, Matusky & Skelly Engineers [LMS], 1998b). In addition, groundwater in the bedrock aquifer beneath the MRIP property exhibited VOC concentrations above the United States Environmental Protection Agency (USEPA) Maximum Contaminant Level, and NYS Class GA Water Standards. Based on the findings of the initial investigations, 1,1,1-TCA, 1,1-dichloroethene (1,1-DCE), 1,1-dichloroethane (1,1-DCA), trichloroethene, tetrachloroethene, ethylbenzene and xylenes were identified as contaminants of concern (COCs) in Site soils. Data collected from groundwater sampling indicated that a dissolved-phase VOC plume extended approximately one mile north-northeast from the MRIP property.

The Record of Decision (ROD) was signed in 2000 (USEPA, 2000). The description of the selected remedy in the ROD as it pertains to contaminant reduction includes:

- Extraction of contaminated groundwater in the near field and far field plume to restore the aquifer to its most beneficial use (as a potable water supply), treatment with an air stripper, and discharge of the treated water to the nearby Rondout Creek and Coxing Kill Creek.

The "near field plume" refers to that portion of the groundwater plume with total VOC concentrations greater than 1,000 ppb, while the "far field plume" refers to the component of the groundwater plume with 10 ppb to 1,000 ppb total VOCs.

- The construction of a public water supply system to provide potable water to the residences and businesses in the Towns of Marbletown and Rosendale with impacted or threatened private supply wells. The primary water supply for the system will be the Catskill Aqueduct. In addition, the individual granular activated carbon filtration systems currently in use will be operated until the new public water supply system is operational.
- Implementation of a groundwater monitoring program to evaluate the effectiveness of the remedy.
- Institutional controls may be employed to prevent future use of the bedrock aquifer in the impacted or threatened area.
- Excavation of VOC-contaminated soils with concentrations above the cleanup criteria to prevent or minimize cross-media impacts from COCs in soil to groundwater.
- Off-Site disposal of the contaminated soil at appropriately permitted facilities.

In September 2008, USEPA issued a ROD Amendment in which the far field treatment system component of the groundwater remedy was replaced by monitored natural attenuation (USEPA, 2008). The RAOs were updated to reflect activities completed to date including:

- Restoring the aquifer to its most beneficial use, i.e., as a source of potable water, and restore it as a natural resource;
- Eliminating further off-MRIP property contaminated groundwater migration; and
- Eliminating inhalation and ingestion of, and dermal contact with, contaminated groundwater associated with the Site that does not meet state or federal drinking water standards.

The following remedies were implemented to address the contamination originating from the MRIP Site.

- Near field groundwater extraction and treatment system
- Contaminated soils excavation
- Soil vapor extraction (SVE) system
- Vapor intrusion mitigation system
- Institutional controls
- Operation, maintenance and monitoring

2.0 SITE PHYSICAL SETTING

The sections below describe the topography, climate, surface water, groundwater hydrology, and geology in the area of the Site.

2.1 TOPOGRAPHY

The topography in the vicinity of the MRIP site is controlled by the structural geology of the region. The MRIP site is situated along the crest of an anticline that plunges north-northeast. The floor slab in the MRIP building is the topographic high point on the site property, approximately 340 ft above mean sea level (msl). The floor slab is about 3 ft above grade at the east end of the building. The ground surface along the north side of the building slopes approximately 10 ft across its length. A plateau that extends out 100 ft from the toe of the slope may have been graded at the time of building construction.

Rondout Creek is located approximately 0.55 miles northwest of the site at an elevation of approximately 180 ft (msl). Coxing Kill is located 0.33 miles east of the site at an approximate elevation of 180 ft (msl).

2.2 CLIMATE

The climate of the area is characterized by moderately warm summers and cold winters. Mean monthly temperatures range from 22 degrees Fahrenheit (°F) in January to 71°F in July. Average annual precipitation is 50 inches, and average annual snowfall is 39 inches, according to the National Climatic Data Center: for the period of 1981-2010 (NOAA, 2015).

2.3 SURFACE WATER HYDROLOGY

Surface water drainage discharges to Rondout Creek via four primary pathways listed below:

- Site drainage predominantly flows north along a swale that passes through several downgradient residential properties before discharging into a small pond and subsequently to Rondout Creek.
- A portion of the drainage near the building flows to a ditch culvert along Mohonk Road, which ultimately discharges to Rondout Creek.

- The lawn area and a portion of the driveway south of the building drain to a culvert that passes beneath Mohonk Road. Water passing through the culvert eventually flows into Coxing Kill.
- Some of the drainage from the gravel driveway west of the building flows west within a small swale and discharges directly to Rondout Creek.

2.4 GEOLOGY

Depth to on-site bedrock ranges from 9 ft (MW-5B) to approximately 30 ft (MW-11). Overburden material consists of lodgement till, predominantly brown silt and clayey silt, little fine-sand, and trace gravel. The gravel content consists primarily of shale and was observed to increase with depth to some gravel and cobbles in interface well borings (LMS 1997a). Bedrock core samples revealed white to gray orthoquartzite consisting of quartz pebble conglomerate and arenite of the Shawangunk Formation. Fractures were present in most of the cores obtained. Some of the fractures had iron staining or fines in the apertures of the fractures, clearly indicating that these fractures are groundwater pathways. Site geology is detailed further in Section 2.5.

2.5 GROUNDWATER HYDROLOGY

Previous investigations at the Site have identified three hydrostratigraphic zones. These zones consist of an overburden flow zone, a bedrock interface zone, and a bedrock flow zone, as detailed below and presented in Appendix A – Cross Section.

Overburden Flow Zone The overburden flow zone is characterized by groundwater flow in thin deposits of unconsolidated glacial lodgment, ablation, and weathered till, sand lenses, and fill. Some thicker (up to 50 ft) deposits of unconsolidated materials exist in an area just north of the Site. The till is approximately 9 to nearly 30 ft thick on the MRIP. The flux of groundwater through this flow zone is dependent upon precipitation events. At certain times of the year, this overburden unit may be seasonally perched. The water table is typically found in this zone and responds quickly to precipitation events. Overburden groundwater levels historically fluctuate greatly (i.e. approximately 6 ft. variations between sampling events in MW-4), indicative of its perched nature.

The principal direction of horizontal overburden groundwater flow is predominantly to the north. Based on visual inspection of soils, estimates of hydraulic conductivity (K) developed during the RI/FS indicated permeability of the overburden flow unit in the range of 1 x 10^{-6} to 0.1 ft/day. Average linear groundwater velocity was calculated to be approximately 1 x 10^{-4} ft/day (LMS, 1998a). Groundwater in this overburden flow zone also exhibits a downward component of flow into the bedrock interface and bedrock flow zones. Thus, any waste disposed in this zone is anticipated to migrate downward through more transmissive sand lenses or fractures within the glacial till unit.

Bedrock Interface Flow Zone. The transition from unconsolidated material to the underlying bedrock includes a bedrock interface zone consisting of sand, gravel, and weathered rock fragments. This zone appears to be in direct hydraulic connection with the underlying bedrock flow zone in certain areas of the site, and it appears to be confined, or partially confined, by the overlying glacial till unit. This zone is anticipated to be more transmissive than the overlying overburden. The vertical groundwater flow gradients for this zone are strongly downward, ranging from 0.14 to 0.46 ft/ft (RI/FS) indicating that the MRIP site is located in a recharge zone of the deeper bedrock flow zone. Average linear groundwater velocity within this zone was estimated to be approximately 1.33 x 10^{-3} ft/day (LMS, 1998a).

Bedrock Flow Zone. The bedrock flow zone represents the principal source of drinking water for the High Falls area. The flow zone is encountered in highly competent orthoquartzites of the Upper Member of the Shawangunk Formation, and also in gray shale deposits (specifically north of the site in the former septic system area). This unit has little to no remaining primary porosity, but is cut by various fractures. Fracture orientation varies from near vertical to near horizontal. These fractures are the primary storage for groundwater and the anticipated pathways for contaminant transport.

The Site is located near a topographic high, and serves as a recharge area for the fractured bedrock aquifer. Vertical gradients are primarily downward within the bedrock flow zone, and recharge to the bedrock aquifer predominantly occurs from the bedrock interface flow zone where permeable glacial overburden overlies the fractured bedrock interface zone. Estimates of K developed during the RI/FS indicated permeability of the bedrock flow zone in the range of 0.24 to 0.46 ft/day. Based on the regional groundwater gradient and estimated porosity, the average linear groundwater

velocity in bedrock was calculated to be approximately 0.26 ft/day (LMS, 1998a). The primary horizontal direction of bedrock groundwater flow emanating from the site is to the north toward Rondout Creek, with minor components of lateral flow to the northeast and northwest.

3.0 CONCEPTUAL SITE MODEL

A CSM was formulated using information available (MACTEC, 2015). The CSM is considered a dynamic model, subject to modification as more data become available. The CSM presented below will be used to focus, explain and modify data gathering activities as well as subsequent report-writing activities. Staff collecting samples will evaluate conditions to determine if what is observed in the field is consistent with the CSM. If it is not, then the project team will re-evaluate the sampling approach to ensure that the samples collected meet the project objectives. The CSM will be updated when information from field activities and/or laboratory analyses demonstrate the need for its modification.

3.1 SITE BACKGROUND

The Site property had been used for industrial and commercial activities since the early 1960s. These activities included metal finishing, wet spray painting and the manufacturing of store display fixtures, card punch machines and computer frames. Wastes from these operations were typically discharged into the on-property septic system. The MRIP property now consists of approximately seven acres of the original 14.5 acres and currently hosts mixed commercial businesses.

3.2 CONTAMINANTS OF CONCERN AND MEDIA AFFECTED

The primary contaminant at the site is 1,1,1-TCA. The breakdown products 1,1-DCE (abiotic) and 1,1-DCA (biotic) have also been detected in both the overburden and bedrock groundwater systems, although the concentrations have been low in comparison to 1,1,1-TCA. These contaminants have migrated through the source area till to bedrock, contaminating overburden and bedrock groundwater at and downgradient of the Site. These contaminants have also been detected in soil vapor within the Site building. The highest sub-slab concentration measured in the Site building is located at its west end, at Sample Port #3 (See Appendix B). Other sub-slab sampling points in closer proximity to where the Orangeburg piping exits the building to the former septic system showed lower concentrations than Port #3. The source of the elevated soil gas concentrations at Port #3 has not been identified.

3.3 SOURCE AREAS

Based on the concentration of 1,1,1-TCA (26%) detected in the sludge remaining in the onsite underground septic tank, and the prominence of 1,1,1-TCA as a COC, the former septic system area (Area of Concern [AOC] D) was likely the primary source disposal zone. AOC D is depicted on Figure 3.1. AOC D consisted of a 1,000 gallon steel cylindrical tank, and Orangeburg piping (a bitumenized fiber pipe made from layers of wood pulp and pitch) tracing from the building to the septic tank, and subsequently to a distribution box from which two outlet laterals discharged (eastern and western lateral) (see Figure 3.1). Soil samples collected along the laterals and at their terminal ends revealed little or no contamination. A cross section of the excavated area surrounding the former septic tank is shown in Appendix A.

3.4 CONTAMINANT OF CONCERN POINTS OF ENTRY

Although approximately 20 cubic yards of soil was excavated from the former septic tank area, and confirmatory sampling at the limits of the excavation showed that the soil cleanup goals for the COCs were met, it is anticipated that the source of 1,1,1-TCA found in nearby groundwater samples is a result of vertical migration of 1,1,1-TCA from a shallow source area to deeper overburden soil and subsequently to the shallow overburden/bedrock interface zone, and into localized shale deposits or fractures within bedrock.

3.5 HYDROGEOLOGY AND CONTAMINANT DISTRIBUTION

Based on the current understanding of the CSM, 1,1,1-TCA from the source area is anticipated to have migrated vertically downward through the overburden till and into bedrock. The 1,1,1-TCA present in soil and bedrock appears to be acting as a residual source of groundwater contamination. 1,1,1-TCA tends to be recalcitrant in the environment, and it is not unusual to find it persisting decades after its purported discontinued use. 1,1,1-TCA degrades through reductive dechlorination. Although the presence of daughter products resulting from dechlorination of 1,1,1-TCA suggests that subsurface site conditions may be suitable for its natural degradation, concentrations are not diminishing at a rapid rate.

The near-surface contaminated soil within the source area was remediated, effectively eliminating any surface runoff pathway. The overburden glacial till consists predominantly of sandy silt, and contaminant migration within the till may be controlled by the factors that govern porous media flow. As such, the movement of COCs in the till is anticipated to be slow. The weathered bedrock interface zone, can act as either a porous or fractured media. Therefore, contaminant migration in the bedrock interface zone is anticipated to behave as a dual porosity model (i.e., fractured and porous media flow). Migration in the underlying fractured bedrock will be controlled by fracture aperture, hydraulic gradients, and total organic carbon content.

The downward vertical hydraulic gradients, coupled with denser-than-water COCs and extended pumping from bedrock extraction wells MW-5R, MW-7R, and ERT-1 (Figure 3.1), appear to have resulted in the vertical migration of COCs through the overburden aquifer into the bedrock aquifer. Additionally, the finding of 1,1,1-TCA in wells upgradient of the former septic system may be attributed to historical pumping of the MRIP production wells (MRPW-1 and MRPW-2)or the pumping of residential wells in the area.MRPW-1 is located at the west end of the building and MRPW-2 is located at the east end of the building (Figure 3.1). MRPW-2 was pump tested for 48-hours at a rate of 16 gallons per minute, indicating that it intercepts a highly transmissive fracture. MRPW-1 at one time contained 1,1,1-TCA at a concentration of 200 µg/L (LMS, 1998a).

3.6 HUMAN EXPOSURE PATHWAYS

Public water is supplied to the residences and businesses in the Towns of Marbletown and Rosendale with impacted or threatened private supply wells; therefore, there is no current exposure to groundwater via ingestion. The near-surface contaminated soil has been removed, thus eliminating the potential direct contact threat to VOC-contaminated soil. Vapor intrusion at the nearby residences was evaluated and shown not to require mitigation. Vapor intrusion within the MRIP building is currently being remediated with sub-slab depressurization systems.

4.0 SCOPE OF WORK

The selected remedy for the Site includes the existing pump and treat system. Based on the CSM and hydrogeology presented above, a data gap investigation will be conducted to better understand the contaminant distribution at the site, address identified data gaps, and provide additional data that can be used to effectively modify the existing remedial measure, if needed. The data gap investigation will be conducted to meet the following objectives:

1) Evaluate the potential presence of residual 1,1,1-TCA contamination within the source area. Specifically, evaluate the presence of 1,1,1-TCA in the overburden and in the bedrock matrix of the previously excavated former septic tank area, the area between the former septic tank and the building, the septic piping termini and under the Site building.
2) Evaluate the hydrostratigraphic migration pathways on-site and contaminant concentrations in the source area groundwater zones.
3) Evaluate the hydraulic properties of the deeper overburden and shallow bedrock within the source area to aid in determining if the existing system can be modified to control or mitigate contaminant mass and mobility, or if other remedial options should be considered.

A summary of these field tasks and methodologies, as well as sample IDs and analytical program, are described in more detail in Table 4.1, as well as in the following subsections. Proposed sample locations are shown on Figure 4.1.

4.1 GENERAL FIELD OPERATIONS

General field activities, including health and safety, access and clearance, decontamination, mobilization, air monitoring, and investigation derived wastes (IDW), are described in the following subsections. Companion documents to this FAP that will govern the execution of the field exploration activities include MACTEC's Program Quality Assurance Program Plan (QAPP) (MACTEC, 2011a) and HASP (MACTEC, 2011b). In addition to these program documents, Appendix C provides a Site-specific HASP.

Subcontractors selected to support the field activities include:

- Northeast Geophysical Services – Downhole bedrock borehole geophysics
- GeoLogic, NY, Inc. – Packer Groundwater Sampling

- TestAmerica – Performance of laboratory services for soil and groundwater
- Investigation Derived Waste (OP-TECH) – Transportation and Disposal of IDW Drums
- Subcontractor to be determined – MIP Sampling (MIPS)
- Subcontractor to be determined – Test Pitting
- Subcontractor to be determined – Survey

4.1.1 Health and Safety

The Site-specific HASP is provided as Appendix C to this document. MACTEC anticipates that the fieldwork will be conducted in Level D personal protection. Specific investigation activities, utility clearance procedures, and required level of personal protection are set forth in the Site-specific HASP. Criteria for upgrading or downgrading the specified level of protection are also provided in the Site-specific HASP. Additional health and safety requirements are set forth in the Program HASP (MACTEC, 2011b). Should Site conditions pose a threat to those present on-Site, and/or should Site conditions warrant an upgrade from Level D, as defined by the HASP, work will stop and the situation will be reevaluated by the NYSDEC and MACTEC. The NYS Department of Health (NYSDOH) Community Air Monitoring Plan (CAMP) will also be followed.

4.1.2 Access and Clearance

Exploration locations will be placed on the Site property. The NYSDEC will be responsible for coordinating initial Site access. MACTEC will coordinate logistics and access to sampling points with Site building owner(s) and/or tenants.

For clearing exploration locations of utilities, the drilling contractor will be responsible for marking locations in the field and coordinating utility clearance with Dig Safely – New York. MACTEC will confirm drilling locations and utility clearance prior to conducting drilling activities.

4.1.3 Community Air Monitoring Plan

4.1.3.1 Purpose

The purpose of the CAMP is to provide a measure of protection for the downwind community from potential airborne contaminant releases as a result of remedial work activities performed at the Site. Site-specific procedures described below are consistent with the NYSDOH generic CAMP (NYSDEC, 2010). The proposed borings are located in a commercial parking lot, or landscaped area adjacent to the parking lot.

4.1.3.2 Particulate Air Monitoring

Particulate monitoring will be conducted continuously during ground intrusive activities (e.g., test pitting and MIPS direct-push activities). Dust/particulate monitoring will be conducted in the vicinity of the excavation/drilling activities. Dust monitoring may be suspended during periods of heavy precipitation.

Particulate air monitoring will be conducted with a TSI DustTrak 8520 Aerosol Monitor (or a similar device). This instrument is equipped with an audible alarm (indication of exceedance) and is capable of measuring particulate matter less than 10 micrometers in size (PM-10). The TSI DustTrak 8520 will continually record emissions (calculating 15-minute running average concentrations) generated during field activities. The dust monitoring device will be checked periodically throughout each day of intrusive activities to assess emissions and the need for corrective action.

Weather conditions, including the prevailing wind direction, will be observed and recorded for each day of site activities. As work and weather conditions change throughout the day, the locations where the dust monitoring devices are set up may be adjusted accordingly.

Particulate monitoring response and action levels include:

- If the PM-10 particulate level 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, then dust suppression techniques must be employed. Work may continue with dust

suppression techniques provided that the PM-10 particulate levels do not exceed 150 µg/m^3 above background level and provided that no visible dust is migrating from the work area.

- If after implementation of dust suppression techniques, the PM-10 particulate levels are greater than 150 µg/m^3 above background, work will be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the PM-10 particulate concentration to within 150 µg/m^3 of the background level and in preventing visible dust migration.

4.1.3.3 VOC Air Monitoring

VOC air monitoring will be conducted in conjunction with the dust monitoring program. VOC air monitoring will be conducted using a RAE Systems MiniRAE 2000 VOC instrument (or a similar photoionization detection [PID] device). This will provide real-time recordable air monitoring data.

VOC monitoring will be conducted for ground intrusive (continuous monitoring) and non-intrusive activities (periodic monitoring).

VOCs will be continuously monitored in the vicinity of drilling and test pitting operations. Upwind/background concentrations will be measured before field activities commence and periodically throughout the day to confirm background conditions. The work area VOC monitoring device will also be checked periodically throughout the day to assess emissions and the need for corrective action.

VOC monitoring response and action levels include:

- If the ambient air concentration of total organic vapors at the work area exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities will be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.
- If total organic vapor levels at the work area persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. Work activities can resume provided the total organic vapor level 200 ft downwind of the work area or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less – but in no case less than 20 ft, is below 5 ppm over background for the 15 minute average.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities will be shut down.

Weather conditions, including the prevailing wind direction, will be observed and recorded for each day of site activities. As work and weather conditions change throughout the day, the locations of the VOC monitoring devices may be adjusted accordingly.

4.1.4 Mobilization

Mobilization will include obtaining utility clearances for proposed locations, procurement of subcontractors, and the acquisition and coordination of health and safety and sampling supplies and equipment. The NYSDEC will be responsible for obtaining access to the Site.

4.1.5 Decontamination

Sampling methods and equipment for this field program have been chosen to minimize IDW, reducing the potential for cross-contamination. Disposable sampling equipment will be used as much as practical to minimize decontamination time and water disposal. Non-disposable sampling equipment will be decontaminated before and after the collection of each sample. Decontamination methods and materials are described in detail in Subsection 4.3 of the QAPP.

Non-disposable sampling equipment will be decontaminated by 1) washing the sample collection equipment with potable water and Liquinox, rinsing with potable water, rinsing with deionized water, and then allowing the equipment to air dry, or 2) steam cleaning the equipment and then allowing the equipment to air dry. Drilling equipment (i.e. drill rods and casing) will be decontaminated by steam cleaning with potable water on a temporary decontamination pad constructed at the Site, prior to each boring and before leaving the Site. Decontamination water will be collected, containerized, and stored on-site in labeled United States Department of Transportation (USDOT)-approved containers in an area with secondary containment awaiting on-site treatment and/or proper disposal based on IDW characterization sampling results.

4.1.6 Investigation Derived Wastes

The method of disposing of IDW will be based upon whether the wastes are considered hazardous or non-hazardous. USDOT-approved 55-gallon containers filled during the field investigation will be staged on-site in an area designated by the NYSDEC. Transport and disposal of these containers will be arranged by MACTEC on behalf of the NYSDEC and will be in accordance with the Site Management Plan.

In general, soil cuttings will be segregated by boring. Soil from multiple borings can be combined into one drum if the borings are in the same area (i.e., within the former source area, or outside the former source area), or PID readings from the soil cuttings are similar (i.e. don't mix soils with elevated PID readings, with soils where PID readings do not exceed background). If soil samples were not collected during the installation of the borings, then samples will be collected from the containerized waste for analysis of VOCs by USEPA Method 8260, to characterize the waste for off-site disposal. Wastes will be sampled such that there are representative samples from areas that may be contaminated, and those areas that are less likely to be contaminated. Wastes will then be manifested for disposal based on non-hazardous, a "contained in" determination, hazardous, or hazardous requiring pre-treatment.

IDW water (i.e., decontamination water, development water, purge water) will be collected, containerized, and stored on-site in labeled USDOT-approved containers in an area with secondary containment awaiting on-site treatment and/or proper disposal based on IDW characterization sampling results.

4.2 INVESTIGATION ACTIVITIES

The fieldwork is anticipated to be conducted as described in the following subsections. The fieldwork methodology will be conducted in accordance with the specifications presented in the QAPP (MACTEC, 2011a), a stand-alone document.

Field work will include the following items:

1) MIPS via direct-push drilling to screen soil in the area between the former septic tank and the building for the presence of VOCs for the purpose of identifying residual source areas.

2) Confirmatory soil sampling via direct push in areas showing the highest concentration of contamination based on the MIPS survey.
3) Test pit excavation along points of the Orangeburg piping that leads from the former distribution box, including the eastern and western piping termini areas to assess whether residual contamination is or is not present and providing an on-going source of groundwater contamination.
4) Down-hole geophysical survey of on-site bedrock wells including the deeper and most-contaminated bedrock SVE wells (SVE-20 and SVE-21) and extraction wells (ERT-4, MW-5R, MW-7R, and ERT-1) to identify fractures, dominant flow zones, and possible changes in bedrock stratigraphy that could be serving as contaminant migration pathway(s). Downhole geophysical logging will include borehole caliper, single point resistivity, acoustic televiewer, optical televiewer, heat pulse flow meter, and gamma ray logging;
5) Packer testing of select SVE and/or bedrock extraction well(s) subsequent to the results of the down-hole geophysical logging, and the collection of discrete samples for VOCs from each packer interval;
6) Sub-slab soil sampling in the vicinity of the elevated concentrations of 1,1,1-TCA in previous subslab soil gas points (i.e., Port #3, T2-001 and T2-003 (Appendix B)), conducted using hand driven sampling tubes (e.g., slam-bar with macro core sampler) to evaluate possible residual contaminant sources that may exist under the building.
7) Completion of a simultaneous groundwater level gauging event at all accessible monitoring wells, SVE wells, and extraction wells under pumping conditions.

4.2.1 Membrane Interface Probe (MIP) Sampling

To evaluate the potential that VOC contamination exists in the soils in the area between the former septic tank and the Site building, as well as to better evaluate the stratigraphy of the source area, MIP sampling will be implemented using direct push technology (DPT).

The MIP sampler fits onto conventional DPT equipment and is inserted into the target investigation zone in a manner similar to typical DPT sampling to provide real-time detection of VOCs or non-aqueous phase liquid in the vadose and saturated zones. The tool tip has a membrane that is permeable to VOCs, and a built-in heating element that causes VOCs near the MIP to volatilize from soil or groundwater. The volatilized VOCs pass through the membrane, where a carrier gas transports the VOCs through sealed tubing to one or more truck-mounted detectors (e.g., a Flame Ionization Detector, Electron Capture Detector, or PID). The detectors measure total VOCs in the carrier gas and provide this information in real-time as an instrument response. The detectors do not provide a quantitative concentration of VOCs in the groundwater or soil. However, the response level from the detector corresponds to the amount of VOCs present in the carrier gas,

which is proportional to the mass of VOCs in the soil or groundwater at the MIP location. A greater response from the detector indicates greater VOC concentrations in the subsurface.

The MIP also measures soil electrical conductivity (EC) and hydraulic conductivity (K) and reports these parameters along with the output from the VOC detectors. Data are plotted in respect to depth below ground surface (bgs) on a continuous log. The use of MIP technology will permit collection of chemical (i.e., Halogen Specific Detector [XSD] tool), hydrophysical (i.e., Hydrophysical [HPT] tool) and stratigraphic (EC tool) data with the principal objective of evaluating subsurface materials, hydraulic properties, and contaminant distribution.

Field observations will be used to determine specific locations and number of MIP sampling points. Observations will be recorded on the Field Data Record (FDR). For planning purposes, MACTEC is anticipating to perform MIP sampling at approximately fifteen locations, with the primary goal of analyzing the soil in the area between the former septic tank and the building for the presence of VOCs. The proposed MIP sampling points are depicted on Figure 4.1 and summarized in Table 4.1. The results of the MIP investigation will assist in determining the horizontal and vertical extent of high-concentration contaminant source areas in soil or groundwater. It is anticipated that the MIPS sampling will be completed over a period of approximately two days.

4.2.2 Soil Sampling

Following completion of the MIP survey, five direct-push soil borings will be installed for the purpose of collecting soil samples for laboratory analysis to ground-truth the MIP data. The direct-push soil borings will be offset as close as possible to the corresponding MIP boring (within 12 inches). Discrete soil samples will be collected with a Macro-Core sampler, field screened with a PID and classified according to the USCS. Up to three samples from each boring will be submitted for laboratory analysis of VOCs by EPA Method 5035A/8260. Specific locations and depths of the soil samples will be chosen in the field and will represent:

- a zone where MIP logging indicates significant contamination (e.g., plume core);
- a zone where contamination is less than observed in the plume's core; and
- a sample where contamination is near or at the detection limit of the MIP system.

PID headspace readings and boring observations will be recorded on the FDR and as discussed in Subsection 4.4.3 of the QAPP.

4.2.3 Test Pits

Test pits will be conducted by a standby subcontractor and will extend as deep as the excavation equipment will allow (up to approximately 12 ft bgs, or until the water table is encountered). Soil will be logged using the USCS. It is estimated that four test pits will be excavated, with the principal objectives of determining the depth and character of underlying native soil, and whether VOC contamination is present along and at the eastern and western termini of the septic system laterals. PID headspace readings and excavation observations will be recorded on the FDR and as discussed in Subsection 4.5.1 of the QAPP. Samples will be collected at discrete depths based on field observations of soil, groundwater, and/or the potential presence for VOC contamination (i.e. stained soils and/or elevated PID headspace readings) within each test pit. MACTEC estimates that up to three soil samples will be collected per test pit based on field observations. Sample locations are shown on Figure 4.1, and the proposed field tasks, methodologies, and sample identification and analysis are included in Table 4.1.

4.2.4 Borehole Geophysics

A series of standard geophysical logging suites will be completed by Northeast Geophysical Services within individual open bedrock boreholes to identify fractures and possible changes in bedrock stratigraphy that could be serving as contaminant migration pathway(s). MACTEC will perform borehole geophysical surveys at the most-contaminated bedrock SVE wells including SVE-20 and SVE-21, and extraction wells ERT-4, ERT-1, MW-5R, and MW-7R. Well locations proposed for borehole geophysics are shown on Figure 4.1. MACTEC recommends shutting down the existing treatment system in advance of conducting borehole geophysics as to not interfere with heat-pulse flowmeter logging. The system will need to be shut-down to allow for groundwater stabilization and well pumps removed from the extraction wells at a minimum of two days prior to logging activities.

These geophysical logging suites include the following and will be generally completed in the following sequence:

1) **Caliper** data will be used to measure the diameter of the borehole. Deviations in borehole diameter indicate the presence of fractures leaving breakouts in the borehole wall. Caliper data will also be used to locate packer intervals for a proper seal.
2) **Natural gamma data** will also be recorded. These data values are correlated with single-point resistance logs when distinguishing sandy versus clayey strata, and are obtained with the same logging probe that records single-point resistance and spontaneous potential data.
3) **Electrical logs** indicate the presence of hydraulically active fractures and possible changes in lithology.
4) **Acoustic televiewer and optical televiewer** data will be collected to determine the location and attitude of fractures exposed in each bedrock borehole.
5) **Heat-pulse flowmeter** logging completed under non-pumping (ambient) and pumping conditions will be used to determine the location of water bearing fractures under non-stressed and stressed conditions.

4.2.5 Packer Testing

Based on the geophysical logging, fracture zones in bedrock wells SVE-20, SVE-21, and extraction wells ERT-4, ERT-1, MW-5R, and MW-7R will be identified and targeted for packer sampling (Figure 4.1). Packer sampling will be conducted by GeoLogic, NY of Homer, NY. Packer sampling will be completed by sealing off both ends of a ten-ft zone of the borehole with inflatable packers. Packers will be inflated to approximately 150 pounds per square inch. Once the packer seals are in place, groundwater samples will be collected for VOC analysis using low flow sampling procedures as outlined in section 4.5.4.3 of the QAPP (MACTEC, 2011a). Additionally, water levels above the packers will be monitored during sampling activities. Depending on the space available in the packer rods, water levels may be measured using a transducer.

Upon completion of the sampling, the pumping rate will be increased and water levels will be recorded within and outside of the packered zone. One pumping rate will be evaluated to assess the connectivity of the packered zone to well(s) in the immediate vicinity. Groundwater levels will be measured above the packers during pumping and in nearby wells to assess vertical fracture connectivity. It is estimated that approximately two hours will be spent conducting sampling on each zone, so that the packer sampling of the bedrock wells will be completed in approximately three working days. MACTEC anticipates up to three packer tests/groundwater sampling intervals per well. The actual number of fracture and packer zones will be determined based on the results of the geophysical logging.

4.2.6 Sub-Slab Soil Sampling

Sub-slab soil samples will be collected in the vicinity of the elevated concentrations of 1,1,1-TCA previously identified in sub slab soil gas points shown in Appendix B (i.e., Port #3, T2-001 and T2-003) Sampling will be conducted by MACTEC personnel using hand-driven sampling tubes (e.g., slam-bar with macro core sampler) to evaluate possible residual contaminant sources that may exist under the building. If feasible, samples will be collected between zero to two feet below the slab and will be screened using a PID. One discrete sample will be collected from the depth with visual/olfactory signs of contamination, or PID readings above background; unless field screening suggests otherwise, analytical samples will be collected within the top two ft below the slab. Samples will be submitted for laboratory analysis of VOCs by EPA Method 5035A/8260. Following coring, the hole will be backfilled and the floor will be patched. Four sub-slab soil sampling locations (SS-01, SS-02, SS-03, and SS-04) are depicted on Figure 4.1 and are summarized in Table 4.1.

4.2.7 Groundwater Level Measurement

Comprehensive groundwater level gauging events will be completed at accessible on-site and off-site monitoring wells, SVE wells, and extraction wells, extending from MW-2 and MW-3 to the South to MW-11, 11B, and 11C to the North Groundwater elevation data will be measured at the same set of wells simultaneously under non-pumping and pumping conditions. MACTEC recommends measuring groundwater levels under pumping conditions prior to shutting down the existing treatment system in advance of conducting borehole geophysics (Section 4.2.4). Groundwater levels under non-pumping conditions will be collected approximately two-days following system shut-down once groundwater levels have stabilized.

These data will be used for groundwater contouring and for the purpose of better defining horizontal and vertical groundwater flow in the subsurface under the current pumping regime. It is anticipated that a complete set of groundwater data will be used to update the CSM.

4.2.8 Survey

MACTEC's subcontractor will survey the location of the MIPS sampling points, subsurface soil samples, and test pits. Horizontal locations will be tied to the NYS Plane Coordinate System using North American Datum of 1983 to an accuracy of 0.1 ft. Vertical elevations of groundwater wells will be tied to existing monitoring well data, which is based on msl, using North American Vertical Datum of 1988, and measured to an accuracy of 0.01 ft.

4.3 DELIVERABLE

Data obtained from the data gap investigation will be reviewed and summarized in a Data Gap Investigation Letter Report. Laboratory analytical results will undergo a limited chemist review and be compared to applicable NYS groundwater standards (NYS, 1999) and soil cleanup objectives (NYS, 2006). Boring logs, geophysical data, and environmental sampling data will be included as appendices to the report. Results will be used to update the CSM and aid in the evaluation of remedial system optimization.

The report will be submitted in draft to the NYSDEC for review and comment. Upon receipt of NYSDEC comments, MACTEC will address the comments and submit a final report in PDF format. Analytical data will be uploaded to EQuIS, and laboratory deliverables will also be submitted electronically (PDF and electronic data deliverable) with the Data Gap Report.

5.0 REFERENCES

Lawler, Matusky & Skelly Engineers LLP (LMS), 1998a. Remedial Investigation Report – Mohonk Road Industrial Plant, Site 356023. September 1998.

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MACTEC Engineering and Consulting, P.C. (MACTEC), 2015. Conceptual Site Model (CSM) and Data Gap Review Letter. Prepared for New York State Department of Environmental Conservation, Albany, New York. July 8, 2015.

MACTEC, 2011a. Program Quality Assurance Program Plan. Prepared for the New York State Department of Environmental Conservation, Albany, New York. June 2011.

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NYS, 1999. New York Codes, Rules, and Regulations, Title 6, Part 700-705 Water Quality Regulations Surface Water and Groundwater Classifications and Standards. Amended August 1999.

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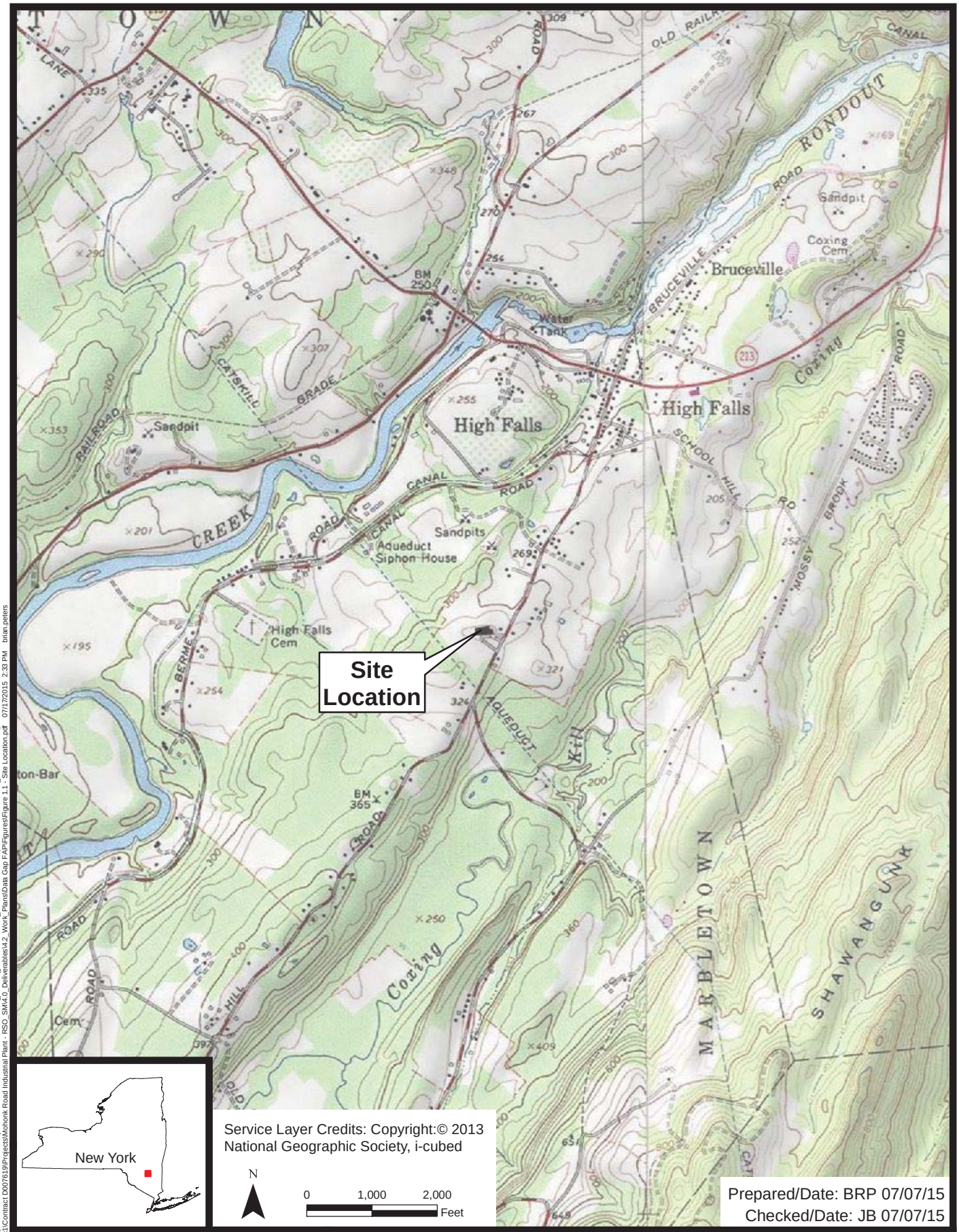
NYSDEC, 2010. DER-10, Technical Guidance for Site Investigation and Remediation. May 3, 2010.

USEPA, 2000. Record of Decision – Mohonk Road Industrial Plant Superfund Site. March 2000.

USEPA, 2008. Record of Decision Amendment – Mohonk Road Industrial Plant Superfund Site. September 2000.

FIGURES



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Site Location Map

Project 3617157346 Figure 1.1

Document: P:\Projects\nystec1\Contract D007619\Projects\Mohonk Road Industrial Plant - RSO_SMI4.0_Deliverables\4.5_Databases\GIS\MapDocuments\Mohonk_SiteLocationMap.mxd
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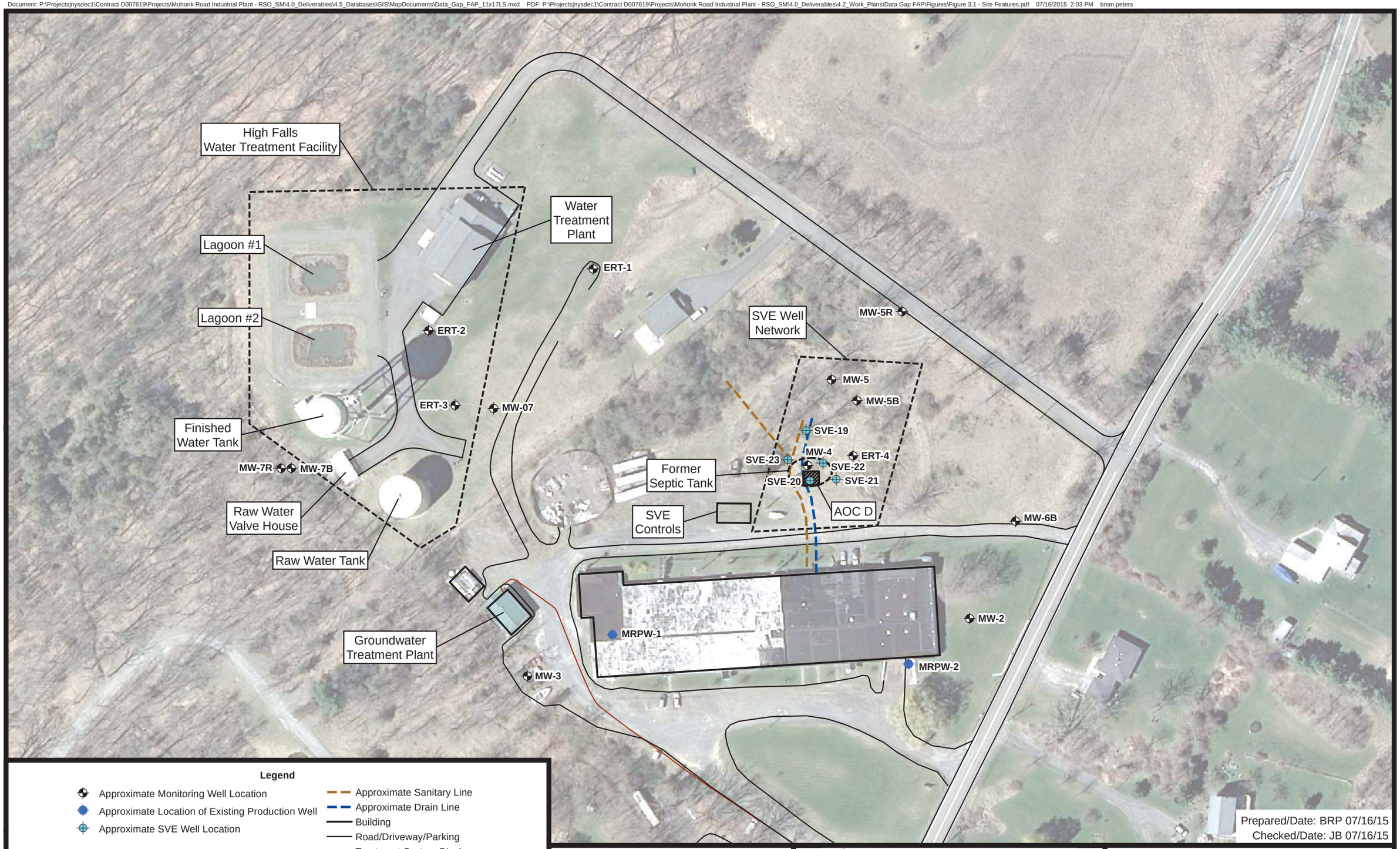

Legend

- Approximate Monitoring Well Location
- Approximate Location of Existing Production Well
- Approximate SVE Well Location
- Approximate Sanitary Line
- Approximate Drain Line
- Building
- Road/Driveway/Parking
- Treatment System Discharge

N

0 50 100 Feet

Ulster County color digital orthoimagery (2013) obtained from New York State GIS Clearinghouse at: http://www.nysgis.state.ny.us

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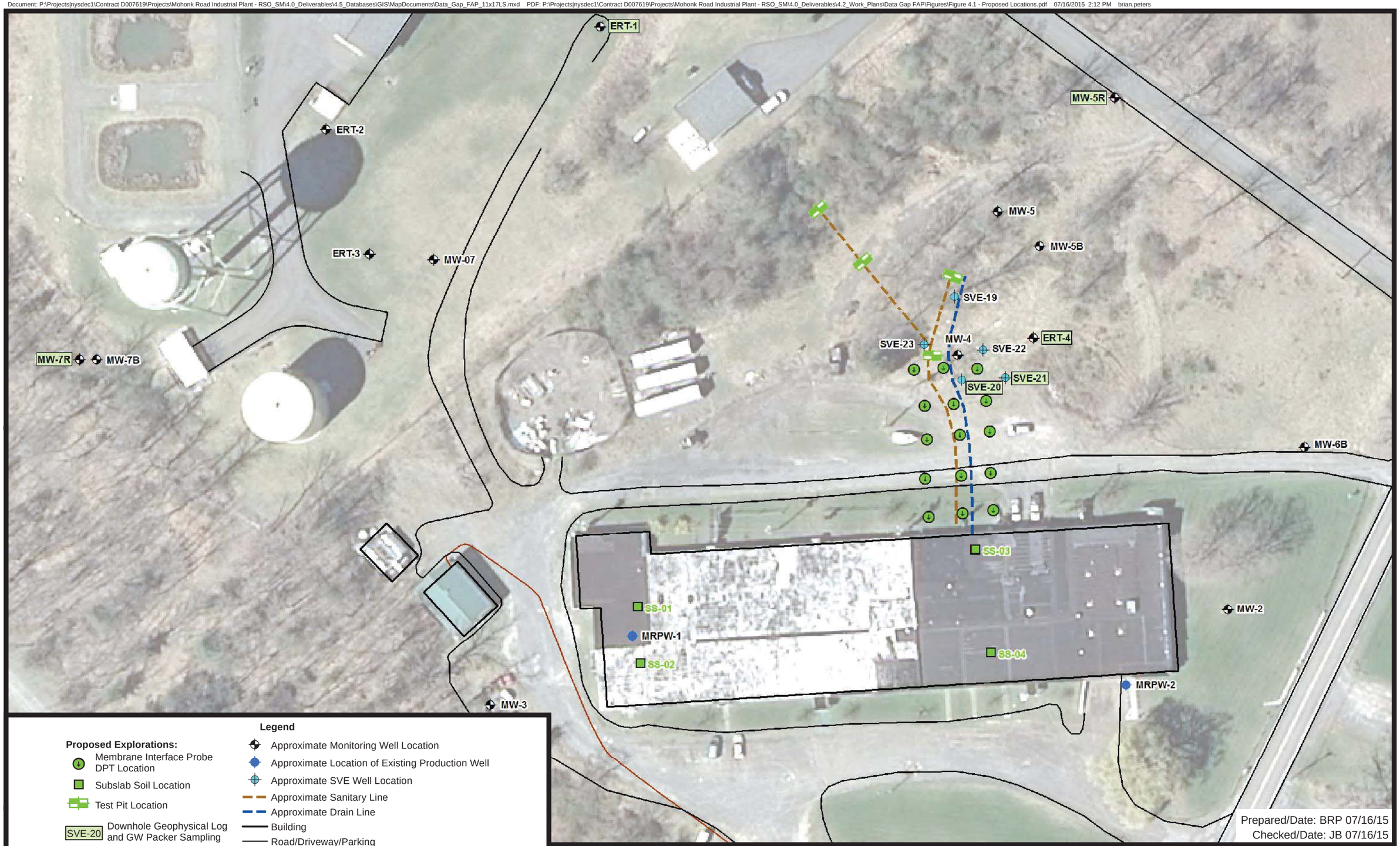
Site Features

Project 3617157346 Figure 3.1



Legend

Proposed Explorations:

- Membrane Interface Probe DPT Location
- Subslab Soil Location
- Test Pit Location
- SVE-20 Downhole Geophysical Log and GW Packer Sampling

- Approximate Monitoring Well Location
- Approximate Location of Existing Production Well
- Approximate SVE Well Location
- Approximate Sanitary Line
- Approximate Drain Line
- Building
- Road/Driveway/Parking
- Treatment System Discharge

N

0 30 60 Feet

Ulster County color digital orthoimagery (2013) obtained from New York State GIS Clearinghouse at: http://www.nysgis.state.ny.us

Prepared/Date: BRP 07/16/15
Checked/Date: JB 07/16/15

NYSDEC
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Marbletown, New York

MACTEC

Proposed Sample Locations

Project 3617157346 Figure 4.1

TABLES

Table 4.1: Proposed Sample Methodology, Rationale, Identification, and Analytical Schedule

Methodology	Evaluation Rationale	Loc I.D.	Medium	Depth bgs ft.	Sample I.D.		VOCs
						method water	8260C
						method soil	5035A/8260C
						groundwater DL needed * ppb	0.5
						soil DL needed ** ppm	0.05 (1)
						Validation Level	Chem Review
MIP Sampling MIP sampling using direct push at approximately 15 locations to an estimated depth of 20 feet (depth will be selected based on field observations or refusal).	To screen soil in the area between the former septic tank and the building for the presence of VOCs for the purpose of identifying residual source areas and measuring soil hydraulic properties.	MP-01	Soil	0 - 20	356023MP01___		
		MP-02	Soil	0 - 20	356023MP02___		
		MP-03	Soil	0 - 20	356023MP03___		
		MP-04	Soil	0 - 20	356023MP04___		
		MP-05	Soil	0 - 20	356023MP05___		
		MP-06	Soil	0 - 20	356023MP06___		
		MP-07	Soil	0 - 20	356023MP07___		
		MP-08	Soil	0 - 20	356023MP08___		
		MP-09	Soil	0 - 20	356023MP09___		
		MP-10	Soil	0 - 20	356023MP10___		
		MP-11	Soil	0 - 20	356023MP11___		
		MP-12	Soil	0 - 20	356023MP12___		
		MP-13	Soil	0 - 20	356023MP13___		
		MP-14	Soil	0 - 20	356023MP14___		
		MP-15	Soil	0 - 20	356023MP15___		
Direct Push Soil Sampling Collect direct push samples from 5 of the MIP survey locations. Collect samples for off-site laboratory analysis from up to 3 depths per boring (15 total samples).	MIP confirmation, contaminant characterization, and soil classification.	DP-01	Soil		356023DP01___		1
			Soil		356023DP01___		1
			Soil		356023DP01___		1
		DP-02	Soil		356023DP02___		1
			Soil		356023DP02___		1
			Soil		356023DP02___		1
		DP-03	Soil		356023DP03___		1
			Soil		356023DP03___		1
			Soil		356023DP03___		1
		DP-04	Soil		356023DP04___		1
			Soil		356023DP04___		1
			Soil		356023DP04___		1
		DP-05	Soil		356023DP05___		1
			Soil		356023DP05___		1
			Soil		356023DP05___		1

Table 4.1: Proposed Sample Methodology, Rationale, Identification, and Analytical Schedule

Methodology	Evaluation Rationale	Loc I.D.	Medium	Depth bgs ft.	Sample I.D.		VOCs
						method water	8260C
						method soil	5035A/8260C
						groundwater DL needed * ppb	0.5
						soil DL needed ** ppm	0.05 (1)
						Validation Level	Chem Review
Test Pits Install 4 test pits and collect samples for off-site laboratory analysis from up to 3 depths (12 total samples) per test pit as follows:	Along points of the Orangeburg piping that leads from the former distribution box, including the eastern and western piping termini areas to assess whether residual contamination is or is not present and providing an on-going source of groundwater contamination	TP-01	Soil		356023TP01___		1
			Soil		356023TP01___		1
			Soil		356023TP01___		1
		TP-02	Soil		356023TP02___		1
			Soil		356023TP02___		1
			Soil		356023TP02___		1
		TP-03	Soil		356023TP03___		1
			Soil		356023TP03___		1
			Soil		356023TP03___		1
		TP-04	Soil		356023TP04___		1
			Soil		356023TP04___		1
			Soil		356023TP04___		1
Down-Hole Geophysical Survey Downhole geophysical logging of on-site bedrock wells (including select SVE and Extraction wells). Survey suite will include borehole caliper, single point resistivity, acoustic televiewer, optical televiewer, heat pulse flow meter, and gamma ray logging.	To identify fractures and possible changes in bedrock stratigraphy that could be serving as contaminant migration pathway(s)	ERT-1					
		ERT-4					
		MW-5R					
		MW-7R					
		SVE-20					
		SVE-21					

Table 4.1: Proposed Sample Methodology, Rationale, Identification, and Analytical Schedule

Methodology	Evaluation Rationale	Loc I.D.	Medium	Depth bgs ft.	Sample I.D.		VOCs
						method water	8260C
						method soil	5035A/8260C
						groundwater DL needed * ppb	0.5
						soil DL needed ** ppm	0.05 (1)
						Validation Level	Chem Review
Groundwater Packer Sampling Packer sampling of select SVE and/or bedrock extraction well(s) subsequent to the results of the down-hole geophysical logging, and the collection of discrete samples for VOCs from each packer interval.	To sample bedrock fracture zones and determine depth and migration of VOC contamination	ERT-4	Water		356023ERT04___		1
			Water		356023ERT04___XD		1
			Water		356023ERT04___MS		1
			Water		356023ERT04___MD		1
		ERT-1	Water		356023ERT01___		1
			Water		356023ERT01___		1
			Water		356023ERT01___		1
		MW-5R	Water		356023MW05R___		1
			Water		356023MW05R___		1
			Water		356023MW05R___		1
		MW-7R	Water		356023MW07R___		1
			Water		356023MW07R___		1
			Water		356023MW07R___		1
		SVE-20	Water		356023SVE20___		1
			Water		356023SVE20___		1
			Water		356023SVE20___		1
		SVE-21	Water		356023SVE21___		1
			Water		356023SVE21___		1
			Water		356023SVE21___		1
Sub-Slab Soil Sampling Sub-slab soil samples will be collected in the vicinity of the elevated concentrations of 1,1,1-TCA in sub-slab soil gas points (i.e., Port #3, T2-001 and T2-003) using hand driven sampling tubes.	To evaluate possible residual contaminant sources that may exist under the building.	SS-01	Soil		356023SS01___		1
			Soil		356023SS01___		1
			Soil		356023SS01___		1
		SS-02	Soil		356023SS02___		1
			Soil		356023SS02___		1
			Soil		356023SS02___		1
		SS-03	Soil		356023SS03___		1
			Soil		356023SS03___		1
			Soil		356023SS03___		1
		SS-04	Soil		356023SS04___		1
			Soil		356023SS04___		1
			Soil		356023SS04___		1

58

Table 4.1: Proposed Sample Methodology, Rationale, Identification, and Analytical Schedule

Methodology	Evaluation Rationale	Loc I.D.	Medium	Depth bgs ft.	Sample I.D.		VOCs
						method water	8260C
						method soil	5035A/8260C
						groundwater DL needed * ppb	0.5
						soil DL needed ** ppm	0.05 (1)
						Validation Level	Chem Review

NOTES:

PCBs	(1)- 0.02 vinyl chloride, 1,2 dichloroethane	PCBs analyzed by USEPA Method 8082.
VOCs	(2)- 0.33 ppm for dibenz(ah)anthracene, cresol	VOCs 5035A/8260C (soils), 8260C (water)
SVOCs	(m,p,& o), phenol; 80 ppm for pentachlorophenol	SVOCs 8270C (soils and water)
Metals	(3)- 0.0033 ppm DDT, DDD, DDE	TAL Metals by USEPA 6010/(7471-soil, 7470-water)
DL		Detection Limit
bgs		below ground surface
MP		Membrane Interface Probe Sample
DP		Direct Push
TP		Test Pit
ERT		Extraction Well
SVE		Soil Vapor Extraction
XD		Duplicate
MS		Matrix Spike
MD		Matrix Spike Duplicate
___		placeholder for sample depth (two digits)

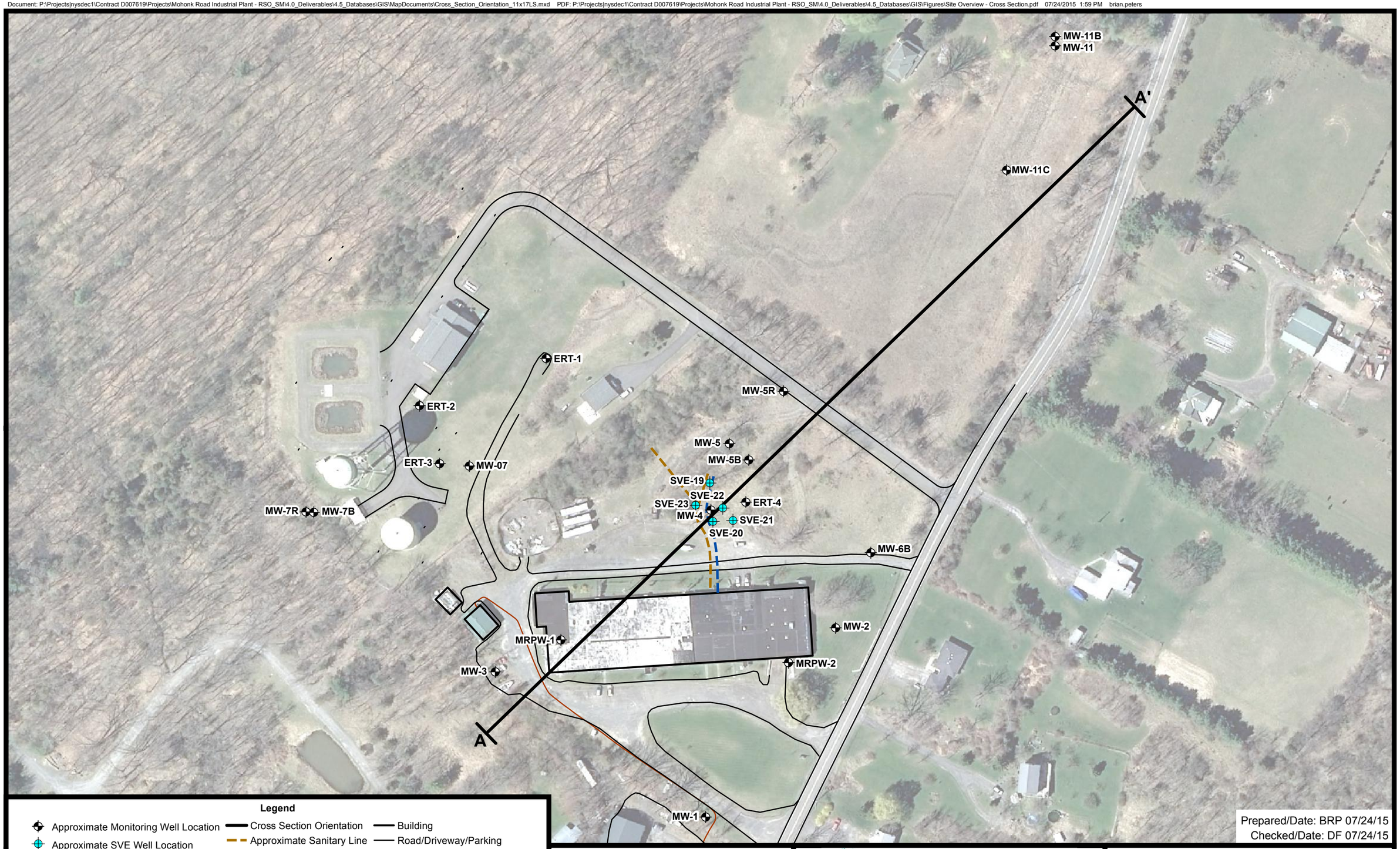
Detection limits should be low enough to achieve the following comparisons:

* -Soil analytical results will be compared to the 6 NYCRR Part 375 Soil Cleanup Objectives for Unrestricted Use.

** -Water analytical results will be compared to The NYS Class GA Groundwater Quality Standards from 6 NYCRR Parts 700-705.

APPENDIX A

CROSS SECTION



Legend

- Approximate Monitoring Well Location
- Approximate SVE Well Location
- Cross Section Orientation
- Approximate Sanitary Line
- Approximate Drain Line
- Building
- Road/Driveway/Parking
- Treatment System Discharge

N

0 65 130 Feet

Ulster County color digital orthoimagery (2013) obtained from New York State GIS Clearinghouse at: http://www.nysgis.state.ny.us

Prepared/Date: BRP 07/24/15
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NYSDEC
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Marbletown, New York

MACTEC

Site Overview - Cross Section

Project 3617157346

SOUTHWEST

A

A^1

NORTHEAST

ELEVATION (FT. MSL)

MW-3 (62' OFFSET)

SOUTHWEST CORNER

MRIP BUILDING

AOC-C

APPROX. LIMIT OF AOC-C EXCAVATION

SEPTIC LINE

FORMER SVE-01 (46' OFFSET)

SVE-23 (10' OFFSET)

SVE-20 (25' OFFSET)

SVE-22

SVE-21 (32' OFFSET)

SVE-19 (30' OFFSET)

MW-4

LOCATION OF FORMER 1,000 GAL. SEPTIC UST

DISTRIBUTION BOX

ERT-4 (10' OFFSET)

MW-5 (50' OFFSET)

MW-5B (15' OFFSET)

EASTERN DISCHARGE FROM 1000 GAL. SEPTIC LATERAL 4-INCH ORANGEBURG PIPE

WESTERN DISCHARGE FROM 1000 GAL. SEPTIC LATERAL 4-INCH ORANGEBURG PIPE

MW-5R (50' OFFSET)

EXISTING GRADE

OVERBURDEN (LODGEMENT TILL)

INTERPRETED GROUNDWATER SURFACE (TYP)

BEDROCK INTERFACE FLOW ZONE

CASINGS TO 15' BGS

CASING TO 19' BGS

APPROX. LIMIT OF 1998 AOC-D IRM EXCAVATION

TCA; 1,600 µg/L

TCA; 3,000 µg/L

TCA; 7,900 µg/L

TCA; 840 µg/L

TCA; 13,000 µg/L

TCA; 31,000 µg/L

TCA; 8,400 µg/L

TCA; 27,000 µg/L

DARK GRAY SHALE DEPOSIT

BEDROCK (WHITE ORTHOQUARTZITE)

775'

MATCH LINE

MATCH LINE

MW-11C

MW-11

MW-11B

EXISTING GRADE

BROWN CLAYEY SILT

GRAY CLAYEY SILT

28'

GRAY SILTY SAND/GRAVEL

WHITE ORTHOQUARTZITE

BEDROCK

BEDROCK (WHITE ORTHOQUARTZITE)

TOTAL DEPTH 125 FT BGS (188.63 MSL)

TOTAL DEPTH 223 FT BGS (59.0 MSL)

SHALE

TOTAL DEPTH 220 FT BGS (64.0 MSL)

LEGEND

- ESTIMATED GROUND SURFACE
- AOC-C EXCAVATION
- ESTIMATED BEDROCK SURFACE
- BEDROCK INTERFACE ZONE
- GROUNDWATER ELEVATION MEASURED FROM 2011 (DURING PUMPING CONDITIONS)
- INTERPRETED GROUNDWATER SURFACE
- BGS — BELOW GROUND SURFACE
- MONITORING WELL SCREEN
- MONITORING WELL CASING
- F — BEDROCK FRACTURE

HORIZONTAL 0 20 40 80 SCALE IN FEET

VERTICAL 0 5 10 20 SCALE IN FEET

Prepared/Date: WJW 07/06/15
Checked/Date: DF 07/06/15

NYDEC
Mohonk Road Industrial Plant
Marbletown, New York

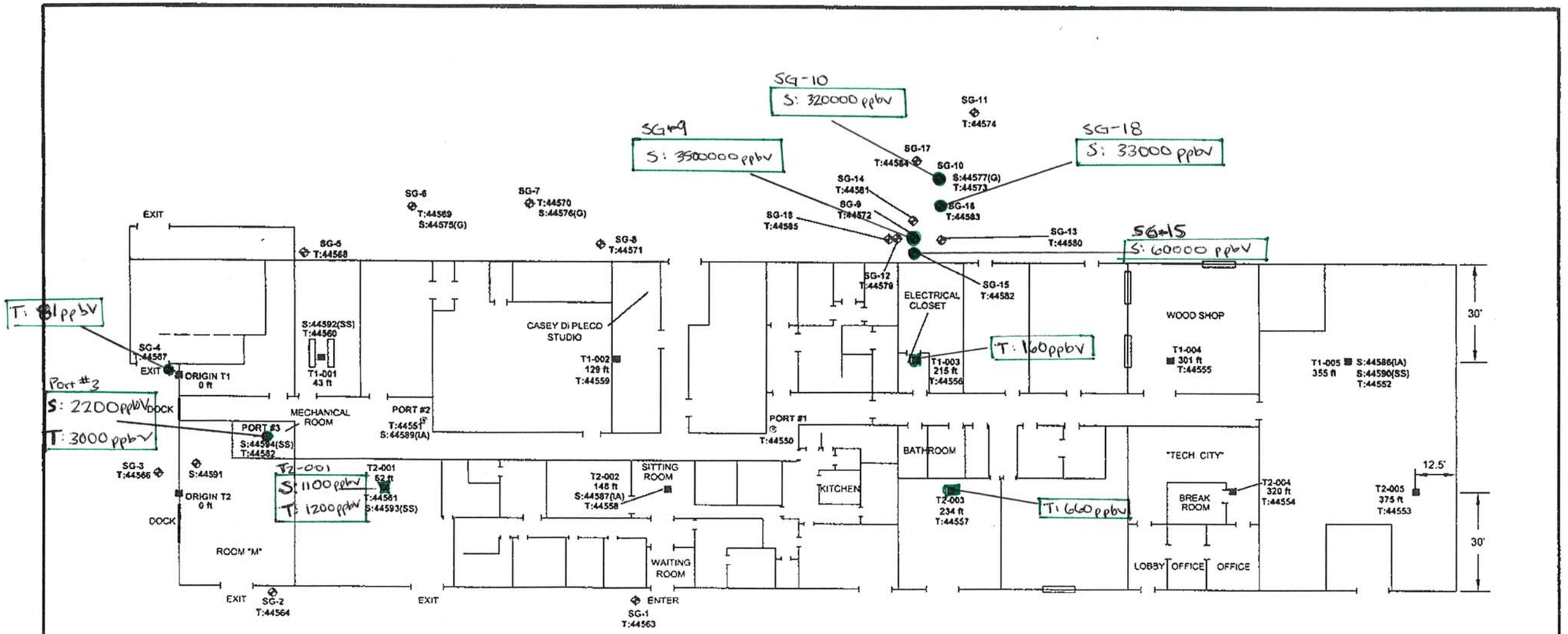
MACTEC

ATTACHMENT 1
CROSS SECTION A-A
Project 3617-15-7346
Figure 1

Z:\Projects\Vyndec\Mohonk Road Industrial Plant\Mohonk Section A-A.dwg Mon, 06 Jul 2015 - 2:05pm william.whitten

APPENDIX B

HISTORICAL SOIL GAS DATA



Edits Prepared by: DF 6/3/15
Edits Checked by: HA 6/3/15

Table: 1
Comparison of Current and Historical Sub-Slab Data
SUMMA Canister and Tedlar Bag Samples
186 Mohonk Road
REAC Sampling Events:
February 2005, March 2006, May 2006

LOCATION	PORT #1			
SAMPLE #	17885	0-122-001	44550	44550
SAMPLE TYPE	S	S	T	T
ANALYSIS	SUMMA	SUMMA	TAGA	GC/MS
DATE	Feb-05	Mar-06	May-06	May-06
ANALYTE	ppbv	ppbv	ppbv	ppbv
TCE	5.3	4.3	4.4	U
TCA	72	32	70	61

PORT #2			
17886	0-122-002	44551	44551
S	S	T	T
SUMMA	SUMMA	TAGA	GC/MS
Feb-05	Mar-06	May-06	May-06
ppbv	ppbv	ppbv	ppbv
5.3	4.7	8.7	8.3
140	97	20	240

Key:
T = 1-L Tedlar Bag
S = SUMMA Canister
U = Not Detected

Table: 2
Comparison of Sub-Slab Data
SUMMA Canister and Tedlar Bag Samples
186 Mohonk Road
REAC Sampling Event: May 2006

LOCATION	PORT #3		
SAMPLE #	44594	44562	44562
SAMPLE TYPE	S	T	T
ANALYSIS	SUMMA (TO-15)	TAGA	GC/MS
DATE	May-06	May-06	May-06
ANALYTE	ppbv	ppbv	ppbv
TCE	1600	1700	3200 D
TCA	2200	3000	2100

T1-001		
44592	44560	44560
S	T	T
SUMMA (TO-15)	TAGA	GC/MS
May-06	May-06	May-06
ppbv	ppbv	ppbv
1	0.87	U
21	19	19

T1-002	
44559	44559
T	T
TAGA	GC/MS
May-06	May-06
ppbv	ppbv
0.4 J	U
5.4	7.3

T1-003	
44556	44556
T	T
TAGA	GC/MS
May-06	May-06
ppbv	ppbv
9.6	14
160	260

T1-004	
44555	44555
T	T
TAGA	GC/MS
May-06	May-06
ppbv	ppbv
0.24 J	U
87	74

LOCATION	T1-005		
SAMPLE #	44590	44552	44552
SAMPLE TYPE	S	T	T
ANALYSIS	SUMMA (TO-15)	TAGA	GC/MS
DATE	May-06	May-06	May-06
ANALYTE	ppbv	ppbv	ppbv
TCE	U	72	58
TCA	64	0.23J	U

T2-001		
44593	44561	44561
S	T	T
SUMMA (TO-15)	TAGA	GC/MS
May-06	May-06	May-06
ppbv	ppbv	ppbv
1500	1300	1400D
1100	1200	100D

T2-002	
44558	44558
T	T
TAGA	GC/MS
May-06	May-06
ppbv	ppbv
3.9	5.2
95	130

T2-003	
44557	44557
T	T
TAGA	GC/MS
May-06	May-06
ppbv	ppbv
4.9	0.22
660	1100 D

T2-004	
44554	44554
T	T
TAGA	GC/MS
May-06	May-06
ppbv	ppbv
DL=0.22	U
29	23

T2-005	
44553	44553
T	T
TAGA	GC/MS
May-06	May-06
ppbv	ppbv
DL=0.22	U
54	57

Key:
T = 1-L Tedlar Bag
S = SUMMA Canister
J = Estimated Value
DL = Detection Limit
D = Sample Diluted
U = Not Detected

Table: 3
Comparison of Soil Gas Results
Tedlar Bag TAGA Analysis and SUMMA Canister Results
186 Mohonk Road
REAC Sampling Event: May 2006

LOCATION	SG-1	SG-2	SG-3	SG-4	SG-5	SG-6		SG-7	
SAMPLE #	44563	44564	44566	44567	44568	44569	44575	44570	44567
SAMPLE TYPE	T	T	T	T	T	T	G	T	G
ANALYSIS	TAGA	TAGA	TAGA	TAGA	TAGA	TAGA	SUMMA (TO-15)	TAGA	SUMMA (TO-15)
DATE	May-06	May-06	May-06	May-06	May-06	May-06	May-06	May-06	May-06
ANALYTE	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv
TCE	DL=0.11	0.3 J	19	43	DL=0.11	DL=0.11	U	DL=0.11	0.92
TCA	1.3	20	39	81	0.8	6.2	1.88	4	0.08 J

LOCATION	SG-8	SG-9	SG-10		SG-11	SG-12
SAMPLE #	44571	44572	44573	44577	44574	44579
SAMPLE TYPE	T	T	T	G	T	T
ANALYSIS	TAGA	TAGA	TAGA	SUMMA (TO-15)	TAGA	TAGA
DATE	May-06	May-06	May-06	6-May	May-06	May-06
ANALYTE	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv
TCE	0.2 J	380	69 J	0.6	DL= 55	DL= 22
TCA	6.4	3500000	320000	74.5	1700	5100

LOCATION	SG-13	SG-14	SG-15	SG-16	SG-17	SG-18
SAMPLE #	44580	44581	44582	44583	44584	44585
SAMPLE TYPE	T	T	T	T	T	T
ANALYSIS	TAGA	TAGA	TAGA	TAGA	TAGA	TAGA
DATE	May-06	May-06	May-06	May-06	May-06	May-06
ANALYTE	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv
TCE	DL= 22	DL= 22	DL= 55	0.43	0.2 J	DL= 22
TCA	820	10000	60000	95	100	33000

Key:
T = 1-L Tedlar Bag
S = SUMMA Canister
G = Grab
DL = Detection Limit
J = Estimated Value
SG = Soil Gas

Note: DL=X
indicates a non-detect, with the DL for that sample listed, for TAGA results.

Table: 4
Comparison of TAGA Monitoring and Indoor Air Sampling Data
SUMMA Canister and Tedlar Bag Samples
186 Mohonk Road
REAC Monitoring/Sampling Events:
March 2006, May 2006

LOCATION	ROOM "M"		
TAGA FLAG/SAMPLE #	FG	R1S1	44591
ANALYSIS	TAGA	TAGA	SUMMA (TO-15)
DATE	Mar-06	May-06	May-06
ANALYTE	ppbv	ppbv	ppbv
TCE	0.9	1.3	0.91
TCA	NA	3.8	2.5

PORT #2		
P1E1	L1M1	44589
TAGA	TAGA	SUMMA (TO-15)
Mar-06	May-06	May-06
ppbv	ppbv	ppbv
0.98	0.53	0.4
NA	1.2	0.7

LOCATION	T2-002		
TAGA FLAG/SAMPLE #	DE	D1E1	44587
ANALYSIS	TAGA	TAGA	SUMMA (TO-15)
DATE	Mar-06	May-06	May-06
ANALYTE	ppbv	ppbv	ppbv
TCE	0.7	0.32	0.39
TCA	NA	0.84	0.71

T1-005		
NA	NA	44586
TAGA	TAGA	SUMMA (TO-15)
Mar-06	May-06	May-06
ppbv	ppbv	ppbv
NA	NA	0.2
NA	NA	0.47

Key:
NA = No Data Collected

APPENDIX C

HEALTH AND SAFETY PLAN

MACTEC, Inc.

MACTEC Short Form HASP

Site: Mohonk Road Industrial Plant Job #/Task # 3617157346.02
Street Address: 186 Mohonk Road, Hamlet of High Falls, Marbletown, Ulster County, NY
Proposed Date(s) of Investigation: August 2015 – September 2015
Prepared by: Danielle Lerner Date: 7/7/2015
*Approved by: Kendra Bavor, CSP Date: 7/20/2015
Site Description: **(attach map)** The Mohonk Road Industrial Plant site is located on approximately 114 acres in the town of Marbletown, NY. This site is bordered to the southeast by Mohonk Road and large wooden lots in all other directions. A groundwater treatment system consisting of on-site extraction wells and an air stripper is currently in operation to remove volatile organic compounds. The site is active.
General Scope: The scope of work for the Mohonk Road Industrial Plant site includes a down-hole geophysical survey, environmental sampling of test pits, sampling of surface soils, sub-slab soils, and groundwater, and direst-push MIP sampling/drilling. Work will be inside and outside.

*Approval also serves as certification of a Hazard Assessment as required by 29 CFR 1910.132

Tasks:

AMEC	Other contractor	Task Description
☒	☒	Overall inspection of the site
☒	☒	Geophysical Survey
☒	☒	Mobilization/demobilization
☒	☒	Test pitting
☒	☐	Surface soil sampling
☒	☐	Water level measurements
☒	☐	Groundwater sampling
☒	☒	Underground utility clearance
☒	☒	DirectPush MIP Sampling/Drilling
☒	☐	Sub-Slab Soil Sampling

Dates of Required Training and Medical Surveillance (add additional training topics, as required):

Job duties:	Field Team Lead	HSO/ Field Team	Field Team
Names:	Josh Bowe	Brad Wolfe	Dylan Farrell
	Dates	Dates	Dates
Medical Surveillance	5/11/15	8/19/2014	5/12/15
40-Hour Initial	5/19/06	5/23/1997	5/5/14
8-Hour Supervisor [1]	12/15/11		
8-Hour Refresher	3/10/15	8/21/2014	TBD
First Aid[2]	4/17/13	2/21/2014	8/23/14
CPR[2]	4/17/13	2/22/2014	8/23/14
Hazard Communication			3/26/14

[1] Required for Field Lead and Site Health and Safety Officer
[2] At least one worker must be trained in First Aid/CPR and should have received Bloodborne Pathogen Training

Known or Suspected Contaminants (include PELs/TLVs):

Contaminants of Concern (COC) (Attach Fact Sheets*)	Maximum Concentrations		PEL/TLV
	Soil (mg/kg)	Water/Groundwater (µg/l)	
1,1,1-TCA	Unknown	Unknown	350 ppm/ STEL 450ppm
1,1-DCE	Unknown	Unknown	No PEL/1 ppm
1,1-dichloroethane (1,1-DCA)	Unknown	Unknown	100 ppm
Trichloroethene (TCE)	Unknown	Unknown	10 ppm/ STEL 100/ C 200 ppm
PCE	Unknown	Unknown	25 ppm/ STEL 100ppm/ C 200ppm
Ethylbenzene	Unknown	Unknown	100 ppm/ STEL 125ppm
Xylene	Unknown	Unknown	100 ppm/ STEL 150 ppm

*Workers must be made aware of the signs, symptoms, and first aid for each COC. Information is located on the COC fact sheets.

Air Monitoring Action Levels:

PID/FID Reading[1]	Detector Tube[1]	Dust Meter[1]	LEL[2]/O_2[1]	Action
≥ 5 ppm		Visible Dust		Use control measures for nuisance dust (ie. Spray with water) continue to monitor breathing zone with PID and dust meter. Backoff and reassess as Level C PPE required.
			≥ 10% LEL	Stop work. Evacuate area. Consider return with ventilation system and spark proof/intrinsically safe equipment.
			≤19.5% O_2	Stop work and evacuate area.

[1] Sustained readings measured in the breathing zone
[2] Readings at measured at the source (borehole, well, etc.)

Activity Specific AHAs:

☒	Mobilization/Demobilization and Site Preparation
☒	Field Work – General
☒	Field Work – Oversight
☒	Decontamination
☒	Utility Clearance Activities
☒	Groundwater Sampling
☒	Soil Sampling
☒	Environmental Drilling Operation
☒	Poisonous Plants
☒	Excavations and Backfilling

Hazard Specific AHAs:

☒	Insect Stings and Bites
☒	Geophysical Survey
☒	Working with Preservatives (Acids)
☒	Geoprobe Soil Sampling
☐	
☐	
☐	
☐	

HAZARD IDENTIFICATION SUMMARY

Complete the checklist for summarizing the hazards identified in the JHAs

Standard Hazards			
☐ Falling Objects	☒ Slips and trips	☒ Pinch points	☒ Rotating equipment
☒ Falls	☒ Power equipment/tools	☐ Elevated work surfaces	☐ _____

Eye Hazards			
☒ Particulates	☒ Liquid splashes	☐ Welding Arc	☐ _____
Hearing Hazards			
☐ None	☒ Impact noise	☒ High frequency noise	☒ High ambient noise
Respiratory Hazards			
☐ None	☒ Dust/aerosols/particulates	☒ Organic Vapors	☐ Acid Gases
☐ O_2 deficient	☐ Metals	☐ Asbestos	
Chemical Hazards			
☐ None	☒ Organic solvents	☐ Reactive metals	☐ PCBs
☒ Acids / bases	☐ Oxidizers	☒ Volatiles/Semi-volatiles	☐ _____
Environmental Hazards			
☐ None	☒ Cold Stress	☒ Heat Stress	☒ Wet location
☒ Bio hazards (snakes, insects, spiders, poisonous plants, etc.)			
☐ Explosive vapors	☐ Confined space	☐ Engulfment Hazard	☐ _____
Electrical Hazards			
☐ None	☐ Energized equipment or circuits	☒ Overhead utilities	☒ Underground utilities
☐ Wet location			
Fire Hazards			
☒ None	☐ Cutting, welding, or grinding generated sparks or heat sources	☐ Flammable materials present	☐ Oxygen enriched location
Ergonomic Hazards			
☒ Lifting	☒ Bending	☐ Twisting	☐ Pulling/tugging
☐ Repetitive motion	☒ Carrying		
Computer Use in the: ☐ Office ☒ Field	☐ _____	☐ _____	
Radiological Hazards			
☒ None	☐ Alpha	☐ Beta	☐ Gamma/X-rays
☐ Neutron	☐ Radon	☐ Non-Ionizing	
Other Hazards			
☐			

PPE and Monitoring Instruments

Initial Level of PPE *			
☐ Level D	☒ Modified Level D	☐ Level C	* Cannot use Short Form HASP for Level B or A work
Standard PPE			
☒ Hard Hat	☒ Safety boots	☒ Safety glasses	☐ Chem. Resistant Boots
☒ High visibility vest	☐ Other:_____		
Eye and Face Protection			
☐ Face shield	☐ Vented goggles	☐ Unvented goggles	☐ Indirect vented goggles
Hearing Protection			
☒ Ear plugs	☐ Ear Muffs	☐ Ear plugs and muffs	☐ Other _____
Respiratory Protection			
☒ None	☐ Dust mask	☐ Full Face APR	☐ Half Face APR
Cartridge Type: _____	Change Cartridges: _____		

Protective Clothing			
☒ Work uniform	☐ White uncoated Tyvek®	☐ Poly-coated Tyvek®	☐ Saranex®
☐ Boot covers	☒ Reflective vest	☐ Chaps or Snake Legs	☐ Other ___

Hand Protection					
☐ None	☐ Cotton gloves	☐ Leather gloves	☐ Glove liners	☐ Cut-resistant gloves	☐ Other _____
☒ Outer Gloves: List Type_____Nitrile_____			☒ Inner Gloves: List Type__Nitrile_____		

Monitoring Instruments Required*

Periodic monitoring shall be conducted when the possibility of an IDLH condition or flammable atmosphere has developed or when there is indication that exposures may have risen over permissible exposure limits or published exposure levels since prior monitoring. Situations where it shall be considered whether the possibility that exposures have risen are as follows:

- When work begins on a different portion of the site.
- When contaminants other than those previously identified are being handled.
- When a different type of operation is initiated (e.g., drum opening as opposed to exploratory well drilling.)
- When employees are handling leaking drums or containers or working in areas with obvious liquid contamination (e.g., a spill or lagoon.)

☒ LEL/O2 Meter	☒ PID: ☐ 10.0-10.6 eV Lamp ☒ 11.7 eV Lamp	☐ FID	☐ Hydrogen Sulfide/Carbon Monoxide
☐ Dräger Pump (or equivalent) List Tubes _____	☐ Dust Meter: ☐ Respirable dust ☐ Total dust	☐ Other Micro Rem Radiation Meter	

*Monitoring instruments will be calibrated daily in accordance with manufacturer's instructions. Results will be recorded in the field logbook.

Chemicals Brought to the Site:
List all chemicals brought to the site (e.g., preservatives, decon solutions, calibration gases, gasoline, etc.).

Chemicals (Note: Name listed must match name on label and MSDS)	**SDS Attached?**
HYDROCHLORIC ACID	☒
NITRIC ACID	☒
ISOBUTYLENE IN AIR	☒
LIQUINOX	☒
HANNA PH 4 BUFFER SOLUTION PH 4.01	☒
HANNA PH 7 BUFFER SOLUTION PH 7.01	☒
HANNA 1413 CONDUCTIVITY CALIBRATION SOLUTION	☒
HI 7021 240 MV ORP SOLUTION	☒
OAKTON ZERO OXYGEN SOLUTION	☒

Chemicals will be kept in their original containers. If transferred to another container, aside from days use by one individual, the new container will be labeled with the name of the chemical and the hazard warnings.

Work Zones:
The work zones will be defined relative to the location of the work activity. The Exclusion Zone is considered the area within a 10-foot diameter of the sampling location. The Contamination Reduction Zone is considered to be the area with in a 20-foot diameter of the sampling location. The decontamination zone is to be located upwind of the work area. Work zones will be maintained through the use of:

☒ Warning Tape
☒ Cones and Barriers
☒ Visual Observations

Decontamination Procedures and Equipment:
Note: See Decontamination JHA for further information

Level D Decontamination Procedures

Decontamination Solution:	Detergent and Water
Station 1: Equipment Drop	Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, etc. on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, a cool-down station may be set up within this area.
Station 2: Outer Gloves Wash and Rinse	Scrub outer gloves decon solution or detergent water. Rinse off using copious amounts of water.
Station 3: Outer Glove Removal	Remove outer boots and gloves. Deposit in plastic bag.
Station 4: Inner glove removal	Remove inner gloves and place in plastic bag.
Station 5: Field Wash	Hands and face are thoroughly washed. Shower as soon as possible.

Modified Level D and Level C PPE Decontamination Procedures

Decontamination Solution:	Detergent and Water
Station 1: Equipment Drop	Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, etc. on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, a cool-

		down station may be set up within this area.
Station 2:	Outer Garment, Boots, and Gloves Wash and Rinse	Scrub outer boots (if worn), outer gloves, and splash suit with decon solution or detergent water. Rinse off using copious amounts of water.
Station 3:	Outer Boot and Glove Removal	Remove outer boots (if worn) and gloves. Deposit in container with plastic liner.
Station 4:	Canister or Mask (Level C only) Change	If worker leaves exclusion zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boot covers are donned, joints are taped, and worker returns to duty.
Station 5:	Boot, Gloves and Outer Garment Removal	Boots (if worn), chemical resistant splash suit, and inner gloves are removed and deposited in separate containers lined with plastic.
Station 6:	Face Piece Removal (Level C only)	Facepiece is removed. Avoid touching face with fingers. Facepiece is deposited on plastic sheet.
Station 7:	Field Wash	Hands and face are thoroughly washed. Shower as soon as possible.

Site Communication:

- ☒ Verbal
- ☐ Two-way radio
- ☒ Cellular telephone
- ☒ Hand signals
  - Hand gripping throat _____ Out of air, can't breathe
  - Grip partner's wrist or both hands around waist _____ Leave area immediately
  - Hands on top of head _____ Need assistance
  - Thumbs up _____ OK, I am all right, I understand
  - Thumbs down _____ No, negative
- ☐ Horn
- ☐ Siren
- ☐ Other:

EMERGENCY CONTACTS

NAME	TELEPHONE NUMBERS		DATE OF PRE-EMERGENCY NOTIFICATION (if applicable)
Fire Department:	911		
Hospital: St. Luke's Cornwall Hospital Center	845-256-0253		
WorkCare (Early case management)	1-888-449-7787		
Police Department:	911		
	Office	**Cell**	
Site Health And Safety Officer: Bradley Wolfe	207-828-2627	925-323-4082	

NAME	TELEPHONE NUMBERS		DATE OF PRE-EMERGENCY NOTIFICATION (if applicable)
Client Contact: Joshua Haugh	518-402-9814		
Project Manager: Jayme Connolly	207-828-3455	207-205-3155 (Cell)	
*Division EH&S Manager: Cindy Sundquist	207-828-3309	207-650-7593 (Cell) 207-892-4402 (Home)	
Kendra Bavor, HSE Coordinator	207-775-5401	207-650-8671 (cell)	
Corporate VP of HSE – Vlad Ivensky	610-877-6144	484-919-5175 (Cell) 215-947-0393 (Home)	
EPA/DEP (if applicable):			
OTHER: Ambulance	911		

*See Incident Flow Chart for additional Group HSE Manager's Contact Information

Emergency Equipment:
The following emergency response equipment is required for this project and shall be readily available:

- ☒ Field First Aid Kit (including bloodborne pathogen kit/supplies)
- ☐ Fire Extinguisher (ABC type)
- ☐ Eyewash (Note: 15 minutes of free-flowing fresh water)
- ☐ Other: _____

EMERGENCY PROCEDURES

- The HSO (or alternate) should be immediately notified via the on-site communication system. The HSO assumes control of the emergency response.
- The HSO notifies the Project Manager and client contact of the emergency.
- If the emergency involves an injury to an AMEC employee, the HSE Coordinator or Field Lead are to implement the AMEC Early Injury Case Management program. See procedures and Flow Diagram below:
- If applicable, the HSO shall notify off-site emergency responders (e.g. fire department, hospital, police department, etc.) and shall inform the response team as to the nature and location of the emergency on-site.
- If applicable, the HSO evacuates the site. Site workers should move to the predetermined evacuation point (See Site Map).
- For small fires, flames should be extinguished using the fire extinguisher. Large fires should be handled by the local fire department.
- In an unknown situation or if responding to toxic gas emergencies, appropriate PPE, including SCBAs (if available), should be donned. If appropriate PPE is unavailable, site workers should evacuate and call in emergency personnel.
- For chemical spills, follow the job specific JHA for spill containment
- If chemicals are accidentally spilled or splashed into eyes or on skin, use eyewash and wash affected area. Site worker should shower as soon as possible after incident.
- If the emergency involves toxic gases, workers will back off and reassess. Prior to re-entering the work zone, the area must be determined to be safe. Entry will be using Level B PPE and utilize appropriate monitoring

equipment to verify that the site is safe.

- An injured worker shall be decontaminated appropriately.
- Within 24 hours after any emergency response, the Incident Analysis Report (and Vehicle Incident Report if vehicle incident) shall be completed and returned to the Group HSE Manager. Injuries requiring medical treatment beyond first aid (as well as work-related vehicle incidents) will require the employee to submit a post incident drug test.

AMEC Early Injury Case Management Program

NON-EMERGENCY INCIDENT	EMERGENCY INCIDENT
Steps 1 & 2 must be completed before seeking medical attention other than local first aid. 1. Provide first-aid as necessary. Report the situation to your immediate supervisor AND HSE coordinator (all incidents with the apparent starting event should be reported within 1 hour of occurrence). 2. Injured employee:	1. Provide emergency first aid. Supervisor on duty must immediately call 911 or local emergency number; no employee may respond to outside queries without prior authorization. Any outside media calls concerning this incident must be referred immediately to Lauren Gallagher at 602-757-3211. 2. Once medical attention is sought and provided, the supervisor must:
Call WorkCare 24/7 Hotline* (888) II-XPRTS or (888) 449-7787	
WorkCare will assess the situation and determine whether the incident requires further medical attention. During this process, WorkCare will perform the following: • Explain the process to the caller. • Determine the nature of the concern. • Provide appropriate medical advice to the caller. • Determine appropriate path forward with the caller. • Maintain appropriate medical confidentiality. • Help caller to execute path forward, including referral to the appropriate local medical facility. • Send an email notification to the Corporate HSE Department.	WorkCare will be responsible for performing the following: • Contact the treating physician. • Request copies of all medical records from clinic. • Send an email update to the Corporate HSE Department.

3. IMMEDIATELY after contacting WorkCare send a brief email notification AND inform verbally (direct contact is required) ONE of HSE corporate representatives See Figure 11.3.
4. Make all other local notifications and client notifications.
5. Local Supervisor, HSE Coordinator, SSHO and any applicable safety committees to complete preliminary investigation, along with the initial Incident Report within 24 hours.
6. Corporate Loss Prevention Manager to complete Worker's Compensation Insurance notifications as needed.
7. Corporate HSE to conduct further incident notifications, investigation, include in statistics, classify, and develop lessons learned materials.

* - **NOTE: Step 2 is only applicable to the North-American operations and to incidents involving AMEC personnel. High potential near misses, subcontractors' incidents, regulatory inspections, spills and property damages above $1,000 should be reported immediately, following directions from Step 3.**

Site Specific Procedures are as follows:

Site personnel will not enter test pits. Any samples will be collected from the backhoe bucket or some other means of remote sampling.
Control work zone to protect workers, general public, and site workers.

INCIDENT FLOW CHART

Incident Flow Chart

amec

Call Immediately

Incident Occurs

- **Emergency** → **CALL 911 Emergency**
- **Non-Emergency** → **Contact Supervisor, HSE Coordinator and WorkCare 24/7 Hotline (888) 449-7787**

Supervisor Immediately Calls After Medical Attention is Sought and Provided

Verbally Contact One HSE Representative Below Within 2 Hours

E&I Corporate HSE Department Contact List

Name/Email	Office Location	Contact Information
Bruce Voss bruce.voss@amec.com	Cathedral City, CA	760.202.3737 (office) 951.897.6381 (cell)
Chad Barnes chad.barnes@amec.com	Phoenix, AZ	602.733.6000 (office) 480.495.9846 (cell)
Cindy Sundquist cynthia.sundquist@amec.com	Portland, ME	207.828.3309 (office) 207.650.7593 (cell) 207.892.4402 (home)
Don Kubik don.kubik@amec.com	Oakland, CA	510.663.4100 (office) 510.368.6433 (cell)
Gabe Sandholm gabe.sandholm@amec.com	Minneapolis, MN	612.252.3785 (office) 206.683.9190 (cell)
John Mazur john.mazur@amec.com	Wilmington, NC	910.444.2978 (office) 910.431.2330 (cell) 910.681.0538 (home)
Lori Dowling lori.dowling@amec.com	Prince George, BC	250.564.3243 (office)
Philip Neville philip.neville@amec.com	Thorold, ON	905.687.6616 (office) 905.380.4465 (cell)
Tim Kihn tim.kihn@amec.com	Edmonton, AB	780.944.6363 (office) 780.717.5058 (cell)
Vladimir Ivensky (can call 247) vladimir.ivensky@amec.com	Plymouth Meeting, PA	610.877.6144 (office) 484.919.5175 (cell) 215.947.0393 (home)
Kirby Lastinger kirby.lastinger@amec.com	Lakeland, FL	836-667-2345 x207 (office) 863-272-4775 (cell)

**High potential near misses, subcontractor incidents, regulatory inspections, spills, and property damage should be reported within 60 minutes to one of the above HSE Representatives.*

Revised Sept2014-hb

FIELD TEAM REVIEW: I acknowledge that I understand the requirements of this HASP, and agree to abide by the procedures and limitations specified herein. I also acknowledge that I have been given an opportunity to have my questions regarding the HASP and its requirements answered prior to performing field activities. Health and safety training and medical surveillance requirements applicable to my field activities at this site are current and will not expire during on-site activities.

Name: _____ Date: _____

Name: _____ Date: _____

Name: _____ Date: _____

Name: _____ Date: _____

Name: _____ Date: _____

Routes to Emergency Medical Facilities

HOSPITAL(for immediate emergency treatment):

Facility Name: St. Luke's Cornwall Hospital Center

Address: 279 Main Street, New Paltz, NY 12561

Telephone Number: (845) 256-0253

DIRECTIONS TO PRIMARY HOSPITAL (attach map):

CLINIC (for non-emergency medical treatment):

Facility Name: New Paltz Family Health Center

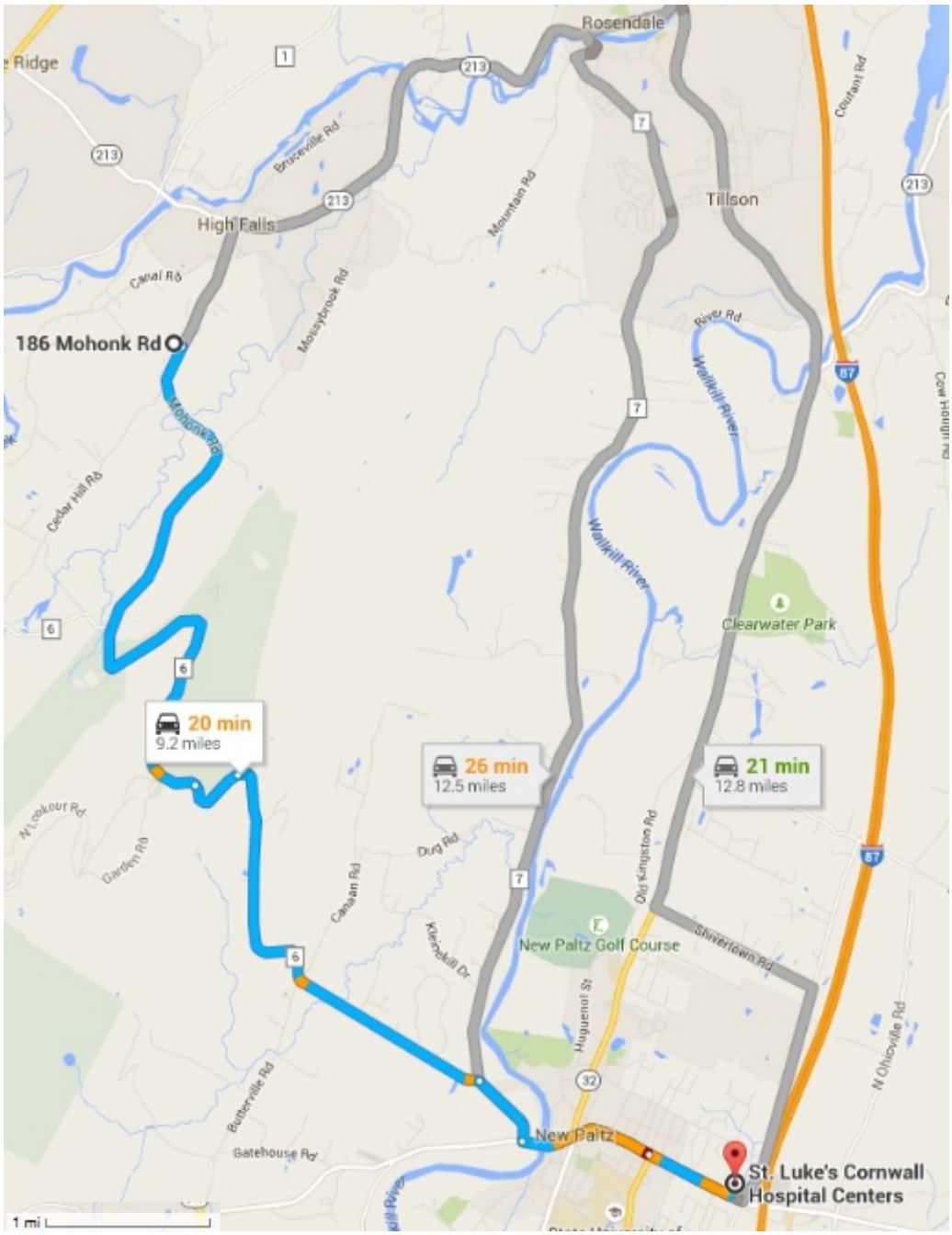
Address: 239 Golden Hill Drive, Kingston, NY 12401

Telephone Number: (845) 340-4000

DIRECTIONS TO CLINIC (attach map):

Site-Specific Health and Safety Plan

Directions to Emergency Room at St. Lukes Cornwall Hospital Center:



Start:
186 Mohonk Rd
High Falls, NY 12440, US

End:
St. Lukes Cornwall Hospital Center
279 Main Street, New Paltz, NY 12561, US

MACTEC, Inc.

Routes to Emergency Medical Facilities

PRIMARY HOSPITAL:

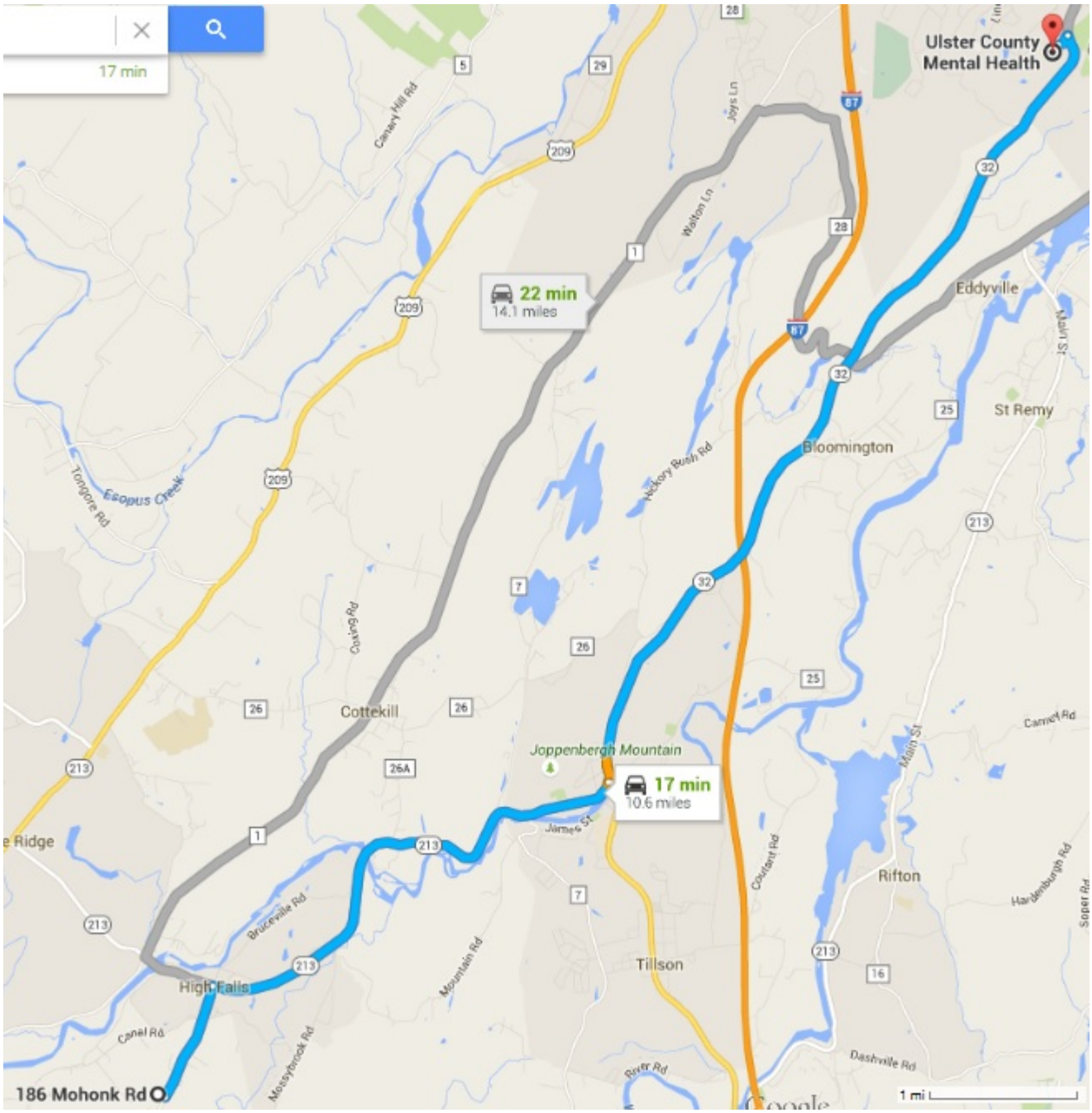
Facility Name: St. Luke's Cornwall Hospital Centers
Address: 279 Main Street, New Paltz, NY 12561, US
Telephone Number (845) 256-0253

via Mohonk Rd and Mountain Rest Rd — 20 min
16 min without traffic · Show traffic — 9.2 miles

186 Mohonk Rd
High Falls, NY 12440

- Head southwest on Co Rd 6a/Mohonk Rd
  - Continue to follow Mohonk Rd
  - 4.2 mi
- Continue onto Mt Rest Rd
  - 0.4 mi
- Continue onto Mountain Rest Rd
  - 2.8 mi
- Slight right onto Springtown Rd
  - 0.5 mi
- Turn left onto NY-299 E
  - 0.8 mi
- Continue straight onto NY-299 E/Main St
  - Destination will be on the left
  - 0.5 mi

St. Luke's Cornwall Hospital Centers
279 Main Street #203, New Paltz, NY 12561



Start:
186 Mohonk Rd
High Falls, NY 12440, US

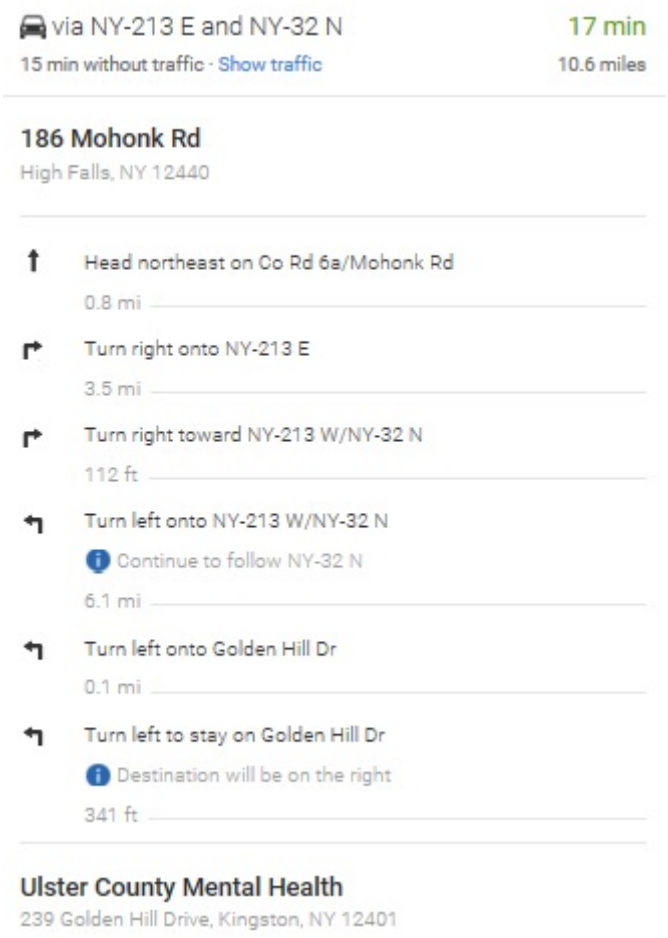
End:
Ulster County Mental Health
239 Golden Hill Dr, Kingston, NY 12401

Site-Specific Health and Safety Plan

Routes to Emergency Medical Facilities

ALTERNATE HOSPITAL

Facility Name: Ulster County Mental Health
Address: 239 Golden Hill Drive, Kingston, NY 12401
Telephone Number (845) 340-4000



Site-Specific Health and Safety Plan
DAILY TAILGATE SAFETY MEETING CHECKLIST

MACTEC, Inc.

Project: _____ Site: _____
Date: Location:

To be reviewed on the first day of site activities and when new workers arrive on site:

Alternate for Health & Safety: _____
Location of on-site HASP: _____
Site training requirements: See HASP
Specific medical surveillance requirements: See HASP

Agenda:

During the project, one or more of the agenda items could be selected for the required daily site training.

		Date						
		__	__	__	__	__	__	__
		Check-off:						
1.	Planned work for this day (discuss – include review of applicable JHAs)	☐	☐	☐	☐	☐	☐	☐
2.	Physical hazards and controls (discuss/review)	☐	☐	☐	☐	☐	☐	☐
3.	Chemical hazards and controls (discuss/review)	☐	☐	☐	☐	☐	☐	☐
4.	Biological hazards and controls (discuss/review)	☐	☐	☐	☐	☐	☐	☐
5.	Personal protective equipment Modified D	☐	☐	☐	☐	☐	☐	☐
6.	Personal protective equipment required per the hazard assessment in JHA:	☐	☐	☐	☐	☐	☐	☐

SPECIFY TYPE	
Protective coveralls	
Safety glasses/goggles	ANSI approved
Hard hat	ANSI approved
Foot protection	Safety toe boots & overboots
Work gloves	
Chemical gloves	Nitrile outer, nitrile inner
Hearing protection	
Other	

7.	Review inspection, decon, and maintenance procedures and the limitations of the above stated PPE.	☐	☐	☐	☐	☐	☐	☐
8.	Decontamination procedure (discuss/review)	☐	☐	☐	☐	☐	☐	☐
9.	Exclusion zone maintained	☐	☐	☐	☐	☐	☐	☐
10.	Site emergency response plan (discuss/review)	☐	☐	☐	☐	☐	☐	☐
11.	Signs and symptoms of overexposure to chemicals anticipated on site	☐	☐	☐	☐	☐	☐	☐
12.	General health and safety rules	☐	☐	☐	☐	☐	☐	☐
13.	Specific health and safety requirements relating to site activities including: (discuss/review)	☐	☐	☐	☐	☐	☐	☐
14.	Drilling/boring	☐	☐	☐	☐	☐	☐	☐
15.	UST	☐	☐	☐	☐	☐	☐	☐
16.	Excavations (including UG utility locations)	☐	☐	☐	☐	☐	☐	☐
17.	Heavy equipment	☐	☐	☐	☐	☐	☐	☐
18.	Slips, trips, and falls	☐	☐	☐	☐	☐	☐	☐
19.	Lockout/tagout	☐	☐	☐	☐	☐	☐	☐
20.	Working in temperature extremes	☐	☐	☐	☐	☐	☐	☐
21.	Rain or other weather advisories	☐	☐	☐	☐	☐	☐	☐
22.	Other health & safety issues (discuss/note)	☐	☐	☐	☐	☐	☐	☐
23.	Issued Daily Work Permit	☐	☐	☐	☐	☐	☐	☐

I have participated in the daily safety meeting discussing the topics indicated and fully understand my responsibility for complying with all health and safety requirements. I have had the opportunity to have my questions on site health and safety issues and procedures answered.

Employee Name	Employee Signature	Date

PPE Selection Guidelines

When selecting the appropriate PPE for the job, consider the following:

- **Safety glasses** – general eye protection – source of hazard, typically coming from straight on, required at most sites
- **Tinted Safety Glasses** – same as above, but when working in direct sunlight. May need two both tinted and untinted if working in both sunlight and shade/overcast skys.
- **Safety goggles** – needed for splash hazard, more severe eye exposures coming from all directions. Non-vented or indirect venting for chemical splash, non-vented for hazardous gases or very fine dust, vented for larger particulates coming from all directions.
- **Face shield** – needed to protect face from cuts, burns, chemicals (corrosives or chemicals with skin notation), etc.
- **Safety boots** – needed if danger of items being dropped on foot that could injure foot
- **Hard hat** – danger from items falling on head – any overhead work, tools, equipment, etc that is above the head and could fall on head of item fails, or falls off work platform. Typically required at most sites as a general PPE
- **Thin, chemical protective inner gloves** (e.g., thin Nitrile, PVC – do not use latex – many people are allergic to latex) –needed to protect hands from incidental contact with low risk contamination at very low concentrations (ppb or low ppm concentrations in groundwater or soil) or used in combination with outer gloves as a last defense against contamination. Need to specify type
- **Outer gloves** – thicker gloves (e.g., Nitrile, Butyl, Viton, etc.) – used when potential for high concentrations of contaminants (e.g., floating product, percent ranges of contaminant, opening drums, handling pure undiluted chemicals, etc.). Need to specify type.
- **Leather gloves, leather palm, cotton** – good in protecting hands against cuts – no protection from chemicals. May be used in combination with chemical protective gloves.
- **Boot Covers –** when there is contamination in surface soils or waking surface in general. When safety boots need protection from contact with contaminants.
- **White (uncoated) Tyveks** – protect clothing from getting dirty, good for protection against solid, non-volatile chemicals (e.g., asbestos, metals) – no chemical protection.
- **Polycoated Tyveks** – least protective of chemical protective clothing. Used when some risk of contamination getting on skin or clothing. Usually, lower ppm ranges of contaminants.
- **Saranex** – Greater protection against contamination than Polycoated Tyveks. Used to protect against PCBs or higher concentrations of contaminants in the soil or groundwater.
- **Other Chemical protective clothing** – if significant risk of dermal exposure, contact H&S to determine best kind.
- **Long sleeved shirts, long pants** – if working in areas with poison ivy/oak/sumac, poisonous insects, etc. and no chemicals exposure. May want to use uncoated Tyveks for work in areas where poisonous plants are know to be to protect clothing.
- **Cartridge Respirator (Level C PPE)** – Need to calculate change schedule (contact Division EH&S Manager for this) to determine length of use. To be able to use cartridge respirators, need to know contaminants, estimate levels to be encountered in the breathing zone, need to ensure that cartridge will be effective against COCs, and need to be able to monitor for COCs using PID, FID, Dräger tubes, etc.. If can't do any of these, then Level B PPE is probably going to be needed.
- **High Visibility Vest** – needed for any road work (with in 15 feet of a road) or when working on a site with vehicular traffic or working around heavy equipment. Needed if work tasks would take employee concentration away from movement of vehicles and workers would have to rely on the other driver's ability to see the employee in order not to hit them. This includes heavy equipment as well as cars and trucks, on public roads or the jobsite. Not needed if wearing Polycoated Tyveks – as they are already high visibility.
- **Reflective Vest** – see above, but for use at night.
- **Hearing Protection** – needed if working at noise levels above 85 dBA on a time weighted average. If noise measurements are not available, use around noisy equipment, or in general, if you have to raise your voice to be heard when talking to someone standing two feet away.
- **Protective Chaps –** required when using a machete or chain saw or any other cut hazard to legs.

Incident Report Forms

© 2011 AMEC

Check one
Initial Report: ☐
Update: ☐
Final Report: ☐ ____

INCIDENT ANALYSIS REPORT
AMEC Environment & Infrastructure
Confidential - Privileged

Incident Potential
Letter: Select One
Number: Select One
Investigation Level: Select One

Group: Select One HSE Manager: ____ Incident Review Panel Team (if applicable): ____

Incident Date: _____ Report Date: _____

Section 1 – General Information

Employee Name: ____ Sex: ☐ M ☐ F Date of Birth: ____ Age Range: Select One Time of incident: ____ ☐ am | ☐ pm

Job Position: Select One Hire Date: ____ Time employee began work: _____

Business Line: Select One Department Number: ____ Project Manager: ____

Project Name: ____ Project Number: ____ Client: ____

Office where employee works from: ____ Immediate Supervisor: ____ Hours employee worked during last 7 days: ____ hrs

Location: Select One Is this a Company controlled work site: ☐ Yes ☐ Incident Assigned to: Select One

Location description: ____

Section 2 – Incident Type - Process (**mark at least ONE BOLD TYPE** and all that apply)

☐ **Fatality** ☐ **Environmental** ☐ **Injury/Illness Incident** If Injury/illness: Select One

☐ **Security** ☐ **Near Miss / Hazard ID** ☐ **Property Damage** If Damage: Select One ☐ 3rd Party?

☐ Hospitalization ☐ Regulatory Inspection ☐ Notice of Violation or Citation ☐ Agency Reportable?

☐ Motor Vehicle Incident Involving Injury ☐ Other (describe): ____

Outcome/Result: Select One Source of Hazard: Select One If "other", specify: ____ Immediate Cause: Select One

A. If **injury/illness**: Indicate the part of the body: Select One If "other", specify: ____
   Indicate body part location: Select One If "other", specify: ____
   Injury Type: Select One If "other", specify: ____ Illness Type: Select One If "other", specify: ____
B. If **property damage**: describe what happened and estimate ($) of damage to all objects involved? ____
C. If **environmental**: Type of Environmental incident?: Select One Name, CAS#, physical state and quantity? ____
   Receiving Environment?: Select One Mechanism of Incident?: Select One If "other", specify: ____
   Nature of Breach?: Select One Duration of Breach?: Select One
D. If **security**: Security Incident Type: Select One If Physical: Select One If Criminal: Select One If Intellectual: Select One
E. If an **inspection by a regulatory agency**, what agency, who were the inspectors, inspector contact information? ____

Section 3 – Incident Description

Attach and number additional pages, as needed, to ensure all details related to the incident are captured.

A. List the names of all persons involved in the incident, and employer information: ____
B. List the names of any witnesses, their employer, and a local/company telephone number or address: ____
C. Name of Employee's supervisor: ____ Contact phone number for supervisor: ____
D. What specific job/task or action was the employee(s) doing just prior to the incident: ____
E. Was a tool or equipment involved? ☐ Yes ☐ No What was it: ____ Last Inspection Date: ____Defects: ____
F. Explain in **detail** what happened: ____
G. Explain in **detail** what object or substance directly harmed the employee: ____

H. What were the weather conditions at time of incident?: ___

I. What was the lighting like at time of incident? Bright ☐ Shadows ☐ Dark ☐ Other: ___

J. List any damaged equipment or property (other than motor vehicles). Provide model and serial number **and** estimated costs to repair/replace damaged equipment or property, if applicable: ___

Section 4 - Incident Analysis

A. Was a Health and Safety Plan (HASP) or Activity Hazard Analysis (AHA) completed for the work being performed? ☐ Yes ☐ No
If "yes", Who prepared the document?: ___

B. Who and when was the last manager (Project, Unit, etc.) at the site of the incident?: ___

C. When and what safety training **directly related** to the incident has the person(s) involved had?: ___

D. List attached documentation (HASP acknowledgement forms, kickoff/daily/weekly meetings, inspections, photographs): ___

Section 5 - Incident Investigation Results and Corrective Actions

This section to be completed by the Group HSE Manager/IRP with support from location where incident occurred.

Causal Factors (Acts or Omissions / Conditions)

(Attach and number any additional pages as needed to completely address this section)

	IMMEDIATE CAUSE	IMMEDIATE CAUSE SUB-TYPE	DESCRIPTION
1	Select One	_____	_____
2	Select One	_____	_____
3	Select One	_____	_____
4	Select One	_____	_____

Root Cause(s) Analysis - The below items represents major root cause categories which have been determined to be Less Than Adequate (LTA). A more detailed determination of the root cause will be facilitated, if needed, by the applicable Group HSE Manager / IRP.

	ROOT CAUSE TYPE	ROOT CAUSE SUB-TYPE	DESCRIPTION
1	Select One	_____	_____
2	Select One	_____	_____
3	Select One	_____	_____
4	Select One	_____	_____

Corrective Actions

Root Cause #	Corrective Actions Taken (Attach additional pages as needed to completely address this section)	Responsible Person	Proposed Completion Date	Closed on Date	Verified by and Date Verified
_____	___	___	___	___	___
_____	___	___	___	___	___
_____	___	___	___	___	___
_____	___	___	___	___	___
_____	___	___	___	___	___

Section 6 - Notifications, Certification & Approvals

Check the appropriate boxes indicating the applicable reports have been made to the following applicable organizations:

Auto Insurance Carrier was called ☐ Group HSE Manager Notified ☐

WorkCare was called ☐ Post-incident Drug/Alcohol Testing Performed ☐

Incident Report prepared by: ___

Employee (s): ___	Date: ___	Employee's Supervisor: ___	Date: ___
HSE Coordinator/Project/Unit Manager: ___	Date: ___	Group HSE Manager:___	Date: ___

ATTACHMENT 2
VEHICLE INCIDENT REPORT

Confidential - Privileged

Section 1 - General Information Date of Incident: _____

Time incident occurred: _____ ☐ am | ☐ pm | Illumination: ☐ Dark ☐ Dusk ☐ Light | Road Condition: ☐ Dry ☐ Wet ☐ Icy/snow

Were police summoned to scene? ☐ Yes ☐ No Police Department and Location: _____

Report #; _____ Officer's Name: _____ Officer's Badge Number: _____

Section 2 - Company Driver and Vehicle

Driver's name: _____ D/L #: _____ State: _____

Driver's home office address: _____ Driver's Phone #: _____

Company Vehicle #: _____ Year: _____ Model: _____ License #: _____ State: _____

Company car?: ☐ Yes ☐ No Personal Vehicle?: ☐ Yes ☐ No Rental Vehicle?: ☐ Yes ☐ No

If rental, rented from: _____

Passenger/Witness Name(s): _____ Address: _____ Telephone: _____

Passenger/Witness Name(s): _____ Address: _____ Telephone: _____

Damage to vehicle: _____

Was an employee injured?: ☐ Yes ☐ No If yes, please describe: _____

Injuries to others?: ☐ Yes ☐ No If yes, please describe: _____

Vehicle was being used for: Company business ☐ Yes ☐ No Personal business ☐ Yes ☐ No

Towed?: ☐ Yes ☐ No If yes, by whom?: _____ To Where?: _____

Section 3 - Other Driver and Vehicle Information

Driver's Name: _____ D/L # : _____ State: _____

Current address: _____ City: _____ State: _____

Telephone: _____ Work: _____ Cell: _____

Registered Owner's Name: _____ Address: _____ City: _____ State: _____

(verify registration document)

The Other Vehicle: Make: _____ Model: _____ Year: _____ License #: _____ State: _____

Insurance company name: _____ Address: _____ Phone #: _____

Policy No.: _____ Contact Person: _____ Phone #: _____

Passenger/Witness Name(s): _____ Address: _____ Telephone: _____

Passenger/Witness Name(s): _____ Address: _____ Telephone: _____

Damage: (*Make note of pre-existing damage and take pictures if possible – you may attach additional pages if necessary):* _____

Injuries to other driver/passengers: _____

Section 4 – Approvals (signatures required)

Form completed by (please print): _____ Date: _____

Signature: _____

Office/Project Manager (please print): _____ Date: _____

Signature: _____

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Things to Do First In The Event Of a Motor Vehicle Incident

GENERAL INFORMATION

1. Do not decide on your own whether a particular incident is "covered" by insurance. Should there be any doubt, it is always preferable to report an occurrence, as this allows underwriters, the Risk Management Department and insurance adjusters to determine if a covered loss has taken place.

2. Policy Conditions do require that all losses and occurrences, which may result in a claim be promptly reported.

3. Do not admit liability or offer your opinion of liability to anyone.

4. Complete this IAR/VIR form promptly and forward with all applicable supporting documentation. It is essential both division and location information be provided.

5. For automobile collisions within the **United States**, please indicate on the IAR form that you have contacted Zurich at:

Zurich Insurance Company
1-800-987-3373 or
1-877-928-4531
24 hours a day, 7 days a week

6. For automobile collisions within **Canada**, please indicate on the IAR form that you have contacted Zurich at:

Crawford Adjusters Canada
Claims Alert
1-888-218-2346
24 hours a day, 7 days a week

The more details you have the better but, don't delay reporting if you don't have all of the information - that may be obtained later. A Zurich trained operator will answer your call and ask for all relevant information regarding the incident. The initial information required includes:

- Your division,
- Office location and division contact name – advise that you are an AMEC Company
- Name, drivers license and phone number of the driver involved in the loss
- Description of the vehicle which he/she was driving (i.e., year, make, model, license plate number, serial number)
- Date, time and location of incident
- Passenger information (if applicable)
- Third party information (i.e., name, phone number, address, vehicle information, insurance information)
- If any injuries occurred (if applicable)
- Police information
- Witness information (if applicable)

Call 911 if there are serious injuries!

If you are injured or think you were injured, **contact your supervisor and call WorkCare at 888-449-7787**. Your supervisor will notify your HSE Coordinator and your Group HSE Manager. For additional instructions on what to do, go to AMEC's HSE website at:

http://ee.amecnet.com/she/sheweb/incident_reporting.htm

1. Call for an officer if the incident occurred on public property (streets, highways or roads). Disputes often arise between the parties involved as to who was at fault; therefore, a police report is important. If an officer is unable to attend the scene of the collision, a counter police report may be filed at most stations. Insurance companies rely on police reports to determine liability.
2. Complete the Incident Investigation Report and the Vehicle Incident Report forms. It is important that both these forms are completed in detail. Include a diagram of the incident on the provided sheet. Incomplete information may lead to delays in processing associated claims and in helping to prevent this type of incident from occurring again.
3. Give only information that is required by the authorities or as directed by AMEC contractual requirements.
4. Sign only those statements required by the authorities or as directed by AMEC contractual requirements. Do not sign away your or the company's rights.

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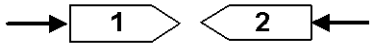
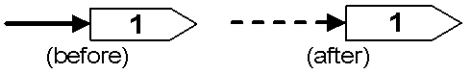
Vehicle Incident Diagram

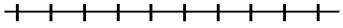
This or a similar diagram must be completed with all VIRs

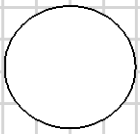
Instructions:

1. Number each vehicle and show directions 

2. Use a solid line to show path before incident and use a dotted line to show path after incient



3. Show pedestrian/non-motorist by: 
4. Show railroad by: 
5. Indicate north by arrow as: 
6. Show street or highway names or numbers
7. Show signs, signals, warning and traffic controls.



Prepared by: _____ Date: _____

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GROUND DISTURBANCE INCIDENT REPORT

AMEC Environment & Infrastructure

Section 1 – General Information

Employee Name: _____ Time of incident: _____ ☐ am | ☐ pm Time Reported:_____ ☐ am | ☐ pm Report Date: _____

Project Name: _____ Project Number: _____ Client: _____

List of All Parties Present

Name	Company	Telephone No.	Role
____	____	____	____
____	____	____	____
____	____	____	____
____	____	____	____
____	____	____	____

Describe the chronological description of Incident and response:____

Section 2 – Date and Location of Event

A. *Date of Event: (MM/DD/YYYY)

B. ***Country** ***State** ***County** **City**

C. **Street address** **Nearest Intersection**

D. *Right of Way where event occurred

E. Public: ☐ City Street ☐ State Highway ☐ County Road ☐ Interstate Highway ☐ Public-Other

F. Private: ☐ Private Business ☐ Private Land Owner ☐ Private Easement

G. ☐ Pipeline ☐ Power /Transmission Line ☐ Dedicated Public Utility Easement

☐ Federal Land ☐ Railroad ☐ Data not collected ☐ Unknown/Other

List attached documentation (Public Utility Locates, Private Utility Locates, Copy of notifications submitted to Owner or other utility Owners, photographs): _____

Section 3 – Affected Facility Information

***What type of facility operation was affected?**

☐ Cable Television ☐ Electric ☐ Natural Gas ☐ Liquid Pipeline ☐ Sewer (Sanitary Sewer)

☐ Steam ☐ Telecommunications ☐ Water ☐ Unknown/Other

***What type of facility was affected?**

☐ Distribution ☐ Gathering ☐ Service/Drop ☐ Transmission ☐ Unknown/Other

Was the facility part of a joint trench?

☐ Unknown ☐ Yes ☐ No

Was the facility owner a member of One-Call Center?

☐ Unknown ☐ Yes ☐ No

Section 4 – Excavation Information

***Type of Excavator**

☐ Contractor ☐ County ☐ Developer ☐ Farmer ☐ Municipality ☐ Occupant
☐ Railroad ☐ State ☐ Utility ☐ Data not collected ☐ Unknown/Other

***Type of Excavation Equipment**

☐ Auger ☐ Backhoe/Trackhoe ☐ Boring ☐ Drilling ☐ Directional Drilling
☐ Explosives ☐ Farm Equipment ☐ Grader/Scraper ☐ Hand Tools ☐ Milling Equipment
☐ Probing Device ☐ Trencher ☐ Vacuum Equipment ☐ Data Not Collected ☐ Unknown/Other

***Type of Work Performed**

☐ Agriculture ☐ Cable Television ☐ Curb/Sidewalk ☐ Bldg. Construction ☐ Bldg. Demolition
☐ Drainage ☐ Driveway ☐ Electric ☐ Engineering/Survey ☐ Fencing
☐ Grading ☐ Irrigation ☐ Landscaping ☐ Liquid Pipeline ☐ Milling
☐ Natural Gas ☐ Pole ☐ Public Transit Auth. ☐ Railroad Maint. ☐ Road Work
☐ Sewer (San/Storm) ☐ Site Development ☐ Steam ☐ Storm Drain/Culvert ☐ Street Light
☐ Telecommunication ☐ Traffic Signal ☐ Traffic Sign ☐ Water ☐ Waterway Improvement
☐ Data Not Collected ☐ Unknown/Other

Section 5 – Pre-Excavation Notification

***Was the One-Call Center notified?**

☐ Yes ☐ No If Yes, which One-Call Center? Ticket number:

Was Private Contract Locator used?

☐ Yes ☐ No

Section 6 – Locating and Marking

***Type of Locator**

☐ Utility Owner ☐ Contract Locator ☐ Data Not Collected

***Were facility marks visible in the area of excavation?**

☐ Yes ☐ No ☐ Data Not Collected

***Were facilities marked correctly?**

☐ Yes ☐ No ☐ Data Not Collected

What technology was used to locate utilities?

☐ Maps ☐ Active(transmitter+receiver) ☐ Passive (receiver only) ☐ GPR
☐ Acoustic ☐ Magnetic ☐ Infrared ☐ Unknown/Other

What Factors affected the ability to locate services?

☐ Soil Type:_____ ☐ Non-Grounded ☐ Common Bonded ☐ Depth
☐ Electromagnetic interference ☐ Parallel facilities ☐ Congested facilities ☐ Unknown/Other

Section 7 – Excavator Downtime

Did Excavator incur down time?

☐ Yes ☐ No

If yes, how much time?

☐ Unknown ☐ Less than 1 hour ☐ 1 hour ☐ 2 hours ☐ 3 or more hours Exact Value _____If

Estimated cost of down time?

☐ Unknown ☐ $0 ☐ $1 to 500 ☐ $501 to 1,000 ☐ $1,001 to 2,500 ☐ $2,501 to 5,000
☐ $5,001 to 25,000 ☐ $25,001 to 50,000 ☐ $50,001 and over Exact Value _____

Section 8 – Description of Damage

***Was there damage to a facility?**
☐ Yes ☐ No (i.e. near miss)
***Did the damage cause an interruption in service?**
☐ Yes ☐ No ☐ Data Not Collected ☐ Unknown/Other
If yes, duration of interruption
☐ Unknown ☐ Less than 1 hour ☐ 1 to 2 hrs ☐ 2 to 4 hrs ☐ 4 to 8 hrs ☐ 8 to 12 hrs ☐ 12 to 24 hrs
☐ 1 to 2 days ☐ 2 to 3 days ☐ 3 or more days ☐ Data Not Collected Exact Value _____
Approximately how many customers were affected?
☐ Unknown ☐ 0 ☐ 1 ☐ 2 to 10 ☐ 11 to 50 ☐ 51 or more Exact Value _____
Estimated cost of damage / repair/restoration
☐ Unknown ☐ $0 ☐ $1 to 500 ☐ $501 to 1,000 ☐ $1,001 to 2,500 ☐ $2,501 to 5,000
☐ $5,001 to 25,000 ☐ $25,001 to 50,000 ☐ $50,001 and over Exact Value _____
Number of people injured
☐ Unknown ☐ 0 ☐ 1 ☐ 2 to 9 ☐ 10 to 19 ☐ 20 to 49 ☐ 50 to 99
☐ 100 or more Exact Value _____
Number of fatalities
☐ Unknown ☐ 0 ☐ 1 ☐ 2 to 9 ☐ 10 to 19 ☐ 20 to 49 ☐ 50 to 99
☐ 100 or more Exact Value _____

Was there a Product Release?
Product Release: ☐ No ☐ Yes ☐ N/A Type: ____ **If Yes, Incident Type is Environmental Report.**
Volume: ____ Spill Controls: ____
Repair Process: ____

Section 9 – Description of the Root Cause

Please choose one

One-Call Notification Practices Not Sufficient
☐ No notification made to the One-Call Center
☐ Notification to one-call center made, but not sufficient
☐ Wrong information provided to One Call Center

Locating Practices Not Sufficient
☐ Facility could not be found or located
☐ Facility marking or location not sufficient
☐ Facility was not located or marked
☐ Incorrect facility records/maps

Excavation Practices Not Sufficient
☐ Failure to maintain marks
☐ Failure to support exposed facilities
☐ Failure to use hand tools where required
☐ Failure to test-hole (pot-hole)
☐ Improper backfilling practices
☐ Failure to maintain clearance
☐ Other insufficient excavation practices

Miscellaneous Root Causes
☐ One-Call Center error
☐ Abandoned facility
☐ Deteriorated facility
☐ Previous damage
☐ Data Not Collected
☐ Other

Section 10 - Notifications, Certification & Approvals

Check the appropriate boxes indicating the applicable reports have been made to the following applicable organizations:

One Call was called ☐ **Spills Reporting Agency Notified ☐**

Emergency Responders (Fire) was called ☐ **Post-incident Drug/Alcohol Testing Performed**

List of All Agencies Contacted

Name/Agency	Phone #	Date	Time

Incident Report prepared by: ____

Employee (s): ____	Date: ____	Employee's Supervisor: ____	Date: ____
HSE Coordinator/Project/Unit Manager: ____	Date: ____	Group HSE Manager:____	Date: ____

Utility Clearance Form

Site Name: Mohonk Road Industrial – Data Gap Investigation
Site Address: 186 Mohonk Rd, High Falls, NY 12440-5228

Project No./Task No.: 3617157346.02
One Call Ticket No.: _____
Ticket Good until: _____

Project Manager Name: Jayme Connolly
Locations cleared by facility? _____

PM Phone No.: _____
Date Cleared: _____

Utility Clearance:

Potential Utilities		Identified		Colors	Utility Company Name(s)	Utilities
Member of One Call	*Non Members	Utility Marked	Utility Responded not Present			
						WHITE - Proposed Excavation
						****PINK** - Temporary Survey Markings
						RED - Electric Power Lines, Cables, Conduit and Lighting Cables
						YELLOW - Gas, Oil, Steam, Petroleum or Gaseous Materials
						ORANGE - Communication, Alarm or Signal Lines, Cables or Conduit
						BLUE - Potable Water
						PURPLE - Reclaimed Water, Irrigation and Slurry Lines
						GREEN - Sewers and Drain Lines

*Contact local municipality
** Survey markings need to be protected. If disturbed or destroyed, replace markings.

Private Utility Locator/Geophysical Survey

Method to be used:
___ Pipe and Cable Location
___ Ground Penetrating Radar
___ Magnetics and Electromagnetics

Non-Destructive Excavation Method to be used

___ *Hand Dig
___ Soil Vacuum
___ Air Knife
___ Water Knife

* Use electrically insulated gloves if potential for power lines

Field Clues Observed/Evaluated:

___ Overhead power lines
___ Cell phone/radio antennas
___ Trench patches
___ Trench settlement
___ Trench drains
___ Utility manholes
___ Manholes just outside building
___ Valve risers
___ Floor cleanout covers
___ Floor drains
___ Patches in concrete floors
___ Drainage ditches in area
___ Utility vaults
___ Transformer pads
___ Conduits from power panels into slab
___ Above ground propane tanks
___ Fire protection rooms
___ Fire protection lines
___ Fire hydrant locations – valves in ground
___ Footings under structural columns
___ Guard shack – service utilities
___ Bathroom and kitchen facilities
___ Radiant heat systems in slabs (ask)
___ Cooling units outside building
___ Process water to equipment in factory
___ Sprinkler system landscaping
___ Grounding systems near perimeter
___ Water tower on site.
___ Foundation drains - building perimeter

Additional Notes/Remarks: _____

Confidence Level that All Utilities have been identified:

___ High ___ Medium High ___ *Moderate ___ *Medium Low ___ *Low

*Contact PM. Get PM and OM permission prior to proceeding

*Cleared by PM? _____ *Cleared by OM? _____

Safety Data Sheets

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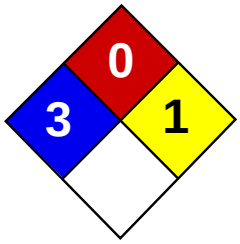

Material Safety Data Sheet
Hydrochloric acid MSDS

Section 1: Chemical Product and Company Identification

Product Name: Hydrochloric acid

Catalog Codes: SLH1462, SLH3154

CAS#: Mixture.

RTECS: MW4025000

TSCA: TSCA 8(b) inventory: Hydrochloric acid

CI#: Not applicable.

Synonym: Hydrochloric Acid; Muriatic Acid

Chemical Name: Not applicable.

Chemical Formula: Not applicable.

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Hydrogen chloride	7647-01-0	20-38
Water	7732-18-5	62-80

Toxicological Data on Ingredients: Hydrogen chloride: GAS (LC50): Acute: 4701 ppm 0.5 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant, corrosive), of ingestion, . Slightly hazardous in case of inhalation (lung sensitizer). Non-corrosive for lungs. Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (sensitizer). CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Hydrochloric acid]. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, mucous membranes, upper respiratory tract, skin, eyes, Circulatory System, teeth. Repeated or prolonged exposure to the substance can produce target

organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

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

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

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

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

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: of metals

Explosion Hazards in Presence of Various Substances: Non-explosive in presence of open flames and sparks, of shocks.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:
Non combustible. Calcium carbide reacts with hydrogen chloride gas with incandescence. Uranium phosphide reacts with hydrochloric acid to release spontaneously flammable phosphine. Rubidium acetylene carbides burns with slightly warm hydrochloric acid. Lithium silicide in contact with hydrogen chloride becomes incandescent. When dilute hydrochloric acid is used, gas spontaneously flammable in air is evolved. Magnesium boride treated with concentrated hydrochloric acid produces spontaneously flammble gas. Cesium acetylene carbide burns hydrogen chloride gas. Cesium carbide ignites in contact with hydrochloric acid unless acid is dilute. Reacts with most metals to produce flammable Hydrodgen gas.

Special Remarks on Explosion Hazards:

Hydrogen chloride in contact with the following can cause an explosion, ignition on contact, or other violent/vigorous reaction: Acetic anhydride AgClO + CCl4 Alcohols + hydrogen cyanide, Aluminum Aluminum-titanium alloys (with HCl vapor), 2-Amino ethanol, Ammonium hydroxide, Calcium carbide Ca3P2 Chlorine + dinitroanilines (evolves gas), Chlorosulfonic acid Cesium carbide Cesium acetylene carbide, 1,1-Difluoroethylene Ethylene diamine Ethylene imine, Fluorine, HClO4 Hexalithium disilicide H2SO4 Metal acetylides or carbides, Magnesium boride, Mercuric sulfate, Oleum, Potassium permanganate, beta-Propiolactone Propylene oxide Rubidium carbide, Rubidium, acetylene carbide Sodium (with aqueous HCl), Sodium hydroxide Sodium tetraselenium, Sulfonic acid, Tetraselenium tetranitride, U3P4 , Vinyl acetate. Silver perchlorate with carbon tetrachloride in the presence of hydrochloric acid produces trichloromethyl perchlorate which detonates at 40 deg. C.

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.

Large Spill:
Corrosive liquid. Poisonous liquid. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of sodium carbonate. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep container dry. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, organic materials, metals, alkalis, moisture. May corrode metallic surfaces. Store in a metallic or coated fiberboard drum using a strong polyethylene inner package.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

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

Personal Protection:
Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

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

Exposure Limits:
CEIL: 5 (ppm) from OSHA (PEL) [United States] CEIL: 7 (mg/m3) from OSHA (PEL) [United States] CEIL: 5 from NIOSH CEIL: 7 (mg/m3) from NIOSH TWA: 1 STEL: 5 (ppm) [United Kingdom (UK)] TWA: 2 STEL: 8 (mg/m3) [United Kingdom (UK)]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Pungent. Irritating (Strong.)

Taste: Not available.

Molecular Weight: Not applicable.

Color: Colorless to light yellow.

pH (1% soln/water): Acidic.

Boiling Point:
108.58 C @ 760 mm Hg (for 20.22% HCl in water) 83 C @ 760 mm Hg (for 31% HCl in water) 50.5 C (for 37% HCl in water)

Melting Point:
-62.25°C (-80°F) (20.69% HCl in water) -46.2 C (31.24% HCl in water) -25.4 C (39.17% HCl in water)

Critical Temperature: Not available.

Specific Gravity:
1.1- 1.19 (Water = 1) 1.10 (20%and 22% HCl solutions) 1.12 (24% HCl solution) 1.15 (29.57% HCl solution) 1.16 (32% HCl solution) 1.19 (37% and 38%HCl solutions)

Vapor Pressure: 16 kPa (@ 20°C) average

Vapor Density: 1.267 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.25 to 10 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility: Soluble in cold water, hot water, diethyl ether.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, water

Incompatibility with various substances:
Highly reactive with metals. Reactive with oxidizing agents, organic materials, alkalis, water.

Corrosivity:
Extremely corrosive in presence of aluminum, of copper, of stainless steel(304), of stainless steel(316). Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Reacts with water especially when water is added to the product. Absorption of gaseous hydrogen chloride on mercuric sulfate becomes violent @ 125 deg. C. Sodium reacts very violently with gaseous hydrogen chloride. Calcium phosphide and hydrochloric acid undergo very energetic reaction. It reacts with oxidizers releasing chlorine gas. Incompatible with, alkali metals, carbides, borides, metal oxides, vinyl acetate, acetylides, sulphides, phosphides, cyanides, carbonates. Reacts with most metals to produce flammable Hydrogen gas. Reacts violently (moderate reaction with heat of evolution) with water especially when water is added to the product. Isolate hydrogen chloride from heat, direct sunlight, alkalies (reacts vigorously), organic materials, and oxidizers (especially nitric acid and chlorates), amines, metals, copper and alloys (e.g. brass), hydroxides, zinc (galvanized materials), lithium silicide (incandescence), sulfuric acid(increase in temperature and pressure) Hydrogen chloride gas is emitted when this product is in contact with sulfuric acid. Adsorption of Hydrochloric Acid onto silicon dioxide results in exothmeric reaction. Hydrogen chloride causes aldehydes and epoxides to violently polymerize. Hydrogen chloride or Hydrochloric Acid in contact with the folloiwng can cause explosion or ignition on contact or

Special Remarks on Corrosivity:

Highly corrosive. Incompatible with copper and copper alloys. It attacks nearly all metals (mercury, gold, platinium, tantalum, silver, and certain alloys are exceptions). It is one of the most corrosive of the nonoxidizing acids in contact with copper alloys. No corrosivity data on zinc, steel. Severe Corrosive effect on brass and bronze

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
Acute oral toxicity (LD50): 900 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 1108 ppm, 1 hours [Mouse]. Acute toxicity of the vapor (LC50): 3124 ppm, 1 hours [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Hydrochloric acid]. May cause damage to the following organs: kidneys, liver, mucous membranes, upper respiratory tract, skin, eyes, Circulatory System, teeth.

Other Toxic Effects on Humans:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of ingestion, . Hazardous in case of eye contact (corrosive), of inhalation (lung corrosive).

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Doses (LDL/LCL) LDL [Man] -Route: Oral; 2857 ug/kg LCL [Human] - Route: Inhalation; Dose: 1300 ppm/30M LCL [Rabbit] - Route: Inhalation; Dose: 4413 ppm/30M

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects (fetoxicity). May affect genetic material.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Corrosive. Causes severe skin irritation and burns. Eyes: Corrosive. Causes severe eye irritation/conjuntivitis, burns, corneal necrosis. Inhalation: May be fatal if inhaled. Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract. Inhalation of hydrochloric acid fumes produces nose, throat, and larryngeal burning, and irritation, pain and inflammation, coughing, sneezing, choking sensation, hoarseness, laryngeal spasms, upper respiratory tract edema, chest pains, as well has headache, and palpitations. Inhalation of high concentrations can result in corrosive burns, necrosis of bronchial epithelium, constriction of the larynx and bronchi, nasospetal perforation, glottal closure, occur, particularly if exposure is prolonged. May affect the liver. Ingestion: May be fatal if swallowed. Causes irritation and burning, ulceration, or perforation of the gastrointestinal tract and resultant peritonitis, gastric hemorrhage and infection. Can also cause nausea, vomitting (with "coffee ground" emesis), diarrhea, thirst, difficulty swallowing, salivation, chills, fever, uneasiness, shock, strictures and stenosis (esophogeal, gastric, pyloric). May affect behavior (excitement), the cardiovascular system (weak rapid pulse, tachycardia), respiration (shallow respiration), and urinary system (kidneys- renal failure, nephritis). Acute exposure via inhalation or ingestion can also cause erosion of tooth enamel. Chronic Potential Health Effects: dyspnea, bronchitis. Chemical pneumonitis and pulmonary edema can also

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

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

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

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

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Hydrochloric acid, solution UNNA: 1789 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Hydrochloric acid Illinois toxic substances disclosure to employee act: Hydrochloric acid Illinois chemical safety act: Hydrochloric acid New York release reporting list: Hydrochloric acid Rhode Island RTK hazardous substances: Hydrochloric acid Pennsylvania RTK: Hydrochloric acid Minnesota: Hydrochloric acid Massachusetts RTK: Hydrochloric acid Massachusetts spill list: Hydrochloric acid New Jersey: Hydrochloric acid New Jersey spill list: Hydrochloric acid Louisiana RTK reporting list: Hydrochloric acid Louisiana spill reporting: Hydrochloric acid California Director's List of Hazardous Substances: Hydrochloric acid TSCA 8(b) inventory: Hydrochloric acid TSCA 4(a) proposed test rules: Hydrochloric acid SARA 302/304/311/312 extremely hazardous substances: Hydrochloric acid SARA 313 toxic chemical notification and release reporting: Hydrochloric acid CERCLA: Hazardous substances.: Hydrochloric acid: 5000 lbs. (2268 kg)

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

Other Classifications:

WHMIS (Canada):
CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASS E: Corrosive liquid.

DSCL (EEC):
R34- Causes burns. R37- Irritating to respiratory system. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 1

Personal Protection:

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

Health: 3

Flammability: 0

Reactivity: 1

Specific hazard:

Protective Equipment:
Gloves. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

Section 16: Other Information

References:
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Guide de la loi et du règlement sur le transport des marchandises dangeureuses au canada. Centre de conformité internatinal Ltée. 1986.

Other Special Considerations: Not available.

Created: 10/09/2005 05:45 PM

Last Updated: 11/01/2010 12:00 PM

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MSDS Number: N3660 * * * * * *Effective Date: 11/18/09* * * * * *Supercedes: 11/07/08*

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

NITRIC ACID, 50-70%

1. Product Identification

Synonyms: Aqua Fortis; Azotic Acid; Nitric Acid 50%; Nitric Acid 65%; nitric acid 69-70%
CAS No.: 7697-37-2
Molecular Weight: 63.01
Chemical Formula: HNO3
Product Codes:
J.T. Baker: 5371, 5796, 5801, 5826, 5856, 5876, 5896, 9597, 9598, 9600, 9601, 9602, 9603, 9604, 9606, 9607, 9608, 9610, 9616, 9617, 9670, 9761
Mallinckrodt: 1409, 2704, 2705, 2706, 2707, 2716, 6623, H862, H988, H993, H998, V077, V650

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Nitric Acid	7697-37-2	50 - 70%	Yes
Water	7732-18-5	30 - 50%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 4 - Extreme (Poison)
Flammability Rating: 0 - None
Reactivity Rating: 3 - Severe (Oxidizer)
Contact Rating: 4 - Extreme (Corrosive)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: White (Corrosive)

Potential Health Effects

Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison.

Inhalation:
Corrosive! Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract.
Ingestion:
Corrosive! Swallowing nitric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract.
Skin Contact:

Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color.
Eye Contact:
Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Chronic Exposure:
Long-term exposure to concentrated vapors may cause erosion of teeth and lung damage. Long-term exposures seldom occur due to the corrosive properties of the acid.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders, eye disease, or cardiopulmonary diseases may be more susceptible to the effects of this substance.

4. First Aid Measures

Immediate first aid treatment reduces the health effects of this substance.
Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion:
DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:
Not combustible, but substance is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition. Can react with metals to release flammable hydrogen gas.
Explosion:
Reacts explosively with combustible organic or readily oxidizable materials such as: alcohols, turpentine, charcoal, organic refuse, metal powder, hydrogen sulfide, etc. Reacts with most metals to release hydrogen gas which can form explosive mixtures with air.
Fire Extinguishing Media:
Water spray may be used to keep fire exposed containers cool. Do not get water inside container.
Special Information:
Increases the flammability of combustible, organic and readily oxidizable materials. In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker NEUTRASORB® acid neutralizers are recommended for spills of this product.

7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, the acid should always be added slowly to water and in small amounts. Never use hot water and never add water to the acid. Water added to acid can cause uncontrolled boiling and splashing. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
2 ppm (TWA), 4 ppm (STEL)
-ACGIH Threshold Limit Value (TLV):
2 ppm (TWA); 4 ppm (STEL)

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial*

Ventilation, A Manual of Recommended Practices, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Nitric acid is an oxidizer and should not come in contact with cartridges and canisters that contain oxidizable materials, such as activated charcoal. Canister-type respirators using sorbents are ineffective.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Colorless to yellowish liquid.
Odor:
Suffocating, acrid.
Solubility:
Infinitely soluble.
Specific Gravity:
1.41
pH:
1.0 (0.1M solution)
% Volatiles by volume @ 21C (70F):
100 (as water and acid)
Boiling Point:
122C (252F)
Melting Point:
-42C (-44F)
Vapor Density (Air=1):
2-3
Vapor Pressure (mm Hg):
48 @ 20C (68F)
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Containers may burst when heated.
Hazardous Decomposition Products:
When heated to decomposition, emits toxic nitrogen oxides fumes and hydrogen nitrate. Will react with water or steam to produce heat and toxic and corrosive fumes.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
A dangerously powerful oxidizing agent, concentrated nitric acid is incompatible with most substances, especially strong bases, metallic powders, carbides, hydrogen sulfide, turpentine, and combustible organics.
Conditions to Avoid:
Light and heat.

11. Toxicological Information

Nitric acid: Inhalation rat LC50: 244 ppm (NO2)/30M; Investigated as a mutagen, reproductive effector. Oral (human) LDLo: 430 mg/kg.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Nitric Acid (7697-37-2)	No	No	None
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: NITRIC ACID
Hazard Class: 8, 5.1
UN/NA: UN2031
Packing Group: II
Information reported for product/size: 6.5GL

International (Water, I.M.O.)

Proper Shipping Name: NITRIC ACID
Hazard Class: 8, 5.1
UN/NA: UN2031
Packing Group: II
Information reported for product/size: 6.5GL

International (Air, I.C.A.O.)

Proper Shipping Name: NITRIC ACID
Hazard Class: 8, 5.1
UN/NA: UN2031
Packing Group: II

Information reported for product/size:

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------------------------------

Ingredient	TSCA	EC	Japan	Australia
Nitric Acid (7697-37-2)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\---------------------------------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Nitric Acid (7697-37-2)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Nitric Acid (7697-37-2)	1000	1000	Yes	No
Water (7732-18-5)	No	No	No	No

--------\Federal, State & International Regulations - Part 2\----------------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Nitric Acid (7697-37-2)	1000	No	No
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No
Reactivity: No (Mixture / Liquid)

Australian Hazchem Code: 2PE
Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the

CPR.

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **0** Other: **Oxidizer**
Label Hazard Warning:
POISON! DANGER! STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe vapor or mist.
Use only with adequate ventilation.
Wash thoroughly after handling.
Keep from contact with clothing and other combustible materials.
Do not store near combustible materials.
Store in a tightly closed container.
Remove and wash contaminated clothing promptly.
Label First Aid:
In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In all cases get medical attention immediately.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 14.
Disclaimer:
****
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****
Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

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PID ANALYZERS

hnu

Instrumentation for Environmental, Process & Industrial Hygiene Monitoring

Isobutylene in Air MSDS

Home

MATERIAL SAFETY DATA SHEET - CALIBRATION CHECK GAS/**ISOBUTYLENE** IN AIR

PRODUCT NAME: 100 PPM ISOBUTYLENE/AIR (**100 PPM ISOBUTYLENE**/AIR) **MSDS**
Version:4 Date: January, 2004

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1. Chemical Product and Company Identification **PID ANALYZERS, LLC** 25 Walpole Park Drive South Walpole, MA 02081 TELEPHONE NUMBER: (508) 660-5001 **24-HOUR EMERGENCY NUMBER: 1-617-699-4307** FAX NUMBER: (508) 660-5040 E-MAIL: sales@hnu.com

PRODUCT NAME: ISOBUTYLENE (**100 PPM** – 0.9%) IN AIR
CHEMICAL NAME: Isobutylene in air

COMMON NAMES/ SYNONYMS: Calibration Gas

CLASSIFICATION: 2.2 WHIMIS CLASSIFICTATION: A, D2A, D2B

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2. COMPOSITION/ INFORMATION ON INGREDIENTS
INGREDIENT %: **Isobutylene** 0.0001-0.9/Air 99-99.9999
VOLUME:17L
PEL-OSHA: N/A
TLV-ACGIH: N/A
LD50or LC50Route/Species:N/A
FORMULA: C4H8/Air 99.0

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3. HAZARDS IDENTIFICATIONEMERGENCY OVERVIEW Release of this product may produce oxygen-deficient atmospheres (especially in confined spaces or other poorly ventilated environments); individuals in such atmospheres may be asphyxiated. **Isobutylene** may cause drowsiness and other central nervous system effects in high concentrations; however, due to the low concentration of this gas mixture, this is unlikely to occur.

ROUTE OF ENTRY:
Skin: No
Contact Skin: No
Absorption: No
Eye Contact: No
Inhalation: Yes
Ingestion:No

HEALTH EFFECTS:
Exposure Limits: Yes
Irritant: No
Sensitization: No
Reproductive Hazard: No
Mutagen: No
Carcinogenicity: No
NTP: No
IARC: No
OSHA: No

EYE EFFECTS: N/A.
SKIN EFFECTS: N/A.

MATERIAL SAFETY DATA SHEET - CALIBRATION CHECK GAS
PRODUCT NAME: **ISOBUTYLENE** (1 **PPM** – 0.9%) IN AIR
INGESTION EFFECTS: Ingestion unlikely. Gas at room temperature.
INHALATION EFFECTS: Due to the small size of this cylinder, no unusual health effects from over-exposure are anticipated under normal routine use.

NFPA HAZARD CODES HMIS HAZARD CODES RATING SYSTEM
Health: **1**
Flammability: **0**
Flammability: **0**
Reactivity: **0**

***0= No Hazard, 1= Slight Hazard, 2= Moderate Hazard, 3= Serious Hazard, 4= Severe Hazard**

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4. FIRST AID MEASURES EYES: N/A

SKIN: N/A

INGESTION: Not required

INHALATION: PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASED OF OVEREXPOSURE. RESCUE PERSONNEL SHOULD BE EQUIPPED THE SELF-CONTAINED BREATHING APPARATUS. Victims should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. If breathing has stopped administer artificial resuscitation and supplemental oxygen. Further treatment should be symptomatic and supportive.

---

5. FIRE-FIGHTING MEASURES These containers hold gas under pressure, with no liquid phase. If involved in a major fire, they should be sprayed with water to avoid pressure increases, otherwise pressures will rise and ultimately they may distort or burst to release the contents. The gases will not add significantly to the fire, but containers or fragments may be

projected considerable distances - thereby hampering fire fighting efforts.

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6. ACCIDENTAL RELEASE MEASURES In terms of weight, these containers hold very little contents, such that any accidental release by puncturing etc. will be of no practical concern.

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7. HANDLING AND STORAGE Suck back of water into the container must be prevented. Do not allow backfeed into the container. Use only properly specified equipment which is suitable for this product, its supply pressure and temperature. Use only in well-ventilated areas. Do not heat cylinder by any means to increase rate of product from the cylinder. Do not allow the temperature where cylinders are stored to exceed 130oF (54oC).

---

8. EXPOSURE CONTROLS/PERSONAL PROTECTION Use adequate ventilation for extended use of gas.

MATERIAL SAFETY DATA SHEET - CALIBRATION CHECK GAS PRODUCT NAME: ISOBUTYLENE (1 **PPM** – 0.9%) IN AIR

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9. PHYSICAL AND CHEMICAL PROPERTIES PARAMETER: VALUE: Physical state : Gas Evaporation point : N/A pH : N/A Odor and appearance : Colorless, odorless gas

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10. STABILITY AND REACTIVITY Stable under normal conditions. Expected shelf life 24 months.

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11. TOXICOLOGICAL INFORMATION No toxicological damage caused by this product.

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12. ECOLOGICAL INFORMATION No ecological damage caused by this product.

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13. DISPOSAL INFORMATION Do not discharge into any place where its accumulation could be dangerous. Used containers are acceptable for disposal in the normal waste stream as long as the cylinder is empty and valve removed or cylinder wall is punctured.

---

14. TRANSPORT INFORMATION
United States DOT/Canada TDG PROPER SHIPPING NAME:
Compressed Gas N.O.S. Compressed Gas N.O.S. (**Isobutylene** in Air)
HAZARD CLASS: 2.2
IDENTIFICATION NUMBER: UN1956
SHIPPING LABEL: NONFLAMMABLE GAS

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15. REGULATORY INFORMATION Isobutylene is listed under the accident prevention provisions of section 112(r) of the Clean Air Act (CAA) with a threshold quantity (TQ) of 10,000 pounds.

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16. OTHER INFORMATION This **MSDS** has been prepared in accordance with the Chemicals

(Hazard Information and Packaging for Supply (Amendment) Regulation 1996. The information is based on the best knowledge of PID Analyzers, LLC , and its advisors and is given in good faith, but we cannot guarantee its accuracy, reliability or completeness and therefore disclaim any liability for loss or damage arising out of use of this data. Since conditions of use are outside the control of the Company and its advisors we disclaim any liability for loss or damage when the product is used for other purposes than it is intended.
MSDS/S010/248/January, 2004

Top

LIQUINOX MSDS

Section 1 : MANUFACTURER INFORMATION

Supplier: Same as manufacturer.

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Manufacturer emergency phone number: 800-255-3924.
813-248-0585 (outside of the United States).

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Supplier MSDS date: 2005/02/24

D.O.T. Classification: Not regulated.

Section 2 : HAZARDOUS INGREDIENTS

C.A.S.	CONCENTRATION %	Ingredient Name	T.L.V.	LD/50	LC/50
25155-30-0	10-30	SODIUM DODECYLBENZENESULFONATE	NOT AVAILABLE	438 MG/KG RAT ORAL 1330 MG/KG MOUSE ORAL	NOT AVAILABLE

Section 3 : PHYSICAL / CHEMICAL CHARACTERISTICS

Physical state: Liquid.

Appearance & odor: Odourless.
Pale yellow.

Odor threshold (ppm): Not available.

Vapour pressure (mmHg): @ 20°C (68°F).
17

Vapour density (air=1): >1

Volatiles (%)

By volume: Not available.

Evaporation rate (butyl acetate = 1): < 1.

Boiling point (°C):	100 (212F)
Freezing point (°C):	Not available.
pH:	8.5
Specific gravity @ 20 °C:	(water = 1). 1.083
Solubility in water (%):	Complete.
Coefficient of water\oil dist.:	Not available.
VOC:	None

Section 4 : FIRE AND EXPLOSION HAZARD DATA

Flammability:	Not flammable.
Conditions of flammability:	Surrounding fire.
Extinguishing media:	Carbon dioxide, dry chemical, foam. Water Water fog.
Special procedures:	Self-contained breathing apparatus required. Firefighters should wear the usual protective gear. Use water spray to cool fire exposed containers.
Auto-ignition temperature:	Not available.
Flash point (°C), method:	None
Lower flammability limit (% vol):	Not applicable.
Upper flammability limit (% vol):	Not applicable.

Not available.

Sensitivity to mechanical impact:	Not available.
Hazardous combustion products:	Oxides of carbon (COx). Hydrocarbons.
Rate of burning:	Not available.
Explosive power:	Containers may rupture if exposed to heat or fire.

Section 5 : REACTIVITY DATA

Chemical stability:	Product is stable under normal handling and storage conditions.
Conditions of instability:	Extreme temperatures.
Hazardous polymerization:	Will not occur.
Incompatible substances:	Strong acids. Strong oxidizing agents.
Hazardous decomposition products:	See hazardous combustion products.

Section 6 : HEALTH HAZARD DATA

Route of entry:	Skin contact, eye contact, inhalation and ingestion.
Effects of Acute Exposure	
Eye contact:	May cause irritation.
Skin contact:	Prolonged and repeated contact may cause irritation.
Inhalation:	May cause headache and nausea.
Ingestion:	May cause vomiting and diarrhea. May cause gastric distress.
Effects of chronic exposure:	See effects of acute exposure.
LD50 of product, species & route:	> 5000 mg/kg rat oral.
LC50 of product, species & route:	Not available.
Exposure limit of material:	Not available.
Sensitization to product:	Not available.
Carcinogenic effects:	Not listed as a carcinogen.
Reproductive effects:	Not available.
Teratogenicity:	Not available.
Mutagenicity:	Not available.
Synergistic materials:	Not available.
Medical conditions aggravated by exposure:	Not available.
First Aid	
Skin contact:	Remove contaminated clothing. Wash thoroughly with soap and water. Seek medical attention if irritation persists.
Eye contact:	Check for and remove contact lenses. Flush eyes with clear, running water for 15 minutes while holding eyelids open: if irritation persists, consult a physician.
Inhalation:	Remove victim to fresh air. If irritation persists, seek medical attention.
Ingestion:	Do not induce vomiting, seek medical attention. Dilute with two glasses of water. Never give anything by mouth to an unconscious person.

Section 7 : PRECAUTIONS FOR SAFE HANDLING AND USE

Leak / Spill:	Contain the spill. Prevent entry into drains, sewers, and other waterways. Wear appropriate protective equipment. Small amounts may be flushed to sewer with water. Soak up with an absorbent material. Place in appropriate container for disposal. Notify the appropriate authorities as required.
Waste disposal:	In accordance with local and federal regulations.
Handling procedures and equipment:	Protect against physical damage. Avoid breathing vapors/mists. Wear personal protective equipment appropriate to task.

Wash thoroughly after handling.
Keep out of reach of children.
Avoid contact with skin, eyes and clothing.
Avoid extreme temperatures.
Launder contaminated clothing prior to reuse.

Storage requirements: Store away from incompatible materials.
Keep containers closed when not in use.

Section 8 : CONTROL MEASURES

Precautionary Measures

Gloves / Type:

Wear appropriate gloves.

Respiratory / Type: None required under normal use.

Eye / Type:

Safety glasses recommended.

Footwear / Type: Safety shoes per local regulations.

Clothing / Type: As required to prevent skin contact.

Other / Type: Eye wash facility should be in close proximity.
Emergency shower should be in close proximity.

Ventilation requirements: Local exhaust at points of emission.

HANNA® instruments

HI 70004

Buffer Solution pH 4.01, ± 0.01 @ 25°C/77°F

Safety Data Sheet

According to Regulation (EC) No. 1907/2006

Revision Date: 2008-12-01
Reason for Revision: REACH Compliance and General Update

SECTION 1: IDENTIFICATION OF THE PRODUCT AND COMPANY

Product Name: HI 70004 Buffer Solution pH 4.01
Application: pH Buffer Solution, ± 0.01 @ 25°C/77°F

Additional Product Codes: HI 70004C
HI 70004P
HI 7004P/5

Company Information (USA):
Hanna Instruments, Inc.
584 Park East Dr, Woonsocket, Rhode Island, USA 02895

Technical Service Contact Information:
1-800-426-6287 (8:30AM - 5:00PM ET)
+1-401-766-4260 (8:30AM - 5:00PM ET)

USA Emergency Contact Information: 1-800-424-9300 (Chemtrec 24Hr. Emergency)

International Emergency Contact Information: +1-703-527-3887 (Chemtrec 24Hr. Emergency)

E-mail Address: tech@hannainst.com

SECTION 2: HAZARD IDENTIFICATION

Non-hazardous product as specified in Directives 67/548/EEC and 1999/45/EC.

SECTION 3: COMPOSITION AND COMPONENT INFORMATION

Component: Aqueous Buffer Solution

EC-No.:

CAS-No.:

Hazard:

Phrases:

Content:

SECTION 4: FIRST AID MEASURES

After Inhalation: Remove to fresh air. Call a physician if breathing becomes difficult.

After Skin Contact: Wash effected area with water and soap.

After Eye Contact: Rinse out with plenty of water for at least 15 minutes. If pain persists, summon medical advice.

After Swallowing: Wash out mouth with plenty of water, provided person is conscious. Obtain medical attention if feeling unwell.

General Information: Not available

SECTION 5: FIRE-FIGHTING MEASURES

Suitable Extinguishing Media:
Water Spray, Foam, Dry Powder, Carbon Dioxide

Special Risks:
Non-combustible. Development of hazardous combustion gases or vapors possible in the event of fire.

Special Protective Equipment:
Do not stay in dangerous zone without suitable chemical protection clothing and self-contained breathing apparatus.

Additional Information:
Contain escaping vapors with water.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions:

None

Environmental Precautions:

None

Additional Notes:

None

SECTION 7: HANDLING AND STORAGE

Handling:

No restrictions

Storage:

Keep container closed and protected from direct sunlight. Store at room temperature (+15°C to +25°C).

SECTION 8: EXPOSURE CONTROL/PERSONAL PROTECTION

Ingredients:

Engineering:

Maintain general industrial hygiene practice.

Personal Protective Equipment:

As appropriate to quantity handled.

Respiratory Protection:

Required when vapors/aerosols are generated.

Protective Gloves:

Rubber or plastic

Eye Protection:

Goggles or face mask

Industrial Hygiene:

Change contaminated clothing. Wash hands after working with substance.

SECTION 9: PHYSICAL/CHEMICAL PROPERTIES

Appearance:	Colorless liquid	***Odor:***	Odorless	***Density at 20° C:***	1.0 g/cm³ at 25°C
Melting Point:	NA	***Boiling Point:***	> 100 °C	***Solubility:***	Soluble
pH at 20° C:	4.01 at 25°C	***Explosion Limit:***	NA	***Flash Point:***	NA
Thermal Decomp.:	NA				

SECTION 10: STABILITY AND REACTIVITY

Conditions to be Avoided:

Heating

Hazardous Polymerization:

Will not occur.

Further Information:

Not available

Hazardous Decomposition Products:

In the event of fire: See section 5.

Substances to be Avoided:

The generally known reaction partners of water

SECTION 11: TOXICOLOGICAL INFORMATION

Quantitative data on the toxicity of this product is not available.

In Case of Inhalation:

In Case of Skin Contact:

In Case of Eye Contact:

In Case of Ingestion:

Further Data: Hazardous properties cannot be excluded, but are relatively unlikely because of the low concentration of the dissolved substances, when the product is handled appropriately. The product should be handled with the usual care when dealing with chemicals.

SECTION 12: ECOLOGICAL INFORMATION

Quantitative data on the ecological effect of this product is not available.

Further Data: No ecological problems are to be expected when the product is handled and used with due care and attention.

SECTION 13: DISPOSAL CONSIDERATIONS

Waste Disposal: Can be safely disposed of as an ordinary refuse.

SECTION 14: TRANSPORTATION INFORMATION

Land:	***Sea:***	***Air:***
Not subject to transport regulations	Not subject to transport regulations	Not subject to transport regulations

SECTION 15: REGULATORY INFORMATION

Labeling according to EC Directives:

Symbol: Non-hazardous according to Directives 67/548/EEC and 1999/45/EC.

R-phrases:

S-phrases:

Contains:

SECTION 16: OTHER INFORMATION

Text of R-phrases under Section 3

Revision Information

Revision Date:	2008-12-01
Supersedes edition of:	2006-05-05
Reason for revision:	REACH Compliance and General Update

Legend

NA: Not Applicable
ND: Not Determined

THE INFORMATION CONTAINED HEREIN IS BASED ON THE PRESENT STATE OF OUR KNOWLEDGE. IT CHARACTERIZES THE PRODUCT WITH REGARD TO THE APPROPRIATE SAFETY PRECAUTIONS. IT DOES NOT REPRESENT A GUARANTEE OF THE PROPERTIES OF THE PRODUCT.

HANNA® instruments

HI 70007
Buffer Solution pH 7.01, ± 0.01 @ 25°C/77°F

Safety Data Sheet

According to Regulation (EC) No. 1907/2006

Revision Date: 2008-12-01
Reason for Revision: REACH Compliance and General Update

SECTION 1: IDENTIFICATION OF THE PRODUCT AND COMPANY

Product Name: HI 70007 Buffer Solution pH 7.01
Application: pH Buffer Solution

Additional Product Codes: HI 70007C
HI 70007P
HI 7007P/5

Company Information (USA):

Hanna Instruments, Inc.
584 Park East Dr, Woonsocket, Rhode Island, USA 02895

Technical Service Contact Information:

1-800-426-6287 (8:30AM - 5:00PM ET)
+1-401-766-4260 (8:30AM - 5:00PM ET)

USA Emergency Contact Information:

1-800-424-9300 (Chemtrec 24Hr. Emergency)

International Emergency Contact Information:

+1-703-527-3887 (Chemtrec 24Hr. Emergency)

E-mail Address:

tech@hannainst.com

SECTION 2: HAZARD IDENTIFICATION

Non-hazardous product as specified in Directives 67/548/EEC and 1999/45/EC.

SECTION 3: COMPOSITION AND COMPONENT INFORMATION

Component: Aqueous Buffer Solution

EC-No.:

CAS-No.:

Hazard:

Phrases:

Content:

SECTION 4: FIRST AID MEASURES

After Inhalation: Remove to fresh air. Call a physician if breathing becomes difficult.

After Skin Contact: Wash effected area with water and soap.

After Eye Contact: Rinse out with plenty of water for at least 15 minutes. If pain persists, summon medical advice.

After Swallowing: Wash out mouth with plenty of water, provided person is conscious. Obtain medical attention if feeling unwell.

General Information: Not available

SECTION 5: FIRE-FIGHTING MEASURES

Suitable Extinguishing Media:

Water Spray, Foam, Dry Powder, Carbon Dioxide

Special Risks:

Non-combustible. Development of hazardous combustion gases or vapors possible in the event of fire.

Special Protective Equipment:

Do not stay in dangerous zone without suitable chemical protection clothing and self-contained breathing apparatus.

Additional Information:

Contain escaping vapors with water.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions:

None

Environmental Precautions:

None

Additional Notes:

None

SECTION 7: HANDLING AND STORAGE

Handling:

No restrictions

Storage:

Keep container closed and protected from direct sunlight. Store at room temperature (+15°C to +25°C).

SECTION 8: EXPOSURE CONTROL/PERSONAL PROTECTION

Ingredients:

Engineering:

Maintain general industrial hygiene practice.

Personal Protective Equipment:

As appropriate to quantity handled.

Respiratory Protection:

Required when vapors/aerosols are generated.

Protective Gloves:

Rubber or plastic

Eye Protection:

Goggles or face mask

Industrial Hygiene:

Change contaminated clothing. Wash hands after working with substance.

SECTION 9: PHYSICAL/CHEMICAL PROPERTIES

Appearance:	Colorless liquid	***Odor:***	Odorless	***Density at 20° C:***	1.0 g/cm³ at 25°C
Melting Point:	NA	***Boiling Point:***	> 100 °C	***Solubility:***	Soluble
pH at 20° C:	7.01 at 25°C	***Explosion Limit:***	NA	***Flash Point:***	NA
Thermal Decomp.:	NA				

SECTION 10: STABILITY AND REACTIVITY

Conditions to be Avoided:

Heating

Hazardous Polymerization:

Will not occur.

Further Information:

Not available

Hazardous Decomposition Products:

In the event of fire: See section 5.

Substances to be Avoided:

The generally known reaction partners of water

SECTION 11: TOXICOLOGICAL INFORMATION

Quantitative data on the toxicity of this product is not available.

In Case of Inhalation:

In Case of Skin Contact:

In Case of Eye Contact:

In Case of Ingestion:

Further Data: Hazardous properties cannot be excluded, but are relatively unlikely because of the low concentration of the dissolved substances, when the product is handled appropriately. The product should be handled with the usual care when dealing with chemicals.

SECTION 12: ECOLOGICAL INFORMATION

Quantitative data on the ecological effect of this product is not available.

Further Data: No ecological problems are to be expected when the product is handled and used with due care and attention.

SECTION 13: DISPOSAL CONSIDERATIONS

Waste Disposal: Can be safely disposed of as an ordinary refuse.

SECTION 14: TRANSPORTATION INFORMATION

Land:
Not subject to transport regulations

Sea:
Not subject to transport regulations

Air:
Not subject to transport regulations

SECTION 15: REGULATORY INFORMATION

Labeling according to EC Directives:

Symbol: Non-hazardous according to Directives 67/548/EEC and 1999/45/EC.

R-phrases:

S-phrases:

Contains:

SECTION 16: OTHER INFORMATION

Text of R-phrases under Section 3

Revision Information

Revision Date:	2008-12-01
Supersedes edition of:	2006-05-05
Reason for revision:	REACH Compliance and General Update

Legend

NA: Not Applicable
ND: Not Determined

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HANNA® instruments

HI 7031

Conductivity Calibration Solution, 1413 µS/cm @ 25°C/77°F

Safety Data Sheet

According to Regulation (EC) No. 1907/2006

Revision Date: 2008-12-01
Reason for Revision: REACH Compliance and General Update

SECTION 1: IDENTIFICATION OF THE PRODUCT AND COMPANY

Product Name: HI 7031 Conductivity Calibration Solution

Application: For calibrating electrodes. 1413 µS/cm @ 25°C/77°F

Additional Product Codes: HI 7031/1G HI 7031L HI 7031L/C HI 7031M HI 7031/120ML

Company Information (USA):
Hanna Instruments, Inc.
584 Park East Dr, Woonsocket, Rhode Island, USA 02895

Technical Service Contact Information:
1-800-426-6287 (8:30AM - 5:00PM ET)
+1-401-766-4260 (8:30AM - 5:00PM ET)

USA Emergency Contact Information: 1-800-424-9300 (Chemtrec 24Hr. Emergency)

International Emergency Contact Information: +1-703-527-3887 (Chemtrec 24Hr. Emergency)

E-mail Address: tech@hannainst.com

SECTION 2: HAZARD IDENTIFICATION

Non-hazardous product as specified in Directives 67/548/EEC and 1999/45/EC.

SECTION 3: COMPOSITION AND COMPONENT INFORMATION

Component: Aqueous Solution

EC-No.:

CAS-No.:

Hazard:

Phrases:

Content:

SECTION 4: FIRST AID MEASURES

After Inhalation: Remove to fresh air. Call a physician if breathing becomes difficult.

After Skin Contact: Wash effected area with water and soap.

After Eye Contact: Rinse out with plenty of water for at least 15 minutes. If pain persists, summon medical advice.

After Swallowing: Wash out mouth with plenty of water, provided person is conscious. Obtain medical attention if feeling unwell.

General Information: Not available

SECTION 5: FIRE-FIGHTING MEASURES

Suitable Extinguishing Media:
Water Spray, Foam, Dry Powder, Carbon Dioxide

Special Risks:
Non-combustible.

Special Protective Equipment:
Do not stay in dangerous zone without suitable chemical protection clothing and self-contained breathing apparatus.

Additional Information:
Contain escaping vapors with water.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions:

None

Environmental Precautions:

None

Additional Notes:

None

SECTION 7: HANDLING AND STORAGE

Handling:

No restrictions

Storage:

Keep container closed and protected from direct sunlight. Store at room temperature (+15°C to +25°C).

SECTION 8: EXPOSURE CONTROL/PERSONAL PROTECTION

Ingredients:

Engineering:

Maintain general industrial hygiene practice.

Personal Protective Equipment:

As appropriate to quantity handled.

Respiratory Protection:

Required when vapors/aerosols are generated.

Protective Gloves:

Rubber or plastic

Eye Protection:

Goggles or face mask

Industrial Hygiene:

Change contaminated clothing. Wash hands after working with substance.

SECTION 9: PHYSICAL/CHEMICAL PROPERTIES

Appearance:	Colorless liquid	***Odor:***	Odorless	***Density at 20° C:***	~ 1 g/cm³
Melting Point:	NA	***Boiling Point:***	> 100 °C	***Solubility:***	Soluble
pH at 20° C:	~ 7	***Explosion Limit:***	NA	***Flash Point:***	NA
Thermal Decomp.:	NA				

SECTION 10: STABILITY AND REACTIVITY

Conditions to be Avoided:

Strong Heating (above boiling point). Stable in the recommended storage conditions.

Hazardous Polymerization:

Will not occur.

Further Information:

Not available

Hazardous Decomposition Products:

In the event of fire: See section 5.

Substances to be Avoided:

The generally known reaction partners of water

SECTION 11: TOXICOLOGICAL INFORMATION

Quantitative data on the toxicity of this product is not available.

In Case of Inhalation:

In Case of Skin Contact:

In Case of Eye Contact:

In Case of Ingestion:

Further Data: Hazardous properties cannot be excluded, but are relatively unlikely because of the low concentration of the dissolved substances, when the product is handled appropriately. The product should be handled with the usual care when dealing with chemicals.

SECTION 12: ECOLOGICAL INFORMATION

Quantitative data on the ecological effect of this product is not available.

Further Data: No ecological problems are to be expected when the product is handled and used with due care and attention.

SECTION 13: DISPOSAL CONSIDERATIONS

Waste Disposal: Can be safely disposed of as an ordinary refuse.

SECTION 14: TRANSPORTATION INFORMATION

Land:	***Sea:***	***Air:***
Not subject to transport regulations	Not subject to transport regulations	Not subject to transport regulations

SECTION 15: REGULATORY INFORMATION

Labeling according to EC Directives:

Symbol: Non-hazardous according to Directives 67/548/EEC and 1999/45/EC.

R-phrases:

S-phrases:

Contains:

SECTION 16: OTHER INFORMATION

Text of R-phrases under Section 3

Revision Information

Revision Date:	2008-12-01
Supersedes edition of:	2008-01-17
Reason for revision:	REACH Compliance and General Update

Legend

NA: Not Applicable
ND: Not Determined

THE INFORMATION CONTAINED HEREIN IS BASED ON THE PRESENT STATE OF OUR KNOWLEDGE. IT CHARACTERIZES THE PRODUCT WITH REGARD TO THE APPROPRIATE SAFETY PRECAUTIONS. IT DOES NOT REPRESENT A GUARANTEE OF THE PROPERTIES OF THE PRODUCT.

HI 7021
ORP Solution for Platinum and Gold Electrodes

Safety Data Sheet

According to Regulation (EC) No. 1907/2006

Revision Date: 2008-12-01
Reason for Revision: REACH Compliance and General Update

SECTION 1: IDENTIFICATION OF THE PRODUCT AND COMPANY

Product Name: HI 7021 ORP Solution

Application: ORP Solution for Platinum and Gold Electrodes.
240 mV @ 25°C/77°F

Additional Product Codes: HI 7021L
HI 7021M
HI 7021/G

Company Information (USA):
Hanna Instruments, Inc.
584 Park East Dr, Woonsocket, Rhode Island, USA 02895

Technical Service Contact Information:
1-800-426-6287 (8:30AM - 5:00PM ET)
+1-401-766-4260 (8:30AM - 5:00PM ET)

USA Emergency Contact Information: 1-800-424-9300 (Chemtrec 24Hr. Emergency)

International Emergency Contact Information: +1-703-527-3887 (Chemtrec 24Hr. Emergency)

E-mail Address: tech@hannainst.com

SECTION 2: HAZARD IDENTIFICATION

Non-hazardous product as specified in Directives 67/548/EEC and 1999/45/EC.

SECTION 3: COMPOSITION AND COMPONENT INFORMATION

Component: Aqueous Solution

EC-No.:

CAS-No.:

Hazard:

Phrases:

Content:

SECTION 4: FIRST AID MEASURES

After Inhalation: Remove to fresh air.

After Skin Contact: Wash effected area with plenty of water.

After Eye Contact: Rinse out with water.

After Swallowing: Wash out mouth thoroughly with water and give plenty of water to drink. In severe cases obtain medical attention.

General Information: Remove contaminated, soaked clothing immediately and dispose of safely.

SECTION 5: FIRE-FIGHTING MEASURES

Suitable Extinguishing Media:

Water spray, Carbon Dioxide, Dry Chemical Powder, Appropriate Foam.

Special Risks:

Non-combustible.

Special Protective Equipment:

Do not stay in dangerous zone without suitable chemical protection clothing and self-contained breathing apparatus.

Additional Information:

NA

SECTION 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions:

Avoid formation of dusts. Do not inhale dusts. Avoid substance contact.

Environmental Precautions:

Do not discharge into the drains/surface waters/groundwater.

Additional Notes:

Take up dry. Clean up affected area and dispose according to local regulation. Avoid generation of dusts.

SECTION 7: HANDLING AND STORAGE

Handling:

Cannot be stored indefinitely.

Storage:

Tightly closed. Store at room temperature (+15 to +25 °C recommended). Protect from light.

SECTION 8: EXPOSURE CONTROL/PERSONAL PROTECTION

Ingredients:

Engineering:

Maintain general industrial hygiene practice.

Personal Protective Equipment:

Protective clothing should be selected specifically for the working place, depending on concentration and quantity of the hazardous substances handled.

Respiratory Protection:	***Protective Gloves:***	***Eye Protection:***
Required when vapors/aerosols are generated. Work under hood.	Rubber or plastic	Goggles or face mask

Industrial Hygiene:

Change contaminated clothing. Wash hands after working with substance.

SECTION 9: PHYSICAL/CHEMICAL PROPERTIES

Appearance:	Yellow liquid	***Odor:***	Odorless	***Density at 20° C:***	~ 1 g/cm³
Melting Point:	NA	***Boiling Point:***	ND	***Solubility:***	Soluble
pH at 20° C:	~ 7	***Explosion Limit:***	NA	***Flash Point:***	NA
Thermal Decomp.:	NA				

SECTION 10: STABILITY AND REACTIVITY

Conditions to be Avoided:

Strong Heating

Hazardous Decomposition Products:

None

Hazardous Polymerization:

Will not occur.

Substances to be Avoided:

The generally known reaction partners of water

Further Information:

Not available

SECTION 11: TOXICOLOGICAL INFORMATION

No toxic effects are to be expected when the product is handled appropriately.

In Case of Inhalation:

In Case of Skin Contact:

In Case of Eye Contact:

In Case of Ingestion:

Further Data:

SECTION 12: ECOLOGICAL INFORMATION

No environmental hazard.

Further Data: Can be safely disposed off as an ordinary refuse.

SECTION 13: DISPOSAL CONSIDERATIONS

Waste Disposal:

SECTION 14: TRANSPORTATION INFORMATION

Land:	***Sea:***	***Air:***
Not subject to transport regulations	Not subject to transport regulations	Not subject to transport regulations

SECTION 15: REGULATORY INFORMATION

Labeling according to EC Directives:

Symbol: Non-hazardous according to Directives 67/548/EEC and 1999/45/EC.

R-phrases:

S-phrases:

Contains:

SECTION 16: OTHER INFORMATION

Text of R-phrases under Section 3

Revision Information

Revision Date:	2008-12-01
Supersedes edition of:	2008-01-17
Reason for revision:	REACH Compliance and General Update

Legend

NA: Not Applicable
ND: Not Determined

THE INFORMATION CONTAINED HEREIN IS BASED ON THE PRESENT STATE OF OUR KNOWLEDGE. IT CHARACTERIZES THE PRODUCT WITH REGARD TO THE APPROPRIATE SAFETY PRECAUTIONS. IT DOES NOT REPRESENT A GUARANTEE OF THE PROPERTIES OF THE PRODUCT.

OAKTON® MATERIAL SAFETY DATA SHEET

Section 1. Chemical Product and Company Identification

Catalog Number(s) 00653-00	
Product Identity ZERO OXYGEN SOLUTION	
Manufacturer's Name RICCA CHEMICAL COMPANY	Emergency Telephone Number (24 hr) CHEMTREC®: 800-424-9300
Address (Number, Street, City, State, and ZIP Code) P.O. Box 13090	Telephone Number For Information 817-461-5601
Arlington, Texas 76094	Date Prepared 4-18-2000

Section 2. Composition / Information on Ingredients

Component	CAS Registry #	Percent Concentration	Exposure Limits ACGIH TLV	Exposure Limits OSHA PEL
Sodium Sulfite	7757-83-7	4.5 – 5.5	N/A	N/A
Cobalt Chloride Hexahydrate	7791-13-1	< 0.01	0.02 mg/m^3 (as Co)	0.1 mg/m^3 (Dust as Co)
Water, Deionized	7732-18-5	Balance	N/A	N/A

Section 3. Hazards Identification

☆☆☆

EMERGENCY OVERVIEW

May cause irritation to the eyes, skin and respiratory tract. Contains Cobalt Chloride, a possible carcinogen according to International Agency for Research on Cancer (IARC). Wash areas of contact with water for at least 15 minutes. If ingested, dilute with water and call a physician. Although moderately toxic in large amounts, sulfites can pose risk to some asthmatics producing central nervous system depression, broncho constriction and anaphylaxis.

☆☆☆

POTENTIAL HEALTH EFFECTS:

TARGET ORGANS: eyes, skin, respiratory tract.

EYE CONTACT: May cause irritation, redness, pain, and tearing.

INHALATION: May cause irritation. This solution is not expected to be harmful via inhalation.

SKIN CONTACT: May cause mild irritation.

INGESTION: May cause gastric irritation by the liberation of sulfurous acid. Large doses may result in circulatory disturbances, diarrhea, and central nervous system depression.

CHRONIC EFFECTS / CARCINOGENICITY: Chronic exposure may affect thyroid, heart, lungs and kidneys due to the Cobalt.
IARC – Not classifiable as to carcinogenicity to humans (Sodium Sulfite), Possible carcinogen, limited evidence in humans (Cobalt)
NTP – No
OSHA – No

TERATOLOGY (BIRTH DEFECT) INFORMATION:

Mutation data cited in "Registry of Toxic Effects of Chemical Substances" for Cobalt Chloride and Sodium Sulfite.

REPRODUCTION INFORMATION:

Reproductive effects cited in "Registry of Toxic Effects of Chemical Substances" for Cobalt Chloride.

Section 4. First Aid Measures – In all cases, seek qualified evaluation.

EYE CONTACT: Irrigate immediately with large quantity of water for at least 15 minutes. Call a physician if irritation develops.

INHALATION: Remove to fresh air. Give artificial respiration if necessary.

SKIN CONTACT: Wash areas of contact with soap and water for at least 15 minutes. Call a physician if irritation develops.

INGESTION: Dilute with water or milk. Do not induce vomiting. Call a physician if necessary.

Section 5. Fire Fighting Measures

FLAMMABLE PROPERTIES:

FLASH POINT: N/A METHOD USED: N/A

FLAMMABLE LIMITS

LFL: N/A UFL: N/A

EXTINGUISHING MEDIA: Use any means suitable for extinguishing surrounding fire (water, dry chemical, chemical foam).

FIRE & EXPLOSION HAZARDS: Not considered to be an explosion hazard. May emit irritating and corrosive gases in fire.

FIRE FIGHTING INSTRUCTIONS: Use normal procedures/instructions. Poisonous gases may be produced in fire.

FIRE FIGHTING EQUIPMENT: Use protective clothing and NIOSH-approved self-contained breathing apparatus appropriate for the surrounding fire.

Section 6. Accidental Release Measures

Absorb with suitable material (vermiculite, etc.) and dispose of in accordance with local regulations.

Section 7. Handling and Storage

As with all chemicals, wash hands thoroughly after handling. Avoid contact with eyes and skin. Protect from freezing and physical damage. SAFETY STORAGE CODE: GENERAL

Section 8. Exposure Controls / Personal Protection

ENGINEERING CONTROLS: No specific controls are needed. Normal room ventilation is adequate.

RESPIRATORY PROTECTION: Normal room ventilation is adequate.

SKIN PROTECTION: Chemical resistant gloves, Nitrile Rubber or Neoprene.

EYE PROTECTION: Safety glasses or goggles.

Section 9. Physical and chemical Properties

APPEARANCE:	Clear, colorless liquid	**pH:**	N/A
ODOR:	odorless	**BOILING POINT (^{o}C):**	Approximately 100
SOLUBILITY IN WATER:	infinite	**MELTING POINT (^{o}C):**	Approximately 0
SPECIFIC GRAVITY:	Approximately 1	**VAPOR PRESSURE:**	N/A

Section 10. Stability and Reactivity

CHEMICAL STABILITY: Stable under normal conditions of use and storage. This product absorbs Oxygen from the air.

INCOMPATIBILITY: Strong oxidizing agents, Acids (liberates Sulfur Dioxide), high temperatures.

HAZARDOUS DECOMPOSITION PRODUCTS: Emits toxic and irritating fumes, including Sulfur Oxides, when heated to decomposition.
HAZARDOUS POLYMERIZATION: Will not occur.

Section 11. Toxicological Information

LD50, Oral, Mouse: (Sodium Sulfite) 820 mg/kg, details of toxic effects not reported other than lethal dose value.

Section 12. Ecological Information

ECOTOXICOLOGICAL INFORMATION: No information found.

CHEMICAL FATE INFORMATION: No information found.

Section 13. Disposal Considerations

Whatever cannot be saved for recycling or recovery should be managed in an appropriate and approved waste disposal facility. Always dispose of in accordance with local, state and federal regulations.

Section 14. Transport Information (Not meant to be all inclusive)

D.O.T. SHIPPING NAME:	Not regulated
D.O.T. HAZARD CLASS:	None
U.N. / N.A. NUMBER:	None
PACKING GROUP:	None
D.O.T. LABEL:	None

Section 15. Regulatory Information (Not meant to be all inclusive - selected regulation represented)

OSHA STATUS: This item meets the OSHA Hazard Communication Standard (29 CFR 1910.1200) definition of a hazardous material.

TSCA STATUS: All components of this solution are listed on the TSCA Inventory or are mixtures (hydrates) of items listed on the TSCA Inventory.
CERCLA REPORTABLE QUANTITY: Cobalt Chloride RQ 1 pound
SARA TITLE III:

SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES: No
SECTION 311/312 HAZARDOUS CATEGORIES: Acute, Chronic: Yes Fire, Pressure, Reactivity: No
SECTION 313 TOXIC CHEMICALS: No
RCRA STATUS: No

CALIFORNIA PROPOSITION 65: Not listed

Section 16. Other Information

NFPA Ratings:	**Health: 1**	**Flammability: 0**	**Reactivity: 0**	**Special Notice Key: None**
HMIS® Ratings:	**Health: 1**	**Flammability: 0**	**Reactivity: 0**	**Protective Equipment: B (Protective eyewear, gloves)**

Rev 1, 03-25-2003: Reviewed and approved.
Rev 2, 03-20-2006: Reviewed and approved.

When handled properly by qualified personnel, the product described herein does not present a significant health or safety hazard. Alteration of its characteristics by concentration, evaporation, addition of other substances, or other means may present hazards not specifically addressed herein and which must be evaluated by the user. The information furnished herein is believed to be accurate and represents the best data currently available to us. No warranty, expressed or implied, is made and RICCA CHEMICAL COMPANY assumes no legal responsibility or liability whatsoever resulting from its use.

Contaminant of Concern Fact Sheets

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ATTACHMENT A

CONTAMINANT FACT SHEET

CONTAMINANT FACT SHEET

Chemical Name:
1,1,1-Trichloroethane
CAS Number: 71-55-6
Synonyms:
Methyl chloroform; chlorothene

HEALTH HAZARD DATA

Color: Colorless

Physical State: Solid ; Liquid X ; Gas

Odor: Chloroform-like

Odor Threshold: 100 ppm

Vapor Density: 5.5 g/L
Vapor Pressure 100 mmHg
Ionization Potential (IP): 11.00 eV

IDLH: 700 ppm

Carcinogen: OSHA ; IARC ; NTP ; ACGIH ; NIOSH

Skin absorbable: yes __ no X
Skin corrosive: yes X no ___

Signs/Symptoms of Acute Exposure:
Skin irritation, headaches, dizziness, nausea, vomiting, diarrhea

Source	TWA (units)	STEL (units)	C (units)
OSHA PEL	350 ppm		
ACGIH TLVs	350 ppm	450 ppm	
NIOSH RELs			350 ppm

AIR MONITORING

Type	Brand/Model No.	Calibrations Method/Media	Relative Response or Conversion Factor	Meter Specific Action Level
PID	11.7eV	Isobutylene 100 ppm	1	175 ppm

Checked by: Cindy Sundquist Date: 4/19/10

PERSONAL PROTECTIVE EQUIPMENT

Recommended Protective Clothing Materials:

Suits: Tychem, Teflon, Viton

Gloves: Teflon, Viton, PE/EVAL; Polyvinyl alchohol (Do not use in water)

Boots: Teflon, Viton

Service Limit Concentration (ppm): 1000
1

MUC 1/2 Mask APR=TWA x 10= 1000 ppm
MUC Full-Face APR=TWA x 10= 1000 ppm

FIRE/REACTIVITY DATA

Flash Point: NA

LEL/UEL: 7.5% / 12.5%

Fire Extinguishing Media:

Dry Chemical	X	Foam	X
Water Spray		CO_2	X

Incompatibilities:
Strong caustics; strong oxidizers; chemically active metals such as: zinc, aluminum, magnesium powders, sodium, and potassium; water

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Note: The recommended protective clothing materials assumes that potential for direct contact (by splashing, dust inhalation, or other means) with the contaminants exists. Professional judgment and knowledge of on-site hazards should be used in selecting PPE appropriate to the concentration of the contaminant (trace vs percentage) to which the individual is likely to be exposed.

ATTACHMENT A

CONTAMINANT FACT SHEET

CONTAMINANT FACT SHEET

Chemical Name:
1,1-Dichloroethene
CAS Number: 75-35-4
Synonyms:
Vinylidene chloride
1,1-Dichloroethylene (1,1-DCE)

HEALTH HAZARD DATA

Color: colorless

Physical State: Solid
Liquid X
Gas X (above 89°F)

Odor: chloroform-like

Odor Threshold: 190ppm

Vapor Density: 4.0 g/L
Vapor Pressure 500 mmHg
Ionization Potential (IP): 10.00 eV

IDLH: unknown
1,2-DCE 1000 ppm

Carcinogen: OSHA
IARC
NTP
ACGIH
NIOSH X

Skin absorbable: yes __ no X
Skin corrosive: yes __ no X

Signs/Symptoms of Acute Exposure:
Irritation of skin and eyes, dizziness, headache, nausea, drunkeness and anesthesia.

Source	TWA (units)	STEL (units)	C (units)
OSHA PEL			
ACGIH TLVs	1 ppm		
NIOSH RELs	Lowest Feasible		

AIR MONITORING

Type	Brand/Model No.	Calibrations Method/Media	Relative Response or Conversion Factor	Meter Specific Action Level
PID	Microtip 10.6 eV	Isobutylene 100 ppm	1.18	0.6

Checked by:Cindy Sundquist Date: 4/19/10

PERSONAL PROTECTIVE EQUIPMENT

Recommended Protective Clothing Materials:
Suits Teflon
Gloves Teflon, Polyvinyl Alcohol (do not use in water)
Boots Teflon

Service Limit Concentration (ppm): 1000

MUC 1/2 Mask APR=TWA x 10= 6 ppm
MUC Full-Face APR=TWA x 10= 6 ppm

FIRE/REACTIVITY DATA

Flash Point: (-2°)F

LEL/UEL: 6.5%/15.5%

Fire Extinguishing Media:
Dry Chemical X Foam X
Water Spray ___ CO_2 X

Incompatibilities:
Aluminum, sunlight, air, copper, heat.

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Note: The recommended protective clothing materials assumes that potential for direct contact (by splashing, dust inhalation, or other means) with the contaminants exists. Professional judgment and knowledge of on-site hazards should be used in selecting PPE appropriate to the concentration of the contaminant (trace vs percentage) to which the individual is likely to be exposed.

ATTACHMENT A

CONTAMINANT FACT SHEET

CONTAMINANT FACT SHEET

Chemical Name:
1,1-Dichloroethane (11DCA)
CAS Number: 75-34-3
Synonyms:
Ethylidene chloride
1,1-Ethylidene chloride
Asymmetrical dichloroethane

HEALTH HAZARD DATA

Color: colorless

Physical State: Solid ___ Liquid X Gas ___

Odor: chloroform-like

Odor Threshold: 120 ppm

Vapor Density: 4.0 g/L
Vapor Pressure 182 mmHg
Ionization Potential (IP): 11.06 eV

IDLH: 3000 ppm

Carcinogen: OSHA ___ IARC ___ NTP ___ ACGIH ___ NIOSH ___

Skin absorbable: yes __ no _X_
Skin corrosive: yes __ no _X_

Signs/Symptoms of Acute Exposure:
Central nervous system depression, skin irritation, lung damage

Source	TWA (units)	STEL (units)	C (units)
OSHA PEL	100 ppm		
ACGIH TLVs	100 ppm		
NIOSH RELs	100 ppm		

AIR MONITORING

Type	Brand/Model No.	Calibrations Method/Media	Relative Response or Conversion Factor	Meter Specific Action Level
PID	Micro tip 11.7 eV	Isobutylene 100 ppm	1.67	83 ppm

Checked by: Cindy Sundquist Date: 4/19/10

PERSONAL PROTECTIVE EQUIPMENT

Recommended Protective Clothing Materials:
Suits: Tychem
Gloves: Viton; Polyvinyl Alcohol; (do not use in water)
Boots: Viton

Service Limit Concentration (ppm): 1000

MUC 1/2 Mask APR=TWA x 10= 830 ppm
MUC Full-Face APR=TWA x 10= 830 ppm

FIRE/REACTIVITY DATA

Flash Point: 2°F

LEL/UEL: 5.4%/11.4%

Fire Extinguishing Media:
Dry Chemical X Foam X
Water Spray ___ CO_2 X

Incompatibilities:
Strong oxidizers and strong caustics

2003 by MACTEC Engineering & Consulting, Inc.

Note: The recommended protective clothing materials assumes that potential for direct contact (by splashing, dust inhalation, or other means) with the contaminants exists. Professional judgment and knowledge of on-site hazards should be used in selecting PPE appropriate to the concentration of the contaminant (trace vs percentage) to which the individual is likely to be exposed.

ATTACHMENT A

CONTAMINANT FACT SHEET

CONTAMINANT FACT SHEET

Chemical Name: Trichloroethene

CAS Number: 79-01-6

Synonyms:
Ethylene trichloride, TCE
Trichloroethylene, Trilene

HEALTH HAZARD DATA

Color:	Colorless
Physical State: Solid	
Liquid	X
Gas	
Odor:	Chloroform-like
Odor Threshold:	82 ppm
Vapor Density	4.5 g/L
Vapor Pressure	56 mmHg
Ionization Potential (IP)	9.45 eV
IDLH:	1000 ppm

Carcinogen: OSHA	
IARC	
NTP	
ACGIH	
NIOSH	X
Skin absorbable	yes ___ no X
Skin corrosive	yes ___ no X

Signs/Symptoms of Acute Exposure
Irritant to eyes and skin, headach
nausea, vomiting, dermatitis, vertigo
visual disturbance, fatigue, giddiness
sleepiness

Source	TWA (units)	STEL (units)	C (units)
OSHA PELs	100 ppm		200 ppm
ACGIH TLVs	10 ppm	100 ppm	
NIOSH RELs	25 ppm		

AIR MONITORING

Type	Brand/Mode No.	Calibrations Method/Media	Relative Response or Conversion Factor	Meter Specific Action Level
PID	Microtip 10.6eV	Isobutylene 100 ppm	1.85	9 ppm
PID	11.7 eV	Isobutylene 100 ppm	2.33	11 ppm
Detector Tube	Drager 6828541	2 - 50 ppm		5 ppm

Checked by: Cindy Sundquist Date: 4/19/10

PERSONAL PROTECTIVE EQUIPMENT

Recommended Protective Clothing Materials

Suits	Viton, PE/EVAL, Tychem,
	Barricade, Trellchem
	Teflon, Responder
Gloves	Viton, Teflon
	Polyvinyl alcohol (do not
	use in water)
Boots	Teflon, Viton

Service Limit Concentration (ppm) 1000

MUC 1/2 Mask APR = TWA x 10 = 90 ppm
MUC Full-Face APR = TWA x 10 = 90 ppm

FIRE/REACTIVITY DATA

Flash Point: Unknown

LEL/UEL: 8% / 10.5%

Fire Extinguishing Media

Dry Chemical	X	Alcohol resistant Foam	X
Water Spray	X	CO_2	X

Incompatibilities
Strong caustics and alkalis, chemically active metals (such as barium, lithium, sodium, magnesium, titanium, and beryllium

2003 by AMEC Environment & Infrastructure

Note: The recommended protective clothing materials assumes that potential for direct contact (by splashing, dust inhalation, or other means) with the contaminant exists. Professional judgement and knowledge of on-site hazards should be used in selecting PPE appropriate to the concentration of the contaminant (trace vs percentage) to which the individual is likely to be exposed.

ATTACHMENT A

CONTAMINANT FACT SHEET

CONTAMINANT FACT SHEET

Chemical Name
Tetrachloroethene
CAS Number: 127-18-4
Synonyms:
tetrachloroethylene
Perchloroethylene (Perc

HEALTH HAZARD DATA

Color: colorless

Physical State: Solid ; Liquid X ; Gas

Odor: chloroform-like

Odor Threshold: 47 ppm

Vapor Density: 6.8 g/L

Ionization Potential (IP): 9.32 eV

IDLH: 150 ppm

Carcinogen: OSHA ; IARC ; NTP X ; ACGIH X ; NIOSH X

Skin absorbable: yes __ no X

Skin corrosive: yes __ no X

Signs/Symptoms of Acute Exposure
Irritation of eyes, nose, and throat
nausea; flushing of the face and neck
vertigo; dizziness; incoherence;
headache; sleepiness, and skin irritatio

Source	TWA (units)	STEL (units)	C (units)
OSHA PEL	100 ppm		200 ppm
ACGIH TLVs	25 ppm	100 ppm	
NIOSH RELs	Lowest Feasible		

AIR MONITORING

Type	Brand/Mode No.	Calibrations Method/Media	Relative Response or Conversion Factor	Meter Specific Action Level
PID	RAE 10.6 eV	Isobutylene 100 ppm	1.58	9 ppm
PID	HNu 10.2 eV	Isobutylene 100 ppm	0.86	9 ppm
Detecor Tube	Drager 8101 501	2 - 40 ppm		12.5 ppm

Checked by: Cindy Sundquist Date: 3/19/10

PERSONAL PROTECTIVE EQUIPMENT

Recommended Protective Clothing Materials

Suits: Teflon, Viton, CPF3, Barricade, Responder, Trellchem, Tychem

Gloves: Viton, Teflon, and Polyviny, Alcohol (do not use ir (water)

Boots: Nitrile Rubber

Service Limit Concentration (ppm): 1000

MUC 1/2 Mask APR=TWA x 10= 90 ppm
MUC Full-Face APR=TWA x 10= 90 ppm

FIRE/REACTIVITY DATA

Flash Point: NA

LEL/UEL: NA / NA

Fire Extinguishing Media

Dry Chemical X ; Foam X
Water Spray X ; CO_2 X

Incompatibilities
Strong oxidizers, chemically-active metals
caustic soda, sodium hydroxide, and potas

2003 by MACTEC Engineering & Consulting, Inc.

Note: The recommended protective clothing materials assumes that potential for direct contact (by splashing, dust inhalation, or other means) with the contaminants exists. Professional judgment and knowledge of on-site hazards should be used in selecting PPE appropriate to the concentration of the contaminant (trace vs percentage) to which the individual is likely to be exposed.

ATTACHMENT A

CONTAMINANT FACT SHEET

CONTAMINANT FACT SHEET

Chemical Name: Ethylbenzene

CAS Number: 100-41-4

Synonyms: Ethylbenzol, Phenylethane

HEALTH HAZARD DATA

Color: Colorless

Physical State: Solid / Liquid: X / Gas:

Odor: Aromatic

Odor Threshold: 0.092 - 0.6 PPM

Vapor Density: 3.66 g/L

Ionization Potential (IP): 8.76 eV

IDLH: 800 ppm

Carcinogen: OSHA / IARC / NTP / ACGIH / NIOSH

Skin absorbable: yes ___ no _X_

Skin corrosive: yes ___ no ___

Signs/Symptoms of Acute Exposure: Irritant to eyes, skin, and mucous membranes; dermatitis, and headache

Source	TWA (units)	STEL (units)	C (units)
OSHA PELs	100 ppm		
ACGIH TLVs	100 ppm	125 ppm	
NIOSH RELs	100 ppm	125 ppm	

AIR MONITORING

Type	Brand/Model No.	Calibrations Method/Media	Relative Response or Conversion Factor	Meter Specific Action Level
PID	Microtip 10.6 eV	Isobutylene 100 ppm	1.63	163
PID	HNu 10.2 eV	Isobutylene 100 ppm		
FID	Foxboro TVA 1000 (10.6 eV)	Methane	3.7	370

Checked by: Emmet F. Curtis Date: 12/5/03

PERSONAL PROTECTIVE EQUIPMENT

Recommended Protective Clothing Materials:

Suits: Viton, Barricade, Tychem Responder, Teflon

Gloves: Viton, teflon

Boots: Teflon

Service Limit Concentration (ppm): 1000

MUC 1/2 Mask APR= TWA x 10 = 500 ppm

MUC Full-Face APR= TWA x 10 = 500 ppm

FIRE/REACTIVITY DATA

Flash Point: 55° F

LEL/UEL: 0.8% / 6.7%

Fire Extinguishing Media:

Dry Chemical	X	Alcohol Resistant Foam	X
Water Spray		CO_2	X

Incompatibilities: Strong oxidizers

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Note: The recommended protective clothing materials assumes that potential for direct contact (by splashing, dust inhalation, or other means) with the contaminants exists. Professional judgment and knowledge of on-site hazards should be used in selecting PPE appropriate to the concentration of the contaminant (trace vs percentage) to which the individual is likely to be exposed.

APPENDIX A

CONTAMINANT FACT SHEET

CONTAMINANT FACT SHEET

Chemical Name:
Xylene 108-38-3,
CAS Number: 95-47-6, 106-42-3
Synonyms:
Dimethylbenzene, Xylo

HEALTH HAZARD DATA

Color: Colorless

Physical State: Solid X (below 56˚F)
Liquid X
Gas

Odor: Aromatic

Odor Threshold: 20 ppm

Vapor Density: 4.3 g/L
Vapor Pressure 8 mmHg
Ionization Potential (IP): 8.56 eV

IDLH: 900 ppm

Carcinogen: OSHA
IARC
NTP
ACGIH
NIOSH

Skin absorbable: yes ___ no X
Skin corrosive: yes ___ no X

Signs/Symptoms of Acute Exposure
Irritant to eyes, skin, nose, throat,
dizziness, drowsiness, excitemen

Source	TWA (units)	STEL (units)	C (units)
OSHA PELs	100 ppm		
ACGIH TLVs	100 ppm	150 ppm	
NIOSH RELs	100 ppm	150 ppm	

AIR MONITORING

Type	Brand/Model No.	Calibrations Method/Media	Relative Response or Conversion Factor	Meter Specific Action Level
PID	10.6 eV	Isobutylene 100 ppm	1.6	80 ppm
PID	HNu w/ 10.2 eV	Benzene 100 ppm	1.04	104 ppm

PERSONAL PROTECTIVE EQUIPMENT

Recommended Protective Clothing Materials
Suits: Teflon, Viton, PE/EVAL

Gloves: Teflon, Viton
Polyvinyl Alcohol (Do not use in water)

Boots: Teflon, Viton

Service Limit Concentration (ppm) 1000 ppm

MUC 1/2 Mask APR=TWA x 10 = 480 ppm
*MUC Full-Face APR=TWA x 50 = 1000 ppm

FIRE/REACTIVITY DATA

Flash Point: 81° F

LEL/UEL: 0.9% / 6.7%

Fire Extinguishing Media:
Dry Chemical X Foam X
Water Spray X CO_2 X

Incompatibilities:
Strong oxidizers
Strong Acids

Checked by: Cindy Sundquist Date: 4/27/10

*Use if conducted quantitative fit testing (Portacount), otherwise use MUC for 1/2 respirator if did qualitative fit testing (Irritant smoke)

2003 by MACTEC Engineering & Consulting, Inc.

Note: The recommended protective clothing materials assumes that potential for direct contact (by splashing, dust inhalation, or other means) with the contaminants exists. Professional judgment and knowledge of on-site hazards should be used in selecting PPE appropriate to the concentration of the contaminant (trace vs percentage) to which the individual is likely to be exposed.

Activity Hazard Analyses / Job Hazard Analyses

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Job Hazard Analysis – HASP Format

Job Title: Mobilization/Demobilization and Site Preparation **Date of Analysis:** 7/7/15

Minimum Recommended PPE*: High visibility vest, hard hat, steel-toed boots, safety glasses, hearing protection
*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Prepare for Site Visit	1A) N/A	1A) Prior to leaving for site ▪ Obtain and review HASP prior to site visit, if possible ▪ Determine PPE needs – bring required PPE to the site, if not otherwise being provided at the site (e.g., steel toed boots) ▪ Determine training and medical monitoring needs and ensure all required Health and Safety training and medical monitoring has been received and is current ▪ Ensure all workers are fit for duty (alert, well rested, and mentally and physically fit to perform work assignment) ▪ If respiratory protection is required/potentially required, ensure that training and fit-testing has occurred within the past year. ▪ Familiarize yourself with route to the site
	1B) Vehicle defects	1B) Inspect company owned/leased vehicle for defects such as: ▪ Flat tires ▪ Windshield wipers worn or torn ▪ Oil puddles under vehicle ▪ Headlights, brake lights, turn signals not working
	1C) Insufficient emergency equipment, unsecured loads	1C) Insufficient emergency equipment, unsecured loads ▪ Ensure vehicle has first aid kit and that all medications are current (if first aid kits are not provided at the site) ▪ Ensure vehicle is equpped with warning flashers and/or flares and that the warning flashers work ▪ Cell phones are recommended to call for help in the event of an emergency ▪ Vehicles carrying tools must have a safety cage in place. All tools must be properly secured ▪ Vehicles must be equipped with chocks if the vehicle is to be left running, unattended. ▪ Ensure sufficient gasoline is in the tank
2. Operating vehicles – general	2A) Collisions, unsafe driving conditions	2A) Drive Defensively! ▪ Seat belts must be used at all times when operating any vehicle on company business. ▪ Drive at safe speed for road conditions ▪ Maintain adequate following distance ▪ Pull over and stop if you have to look at a map ▪ Try to park so that you don't have to back up to leave. ▪ If backing in required, walk around vehicle to identify any hazards (especially low level hazards that may be difficult to see when in the vehicle) that might be present. Use a spotter if necessary
3. Driving to the jobsite	3A) Dusty, winding, narrow roads	3A) Dusty, winding, narrow roads ▪ Drive confidently and defensively at all times. ▪ Go slow around corners, occasionally clearing the windshield.
	3B) Rocky or one-lane roads	3B) Rocky or one-lane roads ▪ Stay clear of gullies and trenches, drive slowly over rocks. ▪ Yield right-of-way to oncoming vehicles---find a safe place to pull over.
	3C) Stormy weather, near confused tourists	3C) Stormy weather, near confused tourists ▪ Inquire about conditions before leaving the office. ▪ Be aware of oncoming storms. ▪ Drive to avoid accident situations created by the mistakes of others.

MACTEC

Job Hazard Analysis – HASP Format

Job Title: Mobilization/Demobilization and Site Preparation **Date of Analysis:** 7/7/15

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	3D) When angry or irritated	3D) When angry or irritated ▪ Attitude adjustment; change the subject or work out the problem before driving the vehicle. Let someone else drive.
	3E) Turning around on narrow roads	3E) Turning around on narrow roads ▪ Safely turn out with as much room as possible. ▪ Know what is ahead and behind the vehicle. ▪ Use a backer if available.
	3F) Sick or medicated	3F) Sick or medicated ▪ Let others on the crew know you do not feel well. ▪ Let someone else drive.
	3G) On wet or slimy roads	3G) On wet or slimy roads ▪ Drive slow and safe, wear seatbelts.
	3H) Animals on road	3H) Animals on road ▪ Drive slowly, watch for other animals nearby. ▪ Be alert for animals darting out of wooded areas
4. Gain permission to enter site	4A) Hostile landowner, livestock, pets	4A) Hostile landowner, livestock, pets ▪ Talk to land owner, be courteous and diplomatic ▪ Ensure all animals have been secured away from work area
5. Mobilization/ Demobilization of Equipment and Supplies	5A) Struck by Heavy Equipment/Vehicles	5A) Struck by heavy equipment ▪ Be aware of heavy equipment operations. ▪ Keep out of the swing radius of heavy equipment. ▪ Ground personnel in the vicinity of heavy equipment operations will be within the view of the operator at all times ▪ Employees shall wear a high visibility vest or T-shirt (reflective vest required if working at night). ▪ Ground personnel will be aware of the counterweight swing and maintain an adequate buffer zone. ▪ Ground personnel will not stand directly behind heavy equipment when it is in operation.
	5B) Struck by Equipment/Supplies	5B) Struck by Equipment/Supplies ▪ Workers will maintain proper space around their work area, if someone enters it, stop work. ▪ When entering another worker's work space, give a verbal warning so they know you are there.
	5C) Overexertion Unloading/Loading Supplies	5C) Overexertion Unloading/Loading Supplies ▪ Train workers on proper body mechanics, do not bend or twist at the waist while exerting force or lifting. ▪ Tightly secure all loads to the truck bed to avoid load shifting while in transit.
	5D) Caught in/on/between	5D) Caught in/on/between ▪ Do not place yourself between two vehicles or between a vehicle and a fixed object.
	5E) Slip/Trip/Fall	5E) 1E). Slip/Trip/Fall ▪ Mark all holes and low spots in area with banner tape. Instruct personnel to avoid these areas. ▪ Drivers will maintain 3 point contact when mounting/dismounting vehicles/equipment. ▪ Drivers will check surface before stepping, not jumping down.

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Job Hazard Analysis – HASP Format

Job Title: Mobilization/Demobilization and Site Preparation **Date of Analysis:** 7/7/15

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	5F) Vehicle accident	5F) Vehicle accident ▪ Employees should follow MACTEC vehicle operation policy and be aware of all stationary and mobile vehicles.
6. Site Preparation	6A) Slip/Trip/Fall	6A) Slip/Trip/Fall ▪ Mark all holes and low spots in area with banner tape. Instruct personnel to avoid these areas
7. Installation of soil erosion and sediment controls	7A) Overexertion	7A) Overexertion ▪ Workers will be trained in the proper method of placing erosion controls. ▪ Do not bend and twist at the waist while lifting or exerting force.
	7B) Struck by Equipment/Supplies	7C) Struck by Equipment/Supplies ▪ Workers will maintain proper space around their work area, if someone enters it, stop work. ▪ When entering another worker's work space, give a verbal warning so they know you are there.
8. Driving back from the jobsite	8A) See hazards listed under item #3	8A) See safe work practices under item #3

MACTEC

Job Hazard Analysis – HASP Format

Job Title: Field Work - General **Date of Analysis:** 7/7/15

Minimum Recommended PPE*: hard hat, steel-toed boots, safety glasses
*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Mobilization/ Demobilization and Site Preparation	1A) See Mobilization/Demobilization and Site Preparation JHA	1A) See Mobilization/Demobilization and Site Preparation JHA
2. Communication	2A) Safety, crew unity	2A) Talk to each other. ▪ Log all workers and visitor on and off the site. ▪ Let other crewmembers know when you see a hazard. ▪ Avoid working near known hazards. ▪ Always know the wherabouts of fellow crewmembers. ▪ Carry a radio and spare batteries or cell phone ▪ Review Emergency Evacuation Procedures (see below).
3. Walking and working in the field	3A) Falling down, twisted ankles and knees, poor footing	3A) Always watch your footing. ▪ Horseplay is strictly prohibited ▪ Slow down and use extra caution around logs, rocks, and animal holes. ▪ Extremely steep slopes (>50%) can be hazardous under wet or dry conditions; consider an alternate route. ▪ Wear laced boots with a minimum 8" high upper and non-skid Vibram-type soles for ankle support and traction.
	3B) Falling objects	3B) Protect head agains falling objects. ▪ Wear your hardhat for protection from falling limbs and pinecones, and from tools and equipment carried by other crewmembers. ▪ Stay out of the woods during extremely high winds.
	3C) Chemical/Toxicological Hazards	3C) Chemical/Toxicological Hazards ▪ See HASP for appropriate level of PPE ▪ Use monitoring equipment, as outlined in HASP, to monitor breathing zone ▪ Read MSDSs for all chemicals brought to the site ▪ Be familiar with hazards associated with site contaminants. ▪ Ensure that all containers are properly labelled ▪ Decon thoroughly prior to consumption of food, beverage or tobacco.
	3D) Damage to eyes	3D) Protect eyes: ▪ Watch where you walk, ecpecially around trees and brush with limbs sticking out. ▪ Exercise caution when clearing limbs from tree trunks. Advise wearing eye protection. ▪ Ultraviolet light from the sun can be damaging to the eyes; look for sunglasses that specify significant protection from UV-A and UV-B radiation. If safety glasses require, use one's with tinted lenses
	3E) Bee and wasp stings	3E) See JHA for Insect Stings and Bites
	3F) Ticks and infected mosquitos	3F) See JHA for Insect Stings and Bites
	3G) Wild Animals	3G) Wild Animals ▪ Avoid phyisical contact with wild animals ▪ Do not threaten and/or conrner animals ▪ Make noise to get the animal to retreat. ▪ Stay in or return to vehicle/equipment if in danger

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Job Hazard Analysis – HASP Format

Job Title: Field Work - General **Date of Analysis:** 7/7/15

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	3H) Contact with poisonous plants or the oil from those plants:	3H) Contact with poisonous plants or the oil from those plants: ▪ Look for signs of poisonous plants and avoid. ▪ Ensure all field workers can identify the plants. Mark identified poisonous plants with spray paint if working at a fixed location. ▪ Do not allow plant to touch any part of your body/clothing. ▪ Wear PPE as described in the HASP and wear Tyveks, gloves and boot covers if contact with plant is likely ▪ Always wash gloves before removing them. ▪ Discard PPE in accordance with the HASP. ▪ Use commercially available products such as Ivy Block or Ivy Wash as appropriate.
		 POISON IVY (Rhus toxicondendron L.) POISON OAK (Rhus diversiloba) POISON SUMAC (Rhus toxicondendron vernix)
	3I) Back Injuries	3I) Back Injuries ▪ Site personnel will be instructed on proper lifting techniques. ▪ Mechanical devices should be used to reduce manual handling of materials. ▪ Split heavy loads in to smaller loads ▪ Team lifting should be utilized if mechanical devices are not available. ▪ Make sure that path is clear prior to lift.
	3J) Shoveling	3J) Shoveling ▪ Select the proper shovel for the task. A long handled, flat bladed shovel is recommend for loose material ▪ Inspect the handle for splinters and/or cracks ▪ Ensure that the blade is securely attached to the handle ▪ Never be more than 15 inches from the material you are shoveling ▪ Stand with your feet about hip width for balance and keep the shovel close to your body. ▪ Bend from the knees (not the back) and tighten your stomach muscles as you lift. ▪ Avoid twisting movements. If you need to move the snow to one side reposition your feet to face the direction the snow will be going. ▪ Avoid lifting large shoveling too much at once. When lifting heavy material, pick up less to reduce the weight lifted. ▪ Pace yourself to avoid getting out of breath and becoming fatigued too soon. ▪ Be alert for signs of stress such as pain, numbness, burning and tingling. Stop immediately if you feel any of these symptoms.
	3K) Slips/Trips/Falls	3K) Slips/Trips/Falls ▪ Maintain work areas safe and orderly; unloading areas should be on even terrain; mark or repair possible tripping hazards. ▪ Site SHSO inspect the entire work area to identify and mark hazards. ▪ Maintain three points of contact when climbing ladders or onto/off of equipment

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Job Hazard Analysis – HASP Format

Job Title: Field Work - General **Date of Analysis:** 7/7/15

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	3L) Overhead Hazards	3L) Overhead Hazards ▪ Personnel will be required to wear hard hats that meet ANSI Standard Z89.1. ▪ All ground personnel will stay clear of suspended loads. ▪ All equipment will be provided with guards, canopies or grills to protect the operator from falling or flying objects. ▪ All overhead hazards will be identified prior to commencing work operations.
	3M) Dropped Objects	3M) Dropped Objects ▪ Steel toe boots meeting ANSI Standard Z41 will be worn.
	3N) Noise	3N) Noise ▪ Hearing protection will be worn with a noise reduction rating capable of maintaining personal exposure below 85 dBA (ear muffs or plugs); all equipment will be equipped with manufacturer's required mufflers. Hearing protection shall be worn by all personnel working in or near heavy equipment.
	3O) Eye Injuries	3O) Eye Injuries ▪ Safety glasses meeting ANSI Standard Z87 will be worn.
	3P) Heavy Equipment (overhead hazards, spills, struck by or against)	3P) Heavy Equipment ▪ All operators will be trained and qualified to operate equipment ▪ Equipment will have seat belts. ▪ Operators will wear seat belts when operating equipment. ▪ Do not operate equipment on grades that exceed manufacturer's recommendations. ▪ Equipment will have guards, canopies or grills to protect from flying objects. ▪ Ground personnel will stay clear of all suspended loads. ▪ Personel are prohibited from riding on the buckets, or elsewhere on the equipment except for designated seats with proper seat belts or lifts specifically designed to carry workers. ▪ Ground personnel will wear high visibility vests ▪ Spill and absorbent materials will be readily available. ▪ Drip pans, polyethylene sheeting or other means will be used for secondary containment. ▪ Ground personnel will stay out of the swing radius of excavators. ▪ Eye contact with operators will be made before approaching equipment. ▪ Operator will acknowledge eye contact by removing his hands from the controls. ▪ Equipment will not be approached on blind sides. ▪ All equipment will be equipped with backup alarms and use spotters when significant physical movement of equipment occurs on-site, (i.e., other than in place excavation or truck loading). ▪ Inspect rigging prior to each use.

MACTEC

Job Hazard Analysis – HASP Format

Job Title: Field Work - General **Date of Analysis:** 7/7/15

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	3Q) Struck by vehicle/equipment	3Q) Struck by vehicle/equipment ▪ Be aware of heavy equipment operations. ▪ Keep out of the swing radius of heavy equipment. ▪ Ground personnel in the vicinity of vehicles or heavy equipment operations will be within the view of the operator at all times. ▪ Ground personnel will be aware of the counterweight swing and maintain an adequate buffer zone. ▪ Ground personnel will not stand directly behind heavy equipment when it is in operation. ▪ Drivers will keep workers on foot in their vision at all times, if you lose sight of someone, Stop! ▪ Spotters will be used when backing up trucks and heavy equipment and when moving equipment. ▪ High visibility vests will be worn when workers are exposed to vehicular traffic at the site or on public roads.
	3R) Struck/cut by tools	3R) Struck/cut by tools ▪ Cut resistant work gloves will be worn when dealing with sharp objects. ▪ All hand and power tools will be maintained in safe condition. ▪ Do not drop or throw tools. Tools shall be placed on the ground or worksurface or handed to another employee in a safe manner. ▪ Guards will be kept in place while using hand and power tools.
	3S) Caught in/on/between	3S) Caught in/on/between ▪ Workers will not position themselves between equipment and a stationary object. ▪ Workers will not wear long hair down (place in pony-tail and tuck into shirt) or jewelry if working with tools/machinery.
	3T) Contact with Electricity/Lightning	3T) Contact with Electricity/Lighting ▪ All electrical tools and equipment will be equipped with GFCI. ▪ Electrical extension cords will be of the “Hard” or “Extra Hard” service type. ▪ All extension cords shall have a three-blade grounding plug. ▪ Personnel shall not use extension cords with damaged outer covers, exposed inner wires, or splices. ▪ Electrical cords shall not be laid across roads where vehicular traffic may damage the cord without appropriate guarding. ▪ All electrical work will be conducted by a licensed electrician. ▪ All equipment will be locked out and tagged out and rendered in a zero energy state prior to commencing any operation that may exposed workers to electrical, mechanical, hydraulic, etc. hazards. ▪ All utilities will be marked prior to excavation activities. ▪ All equipment will stay a minimum of 10 feet from overhead energized electrical lines (50 kV). This distance will increase by 4 inches for each 10 kV above 50 kV. Rule of Thumb: Stay 10 feet away from all overhead powerlines known to be 50 kV or less and 35 feet from all others.) ▪ The SHSO shall halt outdoor site operations whenever lightning is visible, outdoor work will not resume until 30 minutes after the last sighting of lightning.
	3U) Equipment failure	3U) Equipment failure ▪ All equipment will be inspected before use. If any safety problems are noted, the equipment should be tagged and removed from service until repaired or replaced.

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Job Hazard Analysis – HASP Format

Job Title: Field Work - General **Date of Analysis:** 7/7/15

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	3V) Hand & power tool usage.	3V) Hand & power tool usage ▪ Daily inspections will be performed. ▪ Ensure guards are in place and are in good condition. ▪ Remove broken or damaged tools from service. ▪ Use the tool for its intended purpose. ▪ Use in accordance with manufacturers instructions. ▪ No tampering with electrical equipment is allowed (e.g., splicing cords, cutting the grounding prong off plug, etc.) ▪ See JHA for Power Tool Use - Electrical and Power Tool Use - Gasoline
	3W) Fire Protection	3W) Fire Protection ▪ Ensure that adequate number and type of fire extinguishers are present at the site ▪ Inspect fire extinguishers on a monthly basis – document ▪ All employees who are expected to use fire exinguishers will have received training on an annual basis. ▪ Obey no-smoking policy ▪ Open fires are prohibited ▪ Maintain good housekeeping. Keep rubbish and combustibles to a minimum. ▪ Keep flammable liquids in small containers with lids closed or a safety can. ▪ When dispensing flammable liquids, do in well vented area and bond and ground containers.
	3X) Confined Space Entry	3X) Confined Space Entry ▪ See JHA for Confined Space Entry
4. Environmental health considerations	4A) Heat Stress	4A) Take precautions to prevent heat stress ▪ Remain constantly aware of the four basic factors that determine the degree of heat stress (air temperature, humidity, air movement, and heat radiation) relative to the surrounding work environmental heat load. ▪ Know the signs and symptoms of heat exhaustion, heat cramps, and heat stroke. Heat stroke is a true medical emergency requiring immediate emergency response action. NOTE: The severity of the effects of a given environmental heat stress is decreased by reducing the work load, increasing the frequency and/or duration of rest periods, and by introducing measures which will protect employees from hot environments. ▪ Maintain adequate water intake by drinking water periodically in small amounts throughout the day (flavoring water with citrus flavors or extracts enhances palatability). ▪ Allow approximately 2 weeks with progressive degrees of heat exposure and physical exertion for substantial acclimatization. ▪ Acclimatization is necessary regardless of an employee's physical condition (the better one's physical condition, the quicker the acclimatization). Tailor the work schedule to fit the climate, the physical condition of employees, and mission requirements. ▪ A reduction of work load markedly decreases total heat stress. ▪ Lessen work load and/or duration of physical exertion the first days of heat exposure to allow gradual acclimatization. ▪ Alternate work and rest periods. More severe conditions may require longer rest periods and electrolyte fluid replacement.

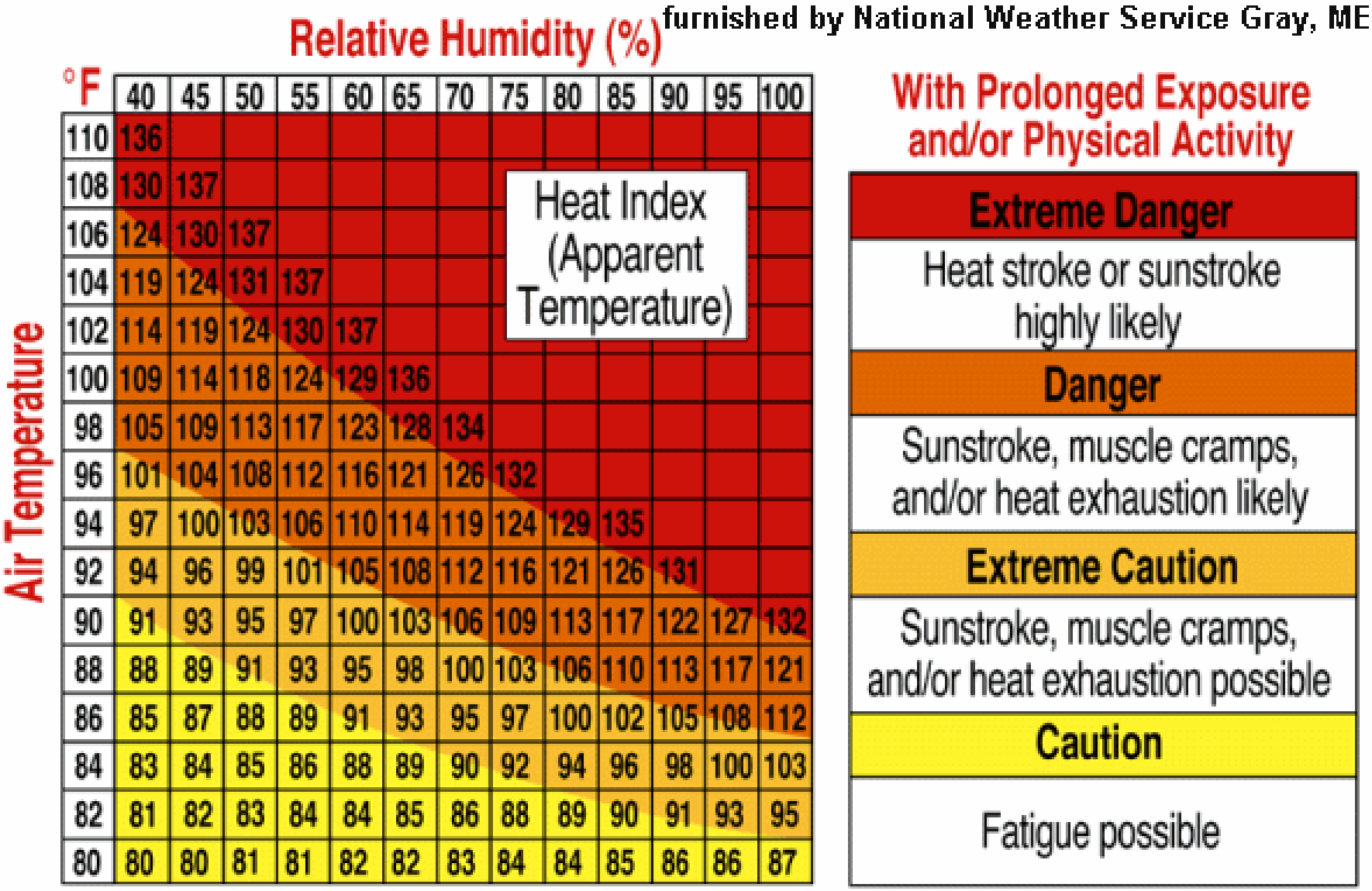
MACTEC

Job Hazard Analysis – HASP Format

Job Title: Field Work - General **Date of Analysis:** 7/7/15

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	4B) Wet Bulb Globe Temperature (WBGT) Index	4B) WBGT ▪ Curtail or suspend physical work when conditions are extremely severe (see attached Heat Stress Index). ▪ Compute a Wet Bulb Globe Temperature Index to determine the level of physical activity (take WBGT index measurements in a location that is similar or closely approximates the environment to which employees will be exposed). WBGT THRESHOLD VALUES FOR INSTITUTING PREVENTIVE MEASURES 80-90 degrees F — Fatigue possible with prolonged exposure and physical activity. 90-105 degrees F — Heat exhaustion and heat stroke possible with prolonged exposure and physical activity. 105-130 degrees F — Heat exhaustion and heat stroke are likely with prolonged heat exposure and physical activity.
	4C) Cold Extremes	4C) Take precautions to prevent cold stress injuries ▪ Cover all exposed skin and be aware of frostbite. While cold air will not freeze the tissues of the lungs, slow down and use a mask or scarf to minimize the effect of cold air on air passages. ▪ Dress in layers with wicking garments (those that carry moisture away from the body – e.g., cotton) and a weatherproof slicker. A wool outer garment is recommended. ▪ Take layers off as you heat up; put them on as you cool down. ▪ Wear head protection that provides adequate insulation and protects the ears. ▪ Maintain your energy level. Avoid exhaustion and over-exertion which causes sweating, dampens clothing, and accelerates loss of body heat and increases the potential for hypothermia. ▪ Acclimate to the cold climate to minimize discomfort. ▪ Maintain adequate water/fluid intake to avoid dehydration.
	4D) Wind	4D) Effects of the wind ▪ Wind chill greatly affects heat loss (see attached Wind Chill Index). ▪ Avoid marking in old, defective timber, especially hardwoods, during periods of high winds due to snag hazards.
	4E) Thunderstorms	4E) Thunderstorms ▪ Monitor weather channels to determine if electrical storms are forcased. ▪ Plan ahead and identify safe locations to be in the event of a storm. (e.g., sturdy building, vehicle, etc.) ▪ Suspend all field work at the first sound of thurnder. You should be in a safe place when the time between the lightning and thunder is less than 30 seconds. ▪ Only return to work 30 minutes after the after the last strike or sound of thunder

furnished by National Weather Service Gray, ME



Wind Chill Chart

Wind (mph) \ Temperature (°F)	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
Calm																		
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times — 30 minutes — 10 minutes — 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

MACTEC

Job Hazard Analysis Form

Job Title: Field Work - Oversight **Date of Analysis:** 7/7/15

Minimum Recommended PPE*: High visibility vest, hard hat, steel-toed boots, safety glasses, hearing protection

*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Prepare for site visit	1A) N/A	▪ Obtain and review HASP prior to site visit, if possible ▪ Determine PPE needs – bring required PPE to the site, if not otherwise being provided at the site (e.g., steel toed boots) ▪ Determine training and medical monitoring needs and ensure all required Health and Safety training and medical monitoring has been received and is current ▪ Complete site specific/ client required training ▪ Ensure all workers are fit for duty (alert, well rested, and mentally and physically fit to perform work assignment) ▪ First aid kits shall be available at the work site and on each transport vehicle. ▪ Familiarize yourself with route to the site ▪ Check weather forecast. Pack appropriate clothing and other items (e.g., sunscreen) for anticipated weather conditions ▪ Verify that subsurface utilities have been identified.
2. Traveling to the site by vehicle	2A) See JHA for Mobilization, Demobilization and Site Preparation	▪ See JHA for Mobilization, Demobilization and Site Preparation
3. Initial Arrival - Assess Site Conditions	3A) Communication with subcontractor and other site personnel	▪ Develop communication methods (agree on hand signals, warning alarms) ▪ Log all workers and visitor on and off the site. ▪ Let other crewmembers know when you see a hazard. ▪ Avoid working near known hazards. ▪ Always know the whereabouts of fellow crewmembers. ▪ Carry a radio and spare batteries or cell phone ▪ Hold and document Safety tailgate meetings ▪ Establish work zones, evacuation routes and rally locations.
	3B) Insect Bites and Stings	▪ Discuss the types of insects expected at the Site and be able to identify them. ▪ Look for signs of insects. ▪ Inform crew members if allergic to insects and what to do if you need assistance. ▪ Avoid wearing heavy fragrances. ▪ Carry first-aid and sting relief kits. ▪ Carry identification of known allergies and necessary emergency medication. ▪ Spray clothing with insect repellant as a barrier. ▪ Wear light colored clothing that fits tightly at the wrists, ankles, and waist. ▪ Cover trouser legs with high socks or boots. ▪ Tuck in shirt tails.

	3C) Poisonous plants	▪ Wear long sleeves, long pants and boots ▪ Ensure all field workers can identify the plants. Mark identified poisonous plants with high visibility spray paint if working at a fixed location. ▪ Look for signs of poisonous plants and demark area to aid in avoiding plant. ▪ Do not touch any plant part to any part of your body/clothing. ▪ Use commercially available products such as Ivy Block or Ivy Wash as appropriate.
	3D) Vermin, leaches, animal borne disease	▪ Survey the area for dens, nests, etc. ▪ Identify areas where biological hazards may be present. ▪ Wear long sleeve shirt and full length pants ▪ Be aware of your surroundings. ▪ Wear appropriate footwear (snake boots, etc.) ▪ Avoid high grass areas if possible ▪ Do not put hand/arm into/under an area that you cannot see into/under clearly ▪ Perform routine inspections for ticks, leaches, etc. of yourself and co-workers.
	3E) Chemical Hazards	▪ Wear chemical resistant PPE as identified in the HASP ▪ Use monitoring equipment, as outlined in HASP, to monitor breathing zone ▪ Read MSDSs for all chemicals brought to the site ▪ Be familiar with hazards associated with site contaminants. ▪ Ensure that all containers are properly labeled
	3F) Overhead Power Lines	▪ Identify the location of all overhead power lines at the site. ▪ Maintain clearances depending on voltage - All equipment will stay a minimum of 10 feet from overhead energized electrical lines (50 kV or less). This distance will increase by 4 inches for each 10 kV above 50 kV. Rule of Thumb: Stay 10 feet away from all overhead power lines known to be 50 kV or less and 35 feet from all others.) ▪ Re-locate work so it is not close to power lines ▪ Avoid storing materials under overhead power lines
	3G) Underground Utilities	▪ All utilities will be marked prior to excavation activities ▪ For areas where utility locations cannot be verified, workers must hand dig for the first 3 feet ▪ Use lineman's gloves when locating underground power lines ▪ Work at adequate offsets from utility locations ▪ Immediately cease work if unknown utility markings are discovered.

	3H) Cold Stress	▪ Dress in layers with wicking garments (those that carry moisture away from the body – e.g., cotton) and a weatherproof slicker. A wool outer garment is recommended. ▪ Take layers off as you heat up; put them on as you cool down. ▪ Wear head protection that provides adequate insulation and protects the ears. ▪ Maintain your energy level. Avoid exhaustion and over-exertion which causes sweating, dampens clothing, and accelerates loss of body heat and increases the potential for hypothermia. ▪ Acclimate to the cold climate to minimize discomfort. ▪ Maintain adequate water/fluid intake to avoid dehydration. ▪ Be aware of signs of hypothermia, its prevention, detection and treatment. ▪ Have extra protection available, in case of an emergency such as blankets and heating devices. ▪ Don't work under extremely adverse weather conditions ▪ Stay in tune to current weather and extended forecasts.
	3I) Heat Stress	▪ Remain constantly aware of the four basic factors that determine the degree of heat stress (air temperature, humidity, air movement, and heat radiation) relative to the surrounding work environmental heat load. ▪ Know the signs and symptoms of heat exhaustion, heat cramps, and heat stroke. Heat stroke is a true medical emergency requiring immediate emergency response action. ▪ Maintain adequate water intake by drinking water periodically in small amounts throughout the day (flavoring water with citrus flavors or extracts enhances palatability). ▪ Lessen work load and/or duration of physical exertion the first days of heat exposure to allow gradual acclimatization. ▪ Alternate work and rest periods. More severe conditions may require longer rest periods and electrolyte fluid replacement.
	3J) Lightning and Thunder	▪ Monitor weather channels to determine if electrical storms are forecasted. ▪ Plan ahead and identify safe locations to be in the event of a storm. (e.g., sturdy building, vehicle, etc.) ▪ Suspend all field work at the first sound of thunder. You should be in a safe place when the time between the lightning and thunder is less than 30 seconds.
	3K) Severe Weather	▪ Watch for clouds and incoming weather. ▪ Monitor weather forecasts. ▪ Train workers about weather and appropriate precautions. ▪ Identify a shelter and a safe place in event of tornado etc
	3L) Sun	▪ Keep body protected ▪ Wear sunscreen, wide brimmed hat or hardhat. ▪ Schedule work for cool part of day. ▪ Take breaks in the shade.
	3M) High Crime Areas	▪ Do not enter areas where threats are present. ▪ Contract security where applicable. Use the buddy system. ▪ Maintain contact with support such as radio or cell phone ▪ Do not work after dark.

	3N) Operations conducted at an active facility	▪ Stay well clear of operations being conducted at the facility ▪ Keep alert for moving materials, equipment or vehicles ▪ Determine client specific PPE needs prior to arriving at the site ▪ Determine client specific emergency response procedures and follow as appropriate ▪ Participate in client required safety training ▪ Get copies of Clients MSDSs for any client chemicals that workers may be exposed to. ▪ Provide MSDSs to client for all chemicals brought to the site.
	3O) Remote Locations	▪ Carry a two-way radio and know how to use it. ▪ Work in teams. Account for all at the end of the work day. ▪ Make sure someone on crew is certified in first aid. ▪ Carry a first aid kit.
	3P) Set up Decon Station	▪ Refer to MSDS for specific hazards associated with decon solutions ▪ Monitor breathing zone for decon solutions (e.g., methanol, hexane, etc.), if appropriate (see HASP) ▪ Removal of PPE will be performed by the following tasks in the listed order: o Gross boot wash and rinse and removal o Outer glove removal o Suit removal o Respirator removal (if worn). o Inner glove removal ▪ Contaminated PPE is to be placed in the appropriate, provided receptacles. ▪ Employees will wash hands, face, and any other exposed areas with soap and water. ▪ Portable eyewash stations and showers will be available should employees come into direct contact with contaminated materials. ▪ Decon solutions will be disposed of according to the work plan.
4. Walk around the Site	4A) Poisonous plants	▪ See section 3C above
	4B) Vermin, leaches, animal borne disease	▪ See Section 3 D above ▪
	4C) Chemical Hazards	▪ See Section 3 E above
	4D) Slips/Trips/Falls	▪ Wear slip resistant footwear preferably laced boots with a minimum 8" high upper and non-skid soles for ankle support and traction. ▪ Pay attention to where you place your feet ▪ Slow down and use extra caution around logs, rocks, and animal holes. ▪ Extremely steep slopes (>50%) can be hazardous under wet or dry conditions; consider an alternate route. ▪ Site SHSO will inspect the entire work area to identify and mark hazards. ▪ Clear area of trip hazards; mark or barricade those that cannot be moved; ▪ Use caution when walking around excavated areas ▪ Stay back at least 5 feet from excavated areas ▪ Use caution when walking on or around loose soil. ▪ Be aware of surroundings. Avoid muddy areas if possible.

5. Oversight during drilling, or construction operations	5A) Heavy Equipment/ Vehicles	▪ Spotters will be used when backing up trucks and heavy equipment and when moving equipment. ▪ Ground personnel in the vicinity of vehicles or heavy equipment operations will be within the view of the operator at all times. ▪ Ground personnel will be aware of the swing radius and maintain an adequate buffer zone. ▪ Ground personnel will not stand directly behind heavy equipment when it is in operation. ▪ Personnel are prohibited from riding on the buckets, or elsewhere on the equipment except for designated seats with proper seat belts or lifts specifically designed to carry workers. Ground personnel will stay clear of all suspended loads. ▪ Ground personnel will wear high visibility vests ▪ Eye contact with operators will be made before approaching equipment.
	5B) Eye Injury	▪ Wear appropriate safety glasses (tinted for sun). ▪ Watch where you walk, especially around trees and brush with protruding limbs.
	5C) Foot Injury	▪ Wear steel toed boots ▪ Wear insulated steel toed boots during winter ▪ Ensure shoes/boots have good traction ▪ Pay attention to where you place your feet, especially when walking on uneven terrain
	5D) Head Injury	▪ Wear hardhat ▪ Do not walk or work under scaffolding or other elevated work unless there are guardrails and toeboards in place ▪ Flag or mark protruding objects at head level
	5E) Chemical Hazards	▪ See Section 3E above ▪ Wash hands and face prior to consumption of food, beverage or tobacco.
	5F) Dust - particulates (respiratory)	▪ Use dust suppression methods ▪ Stand upwind of point of dust generation
	5G) Overhead Power Lines	▪ See Section 3F above.
	5H) Underground Utilities	▪ See Section 3G above
	5I) Standing/Static Posture	▪ Change posture on a frequent basis ▪ Stretch prior to any physical activity
	5J) Slips/`Trips/Falls	▪ See Section 4D above

	5K) Noise	▪ Hearing protection will be worn with a noise reduction rating capable of maintaining personal exposure below 85 dBA (ear muffs or plugs). ▪ All equipment will be equipped with manufacturer's required mufflers. ▪ Hearing protection shall be worn by all personnel working in or near heavy equipment. ▪ Hearing protection will be worn when workers need to shout when standing two feet away from each other. ▪ Segregate noisy equipment from the operators ▪ Use sound dampening around noisy equipment
	5L) Moving Equipment	▪ Clear area of obstructions and communicate with all workers involved that drilling is beginning ▪ Do not exceed manufacturer's recommended speed, force, torque, or other specifications. and penetrate the ground slowly with hands on the controls for at least the first foot of soil to minimize chance of auger kick-out ▪ Stay clear of rotating auger ▪ Use long-handled shovel to clear away cuttings when auger has stopped ▪ Do not wear loose clothing ▪ Wear appropriate PPE including leather gloves and steel-toed boots (See HASP)
6. Sampling Oversight	6A) Chemical Hazards	▪ See Section 3E above ▪ Wash hands and face prior to consumption of food, beverage or tobacco. ▪ Calibrate meters in a clean, well ventilated area ▪ Store calibration gases in well vented area. Ensure chemical labels and warnings are legible.
	6B) Personnel Decontamination	▪ Refer to MSDS for specific hazards associated with decon solutions ▪ Monitor breathing zone for decon solutions (e.g., methanol, hexane, etc.), if appropriate (see HASP) ▪ Removal of PPE will be performed by the following tasks in the listed order: o Gross boot wash and rinse and removal o Outer glove removal o Suit removal o Respirator removal (if worn). o Inner glove removal ▪ Contaminated PPE is to be placed in the appropriate, provided receptacles. ▪ Employees will wash hands, face, and any other exposed areas with soap and water. ▪ Portable eyewash stations and showers will be available should employees come into direct contact with contaminated materials. ▪ Decon solutions will be disposed of according to the work plan.
	6C) Lifting	▪ Good lifting techniques (lift with legs not back) ▪ Mechanical devices (e.g., hand truck, cart, forklift, etc.) should be used to reduce manual handling of materials and drums. ▪ Team lifting should be utilized if mechanical devices are not available. (mandatory for items over 50 lbs) ▪ Split heavy loads in to smaller loads ▪ Make sure that path is clear prior to lift. ▪ Redesign work area to avoid low lifts ▪ Stretch prior to lifting ▪ Maintain a healthy life style and level of physical fitness.

	6D) Hand Tools	▪ Cut resistant work gloves will be worn when dealing with sharp objects. ▪ All hand and power tools will be maintained in safe condition. ▪ Do not drop or throw tools. Tools shall be placed on the ground or work surface or handed to another employee in a safe manner. ▪ Guards will be kept in place while using hand and power tools. ▪ Daily inspections will be performed. ▪ Remove broken or damaged tools from service and tag out as defective ▪ No tampering with electrical equipment is allowed (e.g., splicing cords, cutting the grounding prong off plug, etc.) ▪ Do not use excessive force or impact ▪ Do not use tool improperly. Ensure all workers are trained
	6E) Slips/Trips/Falls	▪ See Section 4D above.
	6F) Struck by Vehicle	▪ Ground personnel in the vicinity of vehicles operations will be within the view of the operator at all times. ▪ Ground personnel will not stand directly behind vehicles when it is in operation ▪ Drivers will keep workers on foot in their vision at all times, if you lose sight of someone, Stop! ▪ High visibility vests will be worn when workers are exposed to vehicular traffic at the site or on public roads. ▪ Try to park so that you don't have to back up to leave. ▪ If backing in required, walk around vehicle to identify any hazards (especially low level hazards that may be difficult to see when in the vehicle) that might be present. Use a spotter if necessary ▪ Place cones in the font and rear of the vehicle ▪ Prior to driving off, walk around vehicle to collect cones and identify any hazards - especially low level hazards that may be difficult to see when in the vehicle. ▪ Set up "Workers in the Road" or similar warning signs and cones to alert traffic. ▪ Use emergency flashers and roof top flashing light (recommended) to alert oncoming vehicular traffic. ▪ Remain alert at all times as to the traffic outside the vehicle. Step to the side of the road when distracted by by-standers. Keep unofficial personnel out of the work area. ▪ Exit vehicle with caution. ▪ Wear High Visibility Vest when outside the vehicle. ▪ Utilize vehicle as a shield from oncoming traffic, as practical
7. IDW pickup oversight	7A) Foot Injury	▪ See Section 5C above.
	7B) Chemical Hazards	▪ See Section 3E above.
	7C) Lifting	▪ See Section 6C above.
	7D) Slips/Trips/Falls	▪ See Section 4D above
8. Return to office/home	8A) See Mobilization/ Demobilization and Site Preparation JHA	**See Mobilization/ Demobilization and Site Preparation JHA**

MACTEC

Job Hazard Analysis - HASP Format

Job Title: Decontamination **Date of Analysis:** 7/7/15

Minimum Recommended PPE*: High visibility vest, hard hat, steel-toed boots, safety glasses, hearing protection
*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Establish Decontamination Station	1A) Materials Handling	1A) Materials Handling ▪ Use proper lifting techniques ▪ Use mechanical aids, if available, to move heavy items.
2. Decontamination / Steam cleaning.	2A) Struck by steam/hot water/pressure washing	2A) Struck by steam/hot water ▪ Workers not directly engaged in steam cleaning operations must stay clear. ▪ Workers using steam cleaning equipment must be trained on operation and safety devices/procedures using the owners/operators manual. ▪ Use face shield **and** safety glasses or goggles, if steam cleaning. ▪ Stay out of the splash/steam radius. ▪ Pressure washer must have dead man switch. ▪ Do not direct steam at anyone. ▪ Do not hold objects with your feet or hands. ▪ Ensure that direction of spray minimizes spread of contaminants of concern. ▪ Use shielding as necessary.
	2B) Exposure to contaminants	2B) Exposure to contaminants ▪ Conduct air monitoring (see HASP). ▪ Wear proper PPE (see HASP). ▪ See MSDSs for hazards associated with the decon solutions used (if other than water alone us used).
	2C) Slips/Trips/Falls	2C) Slips/Trips/Falls ▪ Be cautious as ground/plastic can become slippery ▪ Use boots or boot covers with good traction
3. Vehicle Decontamination	3A) Vehicle traffic in and out of the CRZ	3A) Large Vehicle Traffic ▪ Always wear a hard hat, steel toe boots, and a high visibility vest (unless Tyveks are used and are high visibility). ▪ Vehicle drivers are not to exit the vehicle in the CRZ. ▪ Identify an individual to communicate with vehicle drivers and maintain order ▪ Trucks will be lined with plastic and kept out of direct contact with any contaminated materials during loading. Wear PPE when removing plastic lining from truck beds. ▪ If not in the vehicle, obtain eye contact with the driver, so he is aware of your presence and location in the CRZ. ▪ If you are driving the vehicle, be aware of personnel in the CRZ and maintain communication with the identified personnel.
	3B) Exposure to contaminants	3B) Exposure to contaminants ▪ Use safety glasses or goggles, Polycoated Tyvek (if level of contamination poses dermal hazard or to keep work clothes dry), high visibility vest (if high visibility Tyveks are not used) hard hats, steel toe boots, and gloves while cleaning contaminated materials. ▪ Do not doff PPE until decontamination of the vehicle is complete and a decontamination certificate has been issued by the HSO. ▪ Conduct air monitoring (see HASP). ▪ See MSDSs for hazards associated with the decon solutions (if other than water alone is used).

MACTEC

Job Hazard Analysis - HASP Format

Job Title: Decontamination **Date of Analysis:** 7/7/15

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	3C) Slips/Trips/Falls	3C) Slips/Trips/Falls ▪ Be cautious as ground/plastic can become slippery ▪ Use boots or boot covers with good traction
4. Equipment and Sample Decontamination	4A) Chemical exposure when handling contaminated sample jars and equipment	4A) Chemical exposure ▪ Wear PPE as outlined in the HASP. ▪ Refer to MSDS for specific hazards associated with decon solutions ▪ Monitor breathing zone for contaminants ▪ Monitor breathing zone for decon solutions (e.g., methanol, hexane, etc.) if appropriate (see HASP)
	4B) Materials Handling related injuries	4B) Materials Handling related injuries ▪ Use proper lifting techniques when lifting heavy equipment ▪ Use two person lift for heavy coolers
5. Personal Decontamination	5A) Exposure to contaminants	5A) Exposure to contaminants ▪ Avoid bringing contaminated materials via shoes and clothing into the CRZ by examining such prior to exiting the EZ. ▪ Removal of PPE will be performed by the following tasks in the listed order: ▪ Gross boot wash and rinse and removal ▪ Outer glove removal ▪ Suit removal ▪ Respirator removal (if worn). ▪ Inner glove removal ▪ Contaminated PPE is to be placed in the appropriate, provided receptacles. ▪ Respirators will be removed and decontaminated at a specified location within the CRZ by a designated technician, then placed in storage bag. ▪ Employees will wash hands, face, and any other exposed areas with soap and water. ▪ Portable eyewash stations and showers will be available should employees come into direct contact with contaminated materials. ▪ See MSDSs for hazards associated with the decontamination solutions used. ▪ Decon solutions will be disposed of according to the work plan.

MACTEC

Job Hazard Analysis - HASP Format

Job Title: Utility Clearance Activities **Date of Analysis:** 7/7/15

Minimum Recommended PPE*: High Visibility vest (in the field), work shoes
See Utility Clearance Procedure and Utility Clearance Form

*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Pre-planning	1A) Property Access ▪ Animal bites ▪ Dangerous social areas/ violent neighborhoods ▪ Lost ▪ Electrocution	1A) Ensure communications with the property owner. Request pets and animals to be confined during the survey. ▪ Maintain communications via two way radios or cell phones. ▪ Learn animal posturing including how to identify rabid animals. ▪ Contract security as appropriate for safety and equipment theft. ▪ Be prepared with a map and compass as necessary. ▪ Be aware of overhead and underground utilities. Ensure Dig-Safe has been contacted. ▪ When working with electrical equipment avoid wet surfaces and exposed connections.
	1B) Utilities Not Cleared (damage to utilities, worker injury)	1B) Utilities Not Cleared. ▪ Provide sufficient time and budget to ensure that utilities have been adequately located, prior to the start of up of work. ▪ Contact One Call Utility identifier organization at least 6 days prior to the project start date. ▪ Cite or have subcontractor cite a start date of at least 3 working days prior to actual planned start date (provides window to inspect locations prior to job start-up. ▪ Verify via emails or phone that all utilities have visited the site and marked their respective utilities. ▪ If subcontractor calls One Call organization, require them to forward all e-mail responses from member utilities as they receive them. ▪ If verification cannot be done remotely, send worker to site to inspect ground for markings (cheaper to identify issues prior to mobilization to the site). ▪ Document all phone communications with driller about utility clearance issues and requests (e-mail the conversation highlights or document in a field notebook – it becomes part of the file record) ▪ Call any member utilities that have not responded indicating they have cleared or marked-out utilities. Place the call morning of ticket start date (e.g., 3 days prior to actual start date). Document the phone conversations in notes or e-mails to the file. ▪ If town services (e.g., sanitary sewer, storm sewer, water) aren't listed as a One Call member, contact the town office to schedule mark-out, obtain copies of utility networks, and identify the appropriate town contacts. ▪ If town maps have lateral connections to private lots marked and /or if we are drilling along road right-of way opposite developed properties, identify the locations of the lateral connections. This may mean contacting abutters and asking to look in basements for location of pipes. If possible do this during a site visit prior to field start. If not, it should occur during the first day of work so any issues can be identified and decisions made on the risk of proceeding. ▪ Walk all planned locations with the subcontractor, prior to start of excavation/drilling to identify marked utilities and note any uncertainties. Field Lead should call PM and relay any issues. Document this inspection in the field book and note subcontractor's responses to any MACTEC concerns.

MACTEC

Job Hazard Analysis - HASP Format

Job Title: Utility Clearance Activities **Date of Analysis:** 7/7/15

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	1C) Locating Utilties on Private Property	1C) Locating Utilities on Private Property ▪ Hire private utility locater company ▪ Locate underground utilities by ground penetrating radar, electromagnetic, deep metal detector, pipe transmitter, vibracator, etc ▪ Review locations with property owner, member of operations and maintenance. ▪ Check as built drawings when available. Be aware possible drawing error or construction drawings may not be representative of actual locations. ▪ Use field clues such as manhole covers, repaved areas, depressions, disturbed areas, signs and postings, etc. as indications of access to utilities or recently installed/moved utilities.
	1D) Lack of Reliable Data on Utility Locations	1D) Lack of Reliable Data on Utility Locations ▪ If the surveys are not providing reliable data, plan to use non-destructive means to drill/excavate e.g., soil vacuum, water jet, air knife and/or hand tools. ▪ Use caution and proper PPE when using hand tools (hand augers, posthole diggers, shovels, steel rods, etc.). ▪ Involve the Project Manager, Technical Lead and/or Office Manager to make a decision to proceed or move the location
	1E) Working Near Live Utilities	1E) Working Near Live Utilities ▪ If live utilities are known to be present near drilling/excavation location, if possible, move drilling/excavation to another location. ▪ Lockout/Tagout utilities, if possible. ▪ Use non-destructive means to drill/excavate (see # 1D) until safe to proceed.
2. Walking Around Site Identifying Utility Clearances.	2A) Slips/Trips/Falls	2A) Slips/Trips/Falls ▪ Keep work area free of excess material and debris ▪ Remove all trip hazards by keeping materials/objects organized and out of walkways ▪ Keep work surfaces dry when possible ▪ Wear appropriate PPE (see HASP) including non-slip rubber boots if working on wet or slick surfaces ▪ Install rough work surface covers where possible ▪ Stay aware of footing and do not run
	2B) Heat/Cold Stress	2B) Heat/Cold Stress ▪ Take breaks if feeling faint or overexerted ▪ Consume adequate food/beverages (water, sports drinks) ▪ If possible, adjust work schedule to avoid temperature extremes
	2C) Biological Hazards: Insects, Snakes, Wildlife, Vegetation	2C) Biological Hazards: Insects, Snakes, Wildlife, Vegetation ▪ Inspect work areas when arrive at site to identify hazard(s) ▪ Use insect repellant if observe mosquitoes/gnats ▪ Survey site for presence of biological hazards and maintain safe distance ▪ Wear appropriate PPE including leather gloves, long sleeves and pants, and snake chaps as warranted by site conditions
	2D) Traffic (including pedestrian)	2D) Traffic (including pedestrian) ▪ Notify attendant or site owner/manager of work activities and location ▪ Use cones, signs, flags or other traffic control devices ▪ Wear appropriate PPE including high visibility clothing such as reflective vest ▪ Inspect area behind vehicle prior to backing and use spotter

MACTEC

Job Hazard Analysis - HASP Format

Job Title: Utility Clearance Activities **Date of Analysis:** 7/7/15

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	2E) Back strain due to lifting, pulling or tugging equipment	2E) Back strain ▪ Use mechanical aids when possible, if mechanical aids are not available, use two person lifts for heavy items. ▪ Use proper lifting techniques

MACTEC

Job Hazard Analysis - HASP Format

Job Title: Groundwater Sampling **Date of Analysis:** 7/7/15

Minimum Recommended PPE*: steel-toed boots, safety glasses, chemical resistant gloves
*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Mobilization	1A) See JHA Mobilization/Demobilization/Site Preparation	1A) See JHA Mobilization/Demobilization/Site Preparation
2. General Site Hazards	2A) See JHA Field Work - General	2A) See JHA Field Work - General
	2B) Chemical exposure	2B) Chemical Exposure ▪ Read HASP and determine air monitoring and PPE needs.
3. Calibrate monitoring equipment	3A) Exposure to calibration gases	3A) Exposure to calibration gases ▪ Review equipment manuals ▪ Calibrate in a clean, well ventilated area
4. Opening the well cap, taking water level readings	4A) Contact with poisonous plants or the oil from poisonous plants	4A) Contact with poisonous plants or the oil from those plants: ▪ Look for signs of poisonous plants and avoid. ▪ Ensure all field workers can identify the plants. Mark identified poisonous plants with spray paint if working at a fixed location. ▪ Wear PPE as described in the HASP. ▪ Do not touch any part of your body/clothing. ▪ Always wash gloves before removing them. ▪ Discard PPE in accordance with the HASP. ▪ Use commercially available products such as Ivy Block or Ivy Wash as appropriate.
	4B) Contact with biting insects (i.e., spiders, bees, etc.) which may have constructed a nest in the well cap/well.	4B) Contact with stinging/biting insects ▪ Discuss the types of insects expected at the Site and be able to identify them. ▪ Look for signs of insects in and around the well. ▪ Wear Level of PPE as described in the HASP. At a minimum, follow guidelines in the JHA "Insects Stings and Bites." ▪ If necessary, wear protective netting over your head/face. ▪ Avoid contact with the insects if possible. ▪ Inform your supervisor and the Site Health and Safety Supervisor if you have any allergies to insects and insect bites. Make sure you have identification of your allergies with you at all times and appropriate response kits if applicable. ▪ Get medical help immediately if you are bitten by a black widow or brown recluse, or if you have a severe reaction to any spider bite or bee sting.
	4C) Exposure to hazardous Inhalation and contact with hazardous substances (VOC contaminated groundwater/ soil); liquid splash; flammable atmospheres.	4C) Exposure to hazardous substances ▪ Wear PPE as identified in HASP. ▪ Review hazardous properties of site contaminants with workers before sampling operations begin ▪ Immediately monitor breathing zone after opening well to determine exposure and verify that level of PPE is adequate – see Action Levels in HASP ▪ Monitor headspace in well. After the initial headspace reading (if required by the Work Plan), allow the well to vent for several minutes before obtaining water level and before sampling. ▪ When decontaminating equipment wear additional eye/face protection over the safety glasses such as a face shield.
	4D) Back strain due to lifting bailers or pumps and from moving equipment to well locations	4D) Back strain ▪ Use mechanical aids when possible, if mechanical aids are not available, use two person lifts for heavy items. ▪ Use proper lifting techniques

MACTEC

Job Hazard Analysis - HASP Format

Job Title: Groundwater Sampling **Date of Analysis:** 7/7/15

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	4E) Foot injuries from dropped equipment	4E) Foot Injuries ▪ Be aware when moving objects, ensure you have a good grip when lifting and carrying objects. ▪ Do not carry more than you can handle safely ▪ Wear Steel toed boots
5. Collecting water samples	5A) Fire/Explosion/Contamination hazard from refueling generators	5A) Fire/Explosion/Contamination hazard from refueling generators ▪ Turn the generator off and let it cool down before refueling ▪ Segregate fuel and other hydrocarbons from samples to minimize contamination potential ▪ Transport fuels in approved safety containers. The use of containers other than those specifically designed to carry fuel is prohibited ▪ See JHA for Gasoline use
	5B) Electrocution	5B) Electrocution ▪ A ground fault circuit interrupter (GFCI) device must protect all AC electrical circuits. ▪ Use only correctly grounded equipment. Never use three-pronged cords which have had the third prong broken off. ▪ Make sure that the electrical cords from generators and power tools are not allowed to be in contact with water ▪ Do not stand in wet areas while operating power equipment ▪ Always make sure all electrically-powered sampling equipment is in good repair. Report any problems so the equipment can be repaired or replaced. ▪ When unplugging a cord, pull on the plug rather than the cord. ▪ Never do repairs on electrical equipment unless you are both authorized and qualified to do so.
	5C) Exposure to contaminants	5C) Exposure to Contaminants ▪ Stand up wind when sampling ▪ Monitor breathing zone with appropriate monitoring equipment (see HASP) ▪ Wear chemical resistant PPE as identified in HASP ▪ See section 4C) under Safe Practices above
	5D) Infectious water born diseases	5D) Infectious water born diseases ▪ Wear chemical resistant gloves and other PPE – as identified in HASP ▪ Prevent water from contacting skin ▪ Wash exposed skin with soap and water ASAP after sampling event ▪ Ensure that all equipment is adequately decontaminated using a 10% bleach solution
	5E) Exposure to water preservatives	5E) Exposure to water preservatives ▪ Work in a well ventilated area, upwind of samples ▪ Wear chemical resistant PPE as identified in HASP ▪ When preserving samples always add acid to water, avoid the opposite. ▪ See JHA Working with Preservatives
	5F) Slips/trips/falls	5F) Slips/trips/falls ▪ Ground can become wet/muddy, created by spilled water ▪ Place all purged water in drums for removal ▪ Wear good slip resistant footwear
	5G) Repetitive Motion and other Ergonomic Issues	5G) Ergonomic Issues ▪ Use mechanical means where possible to raise and lower equipment into well. ▪ Alternate raising and lowering equipment between field sampling team members, and alternate bailing the well. ▪ Use safe lifting techniques.

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Job Hazard Analysis - HASP Format

Job Title: Groundwater Sampling **Date of Analysis:** 7/7/15

Key Work Steps	Hazards/Potential Hazards	Safe Practices
6. Sample Processing	6A) Contaminated water	6A) Contaminated water ▪ Wear appropriate PPE as identified in HASP ▪ Decontaminate outside of bottles ▪ Prevent water from contacting skin ▪ Work in well ventilated area – upwind of samples ▪ Waste will be returned to the operation office for storage and disposal
7. Shipping Samples	7A) Freeze burns, back strain, hazardous chemical exposure, sample leakage	7A) Freeze burns, back strain, hazardous chemical exposure, sample leakage ▪ Wear appropriate chemical resistant gloves as identified in HASP. ▪ Wear leather or insulated gloves when handling dry ice. ▪ Follow safe lifting techniques – get help lifting heavy coolers. ▪ Samples that contain hazardous materials under the DOT definition, must be packaged, manifested and shipped by personnel that have the appropriate DOT HAZMAT training.

MACTEC

Job Hazard Analysis - HASP Format

Job Title: Soil Sampling **Date of Analysis:** 7/7/15

Minimum Recommended PPE*: High visibility vest, hard hat, steel-toed boots, safety glasses, hearing protection
*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Prepare for sampling event	1A) Chemical exposure	1A) Chemical Exposure ▪ Read HASP and determine air monitoring and PPE needs.
2. Mobilization	4A) See JHA Mobilization/Demobilization/Site Preparation	2A) See JHA Mobilization/Demobilization/Site Preparation
3. General Site Hazards	3A) See JHA Field Work - General	3A) See JHA Field Work - General
4. Carrying equipment to site location	4B) Back or muscle strain	4A) Back or muscle strain ▪ Use proper lifting techniques when lifting pumps or generators ▪ Use mechanical aids if available ▪ Use 2 person lift for heavy items
5. Calibrate monitoring equipment	5A) Exposure to calibration gases	5A) Exposure to calibration gases ▪ Review equipment manuals ▪ Calibrate in a clean, well ventilated area
6. Preparing sampling location	6A) Contact with poisonous plants or the oil from poisonous plants	6A) Contact with poisonous plants or the oil from those plants: ▪ Look for signs of poisonous plants and avoid. ▪ Wear PPE as described in the HASP. ▪ Do not touch anything part of your body/clothing. ▪ Always wash gloves before removing them. ▪ Discard PPE in accordance with the HASP.
	6B) Contact with biting insects (i.e., spiders, bees, etc.)	6B) Contact with stinging/biting insects ▪ Discuss the types of insects expected at the Site and be able to identify them. ▪ Look for signs of insects in and around the well. ▪ Wear Level of PPE as described in the HASP. At a minimum, follow guidelines in the JHA "Insects Stings and Bites." ▪ If necessary, wear protective netting over your head/face. ▪ Avoid contact with the insects if possible. ▪ Inform your supervisor and the Site Health and Safety Supervisor if you have any allergies to insects and insect bites. Make sure you have identification of your allergies with you at all times and appropriate response kits if applicable. ▪ Get medical help immediately if you are bitten by a black widow or brown recluse, or if you have a severe reaction to any spider bite or bee sting.
	6C) Exposure to hazardous Inhalation and contact with hazardous substances (VOC contaminated soil); flammable atmospheres.	6C) Exposure to hazardous substances ▪ Wear PPE as identified in HASP. ▪ Review hazardous properties of site contaminants with workers before sampling operations begin ▪ Monitor breathing zone air in accordance with HASP to determine levels of contaminants present. ▪ When decontaminating equipment wear additional eye/face protection over the safety glasses such as a face shield.
	6D) Back strain due to lifting or moving equipment to sampling locations	6D) Back strain ▪ Use mechanical aids when possible, if mechanical aids are not available, use two person lifts for heavy items. ▪ Use proper lifting techniques

MACTEC

Job Hazard Analysis - HASP Format

Job Title: Soil Sampling **Date of Analysis:** 7/7/15

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	6E) Foot injuries from dropped equipment	6E) Foot Injuries ▪ Be aware when moving objects, ensure you have a good grip when lifting and carrying objects. ▪ Do not carry more than you can handle safely ▪ Wear steel toed boots
7. Collecting soil samples	7A) Working around drill rigs	7A) See JHA - Drilling
	7B) Encountering underground or overhead utilities	7B) Have all utilities located.
	7C) Fire/Explosion/Contamination hazard from refueling generators	7C) Fire/Explosion/Contamination hazard from refueling generators ▪ Turn the generator off and let it cool down before refueling ▪ Segregate fuel and other hydrocarbons from samples to minimize contamination potential ▪ Transport fuels in approved safety containers. The use of containers other than those specifically designed to carry fuel is prohibited ▪ See JHA for Gasoline use
	7D) Electrocution	7D) Electrocution ▪ A ground fault circuit interrupter (GFCI) device must protect all AC electrical circuits. ▪ Use only correctly grounded equipment. Never use three-pronged cords which have had the third prong broken off. ▪ Make sure that the electrical cords from generators and power tools are not allowed to be in contact with water ▪ Do not stand in wet areas while operating power equipment ▪ Always make sure all electrically-powered sampling equipment is in good repair. Report any problems so the equipment can be repaired or replaced. ▪ When unplugging a cord, pull on the plug rather than the cord. ▪ Never do repairs on electrical equipment unless you are both authorized and qualified to do so.
	7E) Exposure to contaminants	7E) Exposure to Contaminants ▪ Stand up wind when sampling ▪ Monitor breathing zone with appropriate monitoring equipment (see HASP) ▪ Wear chemical resistant PPE as identified in HASP ▪ See section 4C) under Safe Practices above
	7F) Exposure to preservatives	7F) Exposure to preservatives ▪ Work in a well ventilated area, upwind of samples ▪ Wear chemical resistant PPE as identified in HASP ▪ Review MSDSs
	7G) Slips/trips/falls	7G) Slips/trips/falls ▪ Ground can become wet/muddy ▪ Wear good slip resistant footwear
	7H) Lifting Injury	7H) Lifting injury ▪ Use proper lifting techniques when carrying quantities of samples ▪ Use proper ergonomics when hand digging for samples
	7I) Eye injury	7I) Eye Injury ▪ Wear eye protection when using picks or similar devices to loosen soil
	7J) Fire	7J) Fire ▪ When using gas powered auger, maintain fire watch whenever fueling or otherwise handling gasoline ▪ See JHA - Gasoline

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Job Hazard Analysis - HASP Format

Job Title: Soil Sampling **Date of Analysis:** 7/7/15

Key Work Steps	Hazards/Potential Hazards	Safe Practices
8. Soil sampling using floor corer	8A) Back injury	8A) Back Injury ▪ Use proper lifting techniques when moving floor corer and generator ▪ Use mechanincal aids if available ▪ Use two person lift for heavy items.
	8B) Electric Shock	8B) Electric Shock ▪ Use electric cords free from defects ▪ Keep cords out of water ▪ Ensure all electrical equipment is properly grounded ▪ Use GFCI
	8C) Hearing	8C) Hearing ▪ Wear hearing protection
	8D) Fire	8D) Fire ▪ When using generator, maintain fire watch whenever refueling or otherwise handling gasoline ▪ See JHA - Gasoline
	8E) Contamination	8E) Contamination ▪ Use appropriate PPE for the contaminants of concern (see HASP). ▪ Minimize sample contact ▪ Label sample in accordance with procedures ▪ Monitor breathing zone levels.

MACTEC **Job Hazard Analysis - HASP Format**

Job Title: Environmental Drilling/Boring and Associated Soil and/or Bedrock Sampling **Date of Analysis:** 7/7/15

Minimum Recommended PPE*: Steel Toed, Slip Resistant Safety Boots; Safety Glasses; Face Shield (if chipping bedrock to collect sample); Nitrile gloves; High visibility vest; Hard Hat; Hearing Protection; Insulated Gloves (if hand digging to identify underground utilities)
*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. All Drilling/Boring Activities	1A) Slips, Trips, Falls	1A) Slips, Trips, Falls ▪ Keep work area free of excess material and debris ▪ Remove all trip hazards by keeping materials/objects organized and out of walkways ▪ Keep work surfaces dry when possible ▪ Wear appropriate PPE (See HASP) including non-slip rubber boots if working on wet or slick surfaces ▪ Install rough work surface covers where possible ▪ Be alert to conditions that can lead to slippery surfaces including high groundwater or heavy precipitation can result in muddy soils. ▪ Stay aware of footing and do not run
	1B) Heat/Cold Stress	1B) Heat/Cold Stress ▪ See Field Work – General JHA and HASP Appendix B.
	1C) Biological Hazards: Insects, Snakes, Wildlife, Vegetation	1C) Biological Hazards: Insects, Snakes, Wildlife, Vegetation ▪ Inspect work areas when arrive at site to identify hazard(s) ▪ Use insect repellant if observe mosquitoes/gnats ▪ Open enclosures slowly ▪ Survey site for presence of biological hazards and maintain safe distance ▪ Wear appropriate PPE including leather gloves, long sleeves and pants, and snake chaps as warranted by site conditions (See HASP). ▪ See also Insect Stings & Bites JHA.
	1D) Traffic (including pedestrian)	1D) Traffic (including pedestrian) ▪ Notify attendant or site owner/manager of work activities and location ▪ Set up exclusion zone surrounding work area using cones, signs, or flags. A police detail is necessary when working in locations that may disrupt or affect traffic on Route 119 ▪ Wear appropriate PPE including high visibility clothing and a reflective vest (See HASP) ▪ Inspect area behind vehicle prior to backing and use spotter
	1E) Struck By Rig	1E) Struck by Rig ▪ Ensure that drill rig backup alarm is working. If it is not, alert drilling supervisor immediately. This safety device must be working in order to operate the equipment on site ▪ Do not walk in the path of or behind a moving rig ▪ Do not walk behind the moving rig and always establish eye contact with the operator before approaching the equipment
	1F) Fire/ Explosion	1F) Fire/ Explosion ▪ Post No Smoking signs around work area ▪ Establish designated smoking area away from work area ▪ Ensure type ABC, 20-lb, fully charged fire extinguisher on-site and within inspection period ▪ Stop work if hazardous conditions (explosive atmosphere) are identified

Job Title: Environmental Drilling/Boring and Associated Soil and/or Bedrock Sampling **Date of Analysis:** 7/7/15

Key Work Steps	Hazards/Potential Hazards	Safe Practices
2. Ambient Air Monitoring	2A) Vapors/Contaminated Soil/Groundwater	2A) Vapors/Contaminated Soil/Groundwater ▪ Approach area where vapors are suspected from upwind direction and stay upwind/crosswind of from potential sources of vapors (use flagging or similar device to indicate wind direction) ▪ During drilling operations, always be aware of the possibility of encountering potentially hazardous materials, such as petroleum hydrocarbons, herbicides, pesticides, or solid waste materials ▪ In the event that any unknown or questionable materials are encountered, the drilling operations must be suspended immediately until further instructions are received from the Project Manager ▪ Do not handle any suspected contaminated materials unless trained to do so and proper protective methods are followed ▪ During drilling operations, always be aware of the possibility of striking an un-located or improperly located utility ▪ In the event a buried utility line is struck, drilling operations are to be suspended **immediately** - If the utility line is electric, keep personnel at least 10 feet from all metal surfaces connected with the drill rig. - If the utility is gas, then the area is to be evacuated and secured. Immediate notification to the utility company is MANDATORY. ▪ In the event of a gas or oil spill, the proper authorities are to be contacted immediately so that containment operations can be implemented
	2B) Ineffective Air Monitoring	2B) Ineffective Air Monitoring ▪ See Field Work – General JHA.
3. Concrete Coring	3A) Ignition Sources	3A) Ignition Sources ▪ Ensure electrical equipment properly grounded ▪ Apply water as necessary to address surface sparking potential
	3B) High Noise Levels	3B) High Noise Levels ▪ Hearing protection required when working around operating equipment including drill rigs
	3C) Airborne Particulates and Debris	3C) Airborne Particulates and Debris ▪ Use wet methods whenever possible. Water should be used to control dust in area ▪ Wear appropriate PPE including face shield or safety glasses with side shields, dust mask, leather gloves and long sleeves (See HASP)
	3D) Sharp Rough Materials	3D) Sharp Rough Materials ▪ Wear appropriate PPE including leather gloves, long sleeves and pants, and steel-toed boots (See HASP)
	3E) Impact to Subsurface Lines	3E) Impact to Subsurface Lines ▪ Ensure all underground features have been identified in area per SCP prior to start of activities
4. Drill Rig Set-Up	4A) Contact with Electric Lines and Other Overhead Obstacles	4A) Contact with Electric Lines and Other Overhead Obstacles ▪ Operator must position rig to avoid overhead utility lines by distance defined by voltage and local regulations ▪ Operator must use a spotter when raising mast to confirm clearance of overhead lines and other obstructions
	4B) Rig Movement	4B) Rig Movement ▪ Heavy equipment, including drill rigs, must be equipped with back-up alarm ▪ Stay clear of operating equipment and rig when moving
	4C) Sharp or Elevated Equipment	4C) Sharp or Elevated Equipment ▪ Wear appropriate PPE including steel-toed safety boots, leather gloves and hard hat (See HASP) ▪ Operator should establish communication system between him/her and the workers involved in moving/attaching sections of drill rod/augers

MACTEC **Job Hazard Analysis - HASP Format**

Job Title: Environmental Drilling/Boring and Associated Soil and/or Bedrock Sampling **Date of Analysis:** 7/7/15

Key Work Steps	Hazards/Potential Hazards	Safe Practices
5. Ground Disturbance: Auger/Boring Advancement	5A) Faulty or Inappropriate Equipment	5A) Faulty or Inappropriate Equipment ▪ Qualified driller must inspect drill rig prior to use, if faulty or inappropriate, drilling cannot proceed until repaired or replaced ▪ Driller must inspect all tools prior to use, if faulty or inappropriate, do not proceed until repaired or replaced. Tag out all defective tools
	5B) Moving Equipment	5B) Moving Equipment ▪ Clear area of obstructions and communicate with all workers involved that drilling is beginning ▪ Driller must not exceed manufacturer's recommended speed, force, torque, or other specifications. and penetrate the ground slowly with his/her hands on the controls for at least the first foot of soil to minimize chance of auger kick-out ▪ All personnel must stay clear of rotating auger ▪ Use long-handled shovel to clear away cuttings when auger has stopped ▪ Do not wear loose clothing ▪ Wear appropriate PPE including leather gloves and steel-toed boots (See HASP)
	5C) Suspended Loads	5C) Suspended Loads ▪ Do not walk under suspended loads ▪ When possible, remove overhead hazards promptly ▪ Wear appropriate PPE including hard hat and steel-toed boots (See HASP)
	5D) High Noise Levels	5D) High Noise Levels ▪ Use hearing protection if within 20 feet of active drill rig
	5E) Ground Disturbance: Auger/Boring Advancement Vapors and Airborne	5E) Ground Disturbance: Auger/Boring Advancement Vapors and Airborne ▪ Monitor air concentrations using direct-reading, real-time instruments such as PID (See HASP for required monitoring instruments and action limits)
	5F) Particulates	5F) Particulates ▪ Stop work if hazardous conditions (explosive atmosphere, O2 deficient atmosphere) identified until precautions are taken (See HASP for required monitoring instruments and action limits) ▪ Wear appropriate PPE including face shield or safety glasses with side shields, dust masks or respirators, long sleeves and pants (See HASP) ▪ Stay upwind (use flagging or similar device to indicate wind direction)
	5G) Impact to Subsurface Lines/Tanks	5G) Impact to Subsurface Lines/Tanks ▪ In addition to Digsafe utility marking, hand digging to at least 5 feet at each boring location is required at the Conductorlab Site. Exact locations of recovery well pump utility locations are not detectable from the ground surface and the approximate locations can only be determined by a crude map ▪ Only drill in areas where underground features have been identified and cleared. If hole has to be moved, clear new location first ▪ Wear appropriate PPE including insulating gloves or stand on an insulating mat when in contact with drill rig
6. Ground Intrusion: Split Spoon	6A) Faulty Equipment	6A) Faulty Equipment ▪ Inspect rope/cable/rod for wear, fraying, oils and moisture prior to use, do not use if faulty until repaired or replaced. ▪ Inspect cathead for rust and rope grooves prior to use, do not use if faulty until repaired or replaced ▪ Report any defects to your supervisor

Job Title: Environmental Drilling/Boring and Associated Soil and/or Bedrock Sampling **Date of Analysis:** 7/7/15

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	6B) Moving Equipment	6B) Moving Equipment ▪ Do not wrap rope around any part of the hand or body ▪ Maintain distance of at least 18-inches from in-running points on running/reciprocating equipment ▪ Eliminate excess rope ▪ Do not wear loose clothing ▪ Wear appropriate PPE including leather gloves (See HASP)
7. Soil Sampling	7A) Contaminated Materials	7A) Contaminated Materials ▪ Wear appropriate PPE including Nitrile gloves (See HASP)
	7B) Sharp Sampling Tools	7B) Sharp Sampling Tools ▪ When possible, have the driller open the sample sleeve. ▪ Place soil core on sturdy surface prior to cutting ▪ Use correct tools for opening sample sleeves ▪ When opening sleeve, cut away from body
	7C) Vapors	7C) Vapors ▪ Conduct monitoring in accordance with the HASP ▪ Wear appropriate PPE including respirator if conditions warrant
	7D) Sample Cross Contamination	7D) Sample Cross Contamination ▪ Decontaminate or dispose of sampling equipment between sampling locations ▪ Double-check sample labels to ensure accuracy and adhesion to containers
8. Bedrock Sampling	8A) Eye Injuries from Chipping Rock	8A) Eye Injuries from Chipping Rock ▪ Wear face shield and safety glasses while slowly chipping at the rock core to collect sufficient number of bedrock pieces to fill sample container ▪ Focus on the task, make sure no one is in the path of your hammer and watch where you are striking the rock. Keep all body parts out of the path of the hammer
	8B) Contact with Methanol in Sample Containers	8B) Contact with Methanol in Sample Containers ▪ Wear appropriate gloves as described in the HASP. ▪ Carefully place the pieces of rock into the sample container and minimize contact with the liquid. Avoid splashing liquid
9. Solid/Liquid Waste Management/ Disposal	9A) Vapors and Airborne Particulates	9A) Vapors and Airborne Particulates ▪ Monitor air concentrations using direct-reading, real-time instruments such as PID (See HASP for required monitoring instruments and action limits) ▪ Stop work if hazardous conditions (explosive atmosphere, O2 deficient atmosphere) identified until precautions are taken ▪ Wear appropriate PPE including safety glasses with side shields, dust masks and respirators (See HASP) ▪ Stay upwind (use flagging or similar device to indicate wind direction)
	9B) Contaminated Materials and Container Pinch Points	9B) Contaminated Materials and Container Pinch Points ▪ Wear appropriate PPE including Nitrile and leather gloves (See HASP) ▪ Position hands/fingers to avoid pinching/smashing/crushing when closing drum rings

Job Title: Environmental Drilling/Boring and Associated Soil and/or Bedrock Sampling **Date of Analysis:** 7/7/15

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	9C) Heavy Materials and Containers Lifting/ Moving	9C) Heavy Materials and Containers Lifting/ Moving ▪ Do not lift or move heavy containers without assistance ▪ Use proper bending/lifting techniques by lifting with arms and legs and not with back ▪ If possible, use powered lift truck, drum cart, or other mechanical means Take breaks if feeling faint or overexerted ▪ Spot drums in storage area prior to filling ▪ Wear appropriate PPE including leather gloves and steel-toed boots

The following information is meant to convey information about the hazards of a drill rig. Although MACTEC personnel will not be operating the drill rig, they will be stationed in the vicinity of the rig and must be aware of potential hazards. MACTEC has included the following information pertaining to safe operation of the drill rig as awareness to MACTEC personnel on the hazards of drilling. This must not be construed to mean that MACTEC is responsible for the drillers' safety.

Prior to operating the drill rig, the drill rig operator must:

- Inspect the rig prior to any work on site.
- Inspect the work area to confirm the presence of overhead or underground utilities.
- Before the mast (derrick) of a drill rig is raised and drilling is commenced, level the drill rig and stabilize it with leveling jacks and/or solid cribbing. The operator must re-level the rig immediately if settling occurs after the initial set-up.
- Before raising or lowering the mast (derrick), inspect the work area for potential safety hazards. All unnecessary drill rig personnel and visitors shall be cleared from the areas immediately to the rear, front, and the sides of the mast. Once the mast is raised into position, the mast or derrick locks will be secured. The rig shall not be operated unless mast locks are functional and are locked. Prior to lowering, mast hydraulic system(s) will be checked.
- Before raising the mast (derrick), double-check for overhead wires and obstructions. An observer shall be posted at a strategic location to ensure adequate clearance is maintained.
- Ensure that no personnel, other than the assigned rig crew, are allowed on or under an operating rig deck for any reason.
- Not move the drill rig from hole to hole with the mast (derrick) in the raised position.
- Operate a drill rig only from the driller's control station, and remain with the operating controls at all times when the rig is in operation.
- If it is necessary to drill within an enclosed area, make certain that rig exhaust gases are captured and discharged well out of the work area, and any area where people could be present. Provide sufficient ventilation.
- When using a mast or derrick ladder, face the ladder and grasp either the side rails or the rungs with both hands while ascending or descending. The three-point of contact system (2 hands and 1 foot or 2 feet and 1 hand) shall be used when climbing. Always make sure that his/her shoe soles are clean and dry before attempting climbing or descending the mast.
- Ensure that anyone working on a derrick board, platform, or mast shall be provided with fall protection in accordance with OSHA fall protection regulations under 29 CFR 1926.
- When working on a mast or derrick platform, the operator must not guide drill rods or pipe into racks or other supports by taking hold of a moving hoisting line, traveling block, or other moving hoisting equipment. Rack only one pipe stand at a time. Always stay clear of moving hoisting line, traveling block, elevators, or hoisting plugs.

- Ensure that loose tools and similar items are not left on the derrick platform or on structural members of the derrick.
- Ensure that all unattended boreholes be adequately covered or otherwise protected to prevent people or animals from stepping or falling into the hole.

Other safety precautions the drill rig operator and his/her crew must follow are:

- Platforms, steps, handholds, and guardrails shall be provided on the equipment to assure safe access and footing. The platform and decks shall be coated with a nonskid surface.
- Rig personnel shall employ good ergonomic lifting techniques when lifting heavy objects, such as keeping the back straight, keeping weight close to the body, getting help when necessary and using mechanical assistance when possible.
- Personnel shall not ride the hoisting line, catline, traveling block, the traveling block hook, the elevators, or suspended equipment as a means of ascending or descending to or from the derrick.
- All rig steps, ladders, stairways, platforms, and walkways shall be free of mud, snow, ice, tools, and other materials that may cause slipping or tripping.

MACTEC

JOB HAZARD ANALYSIS - SHORT FORM HASP

Job Title: Poisonous Plants **Date of Analysis:** 7/7/15

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1) Mobilization	1A) See JHA Mobilization/ Demobilization/Site Preparation	1A) See JHA Mobilization/Demobilization/Site Preparation
2) Preparation	2A) Training – Identifying Poisonous Plants	2A) Provide training on identifying the specific poisonous plants that could be present at the site
		
	2B) Poison Ivy 	2B) Poison Ivy: ▪ Grows everywhere in United States except Hawaii and Alaska. ▪ In the East, Midwest, and the South, it grows as a vine. ▪ In the Northern and Western United States, it grows as a shrub. ▪ Each leaf has three leaflets. ▪ Leaves are green in the summer and red in the fall. ▪ In the late summer and fall, white berries may grow from the stems.
	2C) Poison Oak 	2C) Poison Oak: ▪ Oak-like fuzzy leaves in clusters of three. ▪ It has two distinct kinds: ▪ Eastern poison oak (New Jersey to Texas) grows as a low shrub. ▪ Western poison oak (Pacific Coast) grows to six-foot-tall clumps or vines up to 30 feet long. ▪ It may have clusters of yellow berries.
	2D) Poison Sumac 	2D) Poison Sumac ▪ Grows in standing water in peat bogs in the Northeast and Midwest and in swampy areas in parts of the Southeast. ▪ Each leaf has clusters of seven to 13 smooth-edged leaflets. ▪ The plants can grow up to 15 feet tall. ▪ The leaves are orange in spring, green in summer and red, and orange or yellow in fall. ▪ There may be clumps of pale yellow or cream-colored berries.

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JOB HAZARD ANALYSIS - SHORT FORM HASP

Job Title: Poisonous Plants **Date of Analysis:** 7/7/15

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	2E) Giant Hogweed  Giant Hogweed  Giant Hogweed Flower (clusters may reach up to 2.5 feet across)  Giant Hogweed Flower Leaves  Giant Hogweed Stem Thick stem with coarse hairs, Blistery dark purple splotches.	2E) Giant Hogweed ▪ Hogweed is a public health hazard. Its clear, watery sap has toxins that cause photo-dermatitis. Skin contact followed by exposure to sunlight produces painful, burning blisters that may develop into purplish or blackened scars. Contact with the eyes can cause temporary or permanent blindness. ▪ Since its introduction into North America, this plant has become established in rich moist soils along roadsides, stream banks and waste ground. In the eastern US, it is known to occur in Maine, New York, Pennsylvania, Connecticut, and now Massachusetts. ▪ A biennial or perennial herb growing 8 to 15 feet tall, giant hogweed usually has a taproot or occasionally fibrous root. The hollow stems are 2 to 4 inches in diameter with dark reddish-purple splotches and coarse white hairs. ▪ The deeply incised compound leaves grow up to 5 feet in width. Hairs on the underside of the leaf are stiff, dense and stubby. ▪ The large umbrella-shaped flower heads are up to 2 1/2 feet in diameter across a flat top with numerous small flowers produced in mid-May through July. ▪ Some plants die after flowering; others flower for several years. The plant produces flattened, 3/8 inch long, oval dry fruits that have a broadly rounded base and broad marginal ridges. Plants sprout in the early spring (or late winter in mild years) from the roots or from seed. ▪ Grows in standing water in peat bogs in the Northeast and Midwest and in swampy areas in parts of the Southeast. ▪ Each leaf has clusters of seven to 13 smooth-edged leaflets. ▪ The plants can grow up to 15 feet tall. ▪ The leaves are orange in spring, green in summer and red, and orange or yellow in fall. ▪ There may be clumps of pale yellow or cream-colored berries.

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JOB HAZARD ANALYSIS - SHORT FORM HASP

Job Title: Poisonous Plants **Date of Analysis:** 7/7/15

Key Work Steps	Hazards/Potential Hazards	Safe Practices
3A) Contact with poisonous plants	3A) Hand Contact	3A) Hand Contact ▪ Apply IvyX (or similar product) to hands, forearms and other potentially exposed parts of the body, prior to starting work in the morning and again right after lunch. ▪ Leather Gloves must be worn at all times when digging, screening or carrying field equipment. ▪ Leather gloves should be of sufficient length to cover the entire wrist and cuff of the shirt. ▪ Carefully remove gloves, without touching the exterior surface, when taking notes and prior to lunch or restroom breaks. ▪ Gloves that become worn should be replaced immediately. ▪ Do not scratch or rub the face or other exposed skin while wearing gloves. ▪ Workers will apply Tecnu (or similar product) to the hands and forearms immediately after removing their gloves, prior to lunch and again at the end of the day. Tecnu will help cleanse the urushiol oil from the skin before it can be absorbed. Sensitive individuals can also apply prior to showering in the evening.
	3B) Arm Contact	3B) Arm Contact ▪ Apply IvyX (or similar product) to hands, forearms and other potentially exposed parts of the body, prior to starting work in the morning and again right after lunch. ▪ Wear light weight, long sleeved shirts as the sleeves will provide a physical barrier between the skin and any urushiol oil encountered. Disposable gauntlets may we worn over arms to keep oil from clothing as well. ▪ Have the sleeves pulled down to the base of the hand, covering the forearm and wrist (all exposed skin). ▪ Workers will apply Tecnu (or similar product) to the hands and forearms immediately after removing their gloves, prior to lunch and again at the end of the day. Tecnu will help cleanse the urushiol oil from the skin before it can be absorbed. Sensitive individuals can also apply prior to showering in the evening.
	3C) Leg Contact	3C) Leg Contact ▪ Wear long pants and boots. ▪ Assume boots are contaminated with the urushiol oil and only handle with gloved hands.
4) Handling Contaminated Equipment and Clothing	4A) Exposure from Handling Contaminated Equipment	4A) Exposure from Handling Contaminated Equipment ▪ Do not handle any field equipment that may have come in contact with poison ivy/oak/sumac without gloves. ▪ Decontaminate all equipment at the end of each workday with a solution of water and dish soap. ▪ Scrub all surfaces of the screens and shovels with a brush. ▪ Rinse with cool water using a portable garden sprayer.

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JOB HAZARD ANALYSIS - SHORT FORM HASP

Job Title: Poisonous Plants **Date of Analysis:** 7/7/15

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	4B) Exposure from Handling Contaminated Clothing	4B) Exposure from Handling Contaminated Clothing ▪ Wash clothing potentially contaminated with urushiol oil prior to wearing again. ▪ Handle contaminated clothing with gloves as the oil can remain on environmental surfaces for up to 5 years.

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Job Hazard Analysis - HASP Format

Job Title: Excavation and Backfilling **Date of Analysis:** 8/20/07

Minimum Recommended PPE*: High visibility vest, hard hat, steel-toed boots, safety glasses, hearing protection
*See HASP for all required PPE

<table>
<tr><th>Key Work Steps</th><th>Hazards/Potential Hazards</th><th>Safe Practices</th></tr>
<tr><td>1. Identify location of underground utilities</td><td>1A) Encountering electrical, gas, communications, water, or other underground utility lines</td><td>1A) Identify utility locations prior to mobilizing:
Contact “Dig Safe” and obtain a permit (or one call center) to have underground utilities located and marked prior to any subsurface work on site.
Use facility engineers and/or employ a private utility locator for utilities on private property</td></tr>
<tr><td>2. Excavation of soils</td><td>2A) Underground utilities</td><td>2A) Underground utilities
Work at adequate offsets from utility locations
For areas where utility locations cannot be verified, workers must hand dig for the first 3 feet
Immediately cease work if unknown utility markings are discovered.
Conform to utility clearances based on voltage of lines. For power lines of 50 KV or less stay at least 10 feet away. For power lines of > 50 KV see table below. Rule of thumb: Stay 10 feet away if power line known to be 50 KV or less. Stay 35 feet away for lines > 50 KV or if voltage is unknown.
United States Overhead Line Criteria<table><tr><th>Line Voltage (Kilovolts)</th><th>Minimum Safe Working Distance</th></tr><tr><td>0 – 50</td><td>10 feet</td></tr><tr><td>>50 – 200</td><td>15 feet</td></tr><tr><td>>200 – 350</td><td>20 feet</td></tr><tr><td>>350 – 500</td><td>25 feet</td></tr><tr><td>>500 – 750</td><td>35 feet</td></tr><tr><td>>750 – 1,000</td><td>45 feet</td></tr></table>Source: American National Standards Institute, Publication B30.5.</td></tr>
<tr><td></td><td>2B) Vapor/Dust Exposure</td><td>2B) Vapor/Dust Exposure
Conduct breathing zone air monitoring as described in the HASP.
Implement dust control measures as applicable.
Wear proper PPE (see HASP).</td></tr>
<tr><td></td><td>2C) Odors</td><td>2C) Odors
Implement odor control mitigation in accordance with the Site Management Plan.</td></tr>
<tr><td></td><td>2D) Heavy Equipment</td><td>2D) Heavy Equipment
See General Site Hazards</td></tr>
<tr><td></td><td>2E) Cave-ins</td><td>2E) Cave-ins
Excavation work must be conduct in accordance with OSHA 1926 Subpart P (650-652) Excavations including but not limited to:
Designate a competent person to inspect, decide soil classification, proper sloping, the correct shoring, or sheeting for the excavation
Walls and faces of trenches 5 feet or more deep, and all excavations in which employees may be exposed to danger from moving ground or cave-in shall be guarded by a shoring system, sloping of the ground, or some other equivalent means.
Cordon-off the perimeter of the excavation to delineate cave-in hazard area.
Construct diversion ditches or dikes to prevent surface water from entering excavation and provide good drainage of the areas surrounding the excavation.
Collect ground water/rain water from excavation and dispose of properly</td></tr>
</table>

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Job Hazard Analysis - HASP Format

Job Title: Excavation and Backfilling **Date of Analysis:** 8/20/07

Key Work Steps	Hazards/Potential Hazards	Safe Practices
		▪ Store spoils, materials and equipment at least 2 feet from the edge of the excavation; prevent excessive loading of the excavation face. ▪ Inspect excavations (when personnel entry is required) daily, any time conditions change and document the inspection.
	2F) Slips/Trips/Falls	2F) Slips/Trips/Falls ▪ Provide sufficient egress (stairs, ladders, or ramps) when workers enter excavations over 4 feet in depth, and place these structures so that workers travel no more than 25 feet to reach ladders. Provide at least two means of exit for personnel working in excavations. ▪ Maintain minimum safe distance from the excavation and only approach the excavation on the short side.
	2G) Site Security	2G) Site Security ▪ Fill in excavation prior to leaving the site or provide barricades or fencing (able to withstand 200 lbs. of vertical pressure) to protect the excavation from the public and place warning signs on fence/barricade. ▪ Consider hiring a security guard ▪ If cover excavation with plywood or other material, ensure cover is labeled with the words “cover” or “hole.”
3). Backfilling of Soils	3A) Heavy Equipment	3A) Heavy Equipment ▪ See General Site Hazards (Heavy Equipment)
	3B) Cave-ins	3B) Cave-ins ▪ See 2E above.

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Job Hazard Analysis - HASP Format

Job Title: Insect Stings and Bites **Date of Analysis:** 7/7/15

Minimum Recommended PPE*: Long sleeved shirt and pants, light colored clothing
*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Traveling/working in areas with potential Tick Bites –Example outdoor wooded areas or fields.	1. Lyme Disease, Rocky Mountain Spotted Fever, etc.	▪ Spray clothing with insect repellant as a barrier. ▪ Wear light colored clothing that fits tightly at the wrists, ankles, and waist. ▪ Each outer garment should overlap the one above it. ▪ Cover trouser legs with high socks or boots. ▪ Tuck in shirt tails. ▪ Search the body on a regular basis, especially hair and clothing; ticks generally do not attach for the first couple of hours. ▪ If a tick becomes attached, pull it by grasping it as close as possible to the point of attachment and pull straight out with gentle pressure. Wash skin with soap and water then cleanse with rubbing alcohol. Place the tick in an empty container for later identification, if the victim should have a reaction. Record dates of exposure and removal. ▪ Do not try to remove the tick by burning with a match or covering it with chemical agents. ▪ If you can not remove the tick, or the head detaches, seek propmt medical help. ▪ Watch for warning signs of illness: a large red spot on the bite area; fever, chills, headache, joint and muscle ache, significant fatigue, and facial paralysis are reactions that may appear within two weeks of the attack. Symptoms specific to Lyme disease include: confusion, short-term memory loss, and disorientation.
2. Working/traveling in areas with potential bee and wasp stings-Example wooded areas and fields	2. Allergic reactions, painful stings	▪ Be alert to hives in brush or in hollow logs. Watch for insects travelling in and out of one location. ▪ If you or anyone you are working with is known to have allergic reactions to bee stings, tell the rest of the crew and your supervisor. Make sure you carry emergency medication with you at all times. ▪ Wear long sleeve shirts and trousers; tuck in shirt.. Bright colors and metal objects may attract bees. ▪ If you are stung, cold compresses may bring relief. ▪ If a stinger is left behind, scrape it off the skin. Do not use a tweezers as this squeezes the venom sack, worsening the injury. ▪ If the victim develops hives, asthmatic breathing, tissue swelling, or a drop in blood pressure, seek medical help immediately. Give victim antihistime, (Benadryl, chlo-amine tabs).
3. Traveling/working in areas of potential Mosquito Bites-Example- Woods, fields, near bodies of water and etc.	3. Skin irritation, encephalitis	▪ Wear long sleeves and trousers. ▪ Avoid heavy scents. ▪ Use insect repellants. If using DEET, do not apply directly to skin, apply to clothing only. ▪ Carry after-bite medication to reduce skin irritation.

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Job Hazard Analysis - HASP Format

Job Title: Geophysical Survey **Date of Analysis:** 7/7/15

Minimum Recommended PPE*: Hard Hat, safety glasses, gloves, steel toe work boots, high visibility safety vest, hearing protection

*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Mobilization	1a) See JHA for Mobilization/Demobilization Site Preparation	See JHA for Mobilization/Demobilization Site Preparation
2. Communication	2a) Safety, crew unity	Talk to each other: ▪ Log all workers and visitors on and off the site. ▪ Let other crewmembers know when you see a hazard. ▪ Avoid working near known hazards. ▪ Always know the whereabouts of fellow crewmembers. ▪ Carry a radio and spare batteries or cell phone
3. Site Walk Over	3a) Slips/Trips/Falls	Slips/Trips/Falls: ▪ Maintain work areas safe and orderly; mark or repair possible tripping hazards. ▪ Always watch your footing. ▪ Horseplay is strictly prohibited ▪ Slow down and use extra caution around logs, rocks, and animal holes. ▪ Extremely steep slopes (>50%) can be hazardous under wet or dry conditions; consider an alternate route. ▪ Wear laced boots with a minimum 8" high upper and non-skid Vibram-type soles for ankle support and traction.
	3b) Exposure to poisonous plants and insects	Exposure to poisonous plants and insects: ▪ See JHA for Insect Stings and Bites ▪ Look for signs of poisonous plants and avoid. ▪ Ensure all field workers can identify the plants. Mark identified poisonous plants with spray paint if working at a fixed location. ▪ Do not allow plant to touch any part of your body/clothing. ▪ If contact is unavoidable, see JHA – Poisonous Plants ▪ Wear PPE as described in the HASP and wear Tyveks, gloves and boot covers if contact with plant is likely ▪ Always wash gloves before removing them. ▪ Discard PPE in accordance with the HASP. ▪ Use commercially available products such as Ivy Block or Ivy Wash as appropriate.
		 POISON IVY (Rhus toxicondendron L.) POISON OAK (Rhus diversiloba) POISON SUMAC (Rhus toxicondendron vernix)
	3c) Struck by vehicle	Struck by vehicle: ▪ High visibility vests will be worn when workers are exposed to vehicular traffic at the site or on public roads. ▪ Use orange cones and signs if working within 15 feet of a road

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Job Hazard Analysis - HASP Format

Job Title: Geophysical Survey **Date of Analysis:** 7/7/15

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	3d) Exposure to Contaminants	Chemical/Toxicological Hazards: ▪ See HASP for a list of contaminants of concern and the appropriate level of PPE ▪ Use monitoring equipment, as outlined in HASP, to monitor breathing zone ▪ Be familiar with hazards associated with site contaminants. ▪ Decon thoroughly prior to consumption of food, beverage or tobacco.
	3e) Overhead Power Lines	Overhead Power Lines: ▪ Do not work within 10 feet of an overhead power line.
4. Layout Survey Lines (applicable in setting up survey grids, seismic lines, and electrical resistivity lines)	4a) Slips/Trips/Falls	Slips/Trips/Falls: ▪ See 3a above. In addition, pay attention to the position of the electrodes as they will be low to the ground and could pose a tripping hazard ▪ See JHA Clearing Brush and Trees
	4b) Materials Handling – Sprains/ Strains	Materials Handling – Sprains/ Strains: ▪ Take precautions when handling heavy equipment. ▪ Site personnel will be instructed on proper lifting techniques. ▪ Mechanical devices should be used to reduce manual handling of materials. ▪ Split heavy loads in to smaller loads ▪ Team lifting should be utilized if mechanical devices are not available. ▪ Make sure that path is clear prior to lift.

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Job Hazard Analysis - HASP Format

Job Title: Working with Preservatives (Acids) **Date of Analysis:** 7/7/15

Minimum Recommended PPE*: Safety glasses/goggles, nitrile gloves,
*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Opening the box of ampoules	1A) Cuts or punctures with a knife	1A) Cuts or punctures with a knife ▪ Use appropriate techniques when handling a knife. Always cut away from you.
	1B) Broken ampoules in the box. Cuts from the broken glass.	1B) Broken ampoules in the box. Cuts from the broken glass. ▪ Wear safety goggles and protective gloves. ▪ Dispose of the preservative and broken glass by approved methods.
	1C) Broken ampoules in the box. Breathing fumes.	1C) Broken ampoules in the box. Breathing fumes. ▪ Wear safety goggles and protective gloves. ▪ Always work in a well-ventilated area.
2. Breaking top of glass ampoule	2A) Cuts from the broken glass.	2A) Cuts from the broken glass ▪ Wear safety goggles and protective gloves. ▪ Use a paper towel to wrap ampoule in to snap the top or use an ampoule breaker. ▪ Always point the ampoule away from you when you snap off the top.
	2B) Skin contact chemical burns.	2B) Skin contact chemical burns. ▪ Wear safety goggles and protective gloves. ▪ Fumes may come into contact with the perspiration on your skin and rehydrate to form an acid. ▪ If your skin itches, flush affected area for 15 minutes with water.
	2C) Eye contact	2C) Eye contact ▪ Wear safety goggles. ▪ If acid splashes in the eyes, flush eyes for 15 minutes with water. Seek medical advice.
	2D) Breathing fumes	2D) Breathing fumes ▪ HNO_3 and HCL have high vapor pressure. Always work in a well-ventilated area.
3. Adding acid to sample	3A) Chemical reaction	3A) Chemical reaction ▪ Wear safety goggles and protective gloves. Acid may react with high alkaline sample and fizz (releases CO_2).
	3B) Eye contact	3B) Eye contact ▪ Wear safety goggles. ▪ If acid splashes in the eyes, flush eyes for 15 minutes with water. Seek medical advice.
	3C) Skin contact chemical burns.	3C) Skin contact chemical burns. ▪ Wear safety goggles and protective gloves.
4. Ampoule disposal	4A) Cuts from the broken glass.	4A) Cuts from the broken glass. ▪ Wear safety goggles and protective gloves. ▪ Place used ampoules in an empty, non-reactive container in the field and bring it back to the office. Dispose of the preservative and broken glass by approved methods.

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JOB HAZARD ANALYSIS

Soil Sampling - Geoprobe

Job Title: Mohonk Road Industrial Plant **Date of Analysis:** 7/7/15

Job Location: 186 Mohonk Road, Marbletown, NY **Proj. Mgr.:** Jayme Connolly

Minimum Recommended PPE*: Hard hat, steel-toed boots, chemically-resistant gloves, safety glasses and hearing protection (when Geoprobe is operating), and a high visibility vest.

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Prepare for sampling event	1A) Chemical exposure 1B) Underground utilities	1A) Chemical Exposure ▪ Read HASP to determine air monitoring. ▪ Read HASP / JHA to determine PPE needs. 1B) Confirm that underground utilities have been clearly marked
2. Carrying equipment to site location (if inaccessible by field vehicle)	2A) Back or muscle strain	2A) Back or muscle strain ▪ Use proper lifting techniques when lifting heavy items ▪ Use mechanical aids if available ▪ Use 2 person lift for heavy items
3. Calibrate air monitoring equipment (i.e. PID or FID)	1A) Exposure to calibration gases	3A) Exposure to calibration gases ▪ Review equipment manuals ▪ Calibrate in a clean, well ventilated area
4. Preparing sampling location	4A) Watch out for other vehicles driving in the parking lot area.	4A) Watch out for other vehicles driving in the parking lot area. • Use flagging and/or traffic cones to delineate the hot zone (work zone) to prevent entry of unauthorized personnel • Wear high visibility vest. • Be aware of your surroundings at all times.
	4B) Mishaps due to loose equipment	4B) Mishaps due to loose equipment ▪ Maintain good housekeeping. ▪ Keep equipment out of the driving lanes. ▪ If necessary, wear protective netting over your head/face.
	4C) Unauthorized personnel in the hot zone (work zone)	4C) Use flagging and/or traffic cones to delineate the hot zone (work zone) to prevent entry of unauthorized personnel • Wear required PPE as described in the HASP / JHA once soil sampling activities begin.

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JOB HAZARD ANALYSIS

Soil Sampling - Geoprobe

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	4D) Exposure to hazardous Inhalation and contact with hazardous substances (VOC contaminated soil); flammable atmospheres.	4D) Exposure to hazardous substances ▪ Wear PPE as identified in HASP/ JHA once soil sampling activities commence. ▪ Review hazardous properties of site contaminants with workers before sampling operations begin ▪ Monitor breathing zone air in accordance with HASP to determine levels of contaminants present. ▪ When decontaminating equipment wear additional eye/face protection over the safety glasses such as a face shield.
	4E) Back strain due to lifting or moving equipment to sampling locations	4E) Back strain ▪ Use mechanical aids when possible, if mechanical aids are not available, use two person lifts for heavy items. ▪ Use proper lifting techniques
	4F) Foot injuries from dropped equipment	4F) Foot Injuries ▪ Be aware when moving objects, ensure you have a good grip when lifting and carrying objects. ▪ Do not carry more than you can handle safely ▪ Wear steel toed boots
5. Collecting soil samples	5A) Working around Geoprobe rigs	5A) Be aware of the Geoprobe's operation and movements during all phases of sampling activities. Communicate project requirements to the operator prior to commencing sampling activities.
	5B) Encountering underground or overhead utilities	5B) Have all utilities located.
	5C) Electrocution	5C) Electrocution ▪ A ground fault circuit interrupter (GFCI) device must protect all AC electrical circuits. ▪ Use only correctly grounded equipment. Never use three-pronged cords which have had the third prong broken off. ▪ Make sure that the electrical cords from generators and power tools are not allowed to be in contact with water ▪ Do not stand in wet areas while operating power equipment ▪ Always make sure all electrically-powered sampling equipment is in good repair. Report any problems so the equipment can be repaired or replaced. ▪ When unplugging a cord, pull on the plug rather than the cord. ▪ Never do repairs on electrical equipment unless you are both authorized and qualified to do so.
	5D) Exposure to contaminants / low level radiation	5D) Exposure to Contaminants / low level radiation ▪ Stand up wind when sampling and do not breathe dust (if conditions are dusty) ▪ Monitor breathing zone with appropriate monitoring equipment (see HASP) ▪ Continually monitor soil samples for low level radiation. ▪ Wear chemical resistant PPE as identified in HASP / JHA ▪ See section 4C) under Safe Practices above
	5E) Exposure to preservatives	5E) Exposure to preservatives ▪ Work in a well ventilated area, upwind of samples ▪ Wear chemical resistant PPE as identified in HASP / JHA. ▪ Review MSDSs

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JOB HAZARD ANALYSIS

Soil Sampling - Geoprobe

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	5F) Slips/trips/falls	5F) Slips/trips/falls ▪ Ground can become wet/muddy ▪ Wear good slip resistant footwear
	5G) Lifting Injury	5G) Lifting injury ▪ Use proper lifting techniques when carrying quantities of samples ▪ Use proper ergonomics when hand digging for samples
	5H) Eye injury	5H) Eye Injury ▪ Wear eye protection during operation of Geoprobe or if misc. debris may harm your eyes.
	5I) Fire	5I) Have an A-B-C rated fire extinguisher on hand in case of small equipment fires. Only individuals trained in fire extinguisher use should use a fire extinguisher.
6. Disposal of leftover soil.	6A) Contamination from impacted soil	6A) Properly dispose of any leftover soil sample ▪ Consult the Project Manager for proper disposal of soil. ▪ Don proper PPE when handling sample cores and disposing of soils. ▪ If soils are placed in a container (i.e. drum) properly label the drum.
7. Backfill Borehole.	7A) Contamination from impacted soil and/or groundwater	7A) Minimize contact with potentially impacted soil and/or groundwater ▪ Don proper PPE when backfilling the borehole. ▪ If the borehole is located in a paved area (i.e. asphalt/concrete), carefully patch the borehole using proper patching materials.

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JOB HAZARD ANALYSIS

Soil Sampling - Geoprobe

Standard Hazards			
□ Falling Objects	**X** Slips and trips	**X** Pinch points	□ Rotating equipment
□ Falls	**X** Geoprobe rig	**X** Underground utilities	□ _____
Eye Hazards			
□ Particulates	□ Liquid splashes	□ Welding Arc	**X** Potential hazard during Geoprobe rig operation
Hearing Hazards			
□ None	**X** Impact noise during Geoprobe rig operation	□ High frequency noise	□ High ambient noise
Respiratory Hazards			
□ None	□ Dust/particulates	**X** Organic Vapors	□ Acid Gases
□ Oxygen deficient	□ Welding fumes	□ Aerosols/Particulates	□ Be, Hg, Cr, Pb
□ _____	□ Radon	□ Asbestos	□ _____
Chemical Hazards			
□ None	□ Organic solvents	□ Metals	□ PCBs
□ Acids / bases	□ Oxidizers	**X** Volatiles / Semi-volatiles	□ _____

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JOB HAZARD ANALYSIS

Soil Sampling - Geoprobe

Environmental Hazards			
□ None	**X** Temperature extremes (Dress appropriately for the expected weather)	□ Wet location	□ Bio hazards (snakes, insects, spiders, bird / mouse droppings, fungus, etc.)
□ Explosive vapors	□ Confined space	□ Engulfment Hazard	□ _____
Electrical Hazards			
□ None	**X** Energized equipment or circuits	**X** Overhead utilities **X** Underground utilities □ Hidden utilities	□ Wet location
Fire Hazards			
X None expected	□ Cutting, welding, or grinding generated sparks or heat sources	□ Flammable materials present	□ Oxygen enriched location
Ergonomic Hazards			
X Lifting	**X** Bending	**X** Twisting	**X** Pulling/tugging
Computer Use in the: □ Office □ Field	□ Repetitive motion	□ _____	□ _____
Radiological Hazards			
□ None	□ Loose contamination	□ Fixed Contamination	**X** Low Level Radiation
□ Airborne contamination	□ Radon	□ EMF	□ Criticality
□ Alpha	□ Beta	□ Gamma/X-rays	□ Neutron
□ Tritium	□ TRU	□ Depleted Uranium	□ Enriched Uranium
Other Hazards			
X Hazards associated with working near moving vehicles in the parking lot area.			
□			
□			
□			

Completed by: Danielle Lerner Date: 7/7/15

FORM ESH-2.9.1-3.3

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JOB HAZARD ANALYSIS

Soil Sampling - Geoprobe

PPE and Monitoring Requirements

Standard PPE (Level D)			
X Hard Hat	**X** Safety shoes	**X** Safety glasses (during operation of Geoprobe rig)	□ Boot Covers
□ Aprons	□ Rubber Boots	**X** Other:_High visibility vest	□ Other:_____
Eye Protection			
□ Welding glasses □ Welding helmet	□ Face Shield	□ Chemical goggles	□ Welding screens
Hearing Protection			
X Ear plugs (during operation of Geoprobe rig)	□ Ear Muffs	□ Ear plugs and muffs	□ Other _____
Respiratory Protection			
X Follow air monitoring guidelines in HASP	□ Dust mask	□ Full Face APR □ Half Face APR Cart. Type _____	□ PAPR Cart. Type _____
□ SCBA	□ Airline respirator	□ _____	□ _____
Protective Clothing			
□ Tyvek® coveralls	□ Poly-coated Tyvek® Coveralls (if splashing of water occurs)	□ Saranex® Coveralls	□ Fully encapsulating suit
□ Cotton coveralls	□ Modesty Clothing	□ Fire resistant clothing	**X** Other: Long pants; long sleeve shirt
Hand Protection			
□ None	□ Cotton gloves	□ Leather gloves	□ Glove liners
X Nitrile gloves □ Viton® gloves □ Butyl gloves □ Neoprene gloves	Surgical gloves □ Latex □ Non-Latex	□ Cut-resistant gloves	□ Other:
Monitoring Requirements			
□ Oxygen	□ Flammable gases/vapors	□ Toxic Gas/vapors	□ Hydrogen Sulfide/Carbon Monoxide
□ Asbestos	□ Full time IH coverage	□ Part time IH coverage	□ Be, Hg, Cr, Pb
□ Metals Specify: _____			
X Organic vapors : Use a PID calibrated to 100 ppm isobutylene or an FID during sampling activities			
□ Radioactive air particulates	□ TLD required	□ CAM	□ Radon
□ Full time RCT coverage	□ Part time RCT coverage	□ Radioactive air particulates	□ Other _____
□ Low Level Radiation : _____		□ Other _____	

PPE and monitoring requirements completed by: Danielle Lerner Date: 7/7/15

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JOB HAZARD ANALYSIS

Soil Sampling - Geoprobe

JHA Preparation Team

Mike Reust

Effective Date From: 12-11-06 through TBD

Approval Signatures

Job Supervisor Date	LHSR Date	RSO Date
ES&H Manager Date	Project Manager Date	Other Date

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JOB HAZARD ANALYSIS

Soil Sampling - Geoprobe

Pre-Job Brief Attendance Sheet

Documents included in this briefing: _____

Print/Type Name	Signature	Date

Briefing presented by: _____ **Signature:** _____