FINAL
FIELD ACTIVITIES PLAN
PHASE II PRE-DESIGN INVESTIGATION
BRAM MANUFACTURING
REMEDIAL DESIGN
SITE # 344055

WORK ASSIGNMENT NO. D007619-22

Prepared for:

New York State Department of Environmental Conservation
Albany, New York

Prepared by:

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

MACTEC: 3612132269

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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

1,1,1-TCA	trichloroethane
Ballard	Ballard Engineering Consulting, P.C.
bgs	below ground surface
Bram	Bram Manufacturing
cis-1,2-DCE	cis-1,2-dichloroethene
COC	chain of custody
DNAPL	dense non-aqueous phase liquid
DUSR	Data Usability Summary Report
ESA	Environmental Site Assessment
°F	degrees Fahrenheit
FAP	Field Activities Plan
FDR	Field Data Records
FS	Feasibility Study
HASP	Health and Safety Plan
IDW	investigation derived waste
ISCO	in-situ chemical oxidation
ISCR	in-situ chemical reduction
MACTEC	MACTEC Engineering and Consulting, P.C.
MERC	methanol extraction of rock chips
mg/Kg	milligrams per kilogram
msl	mean sea level

GLOSSARY OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

NYCRR	New York Codes, Rules, and Regulations
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
PCBs	polychlorinated biphenyls
PID	photoionization detector
ppm	parts per million
PVC	polyvinyl chloride
QAPP	Quality Assurance Program Plan
QC	quality control
RCHD	Rockland County Health Department
RD	Remedial Design
RI	Remedial Investigation
SII	Subsurface Investigations Inc.
SIM	selected ion monitoring
Site	Bram Manufacturing facility site
SVI	soil vapor intrusion
SVOC	semi-volatile organic compound
TAL	target analyte list
TCE	trichloroethylene
TCLP	Toxicity Characteristics Leaching Procedure
TEAM	Team Environmental Consultants, Inc.
µg/L	microgram(s) per liter
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
UST	underground storage tank

GLOSSARY OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

VOC	volatile organic compound
ZVI	zero valent iron

1.0 INTRODUCTION

MACTEC Engineering and Consulting, P.C. (MACTEC), under contract to the New York State (NYS) Department of Environmental Conservation (NYSDEC), is submitting this Field Activities Plan (FAP) for the Bram Manufacturing (Bram) Facility site (Site) in the Town of Congers, Rockland County, New York (Figure 1.1). The Site is listed as a Class 2 Inactive hazardous waste site, Site No. 344055, in the Registry of Hazardous Waste Sites in NYS. This FAP has been prepared in accordance with the NYSDEC requirements in Work Assignment No. D007619-22, dated April 3, 2013, and with the April 2011 Superfund Standby Contract between MACTEC and the NYSDEC.

This FAP includes details regarding the proposed Remedial Design (RD) Phase II Pre-Design Investigation field activities scheduled for the spring of 2016, including a Site-specific Health and Safety Plan (HASP) (MACTEC, 2011b) and a Quality Assurance Project Plan (QAPP) (MACTEC, 2011a).

This FAP is organized into four sections as follows:

- Section 1.0 – Introduction, Work Objectives, and Site Background
- Section 2.0 – Site Physical Setting
- Section 3.0 – Scope of Work, Field Activity Details
- Section 4.0 – References

1.1 FIELD INVESTIGATION OBJECTIVES

The objective of the Phase II Pre-Design Investigation is to acquire and evaluate pertinent site data to support the planned remedial actions at the Site, including:

- Source Area Excavation – removal of accessible source area soil (i.e., above and below the water table) in the Site parking lot area.
- Groundwater Pump & Treat - groundwater pump and treatment options being considered to hydraulically contain overburden and bedrock groundwater at the Site.
- Monitored Natural Attenuation – natural attenuation and long term monitoring of bedrock and overburden groundwater.

The objectives of the field program are described in more detail in Section 3.

1.2 SITE BACKGROUND

Information pertaining to the history of the Site and contained in previous reports is summarized in the following subsections.

1.2.1 Site Description

The Site is located at 26 Route 9W in the Hamlet of Congers, Town of Clarkstown, Rockland County, New York (Figure 1.1). It is identified on the Town of Clarkstown tax map as Section 141, Block A, Lot 8. The Site consists of an open lot containing a one story 12,300 square foot block construction building, and is within 200 feet of the Kill von Beaste (also known as the East Branch of the Hackensack River) which connects Swartwout Lake with Rockland Lake. The Site is currently used as both office space and storage.

The property is bordered immediately to the north by a motel (Holiday Court); to the east by a storage facility (currently used as an indoor sporting facility), a stream (Kill von Beaste), and a wetland; to the south by a commercial property, and to the west by Route 9W. Residences are located further to the north and on the west sides of Route 9W.

1.2.2 Site History

The Site was previously used to manufacture lighting fixtures. Practices at the Site during the manufacturing of the lighting fixtures appear to have led to the contamination of site media, either from disposal of contaminants into floor drains at the Site, or spills/disposal to the ground surface within or outside of the building footprint.

1.2.3 Previous Field Investigations

Several investigations have been conducted previously at the Site and at several properties surrounding the Site. In 1998, Team Environmental Consultants, Inc. (TEAM) conducted a Phase I Environmental Site Assessment (ESA) of the Bram property and two adjacent properties to the east and northeast (TEAM, 1998). Also in 1998, Ballard Engineering Consulting, P.C. (Ballard), performed a groundwater investigation at the Site (Ballard, 1999). In 1990, three underground storage tanks (USTs) were removed at the request of the Rockland County Health Department (RCHD) from the property south of the Site.

The NYSDEC collected groundwater samples in 2003 from an inactive water supply well for the Site. MACTEC performed investigation activities from the fall of 2008 to the spring of 2011 and completed a Remedial Investigation and Feasibility Study (RI/FS) in May 2012 (MACTEC, 2012). Some of these investigations are discussed in more detail below. Existing groundwater monitoring well locations are presented on Figure 1.2. Existing monitoring well details are presented in Table 1.1.

1990 UST Removal. At the property to the south of the Site, three USTs were removed in 1990 at the request of RCHD (NYSDEC Spill no. 89-1 1904). The UST removals were performed by Tank Tech. Reporting was provided by Subsurface Investigations Inc. (SII) (SII, 1990). The three USTs consisted of two 4,000 gallon diesel fuel tanks and one 2,500 gallon unleaded gasoline tank. The diesel tanks were reported as "intact" and the gasoline tank was reported corroded with holes. Approximately 15 tons of contaminated soil was removed from the gasoline tank excavation. An 18-inch slotted monitoring well (MW-1) was installed in the contaminated soil area to be used as a recovery well if needed. Two 2-inch polyvinyl chloride (PVC) monitoring wells (MW-2 and MW-3) were also installed. Groundwater analytical data reported benzene, toluene, ethylbenzene, and xylene concentrations of 26 micrograms per liter (µg/L), 10 µg/L, 8 µg/L, and 33 µg/L respectively. Volatile organic compounds (VOCs) were not detected in the groundwater samples from MW-2 and MW-3. NYSDEC issued a "no further action at this time" decision.

1998 ESA. As part of the Phase I ESA performed by TEAM, the inactive water supply well was sampled. VOCs were detected in this sample including trichloroethylene (TCE) [7,500 µg/L], cis-1,2-dichloroethene (cis-1,2-DCE) [2,600 µg/L], 1,3-dichloropropane [510 µg/L], vinyl chloride [280 µg/L], and 1,1,1-trichloroethane (1,1,1-TCA) [87j µg/L]. The ESA notes that the water supply well was inactivated over twenty years ago (CIRCA 1970s). Other recognized environmental conditions were not observed at the time of this ESA publication (TEAM, 1998).

1998 Groundwater Investigation. The 1998 investigation by Ballard focused on collecting shallow groundwater from eight direct push borings (GW-B1 through GW-B8) (Ballard, 1999). Temporary sampling points were used to collect the groundwater samples. The inactive water supply well was also sampled. Analytical results indicated part per million concentrations of VOCs in GW-PW, GW-B1, GW-B2, and GW-B8. Compounds detected include the chlorinated solvents TCE, 1,1,1-TCA, and cis-1,2-DCE, and vinyl chloride, and the aromatic hydrocarbons trimethylbenzene, ethylbenzene, butylbenzene, propylbenzene, isopropylbenzene and xylenes. Highest levels of the chlorinated solvents

were in GW-PW and GW-B8 respectively and are likely related to the former Site activities. Highest concentrations of aromatic hydrocarbons are GW-B2 and GW-B1 respectively. These are presumed upgradient locations from the Site, downgradient of the former USTs, and are likely related to the former USTs.

NYSDEC sampling. In 2003, the NYSDEC sampled groundwater from the inactive water supply well (GW-PW) to determine if contaminant concentrations were remaining constant. Samples were obtained at 3 feet below ground surface (bgs) and 45 feet bgs in this well. Detected VOCs included TCE (9,500 µg/L), 1,2-DCE (3,100 µg/L), tetrachloroethene (300 µg/L), vinyl chloride (440 µg/L), and acetone (1,700 µg/L).

RI/FS. From 2008 to 2011, MACTEC conducted RI and FS activities at the Site, including monitoring well installations, groundwater sampling, indoor air and sub-slab soil vapor sampling, pore water sampling, surface water sampling, sediment sampling, and surface and subsurface soil sampling. The RI/FS was completed in May 2012 (MACTEC, 2012).

Based on historical and RI investigation results, the RI concluded that petroleum and chlorinated VOCs (primarily TCE) were discharged to the soils in the parking area south of the Bram building and possibly to the soil below the Bram building and are present in soils at the Site above the Chapter 6 New York State Codes, Rules, and Regulations (NYCRR) Part 375 Soil Cleanup Objectives for unrestricted use (the maximum concentration of TCE in soil was reported at 720 milligrams per kilogram (mg/Kg), and the maximum concentration of xylene in soil was reported at 3100 mg/Kg). Based on the concentrations detected, it is possible that TCE is or was present in soil as dense non-aqueous phase liquid (DNAPL). Much of the remaining contaminant mass (both chlorinated and petroleum related) has likely diffused into the silty matrix of the overburden, as well as into the bedrock fractures and pore space. This residual contamination appears to be a continuing source of both overburden and bedrock groundwater contamination (the maximum concentration of TCE detected in bedrock at MW-5B was reported at a concentration of 200,000 µg/L in a duplicate sample). Chlorinated VOC contamination in overburden groundwater appears to be diminishing as it flows east, presumably through anaerobic biological degradation, with the petroleum contamination likely acting as a source of carbon for the bacteria. Although contaminant concentrations in bedrock groundwater diminish north of the Site through dispersion, dilution, and biological process, contaminant concentrations may not have reached a steady

state due to the high concentrations of contamination present in soils and bedrock fractures at the Bram Manufacturing property.

Although groundwater in the vicinity of the Site is not used as a source of drinking water, one bedrock supply well was identified within the groundwater plume area and found to be contaminated. Although not used as a source of drinking water, the NYSDEC installed a point source treatment system at this location. Groundwater flow and contamination discharges to the Kill Von Beaste, both east and north of the Site, as well as to Swartwout Lake. There is also a component of groundwater flow and contamination that underflow these surface waters.

Chlorinated VOCs present in shallow groundwater in the vicinity of the Site appear to be volatilizing to soil vapor. The soil vapor has the potential to migrate to indoor air through soil vapor intrusion (SVI) and based upon detected contaminants in indoor air and sub-slab soil vapor samples, a complete exposure pathway is present. This complete exposure pathway from SVI was identified at the onsite building and the commercial property to the north of the Site.

The FS was conducted to evaluate remedial alternatives for remediation of Site soil, bedrock, groundwater, and soil vapor. Based on the FS, the chosen alternative consists of:

- Soil excavation for vadose zone contamination
- In-situ chemical oxidation (ISCO) for overburden contamination (at the Site and east of the Site)
- In-situ chemical reduction (ISCR) for bedrock source areas (i.e. at the Site and immediately north of the Site)
- Enhanced bioremediation for downgradient bedrock contamination (north of the Site)

Pilot Scale Studies and Pre-Design Investigations to Date. Phase I pre-design investigations and pilot scale studies were conducted at the Site from 2013 to 2014. The objectives of the pre-design investigation were to evaluate the nature and extent of the bedrock contamination below and north of the Site building, and the objectives of the pilot scale studies were to evaluate the effectiveness and implementability of the following remedial actions:

1) ISCO in the overburden soil and groundwater using permanganate (3,300 pounds of potassium permanganate were injected)
2) ISCR in the bedrock fractures and bedrock groundwater using zero valent iron (ZVI) (57,000 pounds of ZVI were injected)
3) Enhanced bio-remediation in off-site overburden/bedrock groundwater using Hydrogen Release Compound (an in-situ microcosm study was performed in MW-5DD).

The Pilot Scale Studies Investigations Report (MACTEC, 2015) describes the implementation, analysis and recommendations of the Phase I Pilot Scale Study and Pre-Design Investigation. The highest concentration of TCE detected in the bedrock groundwater during the pilot study was 900,000 µg/L in BIW-1. This concentration is close to the saturation limit of TCE, and although not visibly observed, or indicated by bedrock samples, it is highly likely that TCE as a DNAPL is present in the vicinity of this well.

Subsequent to its review of the results of the Pilot Scale Studies Report, the NYSDEC decided not to proceed with the original technologies selected for remediation. Rather, the NYSDEC has requested the evaluation of additional remedial alternatives.

2.0 SITE PHYSICAL SETTING

The physical characteristics of the site study area are presented in this section.

2.1 TOPOGRAPHY

The Site is located approximately 160 feet above mean sea level (msl). Topography at the Site is fairly level. Topography begins to rise steeply approximately 1/2 mile east of the Site as a result of the Palisades Sill, a prominent feature along the Hudson River. The Hudson River is approximately 4500 feet east of the Site. Several Lakes surround the Site to the south and east. Figure 1.1 shows these features and the general topography of the surrounding area.

2.2 CLIMATE

The climate of the area is characterized by warm summers and cool winters. Mean monthly temperatures range from 31 degrees Fahrenheit (°F) in January to 75°F in July. Average annual precipitation is 52 inches. Average annual snowfall is 30 inches per year (National Climatic Data Center, 1999).

2.3 SURFACE WATER HYDROLOGY

The Site is located on Route 9W and is within 200 feet of the Kill von Beast (also referred to as the East Branch of the Hackensack) which connects Swartwout Lake with Rockland Lake. Rockland Lake is approximately 1,800 feet south of the Site. Swartwout Lake is approximately 800 feet west and Congers Lake is approximately 2400 feet southwest of the Site. Surface water flow begins at Rockland Lake, through the Kill von Beast to Swartwout Lake, then to Congers Lake.

2.4 GROUNDWATER HYDROLOGY

Groundwater at the Site was determined to be within approximately three to six feet bgs. Shallow groundwater on the west side of the Site, near Route 9W is interpreted to flow to the north, towards the discharge of the Kill von Beaste into Swartwout Lake. Shallow groundwater in the central portion of the site, and in the vicinity of the identified soil contamination, is interpreted to flow east/northeast towards the Kill von Beaste (see Figure 1.2). Geometric mean hydraulic conductivity in the overburden was 4.01E-04 centimeter per second (1.14 feet per day). Based on a horizontal gradient of 0.0077 feet

per foot and an assumed porosity of 0.25, the average travel time for overburden groundwater was calculated to be approximately 12.8 feet per year.

Deeper bedrock groundwater flow is interpreted to flow north, then northwest towards Swartwout Lake (see Figure 1.2). Based on groundwater measurements collected during the RI, there is a semi-confining layer between the shallow groundwater (overburden) and deeper bedrock groundwater. Although vertical gradients were measured in the downward direction, data collected during a pumping test at MW-5DD indicated minimal effect in the overburden monitoring wells during pumping of the bedrock groundwater (e.g., approximately 0.2 feet of drawdown in overburden well MW-5, compared to 4.4 feet of drawdown in the shallow bedrock zone at MW-5B).

Hydraulic conductivity at MW-5DD was estimated from pumping test data at 1.8 feet per day, equating to a range in groundwater velocity of 229 feet per year to 920 feet per year based on the range in estimated bedrock porosity (0.005 to 0.02). Using information learned from the injection of iron into the bedrock fractures below and just north of the central portion of the Site building, the transmissivity of the bedrock aquifer in the vicinity of the injections was estimated to be half what was calculated during the RI.

2.5 GEOLOGY

Surficial Geology. Overburden in the vicinity of the Site consists of fine to medium sand and gravel with some gray silty clay according to the ESA (Ballard, 1999). Reference data provided in the UST removal reporting (SII, 1990) notes that the United States Department of Agriculture Soil Conservation Service Classification and Correlation of soils of Rockland County, NY designate the Site soils as WuB, Weathersfield-Urban which consists of very deep, well drained soils of upland areas. This soil is glacial till derived from mainly red sandstone shale and conglomerate.

Soil borings MW-1, MW-2, and MW-4 through MW-7 drilled in the vicinity of the Site during the RI/FS investigation encountered five to eleven feet of fill composed of silty sand and gravel. The fill material was underlain by a brown to reddish brown sand and gravel till containing varying amounts of silt and cobbles. Overburden thickness around the Site building is anticipated to range from approximately 20 feet to 30 feet. Due to the softness of the weathered rock, and the density/firmness of the till, the exact location of the overburden/bedrock interface is not well defined.

The borings completed east of the Site along the Kill Von Beaste (MW-8, 9, 10) encountered 4 to 5 feet of fill consisting of dark brown topsoil over reddish brown silty fine to medium sand, with some coarse sand, gravel, and cobbles. The fill was underlain by two to four feet of an organic silt material with some clay and traces of fine sand. The organic unit was underlain by a sand and gravel till which contained varying amounts of silt and occasional cobbles. Overburden thickness along the stream was observed from 16 to 31.5 feet.

Bedrock Geology. During the RI, fifteen bedrock explorations were drilled from 20 to 84 feet into bedrock to total depths of up to 101 feet bgs. Bedrock was encountered across the exploration area at depths ranging from nine to 43.5 bgs, and consists of reddish brown to dark reddish brown inter-bedded conglomerates, sandstones, and shale or siltstone. The bedrock is part of the Passaic Formation (formerly the Brunswick Formation) of the late Triassic or early Jurassic eras (NYS Museum, 1989). The Palisades Sill to the east of the Site consists of diabase; however, this formation was not encountered.

The bedrock was observed to be fractured with frequent horizontal and low angle fractures parallel to slightly metamorphosed bedding planes. Occasional high angle fractures and fracture zones connected the horizontal fractures. The finer grained layers of siltstone and fine grained sandstone were more highly fractured then the conglomerate and coarse grained sandstone layers. Bedrock also became more competent with depth. In general, the rock quality data descriptions for core runs in the upper portions of the boreholes were poor to fair becoming good to excellent in the lower portions of the boreholes.

The results of borehole geophysical logging at GW-PW showed bedrock planer features (bedding plane and joint plane fractures) had two primary strike directions north and northeast. The planer features generally dipped to the west and northwest at 10 to 20 degrees. A small subset of joint fractures dipped much more steeply at 60 to 70 degrees with a couple dipping to the west northwest and a couple dipping to the east southeast.

The subsurface bedrock topography is consistent with the regional topography with a bedrock high or ridge greater than 140 feet msl running north south from the Site building to the small bridge on Route 9W that spans Kill Von Beaste.

3.0 SCOPE OF WORK

This FAP provides necessary details for the implementation of the phase II pre-design investigations. The components of the scope of work include:

- Source Area Soil Removal Pre-Design Investigation
- Onsite Overburden/Bedrock Pump and Treat Pre-Design Investigation
- Off-site Bedrock Groundwater Pilot Scale Study Activities

A summary of the field tasks and methodologies, sample IDs and analytical program are described in more detail in Table 3.1, as well as in the following subsections. Existing onsite well locations and proposed new boring/well and test pit locations are shown on Figure 3.1.

3.1 GENERAL FIELD OPERATIONS

Companion documents to this FAP that will govern the execution of the field exploration activities include MACTEC's Program QAPP (MACTEC, 2011a) and HASP (MACTEC, 2011b). In addition to these program documents, Appendix A provides details related to health and safety for onsite activities as presented in the Site-specific HASP.

Subcontractors chosen to support the field activities include:

- Site survey will be completed by Prudent Engineering
- Underground utility clearance will be completed by New York Leak Detection, Inc.
- Test pits, overburden and bedrock borings/wells will be completed by Parratt Wolff, Inc.
- Transport and disposal of Investigation Derived Waste (IDW) will be provided by Environmental Waste Minimization, Inc.
- Bio-trap microbial analysis will be completed by Microbial Insights, Inc.
- Soil and groundwater sample analysis will be provided by Spectrum Analytical Inc.

3.1.1 Health and Safety

The Site-specific HASP is provided as Appendix A to this document. Based on available Site information, MACTEC anticipates that the pre-design field work will be conducted in Level D personal protection. Specific investigation activities 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 onsite, 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 New York State Department of Health Community Air Monitoring Plan (included in Appendix A) will be followed.

3.1.2 Mobilization

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

3.1.3 Decontamination

Sampling methods and equipment have been chosen to minimize decontamination requirements mitigating potential for cross contamination. Disposable sampling equipment will be used to the extent practical to minimize decontamination time and water disposal. Non-disposable sampling equipment will be decontaminated before and after collection of each sample. Decontamination methods and materials are described in detail in Subsection 4.3 of the QAPP (MACTEC, 2011a).

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 will be decontaminated by steam cleaning with potable water prior to each boring, and before leaving the Site. Drilling equipment (i.e. drill rods and casing) will be decontaminated on a temporary decontamination pad constructed at the Site. Decontamination fluids will be containerized for off-Site disposal.

3.1.4 Investigation Derived Wastes

The method of disposing IDW generated during this Pre-Design Investigation will be based upon whether the wastes are considered hazardous or non-hazardous. The approach to field screening and handling of the IDW are described in the following paragraphs.

United States Department of Transportation (USDOT) -approved 55-gallon containers filled during the field investigation will be staged onsite in an area designated by the NYSDEC, and approved by the Site owner. Transport and disposal of these containers will be arranged by MACTEC on behalf of the NYSDEC. Containers will be labeled with the following information: drum contents; Site name and the NYSDEC Site Number; and date drum filling began and date drum was sealed.

Disposable Sampling Equipment. Used disposable equipment will be double bagged in polyethylene trash bags and sealed with twist ties. MACTEC personnel will measure the headspace in the closed bags with a photoionization detector (PID) at least one hour after sealing the bags. If the headspace reading is greater than 5 parts per million (ppm), the tubing will be decontaminated by flushing with potable water and bagged. This process will be repeated until PID readings are below 5 ppm, or for a maximum of three times. If the headspace is below 5 ppm, the disposable equipment will be disposed of as non-hazardous municipal solid waste. If the headspace readings do not drop below 5 ppm, the disposable equipment will be placed in USDOT approved 55-gallon containers for off-Site disposal.

Personal Protective Equipment. Used protective clothing will be double bagged in polyethylene trash bags and sealed with twist ties. The bags will be disposed of as municipal solid waste.

Well Purge Water. Purge water generated during monitoring well sampling will be released onsite to the ground surface in the area of the well if prior well-specific analytical data indicates that VOC concentrations are below the NYS Class GA groundwater criteria. Purge water generated during step and pumping tests, from new wells, or wells with prior analytical data indicating that concentrations are above the NYS Class GA groundwater criteria will be containerized in USDOT approved 55-gallon containers, or in a 10,000-gallon storage tank (frac tank) that will be stored at the Site during the test. Water in the frac tank will be trucked to a licensed disposal facility for treatment and discharge upon completion of the field sampling activities.

Drill Cuttings. Drilling soil cuttings and rock mud will be containerized in USDOT 55-gallon drums for off-Site disposal.

3.2 PRE-DESIGN INVESTIGATION SURVEY

Prior to intrusive field work, MACTEC's utility locating subcontractor will complete a utility location survey. Included in the survey will be a video inspection of the roof drains located on the east side of the Site building and of the storm drain line that located in the alley between buildings, to assess potential drainage system impacts when implementing pre-design and/or remedial action within the alley way.

Concurrently, a MACTEC representative will conduct a site reconnaissance of potentially available locations, inside and outside of the building, to place the full scale pump and treat control system, and of potential locations of sanitary sewer entries that could be used for discharge of treated water during full-scale remedial action.

Additionally, prior to intrusive field work, MACTEC's survey subcontractor will complete:

1) a metes and bounds survey to identify Site property boundaries, including locations of roof drains and subsurface storm water systems located east of the Site building that were identified by the utility locating sub-contractor
2) a topographic survey (0.5 foot contours) of the Site to support the proposed soil excavation activities and location of the pump and treat system.

After the completion of intrusive field work activities, MACTEC's survey subcontractor will then complete a survey of the newly installed test pits and boring/well locations (see section 3.7 for further detail).

The surveyor will submit the survey drawings as an electronic drawing in AutoCAD 2006 (or later) compatible format that includes all located site features, boundary information, survey points, TIN, and horizontal/vertical survey control for the surveyed property, as well as an un-editable electronic file in .pdf, .tiff, or similar format of the full-size survey drawing/map, with certification statement, seal, and signature. In addition, the surveyor will present horizontal and vertical locations in an excel spreadsheet. Horizontal locations will be tied to the NYS Plane Coordinate System using North American Datum of 1983, and will be to an accuracy of 0.1 foot. Vertical elevations of groundwater wells will be tied to msl, using North American Vertical Datum of 1988, and measured to an accuracy of 0.01 foot.

3.3 SOURCE AREA INVESTIGATION

MACTEC will contract and oversee the implementation of a pre-design investigation to support design of the soil removal to address onsite overburden source area soil contamination. Figure 3.1 shows locations of the borings discussed below.

3.3.1 Source Area Soil Boring and Monitoring Well Installation

Five soil (BS-29 through BS-33) borings will be advanced to further refine the horizontal and vertical extent of contaminated soil within the determined source area. The borings will include one in the vicinity of MW-1, one in the center of the excavation area identified during the FS and shown on Figure 3.1, and three on the edges of the proposed excavation area (south, west, and north sides).

Due to the dense till below approximately 12 feet bgs, the overburden soil borings will be advanced to bedrock using a combination of hollow stem auger and mud rotary. Continuous split spoon samples will be collected in the overburden to conduct standard penetration tests for excavation design, as well as to screen soils with a PID to evaluate for the presence of VOCs. Samples will be described using the Unified Soil Classification System. The sample description and classification, VOC headspace reading, and boring observations will be recorded on the Field Data Record (FDR) as discussed in Subsection 4.5.2.2 of the QAPP (MACTEC, 2011a)

Up to four soil samples from each boring will be collected and submitted to Spectrum Analytical Inc. for analysis of VOCs by method 8260. Samples will be collected from approximately each five foot interval, and will be based on the greatest observed PID readings.

The five borings will be continued approximately five feet into bedrock with coring tools to assess the competency of the bedrock for the potential shoring design. One shallow bedrock sample each will be collected from the three potentially contaminated locations (BS-29, BS-32, and BS-33) to evaluate if contamination migrated from the overburden to the shallow bedrock in these areas. Bedrock samples will be collected using the methanol extraction of rock chips (methanol extraction of rock chips [MERC] technique as described in Subsection 4.5.3 of the QAPP (MACTEC, 2011a).

Two samples each from soil borings BS-29, BS-30, and BS-31 (a total of six samples) will be submitted to the laboratory for analysis of select geotechnical parameters (grain size, moisture content, Atterberg

limits, total organic carbon) for evaluating excavation stability and the need for shoring during the remedial action excavation.

Additionally, one composite shallow soil sample (0-8 feet bgs) will be submitted for full suite analysis for predisposal characterization, including: Total polychlorinated biphenyls (PCBs) by method 8082, Toxicity Characteristics Leaching Procedure (TCLP) VOCs by method 8260, TCLP Semi-VOCs (SVOCs) by method 8270, TCLP Pesticides by method 8081, TCLP metals by methods 1311/6010 and 7471, Ignitability by method 1030, and Reactivity by methods 9010 and 9030.

To evaluate overburden groundwater quality in the overburden source area, and allow for evaluating groundwater flow with a dye test, the soil boring in the center of the projected excavation area (BS-29) will be completed with a 2-inch inside diameter schedule 40 PVC well set approximately five feet above bedrock (well depth maybe if PID readings indicate contamination is primarily shallow). The bottom of the boring below the wells will be plugged with bentonite, with six inches of sand on top to place the well. The wells will be set with a ten-foot screen and threaded flush joint riser in accordance with Subsection 4.4.4 of the QAPP (MACTEC, 2011a). Well screens will have 0.010-inch wide machine slots with # 0 sand pack to two feet above the screen, a two foot bentonite seal above the sand pack, and a bentonite grout backfill to the ground surface. The well (MW-29) will be completed with a locking cap and a six-inch flush mount cover, with a two foot concrete apron.

Upon completion of the monitoring well installation, the newly installed monitoring well will be developed (no sooner than 24 hours after installation for wells installed with top of screens below the water table) by over pumping as described in the Section 4.4.4 of the QAPP (MACTEC, 2011a).

The remainder of the borings will be backfilled with bentonite grout to prevent vertical movement of contamination.

3.3.2 Source Area Test Pit Excavation

Two test pits (TP-1 and TP-2) will be excavated adjacent to the site building and will extend as deep as needed to observe the foundation footing. It is not known if the original building or its additions, were built with exterior column footing; therefore, the location of the test pits will be determined by the field technician, to ensure completion of the test pit adjacent to a building column, if present, to observe the

footer construction. Soil will be logged using the Unified Soil Classification System. The objective of the test pit effort is to obtain visual observations and measurement of existing footings of the Site buildings for use during the remedial design for the excavation. Test pit observations will be recorded on the Test Pit FDR as provided in Figure 4.3 of the QAPP (MACTEC, 2011a). The test pit locations are shown on Figure 3.1 and the proposed field task and methodology are included in Table 3.1.

3.3.3 Source Area Dye Test

A dye test will be performed using the new 2-inch monitoring well (MW-29) to assess groundwater movement within the overburden source zone. The fluorescent dye fluorescein will be introduced to the source area overburden well, and eastward migration will be assessed by visible evidence of dye within existing overburden well MW-4, and new wells MW-23, MW-24, and MW-26 (see Subsection 3.4.1) located in the Site alleyway. To confirm groundwater is not moving in other directions, visible observations of groundwater in wells MW-1 and MW-5 will also be conducted. Water will be pumped from the observation wells approximately monthly to evaluate for visual observation of the dye. For the test, one gallon of liquid Bright® Dyes fluorescent yellow/green biodegradable dye will be introduced into the well after the completion of the pumping tests described in Section 3.4.

3.4 SOIL BORINGS AND WELL INSTALLATION

3.4.1 Overburden Soil Boring and Monitoring/Extraction Well Installation

To evaluate the horizontal and vertical extent of VOCs in the overburden groundwater migrating east of the Site building, and to allow for the completion of a pilot study pumping test, four overburden wells are planned as described below and as shown on Figure 3.1. The actual location of the well installation may vary based on access and/or utility clearances.

Four overburden soil borings (BS-23 to BS-26) will be advanced using hollow stem auger and mud rotary due to the hard till anticipated at approximately 15 feet bgs. Boring installations will begin at location BS-25, with the remaining borings completed after the installation of the monitoring well at BS-25. Soil samples will be collected from approximately each five foot interval, beginning at five feet bgs and continuing to bedrock at each boring location, to assess the vertical extent of contamination. PID headspace readings will be used to screen soil samples for the presence of VOCs; samples will be selected for laboratory analysis based on highest PID readings. Samples will be described using the

Unified Soil Classification System. The sample description and classification, VOC headspace reading, and boring observations will be recorded on the FDR as discussed in Subsection 4.5.2.2 of the QAPP (MACTEC, 2011a). Attempts will also be made at BS-25 to use a hydropunch or similar sampler to collect groundwater samples in advancement of the drilling.

Up to five soil and groundwater samples from BS-25 will be submitted to the analytical laboratory, based on highest PID headspace readings, for quick-turn (24-hour) VOC analysis. Up to five soil samples will also be submitted from BS-23, BS-24, and BS-26 for VOC analysis, with standard turnaround time. Additionally, one soil sample will also be submitted for grain size analysis and total organic carbon from each boring from the approximate location of the well screen.

After the analytical results of the soil samples have been reviewed, boring BS-25 will be completed as a 4-inch extraction well (EW-25). It is anticipated that the well will be screened from approximately five feet to 25 feet bgs (i.e., approximately top of rock), but depth may be less if field screening and 24-hour quick turn analytical results do not indicate contamination in the deeper overburden. Bentonite chips will be used to seal the bottom of the borehole, and a minimum of one foot of bentonite chips will be placed between the top of bedrock and the bottom of the wells screen. The extraction well will be installed using a 4-inch ID, up to 20-foot long 10-slot PVC screen and four-inch ID PVC riser to ground surface. A number zero sand pack will be installed around the screen, with the sand pack extending one foot above the well screen, and a two foot bentonite seal above the sandpack. The well will be completed with an eight inch flush mount well casing. The extraction well will be installed as described in Section 4.4.4 of the QAPP (MACTEC, 2011a).

The remaining three borings (BS-23, BS-24, and BS-26) will be drilled to rock and completed as 2-inch monitoring wells with the well depth matching that determined for EW-25 (the boring space below the bottom of the well screen will be filled with bentonite chips, with six inches of sand on top of the bentonite to set the well). The wells will be completed with a 2-inch ID schedule 40 PVC with a ten-foot well screen and threaded flush joint riser in accordance with Subsection 4.4.4 of the QAPP (MACTEC, 2011a). Well screens will have 0.010-inch wide machine slots with # 0 sand pack to 2 feet above the screen, a two foot bentonite seal above the sand pack and a bentonite grout backfill to the ground surface. The wells will be completed with a locking cap and a six-inch flush mount cover, with a two foot concrete apron.

3.4.2 Bedrock Boring and Monitoring/Extraction Well Installation

Three bedrock borings/wells are proposed for the purpose of:

1) Evaluating the vertical extent of groundwater contamination in the bedrock (BS-34/MW-34B)
2) Evaluating the eastern edge of the bedrock groundwater plume in the vicinity of the source area (BS-28/MW-28B), and
3) Extracting contaminated groundwater to prevent the continued migration of the contaminated bedrock groundwater from the source area (BS-27/EW-27B).

The casings for these wells will be installed after the installation of BS-25 (as described above) and in the interim waiting period for the 24-hour quick turn soil and groundwater VOC results.

Cross sections of the site showing lithology, previous sampling locations, VOC sample results, and potential area of impact of the ZVI injections are included in Appendix B. The depth of the bedrock contamination at the Site was not previously defined. To evaluate the vertical extent of contamination and the optimal location for the bedrock extraction well screen, boring BS-34 (Figure 3.1) will be completed first. This will be installed by setting a temporary eight inch casing, two feet into bedrock using either mud rotary or drive and wash techniques, as described in Subsection 4.4.3 of the QAPP (MACTEC, 2011a). Once the temporary casing is installed, the borehole will be advanced using 6-inch air hammer to a depth of 70 feet bgs and a four inch steel casing will be cemented into place. Previous bedrock and groundwater samples indicate that the majority of the bedrock contamination is between approximately 30 and 70 feet bgs and bedrock fractures were determined to be highly interconnected, although they become less numerous with depth. This casing will be placed to seal off the upper fractures to prevent the vertical migration of this source area contamination, and allow a better evaluation of the deeper bedrock fractures. Once the casing has set, the boring will be continued to approximately 210 feet bgs using air hammer techniques.

Upon completion of the boring/well installation, the newly installed well will be developed by overpumping as described in the Section 4.4.4 of the QAPP (MACTEC, 2011a).

Once the well is developed, the borehole geophysical logging suites outlined below will be completed to locate water bearing fractures and to map the attitude of observed fractures.

- Acoustic televiewer and optical televiewer data will be collected to determine the location and attitude of fractures exposed in the bedrock borehole.

- 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.
- Electrical logs (single point resistance, spontaneous potential, fluid conductivity) indicate the presence of hydraulically active fractures and possible changes in lithology.
- 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.

Based on the bedrock cores and the geophysics, six fracture zones will be targeted for packer sampling. Packer sampling will be completed by sealing off both ends of a 10-foot 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). Depending on the space available in the packer rods, water levels may be measured using a transducer. Upon completion of the sampling, the pump rate will be increased and water levels will be recorded within and outside of the packered zone, as well as in wells MW-5B, GW-PW, and BIW-1. One pumping rate will be evaluated to assess the connectivity of the packered zone to the nearby wells. It is estimated that approximately two hours will be spent conducting sampling on each zone, so that the packer sampling will be completed in two working days.

The packer sampling results, bedrock core evaluation, and geophysics results, will be used to assist in determining the depth for the installation of the extraction well EW-27B. In addition, these results will be used to determine if a continuous multi-channel well should be installed inside the borehole to allow for future monitoring of distinct zones within the borehole. If applicable, a FAP addendum will be issued for the installation of this multi-channel well.

Based on the findings of MW-34B, two bedrock well borings (BS-27 and BS-28) (Figure 3.1) will be installed (currently anticipated to be installed to approximately 45 feet below the top of bedrock, anticipated to be present at approximately 25 feet bgs – see cross section in Appendix B). Due to the dense till, the bedrock borings will be advanced to the top of bedrock using hollow stem auger and mud rotary techniques, as described in Subsection 4.4.3 of the QAPP (MACTEC, 2011a). At BS-27, a temporary 6-inch steel casing will be set 1.5 feet into the top of rock. At BS-28, the top 1.5 feet of rock will be drilled using a 6 ¼ tri-cone bit, to allow the setting of a permanent 4-inch steel casing into bedrock. Once the casings are set, borings will continue using HQ-size rock coring equipment up to 70

feet to evaluate the potential for water bearing fractures. Rock cores will be described using the procedures outlined in Section 4.4.3.5 of the QAPP (MACTEC, 2011a). In addition, up to four MERC samples will be collected from each boring to evaluate the potential for VOC contamination within the fractures, and to evaluate the extent of contamination that may have diffused into the bedrock matrix. MERC sampling techniques are described in Subsection 4.5.3 of the QAPP (MACTEC, 2011a). Samples will be submitted for laboratory analysis of VOCs by United States Environmental Protection Agency (USEPA) Method 8260.

Geophysics, as described above for BS-34, will also be conducted on BS-28 to evaluate water bearing fracture zones.

Bedrock boring (BS-27) will be converted into an extraction well (EW-27B) to provide hydraulic control of the source area bedrock groundwater plume to reduce concentrations of VOCs migrating downgradient of the Site. Borehole (BS-27) will be drilled out to six-inch diameter using a tricone bit. The extraction well will be installed using a four-inch ID 40-foot long wire round 20 slot stainless steel screen and four-inch ID stainless steel riser to ground surface (currently anticipated to be installed to a depth of 65 feet bgs, but may change based on findings of BS-34/MW-34B). The well will be completed with an eight inch flush mount well casing. The extraction well will be installed as described in Section 4.4.4 of the QAPP (MACTEC, 2011a).

3.4.3 Groundwater Monitoring Well Development

Upon completion, the newly installed monitoring wells will be developed (no sooner than 24 hours after installation for wells installed with top of screens below the water table) by overpumping as described in the Section 4.4.4 of the QAPP (MACTEC, 2011a).

3.5 GROUNDWATER SAMPLING AND MONITORED NATURAL ATTENUATION PRE-DESIGN ACTIVITIES

3.5.1 Baseline Groundwater Sampling

Baseline groundwater sampling will be conducted to update the existing groundwater dataset. Approximately 50 groundwater samples (plus those for quality control [QC]) will be collected from

existing and newly installed overburden and bedrock wells for VOC analysis. Wells to be sampled include those in the individual pilot tests described above and shown on Figures 1.2 and 3.1.

After new wells have been installed and developed, groundwater samples will be collected as outlined in Table 3.1. Groundwater analytical data will be used as a baseline to the RD, as well as part of the individual pilot studies. Groundwater samples will be collected no sooner than two weeks following the development of the newly installed monitoring/injection wells. Prior to well sampling, a round of water levels will be collected. Monitoring wells will then be sampled using low-flow sampling procedures as described in the Section 4.5.4.3.2 of the QAPP (MACTEC, 2011a). Samples will be collected from the least contaminated to the most contaminated locations as determined from the assumed groundwater flow direction and historic analytical data.

Field measurements for pH, temperature, specific conductivity, oxidation reduction potential, dissolved oxygen, and turbidity will be collected through a flow through cell (with the exception of turbidity) from each monitoring well during pre-sample purging. Field measurements and monitoring well sampling activities will be documented using a Low Flow Groundwater Data Record (QAPP Figure 4-17; MACTEC, 2011a).

Groundwater samples from monitoring wells will be analyzed for VOCs by USEPA Method 8260, as described in the NYSDEC Analytical Services Protocol of June 2005 (NYSDEC, 2005). Samples from seven wells (MW-3B [background], MW5B, MW-12B, MW-22B, EW-27B, BIW-1, and BIW-2) will be analyzed for Natural Attenuation Parameters, including total organic carbon, ethene, ethane, methane, chloride, nitrite, nitrate, sulfide, sulfate, carbon dioxide, iron, manganese, and alkalinity.

To evaluate for the potential presence of 1,4-dioxane, three overburden groundwater monitoring wells (MW-1, MW-4, MW-29) and three shallow bedrock groundwater samples (GW-PW, MW-22B, MW-7B – shallowest sampling port), will be analyzed for 1,4-dioxane by USEPA Method 8270 selected ion monitoring (SIM).

In addition, groundwater samples from the newly installed extraction wells EW-25 and EW-27B will be submitted for analysis of the following parameters to evaluate possible treatment options:

- Target analyte list (TAL) Metals

- Hardness
- Alkalinity
- Total dissolved solids
- Total suspended solids

Purge water from the new wells and from wells where previous analytical results indicated concentrations of contaminants above NYS Class GA groundwater standards will be containerized in a frac tank for future off-site disposal. Wells with previous analytical data indicating concentrations of contaminants below groundwater standards will be allowed to infiltrate into the ground surface at the well location. If contamination is observed, purge water will be containerized.

3.5.2 Microbial Population Assessment

Evaluation of the existing microbial populations and potential effectiveness of natural attenuation in the bedrock groundwater contaminant plume will be conducted. Un-baited standard Bio-Trap samplers supplied by Microbial Insights, Inc. will be installed in three wells (one upgradient of the source area [MW-3B], one in the source area [EW-27B], and one further downgradient [MW-7B]) to evaluate the existing microbial population in the bedrock plume. The Bio-Trap samples will be collected after a minimum of 60 days after the installation.

Bio-Trap groundwater samplers will be installed upon completion of the baseline groundwater sampling. Sampler placement and removal will be conducted following the manufacturers recommendations supplied with the samplers. General description of the Bio Trap samplers and sampling protocols are included in Appendix C.

Upon retrieval, Bio-Traps will be submitted to Microbial Insights, Inc., for analysis of microbial populations necessary for the bio-degradation of the chlorinated solvents (e.g., dehalococcoides).

3.6 GROUNDWATER EXTRACTION PILOT STUDY

Upon completion of monitoring well development, step tests will be performed on the two extraction wells. The step test will be performed by pumping each well at three different rates for a two hour period each, and recording the pumping rate and the level at which the depth to water stabilizes. The test can

be run for a shorter time if the water level stabilizes; however, each step should be run for at least one hour.

In addition, hydraulic conductivity tests will be performed on the new overburden and bedrock monitoring wells. The procedures for conducting the hydraulic conductivity tests are presented in Subsection 4.7.2 of the QAPP (MACTEC, 2011a). The hydraulic conductivity tests will consist of slug tests, using a solid mass of PVC (the slug) and a data logger. For wells with screens installed across the water table, two rising head tests will be conducted at each well. For wells with screens installed below the water table, one rising and one falling head test will be conducted at each well. Hydraulic conductivity test data will be analyzed by the methods of Hvorslev (1951) and Bouwer and Rice (1976).

The pumping tests will be used to measure aquifer hydraulic characteristics (transmissivity and storativity) over a large aquifer volume. The tests will also determine other characteristics such as the area of influence of a pumping well and the location of recharge zones. The tests will consist of pumping water from one well at a constant rate (i.e. constant rate test) while measuring drawdown versus time in that well and in observation wells located at various distances from the pumping well. Measurements will be made both during and after pumping to observe water level recovery. Interpretations of the time-drawdown and distance-drawdown plots will be the basis for determining specific groundwater system characteristics. The pumping rates used for the constant-discharge test will be determined based on results of the step tests.

The two pumping tests will be performed at locations near the interpreted center of 1) the overburden groundwater VOC plume at EW-25, and 2) the bedrock groundwater VOC plume at EW-27 to provide data to refine estimates of extraction rates and capture zones. The test results will be used to determine the pumping rate necessary to provide containment of the VOC plumes near the source, and to determine whether the two pilot extraction wells will suffice or if additional extraction wells will be necessary.

Monitoring wells MW-4, MW-9, MW-23, MW-24, MW-26, MW-29, GP-1A, GP-2A, GP-3, and GP-4 will serve as the monitoring observation wells for the overburden pumping test. Figure 3.1 shows the locations of these wells.

Monitoring wells GW-PW, BIW-1, BIW-2, MW-5, MW-5B, MW-6B, MW-7B, MW-22B, and MW-28B will serve as the monitoring observation wells for the bedrock pumping test. Figure 3.1 shows the locations of these wells.

3.6.1 Overburden Pumping Test

The constant-rate test will be conducted for a maximum of 24 hours, starting with the overburden extraction well EW-25. Before, during, and after the test, water level changes in the overburden extraction well and overburden observation wells (MW-4, MW-23, MW-24, and MW-26) will be monitored using pressure transducers connected to an electronic data logger. At least one monitoring well (MW-6) outside the anticipated extraction well's zone of influence will also be monitored with a pressure transducer as a reference well, for the purposes of evaluating background water level trends. This well will be monitored throughout the duration of both overburden and bedrock pumping tests. Water levels in the other overburden observation wells observed (MW-9, MW-29, GP-1A, GP-2A, GP-3, and GP-4) will be measured with a hand held water level meter. The water levels in the monitoring wells will be measured for approximately 12 hours before the start of the test, and following the cessation of pumping, until the water table has recovered to 90% of the pre-test static water level. Extraction rates will be monitored with an instantaneous flow meter, as well as with a totalizing flow meter. The procedures of aquifer pumping test implementation and data analysis are presented in Appendix D. Based on the tight soils at the site, the pumping rate for the overburden extraction well is anticipated to be less than one gallon per minute. Groundwater extracted during the pumping test will be transferred to the frac tank for off-site disposal pending analysis.

3.6.2 Bedrock Pumping Test

After completion of the overburden pumping test, a bedrock constant-rate test will be conducted for a maximum of 24 hours at EW-27B. Before, during, and after the test, water level changes in the bedrock extraction well and bedrock observation wells (MW-22B, MW-28B, and BIW-2) will be monitored using pressure transducers connected to an electronic data logger; the remaining bedrock observation wells listed in Section 3.6 will be monitored by hand using a water level meter (GW-PW, BIW-1, MW-5, MW-5B, MW-6B, and MW-7B). At least one monitoring well (MW-03B, Figure 1.2) outside the anticipated extraction well's zone of influence will also be monitored with a pressure transducer as a reference well, for the purposes of evaluating background water level trends. This well will be

monitored throughout the duration of both overburden and bedrock pumping tests. The water levels in the monitoring wells will be measured for approximately 12 hours before the start of the test, and following the cessation of pumping, until the water table has recovered to 90% of the pre-test static water level. Extraction rates will be monitored with an instantaneous flow meter, as well as with a totalizing flow meter. The procedures of aquifer pumping test implementation and data analysis are presented in Appendix D. Based on previous pumping test conducted in the area, the pumping rate for the extraction well is anticipated to be less than two gallons per minute. Groundwater extracted during the pumping test will be transferred to the frac tank for off-site disposal pending analysis.

At the conclusion of the groundwater extraction pilot study, a summary report will be prepared to summarize the results of the study, including discussions of flow rates and area of influence, as well as to discuss the feasibility of implementing an effective overburden and bedrock groundwater extraction system at the Site on a full-scale basis. Data collected can also be used to assess potential injection rates, should injection of extracted and treated groundwater be evaluated in the future.

3.7 SITE SURVEY

The seven newly installed monitoring and extraction wells and the four additional borings will be surveyed. Horizontal locations will be tied to the NYS Plane Coordinate System using North American Datum of 1983, and measured to an accuracy of 0.1 foot. Vertical elevations of groundwater monitoring wells will be tied to msl, using National Geodetic Vertical Datum of 1988, and measured to an accuracy of 0.01 foot. Locations of the Geoprobe borings will be surveyed using a Trimble Global Positioning System.

3.8 FIELD ACTIVITIES SCHEDULE

The planned sequence and anticipated field day duration for the investigation tasks are, in chronological order:

- utility clearance – one day
- boundary and topographic survey – one day
- overburden soil borings (11), installation of extraction wells (2) and monitoring wells (5), test pits (2) and development of new wells – 20 days
- step tests (at 2 extraction wells) – one day
- hydraulic conductivity tests (at 5 new monitoring wells) – one day

- baseline groundwater sampling – seven days
- Bio-Trap installation – 1 day
- overburden pumping test – 2.5 days
- bedrock pumping test – 2.5 days
- introduction of dye into MW-29 – one day
- Bio-Trap retrieval – 1 day
- observation of dye movement – 1 day (monthly occurrence after introduction)
- survey of new wells and soil borings – one day

3.9 ANALYTICAL METHODS AND DATA OBJECTIVES

Soil and groundwater samples will be collected for laboratory analysis. The following analytical methods will be used:

Groundwater

- VOCs by Method 8260C
- 1,4-dioxane by Method 8270 SIM (reporting limit of 0.2 ug/L and detection limit of 0.07 ug/L)
- Alkalinity by Method SM 2320B
- Chloride and sulfate by Method 300.0
- Nitrate and nitrite by Method 300.0
- Sulfide by Method SM 4500D S2-D
- Iron and manganese by Method 6010C
- TAL metals by Methods 6010C/7470A
- Ethene, ethane, and methane by Modified Method 3C/RSK-175
- Carbon dioxide by Modified Method 3C/RSK-175
- Total organic carbon by Method SM 5310B
- Hardness by Method SM 2340B
- Total dissolved solids by Method SM 2540C
- Total suspended solids by Method SM 2540D

Soil

- VOCs by Method 8260C
- Total PCBs by Method 8082

- TCLP VOCs by Methods 1311/8260C
- TCLP SVOCs by Methods 1311/8270D
- TCLP Pesticides by Methods 1311/8081B
- TCLP metals by Methods 1311/6010C and 7471B
- Ignitability by Method 1030
- Reactivity by Methods 7.3.3.2 (Cyanide) and 7.3.4.2 (Sulfide)
- pH/corrosivity by Method 9045
- Total organic carbon by Lloyd Kahn Method
- Grain Size by Sieve
- Atterberg Limits

Laboratory results will be reported in a Category B deliverable. A summary of target analytes and reporting limits for these methods is presented in Appendix E. Tentatively identified compounds will not be reported.

Groundwater samples will be compared to the Class GA groundwater standards and guidance values in the Technical and Operational Guidance Series 1.1.1. Soil samples will be compared to 6 NYCRR Part 375 Soil Cleanup Objectives for unrestricted and commercial use.

Laboratory data review levels are specified for each media below. Data review includes Category A review or Data Usability Summary Report (DUSR). The DUSR review will be completed based on NYSDEC DER-10 guidance (NYSDEC, 2010). QC limits found in USEPA Region 2 validation guidelines in combination with the referenced analytical methods will be used during the data validation. The DUSR review includes the following evaluations:

- Lab Report Narrative Review
- Data Package Completeness and chain of custody (COC) records
- Sample Preservation and Holding Times
- Initial/Continuing Calibration (including tunes for Gas chromatography/Mass spectrometry)
- QC Blanks
- Laboratory Control Samples
- Matrix Spike/Matrix Spike Duplicates
- Surrogate Spikes (if applicable)
- Internal Standard Response and Retention Times

- Field Duplicates
- Target Analyte Identification and Quantitation
- Raw Data Checks, Calculation Checks, and Transcription Verifications
- Reporting Limits
- Electronic Data Qualification and Verification

Category A reviews are specified for sample data where a minimum level of evaluation is appropriate due to data use objectives. The Category A review is similar to a Stage 1 review specified in USEPA guidelines for Superfund Sites (USEPA, 2009). The Category A review includes the following evaluations:

- Lab Report Narrative Review
- Data Package Completeness and COC records (Table 1 verification)
- Sample Preservation and Holding Times
- QC Blanks
- Field Duplicate Evaluation (if available)
- Matrix spike and Matrix Spike Duplicate Evaluation (if available)
- Reporting Limits
- Electronic Data Qualification and Verification

The following data quality reviews will be completed on laboratory data collected during this investigation:

- Soil VOC – DUSR
- Soil non VOC - None
- Groundwater VOC- DUSR
- Groundwater non VOC – Category A Review

3.10 REPORT SUBMITTAL

A Phase II Pre-Design/Pilot Studies Report will be prepared to document the investigation findings and to evaluate the viability of the remedial alternatives (groundwater pump and treat and/or monitored natural attenuation) being considered, with the objective to support the future preparation of the remedial design. The report will provide the results of the Pre-Design and Pilot Scale Studies and baseline groundwater sampling event, summarize the findings for each study, present conclusions associated with

the studies, and provide recommendations to support a full scale remedial design. An EQuIS EDD will also be provided to the NYSDEC to document the sample location coordinates, the sampling depths, and the laboratory analytical results.

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FIGURES

PHASE II PRE-DESIGN FAP
BRAM MANUFACTURING
CONGERS, NEW YORK

MACTEC

SITE LOCATION MAP

Project 3612132269 Figure 1.1

Document: P:\Projects
ysdec1\Contracts D004434 and D004444\projects\Bram Manufacturing\4.0 Project Deliverables\4.5 Databases\GIS\MapDocuments\Bram_SiteLocationMap.mxd PDF: P:\Projects
ysdec1\Contract\D007613\Projects\Bram Manufacturing - RD\4.0_Deliverables\4.2_Work_Plans\RD Phase II Pre-Design Investigation FAP\Figures\Figure 1.1_site location map.pdf 02/22/2016 2:47 PM brian.peters

PHASE II PRE-DESIGN FAP
BRAM MANUFACTURING
CONGERS, NEW YORK

MACTEC

Existing Groundwater Well Locations

Project 3612132269

Figure 1.2

Document: P:\Projects
ysdec1\Contracts D004434 and D004444\projects\Bram Manufacturing\4.0 Project Deliverables\4.5 Databases\GIS\MapDocuments\Phase II\PhaseII_PreDesign_11x17LS.mxd PDF: P:\Projects
ysdec1\Contract D007619\Projects\Bram Manufacturing - RD\4.0_Deliverables\4.2_Work_Plans\RD Phase II Pre-Design Investigation FAP\Figures\Figure 3.1 - Proposed Explorations.pdf 03/29/2016 9:27 AM brian.peters

Legend

Proposed:

- BS/MW/EW for Bedrock Pump and Treat Pre-Design Investigation Exploration
- BS/MW/EW for Overburden Pump and Treat Pre-Design Investigation Exploration
- BS/MW Source Area Excavation Pre-Design Investigation Exploration
- Proposed Test Pit
- BS = Soil Boring
- EW = Extraction Well
- MW = Monitoring Well
- Proposed Excavation Area

Existing:

- Overburden Well
- Bedrock Well
- Microwell

N

0 10 20 Feet

Rockland County color digital orthoimagery (2013) obtained from New York State GIS Clearinghouse at: gis.ny.gov

Prepared/Date: BRP 03/29/16
Checked/Date: MJS 03/29/16

PHASE II PRE-DESIGN FAP
BRAM MANUFACTURING
CONGERS, NEW YORK

MACTEC

Proposed Investigation Explorations

Project 3612132269 Figure 3.1

TABLES

Table 1.1: Well Construction Details

Monitoring Well ID	Channel Number	Type	Northing	Easting	Ground Elevation	Casing Elevation	Riser Elevation	TOC-TOR	BOW (TOR)	DTW (TOR) (5/22/2011)	Groundwater Elevation (5/22/2011)
MW-1	NA	Overburden	844059.86	649867.47	154.44	154.44	154.25	0.19	12.35	1.49	152.76
MW-2	NA	Overburden	844028.07	649865.04	153.87	153.87	153.57	0.30	11.25	0.88	152.69
MW-S3	NA	Overburden	843883.34	649863.26	155.74	155.74	155.41	0.33	16.99	2.76	152.65
MW-3B	1,2	Bedrock	843931.24	649847.46	156.50	156.50	156.22	0.28	33	4.26	151.96
MW-3B	3,4	Bedrock	843931.24	649847.46	156.50	156.50	156.22	0.28	48	4.21	152.01
MW-3B	5,6,7	Bedrock	843931.24	649847.46	156.50	156.50	156.22	0.28	61.6	4.33	151.89
MW-4	NA	Overburden	844074.59	649964.65	152.93	152.93	152.62	0.31	15.07	1.03	151.59
MW-4B	1,6	Bedrock	844084.16	649965.53	153.00	153.00	152.58	0.42	33	1.08	151.50
MW-4B	3,4	Bedrock	844084.16	649965.53	153.00	153.00	152.58	0.42	43	1.22	151.36
MW-4B	5	Bedrock	844084.16	649965.53	153.00	153.00	152.58	0.42	53.2	1.11	151.47
MW-4B	7	Bedrock	844084.16	649965.53	153.00	153.00	152.58	0.42	70.5	0.99	151.59
MW-5	NA	Overburden	844120.66	649846.49	155.93	155.93	155.43	0.50	15.75	2.57	152.86
MW-5B	1,6	Bedrock	844120.66	649841.11	155.90	155.90	155.44	0.46	32	3.82	151.62
MW-5B	4,5	Bedrock	844120.66	649841.11	155.90	155.90	155.44	0.46	42	4.02	151.42
MW-5B	2,3,7	Bedrock	844120.66	649841.11	155.90	155.90	155.44	0.46	60.5	4.31	151.13
MW-5DD	NA	Bedrock	844122.04	649825.09	155.90	156.07	155.81	0.26	60	4.49	151.32
MW-6	NA	Overburden	844081.38	649734.33	156.63	156.63	156.36	0.27	12.01	2.47	153.89
MW-6B	1,6	Bedrock	844075.75	649733.82	156.51	156.51	155.84	0.67	32.6	2.50	153.34
MW-6B	4,5	Bedrock	844075.75	649733.82	156.51	156.51	155.84	0.67	48.6	3.98	151.86
MW-6B	2,3,7	Bedrock	844075.75	649733.82	156.51	156.51	155.84	0.67	57.5	4.30	151.54
MW-7	NA	Overburden	844326.42	649859.74	154.81	154.81	154.47	0.34	17.10	4.27	150.20
MW-7B	1,2	Bedrock	844327.05	649854.21	154.76	154.76	154.42	0.34	27.0	4.41	150.01
MW-7B	3,4	Bedrock	844327.05	649854.21	154.76	154.76	154.42	0.34	36.4	4.39	150.03
MW-7B	5,6,7	Bedrock	844327.05	649854.21	154.76	154.76	154.42	0.34	54.5	4.36	150.06
GW-PW	1,2	Bedrock	844061.13	649874.09	155.68	155.68	155.53	0.15	40.1	3.95	151.58
GW-PW	3,4	Bedrock	844061.13	649874.09	155.68	155.68	155.53	0.15	50.9	4.11	151.42
GW-PW	5,6,7	Bedrock	844061.13	649874.09	155.68	155.68	155.53	0.15	60.3	4.09	151.44
MW-8	NA	Overburden	843996.35	650109.83	151.34	151.34	150.96	0.38	15.6	3.66	147.30
MW-9	NA	Overburden	844104.09	650110.97	151.50	151.50	151.17	0.33	23.1	3.68	147.49
MW-9B	1,2	Bedrock	844117.83	650110.59	151.16	151.16	150.83	0.33	35.0	1.47	149.36
MW-9B	3,4	Bedrock	844117.83	650110.59	151.16	151.16	150.83	0.33	50.0	0.97	149.86
MW-9B	5,6	Bedrock	844117.83	650110.59	151.16	151.16	150.83	0.33	60.0	1.12	149.71
MW-9B	7	Bedrock	844117.83	650110.59	151.16	151.16	150.83	0.33	72.7	0.91	149.92
MW-10	NA	Overburden	844218.87	650124.42	151.92	151.92	151.51	0.41	16.7	4.51	147.00
MW-11B	1,4	Bedrock	844381.18	649622.03	154.84	154.84	154.39	0.45	23.7	4.81	149.58
MW-11B	3,6	Bedrock	844381.18	649622.03	154.84	154.84	154.39	0.45	41.6	5.06	149.33
MW-11B	2,5,7	Bedrock	844381.18	649622.03	154.84	154.84	154.39	0.45	60.1	5.03	149.36
MW-12	NA	Overburden	844595.57	649911.39	153.55	153.55	153.29	0.26	14.8	2.99	150.30
MW-12B	1,2	Bedrock	844596.18	649914.29	153.5	153.5	152.9	0.60	34.5	3.51	149.39
MW-12B	3,4	Bedrock	844596.18	649914.29	153.5	153.5	152.9	0.60	47.5	3.49	149.41
MW-12B	5,6,7	Bedrock	844596.18	649914.29	153.5	153.5	152.9	0.60	58.8	3.38	149.52
MW-13	NA	Overburden	844629.56	649685.98	151.77	151.77	151.28	0.49	13.8	3.55	147.73
MW-13B	1,4	Bedrock	844635.63	649686.29	151.75	151.75	151.32	0.43	26.6	2.47	148.85
MW-13B	3,6	Bedrock	844635.63	649686.29	151.75	151.75	151.32	0.43	39.7	2.41	148.91
MW-13B	2,5,7	Bedrock	844635.63	649686.29	151.75	151.75	151.32	0.43	56.8	2.32	149.00

Table 1.1: Well Construction Details

Monitoring Well ID	Channel Number	Type	Northing	Easting	Ground Elevation	Casing Elevation	Riser Elevation	TOC-TOR	BOW (TOR)	DTW (TOR) (5/22/2011)	Groundwater Elevation (5/22/2011)
MW-14	NA	Overburden	844638.04	649513.94	152.31	152.31	152.13	0.18	14.7	5.19	146.94
MW-14B	1,2	Bedrock	844644.06	649513.24	152.96	152.96	151.52	1.44	46	2.93	148.59
MW-14B	3,4	Bedrock	844644.06	649513.24	152.96	152.96	151.52	1.44	59	2.77	148.75
MW-14B	5,6	Bedrock	844644.06	649513.24	152.96	152.96	151.52	1.44	78	2.48	149.04
MW-14B	7	Bedrock	844644.06	649513.24	152.96	152.96	151.52	1.44	97	2.40	149.12
MW-15	NA	Overburden	844836.88	649689.63	150.67	150.67	150.41	0.26	13.9	3.68	146.73
MW-15B	1,2	Bedrock	844835.77	649687.43	150.59	150.59	150.14	0.45	24.5	1.65	148.49
MW-15B	3,4	Bedrock	844835.77	649687.43	150.59	150.59	150.14	0.45	39.5	1.29	148.85
MW-15B	5,6,7	Bedrock	844835.77	649687.43	150.59	150.59	150.14	0.45	58.5	1.26	148.88
MW-17	NA	Overburden	844386.77	650191.47	150.21	150.21	149.99	0.22	18.9	3.01	146.98
MW-18B	1,2	Overburden	844600.64	650115.93	153.44	153.44	152.81	0.63	23.0	3.78	149.03
MW-18B	3,4	Bedrock	844600.64	650115.93	153.44	153.44	152.81	0.63	48.2	3.66	149.15
MW-18B	5,6	Bedrock	844600.64	650115.93	153.44	153.44	152.81	0.63	67.2	3.54	149.27
MW-18B	7	Bedrock	844600.64	650115.93	153.44	153.44	152.81	0.63	95.1	3.25	149.56
MW-19	NA	Overburden	844792.95	649819.28	150.42	150.42	150.26	0.16	14.4	3.35	146.91
MW-20B	NA	Bedrock	844939.38	649858.54	152.17	152.17	151.94	0.23	61.3	2.66	149.28
MW-21B	NA	Bedrock	845192.05	649655.96	150.32	150.32	149.81	0.51	41.9	0.72	149.09
MW-22B	NA	Bedrock	649880.21	844123.39	155.40	155.40	155.08	0.32	37	3.61*	151.47*
BIW-1	NA	Bedrock	649865.44	844122.16	155.94	155.94	155.64	0.30	37.6	4.07*	151.57*
BIW-2	NA	Bedrock	649900.84	844121.78	155.26	155.26	154.81	0.45	43.2	4.74*	150.07*
BIW-3[1]	NA	Bedrock	649870.89	844040.79	153.59	153.59	152.70	0.89	30	1.55*	151.15*
BIW-4[2]	NA	Bedrock	649883.15	844046.95	153.61	153.61	153.18	0.43	70	2.28*	150.9*
GP-01A	NA	Overburden	649975.95	844083.2	152.72	152.72	152.27	0.45	14.5	1.07*	151.2*
GP-02A	NA	Overburden	649977.25	844097.7	152.67	152.67	152.52	0.15	12.8	1.32*	151.2*
GP-03	NA	Overburden	649981.47	844060.4	152.75	152.75	152.52	0.23	12.5	1.41*	151.11*
GP-04	NA	Overburden	649981.95	844070.9	152.85	152.85	152.70	0.15	14.5	1.24*	151.46*

Notes:
TOC = Top of monitoring well casing
TOR = Top of monitoring well riser
BOW = Bottom of monitoring well
DTW = Depth to water
Wells Surveyed by YEC (2009, 2010, and 2014).
Northing/Easting = North American Datum 83/96 - NYSPCS EAST (US survey feet)
Elevations = North American Vertical Datum 88 (US survey feet)
Water levels collected by MACTEC Engineering and Consulting
NM = Not measured
1 = BIW-3 set at 45 degree angle
2 = BIW-4 set at 25 degree angle
* = water levels measured in April 2014

Table 3.1: Proposed Sample Methodology, Rationale, Identification, and Analytical Schedule

						Chemical Analysis						Geotechnical Analysis	
						VOCs	1,4-Dioxane	Waste Disposal Parameters-Soil	Waste Disposal Parameters-Water	MNA Parameters	Bio-Traps	Grain Size / Total Organic Carbon	Moisture Content & Atterberg Limits
					Method water	8260C	8270 SIM		see notes	see notes		-	-
					Method soil	5035A/8260C		see below				ASTM D 422C & LK	ASTM D 2216&4316
					Water RL (µg/L)	1	0.2						
					Soil RL (mg/Kg)	0.05							
					Validation Level	DUSR	DUSR	None	None	Completeness	None	None	None
Investigation Sample Methodology	Rationale	Location ID	Medium	Depth bgs ft.	Sample ID								
Soil Boring Samples													
Excavation Pre-Design Complete borings at 5 locations while conducting split spoon sampling. One of the five soil borings will be completed as a monitoring well to evaluate overburden groundwater quality and to perform a dye test to assess groundwater movement from the source zone. Collect samples for off site chemical laboratory analysis from up to 4 depths per boring based on visual evidence and/or PID response (20 total samples). Collect samples for off site geotechnical laboratory analysis from up to 2 depths for each of the 3 estimated perimeter borings of anticipated excavation area (6 total samples). Collect one composite shallow soil sample (0 - 8 ft bgs) from the source zone soil borings to be submitted for full suite analysis for waste disposal characterization.	Evaluate horizontal and vertical distribution of contamination in the anticipated overburden excavation area.	BS-29/MW-29	Soil	TBD	344055BS029___	1						1	1
			Soil	TBD	344055BS029___	1						1	1
			Soil	TBD	344055BS029___D	1						1	1
			Soil	TBD	344055BS029___	1							
			Soil	TBD	344055BS029___	1							
			Rock	TBD	344055BS029___	1							
		BS-30	Soil	TBD	344055BS030___	1						1	1
			Soil	TBD	344055BS030___	1						1	1
			Soil	TBD	344055BS030___	1							
			Soil	TBD	344055BS030___	1							
		BS-31	Soil	TBD	344055BS031___	1						1	1
			Soil	TBD	344055BS031___	1						1	1
			Soil	TBD	344055BS031___	1							
			Soil	TBD	344055BS031___	1							
		BS-32	Soil	TBD	344055BS032___	1							
			Soil	TBD	344055BS032___	1							
			Soil	TBD	344055BS032___	1							
			Soil	TBD	344055BS032___	1							
			Rock	TBD	344055BS032___	1							
		BS-33	Soil	TBD	344055BS033___	1							
			Soil	TBD	344055BS033___	1							
			Soil	TBD	344055BS033___MS	1							
			Soil	TBD	344055BS033___MD	1							
			Soil	TBD	344055BS033___	1							
			Soil	TBD	344055BS033___	1							
			Rock	TBD	344055BS033___	1							
	Full-suite analysis for waste disposal characterization	Composite BS-29 through BS-33	Soil		344055Comp-1			1					
Overburden Pump and Treat Pre-Design Complete borings at 4 locations while conducting split spoon sampling. Three of the four borings will be completed as 2-inch monitoring wells (anticipated to be screened 5-25 ft, but may be less if field screening and quick turn laboratory results do not indicate deep contamination), and the remaining one will be completed as a 4-inch extraction well. Collect samples for off site chemical laboratory analysis from up to 5 depths per boring based on visual evidence and/or PID response (20 total samples).	Evaluate horizontal and vertical distribution of overburden contamination along the eastern side of the Site building.	BS-23/MW-23	Soil	TBD	344055BS023___	1							
			Soil	TBD	344055BS023___	1							
			Soil	TBD	344055BS023___MS	1							
			Soil	TBD	344055BS023___MD	1							
			Soil	TBD	344055BS023___	1							
			Soil	TBD	344055BS023___	1						1	
		BS-24/MW-24	Soil	TBD	344055BS024___	1							
			Soil	TBD	344055BS024___	1							
			Soil	TBD	344055BS024___	1							
			Soil	TBD	344055BS024___	1						1	
		BS-25/EW-25	Soil	TBD	344055BS025___	1							
			Soil	TBD	344055BS025___	1							
			Soil	TBD	344055BS025___D	1							
			Soil	TBD	344055BS025___	1							
			Soil	TBD	344055BS025___	1						1	
		BS-26/MW-26	Soil	TBD	344055BS026___	1							
			Soil	TBD	344055BS026___	1							
			Soil	TBD	344055BS026___	1							
			Soil	TBD	344055BS026___	1							
		Rinse Blank	Rinse Water		344055QS001	1							
		Rinse Blank	Rinse Water		344055QS002	1							
		Trip Blanks	Blank Methanol (multiple)		344055QT__	1							

Table 3.1: Proposed Sample Methodology, Rationale, Identification, and Analytical Schedule

						Chemical Analysis						Geotechnical Analysis	
						VOCs	1,4-Dioxane	Waste Disposal Parameters-Soil	Waste Disposal Parameters-Water	MNA Parameters	Bio-Traps	Grain Size / Total Organic Carbon	Moisture Content & Atterberg Limits
					Method water	8260C	8270 SIM		see notes	see notes		-	-
					Method soil	5035A/8260C		see below				ASTM D 422C & LK	ASTM D 2216&4316
					Water RL (µg/L)	1	0.2						
					Soil RL (mg/Kg)	0.05							
					Validation Level	DUSR	DUSR	None	None	Completeness	None	None	None
Investigation Sample Methodology	Rationale	Location ID	Medium	Depth bgs ft.	Sample ID								
Bedrock Pump and Treat Pre-Design Complete three borings; one to approximately 210 ft, with a steel casing set to 65 feet, and two to approximately 70 ft. Collect four rock chip samples from each of the 70 foot borings for VOC analysis based on PID response. One of the 70 foot bedrock borings will be completed as a 4-inch extraction well (screened 30-70 ft), and the other will be completed as an open hole bedrock well. Extraction well depths may vary based on findings of 210 foot deep well.	Evaluate horizontal and vertical distribution of contamination within the bedrock north of the Site building.	BS-27/EW-27B	Rock	TBD	344055RC027___	1							
			Rock	TBD	344055RC027___	1							
			Rock	TBD	344055RC027___	1							
			Rock	TBD	344055RC027___	1							
		BS-28/MW-28B	Rock	TBD	344055RC028___	1							
			Rock	TBD	344055RC028___	1							
			Rock	TBD	344055RC028___	1							
			Rock	TBD	344055RC028___	1							
		BS-34/MW-34B	No Samples										
Test Pit Samples													
Complete two test pits adjacent to the buildings.	Obtain visual observations and measurement of existing footings to support excavation design.	TP-01 TP-02	Soil	12 feet - no analytical									
Groundwater Samples													
Excavation Pre-Design Develop and sample one overburden source zone monitoring well. Collect groundwater using low flow sampling technique.	Evaluate source zone overburden groundwater quality.	MW-29	Overburden Groundwater	Center of Well Screen	344055MW29___	1	1						
Overburden Pump and Treat Pre-Design Develop and sample the overburden extraction well. Collect groundwater using low flow sampling technique.	Evaluate VOC concentrations in the groundwater that will be treated. Metals, hardness, alkalinity, TSS and TDS will be conducted to support the design of the pump and treat system.	EW-25	Overburden Groundwater	Center of Well Screen	344055EW25___	1			1				
Bedrock Pump and Treat Pre-Design Develop and sample the bedrock extraction well. Collect groundwater using low flow sampling technique.	Evaluate VOC concentrations in the bedrock groundwater that will be treated. Metals, hardness, alkalinity, TSS and TDS will be conducted to support the design of the pump and treat system.	EW-27B	Bedrock Groundwater	Center of Well Screen	344055EW27___	1			1	1	1		
Develop and sample the deep bedrock well. Geophysics will be conducted to determine up to six depths to collect groundwater samples using a packer system.	Evaluate vertical distribution of groundwater contamination within the bedrock north of the Site building.	BS-34/MW-34B	Overburden Groundwater	TBD	344055MW34B___	1							
			Overburden Groundwater	TBD	344055MW34B___	1							
			Overburden Groundwater	TBD	344055MW34B___	1							
			Overburden Groundwater	TBD	344055MW34B___	1							
			Overburden Groundwater	TBD	344055MW34B___	1							
			Overburden Groundwater	TBD	344055MW34B___	1							

Table 3.1: Proposed Sample Methodology, Rationale, Identification, and Analytical Schedule

						Chemical Analysis						Geotechnical Analysis	
						VOCs	1,4-Dioxane	Waste Disposal Parameters-Soil	Waste Disposal Parameters-Water	MNA Parameters	Bio-Traps	Grain Size / Total Organic Carbon	Moisture Content & Atterberg Limits
					Method water	8260C	8270 SIM		see notes	see notes		-	-
					Method soil	5035A/8260C		see below				ASTM D 422C & LK	ASTM D 2216&4316
					Water RL (µg/L)	1	0.2						
					Soil RL (mg/Kg)	0.05							
					Validation Level	DUSR	DUSR	None	None	Completeness	None	None	None
Investigation Sample Methodology	Rationale	Location ID	Medium	Depth bgs ft.	Sample ID								
Base-Line Monitoring Well Sampling Sample existing and new monitoring wells to establish pre-design baseline conditions for overburden and bedrock groundwater. Collect groundwater using low flow sampling technique.	Evaluate VOC concentrations in overburden groundwater, including the new wells in the alley (MW-23, MW-24, MW-26).	MW-01	Overburden Groundwater	10	344055MW00101016	1	1						
		MW-02	Overburden Groundwater	7	344055MW00200716	1							
		MW-04	Overburden Groundwater	15	344055MW00401516	1	1						
		MW-05	Overburden Groundwater	14	344055MW00501416	1							
		MW-08	Overburden Groundwater	12	344055MW00801216	1							
		MW-09	Overburden Groundwater	18	344055MW00901816	1							
		MW-10	Overburden Groundwater	13	344055MW01001316	1							
		MW-10	Overburden Groundwater	13	344055MW01001316MS	1							
		MW-10	Overburden Groundwater	13	344055MW01001316MD	1							
		MW-13	Overburden Groundwater	9	344055MW01300916	1							
		MW-15	Overburden Groundwater	10	344055MW01501016	1							
		MW-19	Overburden Groundwater	13	344055MW01901316	1							
		MW-23	Overburden Groundwater	TBD	344055MW023___16	1							
		MW-24	Overburden Groundwater	TBD	344055MW024___16	1							
		MW-26	Overburden Groundwater	TBD	344055MW026___16	1							
		PZ-1	Overburden Groundwater- Piezom	12	344055PZ00101216	1							
		PZ-3	Overburden Groundwater- Piezom	12	344055PZ00301216	1							
		PZ-4	Overburden Groundwater- Piezom	14	344055PZ00401416	1							
		PZ-6	Overburden Groundwater- Piezom	14	344055PZ00601416	1							
		GP-01	Overburden Groundwater- Piezom	10	344055GP00101016	1							
		GP-02	Overburden Groundwater- Piezom	10	344055GP00201016	1							
		GP-03	Overburden Groundwater- Piezom	10	344055GP00301016	1							
		GP-04	Overburden Groundwater- Piezom	10	344055GP00401016	1							
	Evaluate VOC concentrations in bedrock groundwater, including the new well MW-28B.	GW-PW	Bedrock Groundwater	40	344055GWPW04016	1	1						
		GW-PW	Bedrock Groundwater	51	344055GWPW05116	1							
		GW-PW	Bedrock Groundwater	61	344055GWPW06116	1							
		MW-3B	Bedrock Groundwater	33	344055MW03B03316	1				1			
		MW-4B	Bedrock Groundwater	33	344055MW04B03316	1							
		EW-5DD	Bedrock Groundwater	40	344055EW5DD04016	1							
		EW-5DD	Bedrock Groundwater	40	344055EW5DD04016MS	1							
		EW-5DD	Bedrock Groundwater	40	344055EW5DD04016MD	1							
		EW-5DD	Bedrock Groundwater	40	344055EW5DD04016D	1							
		MW-5B	Bedrock Groundwater	31	344055MW05B03116	1							
		MW-5B	Bedrock Groundwater	41	344055MW05B04116	1							
		MW-5B	Bedrock Groundwater	61	344055MW05B06116	1				1			
		MW-5B	Bedrock Groundwater	61	344055MW05B06116D	1				1			
		MW-7B	Bedrock Groundwater	36	344055MW07B03616	1	1				1		
		MW-7B	Bedrock Groundwater	54	344055MW07B05416	1							
		MW-11B	Bedrock Groundwater	60	344055MW11B06016	1							
		MW-12B	Bedrock Groundwater	34	344055MW12B03416	1				1	1		
		MW-12B	Bedrock Groundwater	59	344055MW12B05916	1							
		MW-13B	Bedrock Groundwater	26	344055MW13B02616	1							
		MW-13B	Bedrock Groundwater	55	344055MW13B05516	1							
		MW-14B	Bedrock Groundwater	97	344055MW14B09716	1							
		MW-15B	Bedrock Groundwater	24	344055MW15B02416	1							
		MW-15B	Bedrock Groundwater	24	344055MW15B02416MS	1							
		MW-15B	Bedrock Groundwater	24	344055MW15B02416MD	1							
		MW-22B	Bedrock Groundwater	35	344055MW022B03516	1	1			1			
		MW-28B	Bedrock Groundwater	TBD	344055MW028B___16	1							
		Home-1	Bedrock Groundwater	14	344055HM0011416	1							
		Home-1	Bedrock Groundwater	14	344055HM0011416D	1							
		BIW1	Bedrock Groundwater	35	344055BIW103516	1				1			
		BIW2	Bedrock Groundwater	40	344055BIW204016	1				1			
		BIW3	Bedrock Groundwater	20	344055BIW302016	1							
		BIW4	Bedrock Groundwater	55	344055BIW405516	1							
		Trip Blanks	Blank Water (multiple)		344055QT__	4							
TOTAL SAMPLES						124	6	1	2	8	3	10	7

Table 3.1: Proposed Sample Methodology, Rationale, Identification, and Analytical Schedule

						Chemical Analysis						Geotechnical Analysis	
						VOCs	1,4-Dioxane	Waste Disposal Parameters-Soil	Waste Disposal Parameters-Water	MNA Parameters	Bio-Traps	Grain Size / Total Organic Carbon	Moisture Content & Atterberg Limits
					Method water	8260C	8270 SIM		see notes	see notes		-	-
					Method soil	5035A/8260C		see below				ASTM D 422C & LK	ASTM D 2216&4316
					Water RL (µg/L)	1	0.2						
					Soil RL (mg/Kg)	0.05							
					Validation Level	DUSR	DUSR	None	None	Completeness	None	None	None
Investigation Sample Methodology	Rationale	Location ID	Medium	Depth bgs ft.	Sample ID								

NOTES:

VOCs VOCs 5035A/8260C (soils), 8260C (water); subset of GW locations 1,4-dioxane by Method 8270 Sim (RL 0.2 ug/L)

Waste Disposal Parameters - Soil =TCLP VOCs by Methods 1311/8260C; TCLP Semivolatile Organic Compounds - USEPA 1311/8270; Total Polychlorinated biphenyls - USEPA 8082; TCLP Pesticides - USEPA 1311/8081; TCLP Metals - USEPA 1311/6010/7471; Ignitablity - 1030; Reactivity - 7.3.3.2 and 7.3.4.2.; pH/corrosivity - SW846 Method 9045

Waste Disposal Parameters - Water =TAL metals - USEPA 6010/7470; alkalinity - SM 2320B; hardness - SM-2340B, total dissolved solids - SM 2540C, total suspended solids - SM2540D

MNA Parameters =Samples analyzed for Monitored Natural Attenuation (MNA) parameters: Total Organic Carbon by Method SM 5310B, chloride, sulfate, nitrate, nitrite by EPA Method 300.0, sulfide by Method SM 4500D S2-D, methane/ethane/ethene/CO2 by modified Method 3C, alkalinity by Method SM 2320B, and iron and manganese by USEPA Method 6010C.

RL reporting limit; µg/l = micrograms per liter; mg/Kg = milligrams per kilogram

LK Lloyd Kahn (separate container from Grain Size sample)

bgs below ground surface

BS Soil Boring

TP Test Pit

MW/GW-PW Monitoring Well

EW Extraction Well

PZ/GP Piezometer

Home-1 Private Supply Well

APPENDIX A

MACTEC SHORT FORM HASP

MACTEC, Inc.

MACTEC Short Form HASP

Site: Bram Manufacturing Site Job Number: 3612132269
Street Address: US-9W, Congers, New York 10960
Proposed Date(s) of Investigation:
Prepared by: Ian Desjarlais (updated) Date: 10/07/15
*Approved by: Kendra Bavor, CSP Date: 3/18/2016

Site Description: The site includes the former Bram Manufacturing Facility which consists of an open lot and 12,300 sf concrete block building. The property is located between a large Park/Golf Course and residential/commercial development. The Site includes a small stream (i.e, Kill Von Beaste) that runs along the back of the property. Site was formerly used for the manufacture of lighting fixtures.
(See attached Figure 1, Site Location Map)

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

MACTEC	Other contractor	Task Description
☒	☐	Mobilization/demobilizing
☒	☐	Overall inspection of the site
☒	☐	General Field Work Oversight
☐	☒	Overburden Injection Well Installation (Direct Push)
☐	☒	Bedrock Injection Well Installation (Conventional drilling)
☐	☒	Borehole Geophysics
☒	☐	Soil Sampling
☒	☐	Groundwater Sampling
☒	☐	Indoor Air and Sub-Slab Soil Vapor Sampling
☐	☒	Survey
☐	☒	Pumping Test (see Groundwater Sampling JHA)
☐	☒	Excavation and Backfilling
☐	☐	

	Req ?	Names of Field Team*				
		Dylan Farrell	Alex Howe	Dave Lovejoy	Nate Vogan	Jerry Rawcliffe
		Dates	Dates	Dates	Dates	Dates
Medical Surveillance	YES	04/22/15	1/25/2016	03/06/2015	09/02/2015	09/15/14
Site Specific Medical Testing:_____						
40-Hour Initial	YES	05/05/2014	2/12/2016	03/02/1987	06/20/2008	5/17/1986
8-Hour Supervisor [1,3]				03/01/1192		
8-Hour Refresher	YES	07/24/2015		04/20/2015	02/02/2015	10/02/15
First Aid/CPR [1,2]		Thru 08/21/2016		02/07/2016	Thru 05/14/2017	Thru 2/21/16
Respirator Fit Test [1]						
Respirator Brand [1]						
Hazard Communication [1]	YES	03/26/14		12/1/2013	12/05/2013	6/13/12
Fall Protection [1]						
Confined Space Entry [1]						
Lead Awareness						

Dates of Required Training and Medical Surveillance:
[1] If Applicable
[2] At least one worker must be trained in First Aid/CPR and should receive Bloodborne Pathogen Training
[3] Required for Field Lead and Site Health and Safety Officer

*Field Team to be determined at time field work is assigned.

Known or Suspected Contaminants (include PELs/TLVs):

Contaminants of Concern	Historical Highest Sample Data (pre-cleanup)	PEL/TLV	Fact Sheet Included
Soil			
Cis-1,2-Dichloroethene	56 ppm	200 ppm	Yes
Vinyl chloride	5.4 ppm	1 ppm	Yes
Ethylbenzene	540 ppm	100 ppm	Yes
Xylene (total)	3000 ppm`	100 ppm	Yes
Trichloroethene	720 ppm	10 ppm	Yes
Tetrachloroethylene	39 ppm	25 ppm	Yes
Groundwater			
Cis-1,2-Dichloroethene	210000 ppb	200 ppm	Yes
Vinyl Chloride	23000 ppb	1 ppm	Yes
Ethylbenzene	9700 ppb	100ppm	Yes
Xylene (total)	62000 ppb	100 ppm	Yes
Trichloroethene	900000 ppb	10 ppm	Yes
Tetrachloroethylene	5000 ppb	25 ppm	Yes
1,2,4-Trimethylbenzene	12000 ppb	25 ppm	Yes

Air Monitoring Action Levels:

PID/FID Reading [1]	Drager Tube [1]	Dust Meter [1]	LEL[2]/O_2 [1]	Action	Level of PPE
Above Background				Stop work, back away from work area, evaluate potential source of contamination monitor for vinyl chloride and benzene with Drager tubes.	Level D
< 9 ppm	Benzene: <0.5 ppm Vinyl Chloride:<0.5 ppm	<1.5 mg/m3		Continue working at level D	Level D
≥9 ppm	Benzene: ≥0.5 ppm Vinyl Chloride: <0.5 ppm	>1.5 mg/M3		Stop work, use dust control measures and reassess	Level C
≥80 ppm	Benzene: Vinyl Chloride:	15 mg/M3		Stop work, Level B would be required	Level B

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

AHAs: Check and attach all that apply (add applicable AHAs not already listed):

Activity and Hazard Specific AHAs:

☒	Mobilization/Demobilization and Site Preparation	☒	Insect Stings and Bites
☒	Field Work – General	☒	Working with Preservatives (acids)
☒	Field Work – Oversight	☒	Indoor Air and Sub-Slab Soil Vapor Sampling
☒	Decontamination	☒	Excavations and Backfilling
☒	Groundwater Sampling	☐	
☒	Soil Sampling	☐	
☒	Geoprobe, overburden (MACTEC oversight)	☐	
☒	Drilling Operations (MACTEC oversight)	☐	

Chemicals Brought to the Site:
List all chemicals brought to the site (e.g., preservatives, decontamination solutions, gasoline, etc.). Attach MSDS

Chemicals	MSDS Attached?
HYDROGEN CHLORIDE (HCL) (PRESERVATIVE)	☒
NITRIC ACID (PRESERVATIVE)	☒
LIQUINOX/ ALCONOX	☒
ISOBUTYLENE	☒
CALIBRATION SOLUTIONS (YSI)-PH4, PH7, DO, ORP, 1413 SPECIFIC COND.	☒
METHANOL	☒
BENTONITE	☒
SULFURIC ACIS	☒

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.

HAZARD IDENTIFICATION SUMMARY

Complete the checklist for summarizing the hazards identified in the AHAs

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	☒ Temperature extremes: ☒ Cold ☒ Heat	☐ 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 Optional Coveralls

Hand Protection					
☐ None	☐ Cotton gloves	☐ Leather gloves	☐ Glove liners	☐ Cut-resistant gloves	☒ Other –Nitrile Gloves
☐ Outer Gloves: List Type _____			☐ Inner Gloves: List Type_____		

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) **Tubes:** benzene, Vinyl chloride	☒ Dust Meter: ☐ Respirable dust ☒ Total dust		☐ Other _____

*Monitoring instruments will be calibrated daily in accordance with manufacturer's instructions.

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 known to occur 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.

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 being located upwind of the work area. Work zones will be maintained through the use of:

- ☐ Warning Tape
- ☒ Visual Observations
- ☐ Cones and Barriers

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 Boots, and Gloves Wash and Rinse (if worn)	Scrub outer boots, and outer gloves decon solution or detergent water. Rinse off using copious amounts of water.
Station 3: Outer Boot and Glove Removal (if worn)	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, 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 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, 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:	***(845) 348-2345***		
Police Department:	911		
Site Health And Safety Officer: Kendra Bavor	Office:207-828-3699	Cell:207-650-8671	
MACTEC Project Manager: Mark Stelmack	Office: (207) 775-5401	Cell: (207) 838-5928	
Division EH&S Manager: Cindy Sundquist	Office: (207) 828-3309 Cell: (207) 650-7593	Home: (207) 892-4402	
NYSDEC Project Manager: Kevin Carpenter	Office: (518) 402-9799		
OTHER: Ambulance	911		

Emergency Equipment:

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

- ☒ Field First Aid Kit
- ☒ 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. The HSO shall then contact the Division ES&H Manager who will then contact the Corporate EH&S Manager.
- 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 a worker is injured, first aid shall be administered by certified first aid provider.
- 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.
- After the response, the SHSO shall follow-up with the required company reporting procedures, including the completing the MACTEC Incident Analysis Report.

<table>
<tr><th>NON-EMERGENCY INCIDENT</th><th>EMERGENCY INCIDENT</th></tr>
<tr><td>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:</td><td>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:</td></tr>
<tr><td colspan="2">Call WorkCare 24/7 Hotline*
(888) II-XPRTS or (888) 449-7787</td></tr>
<tr><td>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.</td><td>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.</td></tr>
<tr><td colspan="2">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.</td></tr>
</table>

Site Specific Procedures are as follows:

FOLLOW THE “CAMP” in the FAP for dust and perimeter volatile monitoring.

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: _____

Routes to Emergency Medical Facilities

PRIMARY HOSPITAL:

Facility Name: ***Nyack Hospital***
Address: ***160 N Midland Ave, Nyack, New York 10960***
Telephone Number: ***(845) 348-2345***

DIRECTIONS TO PRIMARY HOSPITAL:

See Attached Directions and Maps

NEAREST CLINIC:

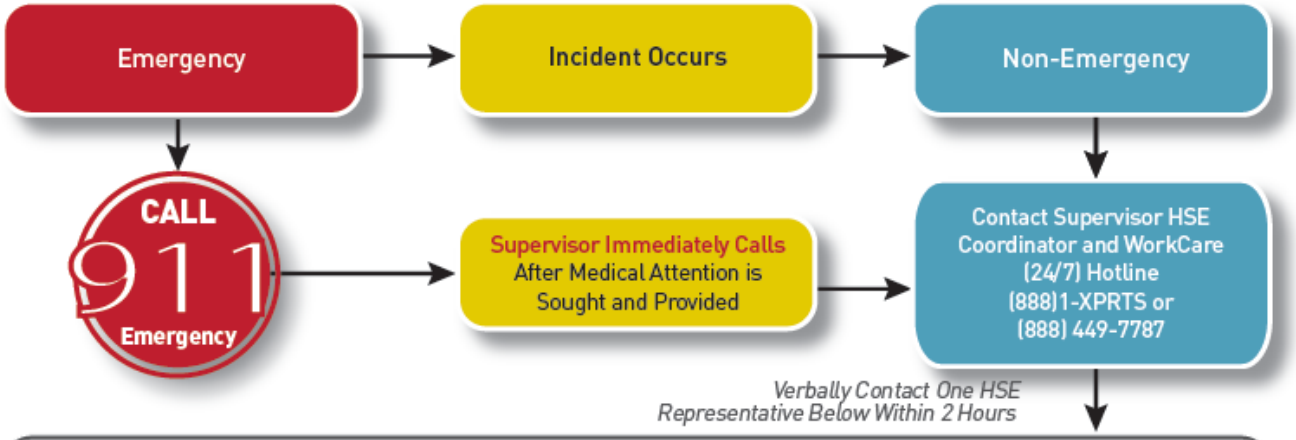
Facility Name: ***Urgent Care of Westchester***
Address: ***155 White Plains Rd., Tarrytown, New York 10591***
Telephone Number: ***(914) 372-7171***

DIRECTIONS TO ALTERNATE HOSPITAL:

See Attached Directions and Maps

Incident Flow Chart

Call Immediatley



E&I Corporate HSE Department Contact List

Name/Email	Office Location	Contact Information
Bruce Voss bruce.voss@amec.com	Catherdral 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	910.452.1185 (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)
Vlad Ivensky (can call 24/7) vlad.ivesky@amec.com	Plymouth Meeting, PA	610.877.6144 (office) 484.919.5175 (cell) 215.947.0393 (home)

**High potential near misses, subcontractor incidents, regulatory inspections, spills, and property damage greater than $1000, should be reported within 60 minutes to one of the above HSE Representatives.*

Revised 17 July 2012-hb

TAILGATE SAFETY MEETING REPORT

Check One:

☐ Initial Kickoff Safety Meeting ☐ Regular/Daily Tailgate Safety Meeting ☐ Unscheduled Tailgate Safety Meeting

Date: _____ Site: _____

Site Manager: _____ Site Health and Safety Officer: _____
Print *Print*

Order of Business

Topics Discussed (Check all that apply)

☐ Scope of Work
☐ Site History/Site Layout
☐ Personnel Responsibilities
☐ Training Requirements
☐ Hazard Analysis of Work Tasks (chemical, physical, biological and energy health hazard effects)
☐ Applicable SOPs (e.g., Hearing Conservation Program, Safe Driving, etc.)
☐ Safe Work Practices
☐ Engineering Controls
☐ Chemical Hazards and Controls
☐ Signs and symptoms of over exposure to site chemicals
☐ Medical Surveillance Requirements
☐ Action Levels
☐ Monitoring Instruments and Personal Monitoring
☐ Perimeter Monitoring, Type and Frequency
☐ PPE Required/PPE Used
☐ Define PPE Levels, Donning, Doffing Procedures
☐ Decontamination Procedures for Personnel and Equipment
☐ Physical Hazards and Controls (e.g., overhead utility lines)
☐ Anticipated Weather (snow, high winds, rain)
☐ Temperature Extremes (heat or cold stress symptoms and controls)
☐ Biological Hazards and Controls (e.g., poison ivy, spiders)
☐ Site Control (visitor access, buddy system, work zones, security, communications)
☐ Sanitation and Illumination
☐ Logs, Reports, Recordkeeping
☐ Incident Reporting Procedures
☐ Near Misses/Hazard ID including worker suggestions to correct and work practices to avoid similar occurrences
☐ General Emergency Procedures (e.g., locations of air horns and what 1 or 2 blasts indicate)
☐ General Emergency Response Procedures (e.g., earthquake response, typhoon response, etc.)
☐ Medical Emergency Procedures (e.g., exposure control precautions, location of first aid kits, etc.)
☐ Route to Hospital and Medical Care Provider Visit Guidelines
☐ Site/Regional Emergency Response Procedures (e.g., exposure control precautions, location of first aid kits, etc.)
☐ Hazardous Materials Spill Procedures

Safety Suggestions by Site Workers: _____

Action Taken on Previous Suggestions: _____

Injuries/Incidents/Personnel Changes since last meeting: _____

Observations of unsafe work practices/conditions that have developed since previous meeting: _____

Location of (or changes in the locations of) evacuation routes/safe refuge areas: _____

Additional Comments: _____

Attendee signatures below indicate acknowledgment of the information and willingness to abide by the procedures discussed during this safety meeting

Name (Print)	Company	Signature

Meeting Conducted by: _____ Title: _____
Print

Signature: _____ Time: _____
Print

Incident Report Forms

1. Incident Analysis Report (IAR)
2. Vehicle Incident Report (VIR)
3. Ground Disturbance Incident Report(GDR)

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: _____

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:

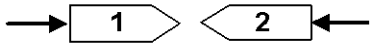
http://ee.amecnet.com/she/sheweb/incident_reporting.htm

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.

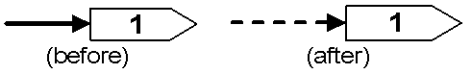
Vehicle Incident Diagram

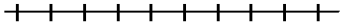
This or a similar diagram must be completed with all VIRs

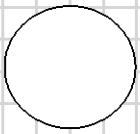
Instructions:

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: _____

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: ____

Activity Hazard Analysis (AHAs)

Mobilization/Demobilization and Site Preparation
Field Work – General
Field Work – Oversight
Decontamination
Groundwater Sampling
Soil Sampling
Geoprobe, overburden (MACTEC oversight)
Drilling Operations (MACTEC oversight)
Insect Stings and Bites
Working with Preservatives (acids)
Indoor Air and Sub-Slab Soil Vapor Sampling
Excavations and Backfilling

MACTEC

Job Hazard Analysis – HASP Format

Job Title: Mobilization/Demobilization and Site Preparation **Date of Analysis:** 8/15/06

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:** 8/15/06

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.

MACTEC

Job Hazard Analysis – HASP Format

Job Title: Mobilization/Demobilization and Site Preparation **Date of Analysis:** 8/15/06

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:** 8/15/06

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

MACTEC

Job Hazard Analysis – HASP Format

Job Title: Field Work - General **Date of Analysis:** 8/15/06

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

MACTEC

Job Hazard Analysis – HASP Format

Job Title: Field Work - General **Date of Analysis:** 8/15/06

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:** 8/15/06

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.

MACTEC

Job Hazard Analysis – HASP Format

Job Title: Field Work - General **Date of Analysis:** 8/15/06

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.

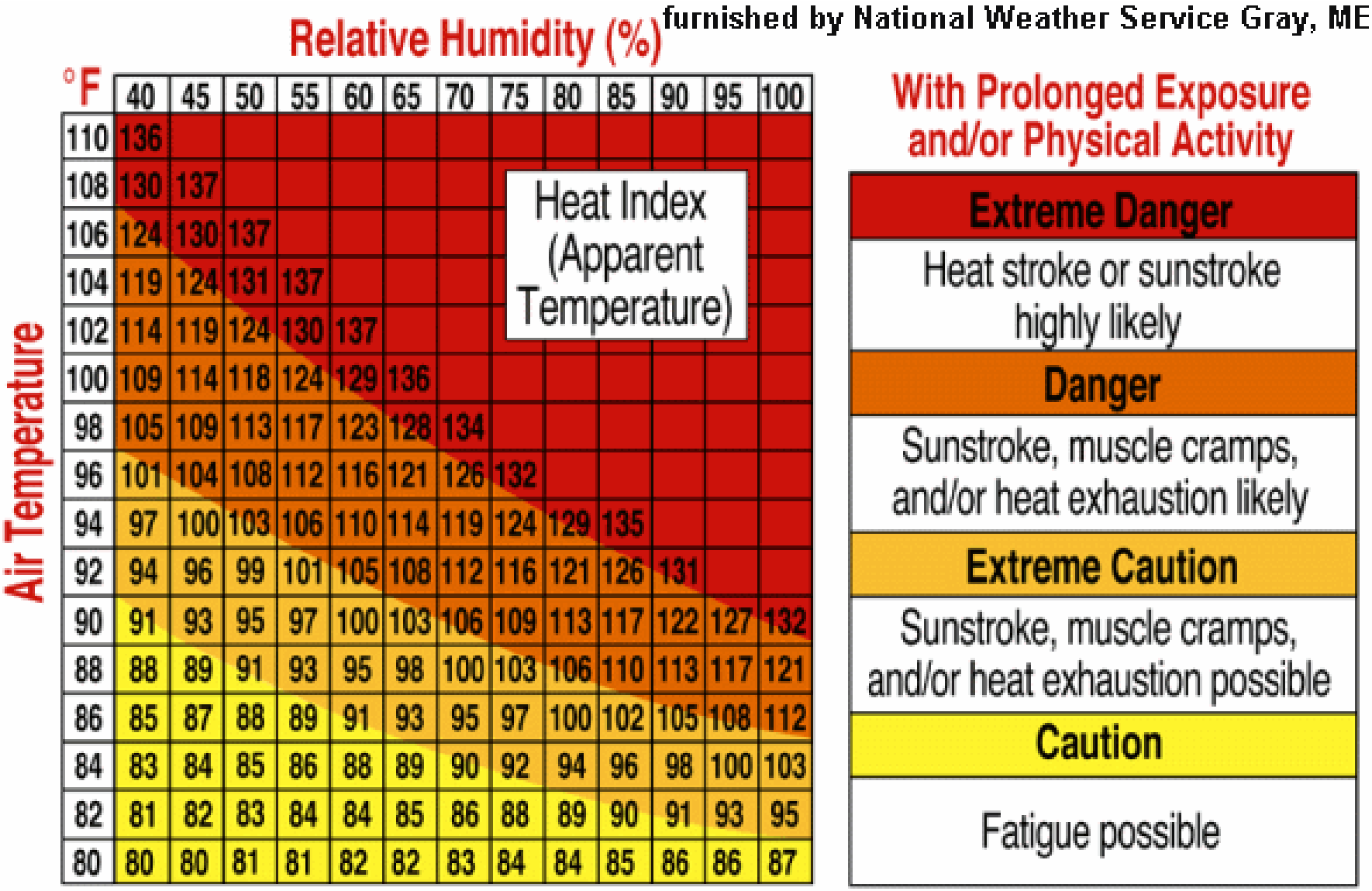
MACTEC

Job Hazard Analysis – HASP Format

Job Title: Field Work - General **Date of Analysis:** 8/15/06

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

Job Hazard Analysis Form

Job Title: Field Work - Oversight **Date of Analysis:** 4/13/10
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**

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Job Hazard Analysis - Short Form HASP

Job Title: Decontamination **Date of Analysis:** 5/30/06

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).

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Job Hazard Analysis - Short Form HASP

Job Title: Decontamination **Date of Analysis:** 5/30/06

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	4C) Exposure to contaminants	4C) 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.

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Job Hazard Analysis - HASP Format

Job Title: Groundwater Sampling **Date of Analysis:** 9/21/06

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

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Job Hazard Analysis - HASP Format

Job Title: Groundwater Sampling **Date of Analysis:** 9/21/06

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:** 9/21/06

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.

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Job Hazard Analysis - HASP Format

Job Title: Soil Sampling **Date of Analysis:** 5/1/07

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

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Job Hazard Analysis - HASP Format

Job Title: Soil Sampling **Date of Analysis:** 5/1/07

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:** 5/1/07

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.

AHA - Geoprobe Investigation – Oversight and Sample Collection ONLY

Activity/Work Task:	Geoprobe Investigation – Oversight and Sample Collection ONLY			Overall Risk Assessment Code (RAC) (Use highest code)	**M**
Project Location:				**Risk Assessment Code (RAC) Matrix**	
Contract Number:				**Severity**	**Probability**
Date Prepared:	8/29/2011	**Date Accepted:**	**5/3/2013**		Frequent / Likely / Occasional / Seldom / Unlikely
Prepared by (Name/Title):				Catastrophic	**E** / **E** / **H** / **H** / **M**
Reviewed by (Name/Title):	Kendra Bavor, CSP			Critical	**E** / **H** / **H** / **M** / **L**
				Marginal	**H** / **M** / **M** / **L** / **L**
				Negligible	**M** / **L** / **L** / **L** / **L**

Notes: (Field Notes, Review Comments, etc.)

This AHA involves the following:

- Establishing site specific measures
-

This AHA is not an exhaustive summary of all hazards associated with the Site. Refer to the site HASP for additional requirements. Contractor to follow general site safety controls for Slips Trips and Falls, Biological hazards, cuts lacerations and pinch points, and emergency procedures.

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

- **E = Extremely High Risk**
- **H = High Risk**
- **M = Moderate Risk**
- **L = Low Risk**

Job Steps	Hazards	Controls	RAC
1. Subcontractor Drive Geoprobe onto site	1A) Malfunction of vehicle/equipment	1A) Drivers shall perform a pre-operational check of equipment, read and be familiar with any operator's manual. ▪ Report all needed repairs promptly. ▪ Operators shall not use defective/unsafe equipment.	**L**

	1B) Wreck of Geoprobe while being driven	1B) Wreck of Geoprobe while being driven ▪ All drivers shall be properly licensed. ▪ Supervisors shall verify that drivers are capable and qualified on each type of equipment before allowing the equipment to be used unsupervised. ▪ Keep wind shields, windshield wipers, side mirrors and side windows clean ▪ Drivers shall conduct a pre-operation vehicle safety check ▪ Drivers shall plan ahead to minimize or eliminate the need for backing. Always check to the rear before backing and use an observer when available. If an observer is not available, the driver shall walk around the vehicle to make sure rear is clear prior to backing. ▪ Seat belts shall be worn when driving by driver and passengers. ▪ Choose the safest location possible to park equipment. Avoid parking in blind spots of other equipment. ▪ Adjust vehicle speed for load and weather. Tire chains should be utilized as dictated by weather conditions. ▪ When operating a vehicle off the roadway, be aware of possible hidden objects in the grass and unstable terrain. ▪ Never allow anyone between truck and trailer when backing to hook trailer ▪ Perform periodic checks of equipment on long trips to assure the load is secure. ▪ Do not leave equipment unattended with the engine running. Shut off engine and set the parking brake when equipment is not in use.	**L**
2. Loading/unloading of equipment	2A) Crush and pinch points created when loading/unloading equipment 2B) Heavy lifting, twisting, bending 2C) Slip, trips and falls	2A) Crush and pinch points created when loading/unloading equipment ▪ Be aware of crushing and pinching hazards when loading, unloading and fastening down equipment. ▪ Make sure cargo is properly loaded and secured. ▪ Wear protective equipment consistent with the hazard (hard hats, safety glasses, leather gloves, safety shoes, etc.) 2B) Size up the load, utilize help for heavy items, split loads as necessary. Use proper body mechanics and ergonomic techniques. 2C) Keep walking area clear. Proper housekeeping.	**M**

3. Geoprobe operation by Subcontractor	3A) Vehicle movement/ unstable 3B) Crushing injuries, pinch points, entanglement and flying particles, 3C) Noise 3D) slip trips and falls, 3E) material under stress, equipment limitations, rope or cable blocks, hydraulic leaks 3F) utility lines, 3G) overhead loads, 3H) lifting 3I) Chemical exposure	Geoprobe operation by the Subcontractor. Read Owner's Manual. 3A) Always apply the parking brake and shut off engine before exiting the vehicle. • Ensure back up alarm is operational. • Complete a visual inspection of the equipment prior to operation. Replace or repair equipment if necessary. Complete a checklist to document inspections and corrective actions required. • Keep body parts clear of probe foot. • Be familiar with Emergency kill switch and controls. Test prior to probing. • When on sloped surface position the unit parallel to the slope with the control on the up hill side. • Use caution on soft or loose surface. Be aware of the weight of loaded vehicle. • Be aware of weather and windy conditions. Do not operate during lighting storm or high winds. 3B) Heed all Caution, Warning or Danger decals on machine. • Ensure everyone is clear of moving parts. • Designate only one experienced operator to avoid unexpected engagement. • Operate only from the control side. Do not reach across operating probe. • Avoid placing your hands on top of the tool string when raising/lowering the hammer or swinging/ folding probe assembly. • DO not wear loose clothing. Tie back hair when operating equipment. • PPE – safety shoes, hard hat, safety glasses, hearing protection, gloves. Optional Tyvek or coveralls. 3C) PPE – hearing protection. 3D) Maintain an orderly and clean site. • Housekeeping. • Barricade or establish work zones to minimize unauthorized entry. • Adequate lighting 3E) Know the capacities, equipment limitations and acceptable operating loads. Follow the equipment operator's manual and proper maintenance requirements. • Stand clear of potential release of energy. Keep body part clear of moving parts. • Use the correct tool for the job. • Limit the rate of the hammer lowering while advancing the tool string to avoid raising the probe foot more than 6 inches off the ground surface. • In the event problem or binding, the operator should release all control levers to neutral. • Inspect hydraulic lines. Repair or replace damaged hoses. 3F) Be aware of surroundings. Establish safe "dig" zones. Contact Dig Safe or "one call" system to mark underground utilities or tanks. • Before moving onto a site, evaluate height restrictions due to overhead utilities and vegetation. • Borings to be located a minimum of 10 feet from overhead lines. • Do not drive the machine with the mast extended.	**M**

		3G) Remain alert. Establish work zone to minimize workers under overhead loads. Avoid sudden jerks or overloading. Check load for balance and appropriate support prior to hoisting. 3H) Use mechanical means to lift heavy loads and removing rod. Don appropriate PPE for chemicals of concern. Work from upwind. Be aware or combustion fumes if equipment has auxiliary power. Practice good hygiene by washing hands, and no eating/smoking within the exclusion zone.	**L**
4. Operational area	4A) adverse weather conditions (temperature extremes), 4B) uneven terrain, 4C) poisonous plants/snakes/insects hazards	4A) Keep a weather eye. Monitor the weather forecast and actual conditions. • Wear appropriate clothing that does not restrict, cause over heat or is too loose. • Be aware of muddy conditions or puddles. 4B) Be aware of drop-offs, uneven ground and potential hidden objects which may cause loss of control when maneuvering rigs or create unstable drill set-ups. In heavily wooded area, scout to locate hidden objects. Use care when walking. 4C) Be aware of poisonous plants, insects, snakes, animals and animal waste products and carcasses. Wear long sleeve shirts, gloves, and high top boots when hazards cannot be avoided. Proper first aid supplies, insect repellents shall accompany field crews.	**M**
	4D) Contaminated soils, buried power or gas lines, landfills and containment of spills	4D) Contaminated soils, buried power or gas lines, landfills and containment of spills ▪ During drilling operations, always be aware of the possibility of encountering potentially hazardous materials, such as petroleum hydrocarbons, herbicides, pesticides, chemical manufacturing by-products or solid waste materials. ▪ In the event that any unknown or questionable materials are encountered, then the drilling operations are to be suspended immediately until further instructions are received from supervision. ▪ 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 gas or power line. ▪ 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.	**M**
5. Subcontractor Mixing grout on site and filling/placing in hole between the well pipe and bore hole wall	5A) Lifting 5B) Chemical exposure	5A) Size the load of materials to be moved and utilize appropriate help for lifting and moving. Use proper ergonomic and body mechanics to move materials (bags of grout, etc.). Use mechanical mixer for large quantities of grout. 5B) PPE – Safety glasses, safety shoes, gloves, optional tyvek/coveralls.	**M**
6. Subcontractor cutting soil acetate sleeve open to sample soil	6A) cutting of hand with a razor blade	6A) MACTEC personnel must let the subcontractor cut the sample liners as they have the appropriate tools to do so. 6B) Subcontractor must be aware of where hands are placed prior and during cutting with hand saw	**M**
7. Subcontractor driving drilling rig offsite.	7A) Reference item # 1	7A) Reference item #1.	

AHA - Geoprobe Investigation – Oversight and Sample Collection ONLY

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
PPE (Hard Hat, safety glasses, gloves, steel toe work boots, high visibility safety vest, hearing protection)	**Competent / Qualified Personnel:** Name – Position/Employer **Training requirements:** List specific certification (as applicable) Site Specific HASP Orientation Toolbox safety meeting Task kick-off meeting	Daily inspection of equipment per manufacturer's instructions. Tag tools that are defective and remove from service. Inspect power cord sets prior to use. Inspect all PPE prior to use

AHA - - Activity Title
Activity Description

Activity/Work Task:	Drilling Operation		
Project Location:			
Contract Number:			
Date Prepared:		**Date Accepted:**	
Prepared by (Name/Title):			
Reviewed by (Name/Title):			

Overall Risk Assessment Code (RAC) (Use highest code) **M**

Risk Assessment Code (RAC) Matrix

Severity	Probability				
	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Notes: (Field Notes, Review Comments, etc.)

This AHA involves the following:

- Establishing site specific measures
-

This AHA is not an exhaustive summary of all hazards associated with the Site. Refer to the site HASP for additional requirements. Contractor to follow general site safety controls for Slips Trips and Falls, Biological hazards, cuts lacerations and pinch points, and emergency procedures.

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

- **E = Extremely High Risk**
- **H = High Risk**
- **M = Moderate Risk**
- **L = Low Risk**

Job Steps	Hazards	Controls	RAC
1. Drive drilling rig onto site	1A) Malfunction of vehicle/equipment	1A) Drivers shall perform a pre-operational check of equipment, read and be familiar with any operator's manual. ▪ Report all needed repairs promptly. ▪ Operators shall not use defective/unsafe equipment.	**M**

	1B) Wreck of drill rig while being driven	1B) Wreck of drill rig while being driven ▪ All drivers shall be properly licensed. ▪ Supervisors shall verify that drivers are capable and qualified on each type of equipment before allowing the equipment to be used unsupervised. ▪ Keep wind shields, windshield wipers, side mirrors and side windows clean ▪ Drivers shall conduct a pre-operation vehicle safety check ▪ Drivers shall plan ahead to minimize or eliminate the need for backing. Always check to the rear before backing and use an observer when available. If an observer is not available, the driver shall walk around the vehicle to make sure rear is clear prior to backing. ▪ Seat belts shall be worn when driving by driver and passengers. ▪ Choose the safest location possible to park equipment. Avoid parking in blind spots of other equipment. ▪ Driver is to be sure the back-up alarm is working ▪ Adjust vehicle speed for load and weather. Tire chains should be utilized as dictated by weather conditions. ▪ Operators should always check and be sure of load height. ▪ When operating a vehicle off the roadway, be aware of possible hidden objects in the grass and unstable terrain. ▪ The mast shall always be in a lowered position when moving the drill rig. ▪ Never allow anyone between truck and trailer when backing to hook trailer ▪ Make sure tilt beds or ramps are secured before putting trailer in use ▪ Perform periodic checks of equipment on long trips to assure the load is secure. ▪ Do not leave equipment unattended with the engine running. Shut off engine and set the parking brake when equipment is not in use.	
2. Mounting and dismounting equipment	2A) Fall while mounting and dismounting equipment	2A) When mounting and dismounting equipment, use steps and handhold. Do not jump from vehicle.	
3. Loading/unloading of equipment	3A) Crush and pinch points created when loading/unloading equipment	3A) Crush and pinch points created when loading/unloading equipment ▪ Be aware of crushing and pinching hazards when loading, unloading and fastening down equipment. ▪ Make sure cargo is properly loaded, secured and covered using only approved chain and load binders. Check for loose material on bed and trailer. Secure loose material. ▪ Wear protective equipment consistent with the hazard (hard hats, safety glasses, leather gloves, safety shoes, etc.) ▪ Hook/unhook on stable ground with the trailer secure.	

4. Rig equipment operation.	4A) Crushing injuries, slip trips and falls, material under stress, power equipment operations, utility lines, overhead loads, flying particles, rope or cable blocks, equipment limitations, lifting and pinch points	4A) Rig equipment operation. ▪ Before use, inspect cable, chain or wire for wear and replace if necessary. ▪ Observe OSHA guidelines for use of cable clamps, safety latches, chains and slings. ▪ Know rated capacity of chain, cable or wire rope being used and never exceed the rating. ▪ Avoid overloading and sudden jerks. ▪ Wear appropriate personal protective equipment with the hazard, including hard hats, safety glasses, leather gloves and safety shoes. ▪ Check loads to be lifted for balance and have the rigging inspected to ensure a safe and balanced condition exists. ▪ Do not allow employees to stand or work under suspended loads. ▪ Awkward loads shall have taglines attached to control the load. ▪ Review signals and operator communications with crew. Only one person shall direct the operator. ▪ Review the area for utility lines, tree limbs and other overhead hazards. Work no closer than 10 feet to active overhead power lines. Follow OSHA guidelines. ▪ Personnel working tag lines shall review the area for slipping, tripping and falling hazards. If not possible to eliminate the hazards, take precautions to avoid them.	
5. Stabilize rig with hydraulic jack/pads	5A) Crushing injuries, slip, trip, fall hazards and potential back injuries.	5A) Crushing injuries, slip, trip, fall hazards and potential back injuries. ▪ Use proper lifting techniques. ▪ Ensure jack is rated for weight/operation with safe limits ▪ Assure that area is clear of personnel and obstacles. ▪ Place pads under jacks to prevent them from sinking into the ground.	

6. Start/operate drill rig	6A) Moving machinery parts, buried and overhead utilities, drill rod stacking, lifting, winching, cathead operations, moving equipment, noise, adverse weather conditions, animals, slippery surfaces, uneven terrain, poisonous plants/snakes/insects and overhead hazards	6A) Moving machinery parts, buried and overhead utilities, drill rod stacking, lifting, winching, cathead operations, moving equipment, noise, adverse weather conditions, animals, slippery surfaces, uneven terrain, poisonous plants/snakes/insects and overhead hazards ▪ Wear appropriate personal protective equipment consistent with the hazard (hard hat, safety glasses, leather gloves, safety shoes, etc.) ▪ Avoid contact with rotating equipment ▪ When cathead is in use, assure a safe travel path for the rope by using proper techniques. Avoid standing on the rope. ▪ Observe and stay clear (minimum of 10 feet for nominal system voltage, utility lines, rated 50kV and an additional 0.4 inch for each kV over 50kV or twice the length of the line insulator, but never less than 10 feet) of overhead utility lines. - In transit with no load and boom lowered, the equipment clearance shall be a minimum of 4 feet for voltage less than 50kV and 10 feet for voltages over 50kV up to and including 345kV and 16 feet for voltages up to and including 750kV. - A person shall be designated to observe clearance of the equipment and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means. - Have underground utility lines properly located and marked prior to drilling. ▪ Employees on foot must use extreme caution to stay clear of operating equipment. Always establish eye contact with the operator before approaching the equipment. ▪ Be aware of drop-offs, uneven ground and potential hidden objects which may cause loss of control when maneuvering drill rigs or create unstable drill set-ups. In heavily wooded area, scout to locate hidden objects. ▪ Drill rod stacking must not exceed a length of 1.5 times the height of the tower. ▪ Be aware of poisonous plants, insects, snakes, animals and animal waste products and carcasses. Wear long sleeve shirts, gloves, and high top boots when hazards cannot be avoided. Proper first aid supplies, insect repellents shall accompany field crews. ▪ Be alert to conditions that can lead to slippery surfaces. Examples: high groundwater resulting in muddy soils brought to the surface by augers and the utilization of bentonite drilling fluid. ▪ Inspect all cables and clamps prior to winching operation. Stand clear of winching operations. ▪ Use proper lifting techniques. Get help or use lifting equipment. ▪ Suspend drilling operations during electrical storms ▪ Be aware of overhead hazards which may come in contact with the drill rig, when moving or setting up equipment. ▪ Complete a daily operations checklist to ensure that equipment is working properly. Make special note of emergency kill switches.	

	6B) Contaminated soils, buried power or gas lines, landfills and containment of spills	6A) Contaminated soils, buried power or gas lines, landfills and containment of spills ▪ During drilling operations, always be aware of the possibility of encountering potentially hazardous materials, such as petroleum hydrocarbons, herbicides, pesticides, chemical manufacturing by-products or solid waste materials. ▪ In the event that any unknown or questionable materials are encountered, then the drilling operations are to be suspended immediately until further instructions are received from supervision. ▪ 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 unlocated or improperly located gas or power line. ▪ 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.	
7. Attach auger to drill	7A) Auger coming loose from drill	7A) Auger coming loose from drill Insert a holding pin in auger ▪ Insert a holding pin in auger ▪ Use personal protective equipment such as leather gloves, safety glasses, hard hat and safety shoes. ▪ Be aware of hand and finger positions when inserting holding pin	
8. Start drill by lever operations	8A) Operation of wrong lever	8A) Label levers as to their operation and review equipment manual.	
9. Maintain proper auger drill speed with down hole pressure speed.	9A) Unstable rig from improper speed of auger	9A) Use of trained drill rig personnel and follow equipment manual specification.	
10. When auger has dug into ground unhook pin and insert another auger on top of the previous auger	10A) Auger coming loose (reference item #7)	10A) Insert another catch pin into newly installed auger (reference item #7)	
11. Insert PVC pipe into hollow stem auger in 10 foot sections	11A) Reference Hazard item #6a	11A) Reference Control item #6A	
12. Install filter pack (50 pound bags of sand) into hole (by pouring) to filter water into screen	12A) Back injuries, slips and falls	12A) Proper lifting procedures, team lifting and use of mechanical devices. Wear proper foot wear and maintain area in good housekeeping condition.	
13. Reverse auger after each five foot section of sand is installed	13A) Reference hazard item #4	14A) Reference Control item #4	
14. Install Betonies on top of sand (3 foot) to seal up area above sand.	14A) Reference hazard item #12	14B) Reference control item #12	
15. Remove auger	15A) Auger falling	15A) Insert auger- maintain auger at ground surface to prevent auger from falling into hole.	

AHA - - Activity Title
Activity Description

16. Release auger tension and remove pins. Remove auger from hole.	16A) Reference hazard item #4	16A) Reference control item #4	
17. Lower drill head attached to auger remaining in bore hole attach with a pin	17A) Reference hazard in item #4	17A) Reference control in item #4	
18. Decontamination of drill equipment-usually pressure water	18A) Contamination of personnel and environment	18A) Follow health and safety plan, dress to proper EPA level, contain material washed from contaminated equipment with proper containment materials. Trained/authorized personnel to use pressure washer and assure area is clean of personnel prior to operation of pressure water device.	
19. Mix grout on site and fill/place in hole between the well pipe and bore hole wall	19A) Reference hazard item #12	19A) Reference control item #12	
20. Cut PVC pipe off at determined height with a hand saw	20A) cutting of hand with hand saw	20A) Be aware of where hands are placed prior and during cutting with hand saw	
21. Install a protective cover and fill with grout.	21A) Reference hazard item #12	21A) Reference control item #12	
22. Driving drilling rig offsite.	22A) Reference item # 1	22A) Reference item #1.	

AHA - - Activity Title
Activity Description

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
PPE (1/2 face respirator with P-100 cartridge, Hard Hat, safety glasses, gloves, steel toe work boots, high visibility safety vest, hearing protection)	**Competent / Qualified Personnel:** Name – Position/Employer **Training requirements:** List specific certification (as applicable) Site Specific HASP Orientation Toolbox safety meeting Task kick-off meeting	Daily inspection of equipment per manufacturer's instructions. Tag tools that are defective and remove from service. Inspect power cord sets prior to use. Inspect all PPE prior to use

MACTEC

Job Hazard Analysis - HASP Format

Job Title: Insect Stings and Bites **Date of Analysis:** 4/20/06

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.

MACTEC

Job Hazard Analysis - HASP Format

Job Title: Working with Preservatives (Acids) **Date of Analysis:** 5/30/06

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.

AHA - - Soil Vapor Sampling
Activity Description

Activity/Work Task:	Soil Vapor Sampling		
Project Location:			
Contract Number:			
Date Prepared:	9/25/2012	**Date Accepted:**	
Prepared by (Name/Title):			
Reviewed by (Name/Title):			

Overall Risk Assessment Code (RAC) (Use highest code): **M**

Risk Assessment Code (RAC) Matrix

Severity	Probability				
	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Notes: (Field Notes, Review Comments, etc.)

This AHA involves the following:

- Establishing site specific measures
-

This AHA is not an exhaustive summary of all hazards associated with the Site. Refer to the site HASP for additional requirements. Contractor to follow general site safety controls for Slips Trips and Falls, Biological hazards, cuts lacerations and pinch points, and emergency procedures.

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

- **E = Extremely High Risk**
- **H = High Risk**
- **M = Moderate Risk**
- **L = Low Risk**

Job Steps	Hazards	Controls	RAC
1. Mobilization	1A) See JHA Mobilization/Demobilization/Site Preparation	1A) See JHA Mobilization/Demobilization/Site Preparation	**M**
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. Access Residence or outdoor location	4A) Tripping hazards	4A) Observe floors/stairs for potential tripping hazards	
	4B) Back strain	4B) Watch back when carrying equipment into residence	
	4C) Chemical Hazard	4C) Be careful when identifying residential chemicals ▪ Wear PPE as described in the HASP.	

AHA - - Soil Vapor Sampling
Activity Description

5. Drill Hole in basement floor or exterior location	5A) Electrocution	5A) 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.	
	5B) Exposure to hazardous Inhalation and contact with hazardous substances (VOC contaminated Soil Vapor).	5B) Exposure to hazardous substances ▪ Wear PPE as identified in HASP (steel-toed boots, safety glasses, nitrile gloves and a flashlight or lamp). ▪ Review hazardous properties of site contaminants with workers before sampling operations begin ▪ Immediately monitor breathing zone using a PID after drilling hole to determine exposure and verify that level of PPE is adequate – see Action Levels in HASP	
	5C) Back strain due to lifting and from moving equipment	5C) Back strain ▪ Use mechanical aids when possible, if mechanical aids are not available, use two person lifts for heavy items. ▪ Use proper lifting techniques	
	5D) Foot injuries from dropped equipment/drill bit	5D) 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 ▪ Watch feet when drilling and hold drill firmly ▪ Wear Steel toed boots	
6. Collecting sample	6A) Burn Hazard/fire Hazard	6A) Burn Hazard/ Fire Hazard from Melting Wax ▪ Place hot plate in safe location away from flammable material ▪ Be careful with exposed skin when working around hot plate and hot wax. ▪ Poor wax with spoon and avoid splatter.	
	6B) Cutting Hazard	6B) Be careful with sharp knives when cutting tubing	
	6C) Exposure to contaminants	6C) Exposure to Contaminants ▪ Monitor breathing zone with appropriate monitoring equipment (see HASP) ▪ Wear chemical resistant PPE as identified in HASP ▪ See section 5B) under Safe Practices above	

AHA - - Soil Vapor Sampling
Activity Description

7. Collecting sample	7A) Pinching Hazard	7A) Pinching Hazard from attaching regulators/tubing ▪ Be careful when using wrenches to attach regulator and or tubing to cans to not pinch fingers	

AHA - - Soil Vapor Sampling
Activity Description

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
PPE (1/2 face respirator with P-100 cartridge, Hard Hat, safety glasses, gloves, steel toe work boots, high visibility safety vest, hearing protection)	**Competent / Qualified Personnel:** Name – Position/Employer **Training requirements:** List specific certification (as applicable) Site Specific HASP Orientation Toolbox safety meeting Task kick-off meeting	Daily inspection of equipment per manufacturer's instructions. Tag tools that are defective and remove from service. Inspect power cord sets prior to use. Inspect all PPE prior to use

MACTEC

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

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Identify location of underground utilities	1A) Encountering electrical, gas, communications, water, or other underground utility lines	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
2. Excavation of soils	2A) Underground utilities	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 powerlines of 50 KV or less stay at least 10 feet away. For powerlines of > 50 KV, add an additional 0.4 inches per KV over 50 KV. Rule of thumb: Stay 10 feet away if powerline known to be 50 KV or less. Stay 35 feet away for lines > 50 KV or if voltage is unknown.
	2B) Vapor/Dust Exposure	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).
	2C) Odors	2C) Odors ▪ Implement odor control mitigation in accordance with the Site Management Plan.
	2D) Heavy Equipment	2D) Heavy Equipment ▪ See General Site Hazards
	2E) Cave-ins	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 ▪ 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.

MACTEC

Job Hazard Analysis - HASP Format

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

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	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.

Chemicals of Concern

1. 1,2 Dichloroethene
2. Vinyl Chloride
3. Ethylbenzene
4. Xylene
5. Trichloroethene
6. Tetrachloroethene
7. 1,2,4 Trimethylbenzene

ATTACHMENT A

CONTAMINANT FACT SHEET

CONTAMINANT FACT SHEET

Chemical Name:
Cis -1,2-Dichloroethylene
CAS Number: 540-59-0
Synonyms:
Acetylene dichloride,
cis -Acetylene dichloride,
trans-Acetylene dichloride,

HEALTH HAZARD DATA

Color: Colorless

Physical State: Solid
Liquid X
Gas

Odor: Chloroform-like

Odor Threshold: 0.08-17 ppm

Vapor Density: 3.35 g/L

Ionization Potential (IP): 9.65 eV

IDLH: 1000 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 and respiratory system,
CNS, depression

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

AIR MONITORING

Type	Brand/Model No.	Calibrations Method/Media	Relative Response or Conversion Factor	Meter Specific Action Level
PID	Microtip 10.6eV	Isobutylene 100 ppm	1.25	125 ppm

Checked by: Emmet C. Sundquist Date: 6/12/08

PERSONAL PROTECTIVE EQUIPMENT

Recommended Protective Clothing Materials:
Suits: Teflon, Viton, PE/EVAL, Barricade, CPF3, Tychem 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 = 1000 ppm
MUC Full-Face APR = TWA x 10 = 1000 ppm

FIRE/REACTIVITY DATA

Flash Point: 36-39 ° F

LEL/UEL: 5.6% / 12.8%

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

Incompatibilities:
Strong oxidizers, strong alkalis, potassium hydroxide, copper

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:
Vinyl Chloride

CAS Number: 75-01-4

Synonyms:
Chloroethene, chloroethylene, ethylene monochloride, VC, monochloroethene

HEALTH HAZARD DATA

Color: Colorless

Physical State: Solid
Liquid X below 7^0 F
Gas X

Odor: pleasant

Odor Threshold: 10-20 ppm

Vapor Density: 2.15 g/L
Vapor Pressure 3.3 atm
Ionization Potential (IP): 9.99 eV

IDLH: Not Determined

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

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

Signs/Symptoms of Acute Exposure:
Weakness, abdominal pain, frostbite paleness or blueness of extremeties

Source	TWA (units)	STEL (units)	C (units)
OSHA PELs	1.0 ppm		5.0 ppm
ACGIH TLVs	1.0 ppm		
NIOSH RELs	Lowest Feasible		

AIR MONITORING

Type	Brand/Model No.	Calibrations Method/Media	Relative Response or Conversion Factor	Meter Specific Action Level
PID	10.6eV	Isobutylene 100 ppm	0.51	0.5 ppm*
PID	HNu 10.2eV	Isobutylene 100 ppm	0.32	0.32 ppm*
PID	HNu 11.7 eV	Isobutylene 100 ppm	0.78	0.78 ppm*
Detector Tube	Drager 6728061	0.5 - 3 ppm		0.5 ppm

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

PERSONAL PROTECTIVE EQUIPMENT

Recommended Protective Clothing Materials:

Suits: Tychem, Teflon

Gloves: Teflon, Tychem; Nitrile Rubber

Boots: Nitrile Rubber, Teflon

Service Limit Concentration (ppm): N/A

MUC 1/2 Mask APR = TWA x 10 = N/A*
MUC Full-Face APR = TWA x 10 = N/A*

* Upgrade to Level B ppe. No Level C.

FIRE/REACTIVITY DATA

Flash Point: NA

LEL/UEL: 3.6% / 33%

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

Incompatibilities:
Copper, oxidizers, aluminum, peroxides, iron, steel (polymerizes in air, sunlight, or heat unless stabilized by inhibitors). Attacks iron and steel in presence of moisture.

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: 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

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, Xylol

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

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, excitement

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	Microtip 10.6 eV	Isobutylene 100 ppm	1.2	120 ppm
PID	HNu w/ 10.2 eV	Benzene 100 ppm	1.04	104 ppm

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

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

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

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:
Trichloroethene

CAS Number: 67-64-1

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

Ionization Potential (IP): 9.69 eV

IDLH: 1000 ppm

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

Skin absorbable: NO

Skin corrosive: NO

Signs/Symptoms of Acute Exposure:

Irritant to eyes and skin, headache, 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	25 ppm	
NIOSH RELs	25 ppm		

AIR MONITORING

Type	Brand/Model No.	Calibrations Method/Media	Relative Resonse or Conversion Factor	Meter Specific Action Level
PID	Micro tip 10.6 eV	Isobutylene 100 ppm	1.82	9.1 ppm
Detector Tube	Drager 6828541	2 – 50 ppm		5 ppm

Checked by: Date:

PERSONAL PROTECTIVE EQUIPMENT

Recommended Protective Clothing Materials:

Suits Viton, PE/EVAL, Tychem, Barricade, Trellchem, Teflon, Responder

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

Boots Teflon, Viton

Service Limit Concentration (ppm): 1000

MUC 1/2 Mask APR = TWA x 10 = 91 ppm

-MUC Full-Face APR = TWA x *50 = 606 ppm

*If quantitative fit testing is conducted, otherwise, use protection factor of 10

FIRE/REACTIVITY DATA

Flash Point: Unknown

LEL/UEL: 8%/10.5%

Fire Extinguishing Media:

Dry Chemical X Foam X

Water Spray X CO_2 X

Incompatibilities:

Strong caustics and alkalis, chemically-active metals(surch as barium, lithium, sodium, magnesium, titanium, and beryllium)

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 irritation

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/Model 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 Polyvinyl Alcohol (do not use in (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 potash

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:
1,2,4 Trimethylbenzene
CAS Number: 95-63-6
Synonyms:
psi-Cumeme, Pseudodocumene
asymmetrical trimethylbenzene

HEALTH HAZARD DATA

Color: clear, colorless

Physical State: Solid
Liquid X
Gas

Odor: distinctive, aromatic

Odor Threshold: 0.006 - 2.4 ppm

Vapor Density: 4.2
Vapor Pressure: 1 mm Hg @ 56° F
Ionization Potential (IP): 8.27 eV

IDLH: N.D.

Carcinogen: OSHA
IARC
NTP
ACGIH
NIOSH

Skin absorbable: Yes
Skin corrosive: No

Signs/Symptoms of Acute Exposure:
Irritates eyes, skin, nose, throat and respiratory system. Causes bronchitis, anemia, headaches drowsiness, lassitude, dizziness, nausia, vomiting confusion, chemical pneumonia.

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

AIR MONITORING

Type	Brand/Model No.	Calibrations Method/Media	Relative Response or Conversion Factor	Meter Specific Action Level
PID	Microtip 10.6eV	Isobutylene 100 ppm	0.86	10 ppm*
PID	Hnu 10.2 eV	Isobutylene 100 ppm		10 ppm*
FID	Foxboro OVA 128	Methane	0.63	

* when PID calibrated to read benzene equivalent.

Checked by: Date:

PERSONAL PROTECTIVE EQUIPMENT

Recommended Protective Clothing Materials:
Suits: Tychem responder - pure chem
Polycoated - ppm/ppb

Gloves: Nitrile, neoprene

Boots: Tychem, neoprene

Service Limit Concentration (ppm): 100 ppm*

MUC 1/2 Mask APR = TWA x 10 = 100 ppm*
MUC Full-Face APR = TWA x 10 = 100 ppm*
*Action limit as read on PID calibrated to read 1:1 benzene

FIRE/REACTIVITY DATA

Flash Point: 112° F

LEL/UEL: 0.9% - 6.4%

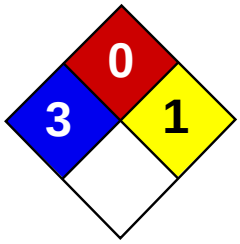
Fire Extinguishing Media:
Dry Chemical Foam
Water Spray ___ CO_2

Incompatibilities:
Oxidizers, Nitric Acid

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.

Safety Data Sheets (SDS)
Materials Brought to the Site

HYDROGEN CHLORIDE (HCL) (PRESERVATIVE)
NITRIC ACID (PRESERVATIVE)
LIQUINOX/ ALCONOX
ISOBUTYLENE
CALIBRATION SOLUTIONS (YSI)-PH4, PH7, DO, ORP, 1413 SPECIFIC COND.
METHANOL
BENTONITE
SULFURIC ACID



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

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:
****
Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.
****
Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

Effective date: 05/12/2015 **Revision:** 05/12/2015

LIQUINOX

1 Identification of the Substance/mixture and of the Company/Undertaking

1.1 Product identifier

Trade name: LIQUINOX

Application of the substance / the preparation: Hand detergent.

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

No additional information available.

1.3 Details of the supplier of the Safety Data Sheet

Manufacturer/Supplier:

Alconox, Inc.
30 Glenn St., Suite 309
White Plains, NY 10603
Phone: 914-948-4040

Further information obtainable from: Product Safety Department.

1.4 Emergency telephone number:

ChemTel Inc.: (800)255-3924, +1 (813)248-0585

2 Hazards Identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008:

Classification according to Directive 67/548/EEC or Directive 1999/45/EC:

GHS07

Skin Irrit. 2, H315: Causes skin irritation.

Information concerning particular hazards for human and environment:

The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.

Classification system:

The classification is according to the latest editions of the EU-lists, and extended by company and literature data

2.2 Label elements

Labelling according to Regulation (EC) No 1272/2008:

The product is classified and labelled according to the CLP regulation.

Hazard pictograms:

GHS07

Signal word: Warning

Hazard-determining components of labelling:

Alkyl benzene sulfonic acid, sodium salt.

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

Effective date: 05/12/2015 **Revision:** 05/12/2015

LIQUINOX

Hazard statements:
H315: Causes skin irritation.

Precautionary statements:

P332+P313: If skin irritation occurs: Get medical advice/attention.

P302+P352: IF ON SKIN: Wash with plenty of soap and water.

P501: Dispose of contents/container in accordance with local/regional/national/international regulations.

Other Hazard description:
WHMIS-classification and symbols:
D2B - Toxic material causing other toxic effects

NFPA ratings (scale 0 - 4)

Health = 1
Fire = 0
Reactivity = 0

HMIS-ratings (scale 0 - 4)

HEALTH	1
FIRE	0
REACTIVITY	0

Health = 1
Fire = 0
Reactivity = 0

2.3 Other hazards
Results of PBT and vPvB assessment
PBT: Not applicable.
vPvB: Not applicable.

3 Composition/Information on Ingredients

3.2 Chemical characterization: Mixture
Description: Hazardous ingredients of mixture listed below.

Identifying Nos.	Description	Wt. %
CAS: 68081-81-2	Alkyl benzene sulfonic acid, sodium salt	10 - 25%
CAS: 1300-72-7 EINECS: 215-090-9	Sodium xylene sulphonate	2.5 - 10%
CAS: 84133-50-6	Alcohol Ethoxylate	2.5 - 10%
CAS: 68603-42-9 EINECS: 271-657-0	Coconut diethanolamide	2.5 - 10%
CAS: 17572-97-3 EINECS: 241-543-5	Ethylenediaminetetraacetic acid, tripotassium salt	2.5 - 10%

Additional information: For the wording of the listed risk phrases refer to section 16.

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

Effective date: 05/12/2015 **Revision:** 05/12/2015

LIQUINOX

4 First Aid Measures

4.1 Description of first aid measures

General information:

Take affected persons out into the fresh air.

After inhalation:

Supply fresh air; consult doctor in case of complaints.

After skin contact:

Immediately wash with water and soap and rinse thoroughly for 30 minutes. If skin irritation continues, consult a doctor.

After eye contact:

Remove contact lenses if worn.

Rinse opened eye for at least 30 minutes under running water, lifting upper and lower lids occasionally. Immediately consult a doctor.

After swallowing:

Do not induce vomiting; call for medical help immediately. Rinse out mouth and then drink plenty of water.

A person vomiting while laying on their back should be turned onto their side.

4.2 Most important symptoms and effects, both acute and delayed:

Irritating, all routes of exposure.

4.3 Indication of any immediate medical attention and special treatment needed:

No additional information available.

5 Firefighting Measures

5.1 Extinguishing media:

Suitable extinguishing agents:

CO2, powder or water spray. Fight larger fires with water spray or alcohol resistant foam.

5.2 Special hazards arising from the substance or mixture:

No additional information available.

5.3 Advice for firefighters:

Protective equipment:

Wear self-contained respiratory protective device.

Wear fully protective suit.

6 Accidental Release Measures

6.1 Personal precautions, protective equipment and emergency procedures:

Ensure adequate ventilation.

Particular danger of slipping on leaked/spilled product.

6.2 Environmental precautions:

Dilute with plenty of water.

Do not allow to enter sewers/ surface or ground water.

6.3 Methods and material for containment and cleaning up:

Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).

Clean the affected area carefully; suitable cleaners are: Warm water

Dispose contaminated material as waste according to item 13. Ensure adequate ventilation.

6.4 Reference to other sections:

See Section 7 for information on safe handling.

See Section 8 for information on personal protection equipment.

See Section 13 for disposal information

7 Handling and Storage

7.1 Precautions for safe handling:

No special precautions are necessary if used correctly.

Information about fire - and explosion protection:

No special measures required.

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

Effective date: 05/12/2015 **Revision:** 05/12/2015

LIQUINOX

7.2 Conditions for safe storage, including any incompatibilities:
Storage:
Requirements to be met by storerooms and receptacles: No special requirements.
Information about storage in one common storage facility: No special requirements.
Further information about storage conditions: None

7.3 Specific end use(s): No additional information available.

8 Exposure Controls/Personal Protection

8.1 Control parameters
Ingredients with limit values that require monitoring at the workplace:
The product does not contain any relevant quantities of materials with critical values that have to be monitored at the workplace.

Additional information: The lists valid during the making were used as basis.

8.2 Exposure controls:
Personal protective equipment:
General protective and hygienic measures:
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Avoid contact with the eyes and skin.
Respiratory protection:
Not required under normal conditions of use.
Protection of hands:


Protective gloves

The glove material has to be impermeable and resistant to the product. Selection of the glove material should be based on the penetration time, rates of diffusion and the degradation of the glove material.

Material of gloves:
The selection of a suitable gloves does not only depend on the material, but also on the quality, and varies from manufacturer to manufacturer.
Penetration time of glove material:
The exact break through time has to be determined by the manufacturer of the protective gloves. DO NOT exceed the breakthrough time set by the Manufacturer.
For long term contact, gloves made of the following materials are considered suitable:
Butyl rubber, BR
Nitrile rubber, NBR
Natural rubber (NR)
Neoprene gloves
Eye protection:


Safety glasses
Goggles recommended during refilling.

Body protection: Protective work clothing

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

Effective date: 05/12/2015 **Revision:** 05/12/2015

LIQUINOX

9 Physical and Chemical Properties

9.1 Information on basic physical and chemical properties:

General Information:	
Appearance:	
Form:	Liquid
Color:	Light Yellow
Odor:	Odorless
Odor threshold:	Not determined.
pH-value:	8.5
Change in condition:	
Melting point/Melting range:	Not determined.
Boiling point/Boiling range:	100°C
Flash point:	Not applicable.
Flammability (solid, gaseous):	Not applicable.
Ignition temperature:	Not applicable.
Decomposition temperature:	Not determined.
Self-igniting:	Product is not selfigniting.
Danger of explosion:	Product does not present an explosion hazard.
Explosion limits:	
Lower:	Not determined.
Upper:	Not determined.
Vapor pressure at 20°C:	23 hPa
Density:	1.08 g/cm³
Relative density:	Not determined.
Vapor density:	Not determined.
Evaporation rate:	Not determined.
Solubility in / Miscibility with water:	Fully miscible.
Segregation coefficient (n-octanol/water):	Not determined.
Viscosity:	
Dynamic:	Not determined.
Kinematic:	Not determined.
Solvent content:	
Organic solvents:	Not determined.
Solids content:	Not determined.
9.2 Other information:	No additional information available.

10 Stability and Reactivity

10.1 Reactivity:

10.2 Chemical stability:

Thermal decomposition / conditions to be avoided:

No decomposition if used according to specifications.

10.3 Possibility of hazardous reactions:

Reacts with strong oxidizing agents. Reacts with strong acids.

10.4 Conditions to avoid:

No additional information available.

10.5 Incompatible materials:

No additional information available.

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

Effective date: 05/12/2015 **Revision:** 05/12/2015

LIQUINOX

10.6 Hazardous decomposition products:
Carbon monoxide and carbon dioxide
Sulphur oxides (SOx)
Nitrogen oxides

11 Toxicological Information

11.1 Information on toxicological effects:
Toxicity data: Toxicity data is available for mixture:
Primary irritant effect:
On the skin: Irritating to skin and mucous membranes.
On the eye: Strong irritant with the danger of severe eye injury.
Sensitization: No sensitizing effects known.
Additional toxicological information:
The product shows the following dangers according to the calculation method of the General EU Classification Guidelines for Preparations as issued in the latest version: Irritant

12 Ecological Information

12.1 Toxicity:
Aquatic toxicity: No additional information available.
12.2 Persistence and degradability: Biodegradable.
12.3 Bioaccumulative potential: Does not accumulate in organisms.
12.4 Mobility in soil: No additional information available.
Additional ecological information:
General notes:
Water hazard class 1 (German Regulation) (Self-assessment): slightly hazardous for water.
Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
Must not reach sewage water or drainage ditch undiluted or un-neutralized.
12.5 Results of PBT and vPvB assessment:
PBT: Not applicable.
vPvB: Not applicable.
12.6 Other adverse effects: No additional information available.

13 Disposal Considerations

13.1 Waste treatment methods:
Recommendation:
Smaller quantities can be disposed of with household waste.
Small amounts may be diluted with plenty of water and washed away. Dispose of bigger amounts in accordance with Local Authority requirements.
The surfactant used in this product complies with the biodegradability criteria as laid down in Regulation (EC) No. 648/2004 on detergents. Data to support this assertion are held at the disposal of the competent authorities of the Member States and will be made available to them, at their direct request or at the request of a detergent manufacturer.
Uncleaned packaging:
Recommendation: Disposal must be made according to official regulations.
Recommended cleansing agents: Water, together with cleansing agents, if necessary.

14 Transport Information

14.1 UN-Number:
DOT, ADR, ADN, IMDG, IATA: Not Regulated

14.2 UN proper shipping name:
DOT, ADR, IMDG, IATA: Not Regulated

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

Effective date: 05/12/2015 **Revision:** 05/12/2015

LIQUINOX

14.3 Transport hazard class(es):
DOT, ADR, IMDG, IATA:
Class: Not Regulated
Label: -

14.4 Packing group:
DOT, ADR, IMDG, IATA: Not Regulated

14.5 Environmental hazards:
Marine pollutant: No

14.6 Special precautions for user: Not applicable.

14.7 Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code: Not applicable.

UN "Model Regulation": Not Regulated

15 Regulatory Information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture:
United States (USA):
SARA:
Section 355 (extremely hazardous substances): None of the ingredient is listed.
Section 313 (Specific toxic chemical listings): None of the ingredient is listed.
TSCA (Toxic Substances Control Act): All ingredients are listed.

Proposition 65 (California):
Chemicals known to cause cancer: None of the ingredient is listed.
Chemicals known to cause reproductive toxicity for females: None of the ingredient is listed.
Chemicals known to cause reproductive toxicity for males: None of the ingredient is listed.
Chemicals known to cause developmental toxicity: None of the ingredient is listed.

Carcinogenic Categories:
EPA (Environmental Protection Agency): None of the ingredient is listed.
TLV (Threshold Limit Value established by ACGIH): None of the ingredient is listed.
NIOSH-Ca (National Institute for Occupational Safety and Health): None of the ingredient is listed.
OSHA-Ca (Occupational Safety & Health Administration): None of the ingredient is listed.

Canadá:
Canadian Domestic Substances List (DSL): All ingredients are listed.
Canadian Ingredient Disclosure list (limit 0.1%): None of the ingredient is listed.
Canadian Ingredient Disclosure list (limit 1%): None of the ingredient is listed.

15.2 Chemical safety assessment: A Chemical Safety Assessment has not been carried out.

16 Other Information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

Relevant phrases:
H315: Causes skin irritation.

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

Effective date: 05/12/2015 **Revision:** 05/12/2015

LIQUINOX

Abbreviations and Acronyms:

ADR: European Agreement concerning the International Carriage of Dangerous Goods by Road.
IMDG: International Maritime Code for Dangerous Goods.
DOT: US Department of Transportation.
IATA: International Air Transport Association.
GHS: Globally Harmonized System of Classification and Labelling of Chemicals.
ACGIH: American Conference of Governmental Industrial Hygienists.
NFPA: National Fire Protection Association (USA).
HMIS: Hazardous Materials Identification System (USA).
WHMIS: Workplace Hazardous Materials Information System (Canada).
VOC: Volatile Organic Compounds (USA, EU).
LC50: Lethal concentration, 50 percent.
LD50: Lethal dose, 50 percent.

SDS Created by:
Global Safety Management, Inc.
10006 Cross Creek Blvd
Tampa, FL, 33647
Tel: 1-844-GSM-INFO (1-844-476-4636)
Website: www.GSMSDS.com

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

---

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

---

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

---

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**

---

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.

---

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.

---

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

---

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

---

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

---

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

---

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

---

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

---

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.

---

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

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

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.

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.

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.

Material Safety Data Sheet
Methanol

ACC# 14280

Section 1 - Chemical Product and Company Identification

MSDS Name: Methanol
Catalog Numbers: AC167830000, AC167830025, AC167835000, AC176840000, AC176840010, AC176840025, AC176840250, AC176845000, AC177150000, AC177150010, AC177150025, AC177150050, AC177150051, AC177150250, AC177150251, AC268280000, AC268280010, AC268280025, AC325740000, AC325740010, AC325740025, AC326630000, AC326630010, AC326630025, AC326950000, AC326950010, AC326951000, AC326952500, AC327900000, AC327900010, AC364390000, AC364390010, AC364391000, AC413770000, AC413770040, AC413775000, AC423950000, AC423950010, AC423950040, AC423950200, AC423955000, AC610090040, AC610200040, AC610400010, AC61040019, AC61040019, AC61040050, AC61040050, AC610401000, AC61040115, AC61040115, AC61040200, AC610981000, AC611070040, AC615130025, S75162, S75163, S75959, S75965, S75965A, S75965HPLC, S93301, S93301A, S93302, S93302A, 19123467, A408-1, A408-4, A408-4LC, A408SK-4, A411-20, A411-4, A412-1, A412-20, A412-200, A412-200LC, A412-4, A412-4LC, A412-500, A412200001, A412CU-1300, A412FB-200, A412FB115, A412FB19, A412FB50, A412J500, A412P-4, A412P-4LC, A412POP19, A412POPB-200, A412RB-200, A412RB-50, A412RB115, A412RS-200, A412RS115, A412RS19, A412RS28, A412RS50, A412SK-4, A412SS-115, A412SS-200, A412SS-50, A413-20, A413-200, A413-4, A413-500, A433F-1GAL, A433P-1GAL, A433P-4, A433P1GAL, A433S-20, A433S-200, A433S-4, A434-20, A450-4, A452-1, A452-212, A452-4, A452-4LC, A452J1, A452N1-19, A452N2-19, A452POP-200, A452POP50, A452RS-115, A452RS-19, A452RS-200, A452RS-28, A452RS-50, A452SK-1, A452SK-4, A452SS-115, A452SS-19, A452SS-200, A452SS-28, A452SS-50, A453-1, A453-1LC, A453-4, A453-500, A453J1, A454-1, A454-4, A454-4LC, A454J1, A454RS-115, A454RS-200, A454RS-28, A454SS-19, A454SS-200, A454SS-28, A454SS-50, A455-1, A455RS19, A456-1, A456-4, A457-4, A4574LC, A935-4, A935RB-200, A935RB200, A947-4, A947-4LC, A947POP-200, A947POP200, A947RS-115, A947RS-200, A947RS-28, A947SS-115, A947SS-200, A947SS-28, A947SS-50, BP1105-1, BP1105-4, BP1105SS19, BP1105SS28, BP2618100, HC400 1GAL, NC9105104, NC9134255, NC9173853, NC9283877, NC9360649, NC9386568, NC9419923, NC9433033, NC9433739, NC9541632, NC9942270, NC9964975, SC95-1, SW2-1, TIA947-4, TIA947P-200, TIA947P-200L
Synonyms: Carbinol; Methyl alcohol; Methyl hydroxide; Monohydroxymethane; Wood alcohol; Wood naptha; Wood spirits; Columbian spirits; Methanol.
Company Identification:

Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410

For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
67-56-1	Methanol	> 99	200-659-6

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: APHA: 10 max clear liquid. Flash Point: 12 deg C.
Danger! Poison! May be fatal or cause blindness if swallowed. Vapor harmful. **Flammable liquid and vapor.** Harmful if swallowed, inhaled, or absorbed through the skin. Causes eye, skin, and respiratory tract irritation. May cause central nervous system depression. Cannot be made non-poisonous.
Target Organs: Eyes, nervous system, optic nerve.

Potential Health Effects

Eye: May cause painful sensitization to light. Methanol is a mild to moderate eye irritant. Inhalation, ingestion or skin absorption of methanol can cause significant disturbances in vision, including blindness.
Skin: Causes moderate skin irritation. May be absorbed through the skin in harmful amounts. Prolonged and/or repeated contact may cause defatting of the skin and dermatitis. Methanol can be absorbed through the skin, producing systemic effects that include visual disturbances.
Ingestion: May be fatal or cause blindness if swallowed. Aspiration hazard. Cannot be made non-poisonous. May cause gastrointestinal irritation with nausea, vomiting and diarrhea. May cause systemic toxicity with acidosis. May cause central nervous system depression, characterized by excitement, followed by headache, dizziness, drowsiness, and nausea. Advanced stages may cause collapse, unconsciousness, coma and possible death due to respiratory failure. May cause cardiopulmonary system effects.
Inhalation: Methanol is toxic and can very readily form extremely high vapor concentrations at room temperature. Inhalation is the most common route of occupational exposure. At first, methanol causes CNS depression with nausea, headache, vomiting, dizziness and incoordination. A time period with no obvious symptoms follows (typically 8-24 hrs). This latent period is followed by metabolic acidosis and severe visual effects which may include reduced reactivity and/or increased sensitivity to light, blurred, doubl and/or snowy vision, and blindness. Depending on the severity of exposure and the promptness of treatment, survivors may recover completely or may have permanent blindness, vision disturbances and/or nervous system effects.
Chronic: Prolonged or repeated skin contact may cause dermatitis. Chronic exposure may cause effects similar to those of acute exposure. Methanol is only very slowly eliminated from the body. Because of this slow elimination, methanol should be regarded as a cumulative poison. Though a single exposure may cause no effect, daily exposures may result in the accumulation of a harmful amount. Methanol has produced fetotoxicity in rats and teratogenicity in mice exposed by inhalation to high concentrations that did not produce significant maternal toxicity.

Section 4 - First Aid Measures

Eyes: In case of contact, immediately flush eyes with plenty of water for a t least 15 minutes. Get medical aid.
Skin: In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid immediately. Wash clothing before reuse.
Ingestion: Potential for aspiration if swallowed. Get medical aid immediately. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If vomiting occurs naturally, have victim lean forward.
Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
Notes to Physician: Effects may be delayed.
Antidote: Ethanol may inhibit methanol metabolism.

Section 5 - Fire Fighting Measures

General Information: Ethanol may inhibit methanol metabolism. As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Use water spray to keep fire-exposed containers cool. Water may be ineffective. Material is lighter than

water and a fire may be spread by the use of water. Vapors are heavier than air and may travel to a source of ignition and flash back. Vapors can spread along the ground and collect in low or confined areas.

Extinguishing Media: For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam. Water may be ineffective. For large fires, use water spray, fog or alcohol-resistant foam. Do NOT use straight streams of water.
Flash Point: 12 deg C (53.60 deg F)
Autoignition Temperature: 455 deg C (851.00 deg F)
Explosion Limits, Lower:6.0 vol %
Upper: 31.00 vol %
NFPA Rating: (estimated) Health: 1; Flammability: 3; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Use water spray to disperse the gas/vapor. Remove all sources of ignition. Absorb spill using an absorbent, non-combustible material such as earth, sand, or vermiculite. Do not use combustible materials such as sawdust. Use a spark-proof tool. Provide ventilation. A vapor suppressing foam may be used to reduce vapors. Water spray may reduce vapor but may not prevent ignition in closed spaces.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Ground and bond containers when transferring material. Use spark-proof tools and explosion proof equipment. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep container tightly closed. Do not ingest or inhale. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames. Use only with adequate ventilation. Keep away from heat, sparks and flame. Avoid use in confined spaces.
Storage: Keep away from heat, sparks, and flame. Keep away from sources of ignition. Store in a cool, dry, well-ventilated area away from incompatible substances. Flammables-area. Keep containers tightly closed.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Use explosion-proof ventilation equipment. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.
Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Methanol	200 ppm TWA; 250 ppm STEL; Skin - potential significant contribution to overall exposure by the cutaneous r oute	200 ppm TWA; 260 mg/m3 TWA 6000 ppm IDLH	200 ppm TWA; 260 mg/m3 TWA

OSHA Vacated PELs: Methanol: 200 ppm TWA; 260 mg/m3 TWA
Personal Protective Equipment
Eyes: Wear chemical splash goggles.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

Section 9 - Physical and Chemical Properties

Physical State: Clear liquid
Appearance: clear, colorless - APHA: 10 max
Odor: alcohol-like - weak odor
pH: Not available.
Vapor Pressure: 128 mm Hg @ 20 deg C
Vapor Density: 1.11 (Air=1)
Evaporation Rate:5.2 (Ether=1)
Viscosity: 0.55 cP 20 deg C
Boiling Point: 64.7 deg C @ 760 mmHg
Freezing/Melting Point:-98 deg C
Decomposition Temperature: Not available.
Solubility: miscible
Specific Gravity/Density:.7910 g/cm3 @ 20°C
Molecular Formula:CH4O
Molecular Weight:32.04

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: High temperatures, ignition sources, confined spaces.
Incompatibilities with Other Materials: Oxidizing agents, reducing agents, acids, alkali metals, potassium, sodium, metals as powders (e.g. hafnium, raney nickel), acid anhydrides, acid chlorides, powdered aluminum, powdered magnesium.
Hazardous Decomposition Products: Carbon monoxide, irritating and toxic fumes and gases, carbon dioxide, formaldehyde.
Hazardous Polymerization: Will not occur.

Section 11 - Toxicological Information

RTECS#:
CAS# 67-56-1: PC1400000
LD50/LC50:
CAS# 67-56-1:
Draize test, rabbit, eye: 40 mg Moderate;
Draize test, rabbit, eye: 100 mg/24H Moderate;
Draize test, rabbit, skin: 20 mg/24H Moderate;
Inhalation, rabbit: LC50 = 81000 mg/m3/14H;
Inhalation, rat: LC50 = 64000 ppm/4H;
Oral, mouse: LD50 = 7300 mg/kg;
Oral, rabbit: LD50 = 14200 mg/kg;
Oral, rat: LD50 = 5600 mg/kg;
Skin, rabbit: LD50 = 15800 mg/kg;
.
Human LDLo Oral: 143 mg/kg; Human LDLo Oral: 428 mg/kg; Human TCLo Inhalation; 300 ppm caused visual field changes & headache; Monkey LDLo Skin: 393 mg/kg. Methanol is significantly less toxic to

most experimental animals than humans, because most animal species metabolize methanol differently. Non-primate species do not ordinarily show symptoms of metabolic acidosis or the visual effects which have been observed in primates and humans.
Carcinogenicity:
CAS# 67-56-1: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: No information found
Teratogenicity: There is no human information available. Methanol is considered to be a potential developmental hazard based on animal data. In animal experiments, methanol has caused fetotoxic or teratogenic effects without maternal toxicity.
Reproductive Effects: See actual entry in RTECS for complete information.
Mutagenicity: See actual entry in RTECS for complete information.
Neurotoxicity: ACGIH cites neuropathy, vision and CNS under TLV basis.
Other Studies:

Section 12 - Ecological Information

Ecotoxicity: Fish: Fathead Minnow: 29.4 g/L; 96 Hr; LC50 (unspecified)Fish: Goldfish: 250 ppm; 11 Hr; resulted in deathFish: Rainbow trout: 8000 mg/L; 48 Hr; LC50 (unspecified)Fish: Rainbow trout: LC50 = 13-68 mg/L; 96 Hr.; 12 degrees CFish: Fathead Minnow: LC50 = 29400 mg/L; 96 Hr.; 25 degrees C, pH 7.63Fish: Rainbow trout: LC50 = 8000 mg/L; 48 Hr.; UnspecifiedBacteria: Phytobacterium phosphoreum: EC50 = 51,000-320,000 mg/L; 30 minutes; Microtox test No data available.
Environmental: Dangerous to aquatic life in high concentrations. Aquatic toxicity rating: TLm 96>1000 ppm. May be dangerous if it enters water intakes. Methyl alcohol is expected to biodegrade in soil and water very rapidly. This product will show high soil mobility and will be degraded from the ambient atmosphere by the reaction with photochemically produced hyroxyl radicals with an estimated half-life of 17.8 days. Bioconcentration factor for fish (golden ide) < 10. Based on a log Kow of -0.77, the BCF value for methanol can be estimated to be 0.2.
Physical: No information available.
Other: No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series:
CAS# 67-56-1: waste number U154 (Ignitable waste).

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	METHANOL	METHANOL
Hazard Class:	3	3
UN Number:	UN1230	UN1230
Packing Group:	II	II
Additional Info:		FLASHPOINT 11 C

Section 15 - Regulatory Information

US FEDERAL

TSCA

CAS# 67-56-1 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

CERCLA Hazardous Substances and corresponding RQs

CAS# 67-56-1: 5000 lb final RQ; 2270 kg final RQ

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 67-56-1: immediate, fire.

Section 313

This material contains Methanol (CAS# 67-56-1, > 99%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:

CAS# 67-56-1 is listed as a hazardous air pollutant (HAP).
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.
None of the chemicals in this product are listed as Priority Pollutants under the CWA.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 67-56-1 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

California No Significant Risk Level: None of the chemicals in this product are listed.

European / International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

T F

Risk Phrases:

R 11 Highly flammable.
R 23/24/25 Toxic by inhalation, in contact with skin and if swallowed.
R 39/23/24/25 Toxic : danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed.

Safety Phrases:

S 16 Keep away from sources of ignition - No smoking.
S 36/37 Wear suitable protective clothing and gloves.
S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 7 Keep container tightly closed.

WGK (Water Danger/Protection)

CAS# 67-56-1: 1

Canada - DSL/NDSL

CAS# 67-56-1 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of B2, D1B, D2B.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian Ingredient Disclosure List

CAS# 67-56-1 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information

MSDS Creation Date: 7/21/1999
Revision #14 Date: 9/05/2006

HALLIBURTON

MATERIAL SAFETY DATA SHEET

Product Trade Name: **BENTONITE**

Revision Date: 24-Jul-2014

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Trade Name: BENTONITE
Synonyms: None
Chemical Family: Mineral
Application: Weight Additive

Manufacturer/Supplier
Halliburton Energy Services, Inc.
P.O. Box 1431
Duncan, Oklahoma 73536-0431
Emergency Telephone: (281) 575-5000

Prepared By
Chemical Compliance
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

2. COMPOSITION/INFORMATION ON INGREDIENTS

Substances	CAS Number	PERCENT (w/w)	ACGIH TLV-TWA	OSHA PEL-TWA
Bentonite	1302-78-9	60 - 100%	TWA: 1 mg/m^3	Not applicable
Crystalline silica, quartz	14808-60-7	1 - 5%	TWA: 0.025 mg/m^3	$\frac{10\ mg/m^3}{\%SiO2 + 2}$
Crystalline silica, cristobalite	14464-46-1	0.1 - 1%	TWA: 0.025 mg/m^3	1/2 x $\frac{10\ mg/m^3}{\%SiO2 + 2}$
Crystalline silica, tridymite	15468-32-3	0.1 - 1%	0.05 mg/m^3	1/2 x $\frac{10\ mg/m^3}{\%SiO2 + 2}$

More restrictive exposure limits may be enforced by some states, agencies, or other authorities.

3. HAZARDS IDENTIFICATION

Hazard Overview

CAUTION! - ACUTE HEALTH HAZARD
May cause eye and respiratory irritation.

DANGER! - CHRONIC HEALTH HAZARD
Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease.

This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposures below recommended exposure limits. Wear a NIOSH certified, European Standard EN 149, AS/NZS 1715, or equivalent respirator when using this product. Review the Safety Data Sheet (SDS) for this product, which has been provided to your employer.

4. FIRST AID MEASURES

Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Skin Wash with soap and water. Get medical attention if irritation persists.

Eyes In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

Ingestion Under normal conditions, first aid procedures are not required.

Notes to Physician Treat symptomatically.

5. FIRE FIGHTING MEASURES

Flash Point/Range (F):	Not Determined
Flash Point/Range (C):	Not Determined
Flash Point Method:	Not Determined
Autoignition Temperature (F):	Not Determined
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined

Fire Extinguishing Media All standard firefighting media.

Special Exposure Hazards Not applicable.

Special Protective Equipment for Fire-Fighters Not applicable.

NFPA Ratings: Health 0, Flammability 0, Reactivity 0
HMIS Ratings: Health 0*, Flammability 0, Physical Hazard 0 , PPE: E

6. ACCIDENTAL RELEASE MEASURES

Personal Precautionary Measures Use appropriate protective equipment. Avoid creating and breathing dust.

Environmental Precautionary Measures None known.

Procedure for Cleaning / Absorption	Collect using dustless method and hold for appropriate disposal. Consider possible toxic or fire hazards associated with contaminating substances and use appropriate methods for collection, storage and disposal.

7. HANDLING AND STORAGE

Handling Precautions	This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposure below recommended exposure limits. Wear a NIOSH certified, European Standard En 149, or equivalent respirator when using this product. Material is slippery when wet.
Storage Information	Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Do not reuse empty container.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls	Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits.
Respiratory Protection	Wear a NIOSH certified, European Standard EN 149 (FFP2/FFP3), AS/NZS 1715, or equivalent respirator when using this product.
Hand Protection	Normal work gloves.
Skin Protection	Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing.
Eye Protection	Wear safety glasses or goggles to protect against exposure.
Other Precautions	None known.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid
Color:	Various
Odor:	Odorless
pH:	9.9
Specific Gravity @ 20 C (Water=1):	2.65
Density @ 20 C (lbs./gallon):	Not Determined
Bulk Density @ 20 C (lbs/ft3):	60
Boiling Point/Range (F):	Not Determined
Boiling Point/Range (C):	Not Determined
Freezing Point/Range (F):	Not Determined
Freezing Point/Range (C):	Not Determined
Vapor Pressure @ 20 C (mmHg):	Not Determined
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	Not Determined
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	Insoluble
Solubility in Solvents (g/100ml):	Not Determined
VOCs (lbs./gallon):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistokes):	Not Determined

Partition Coefficient/n-Octanol/Water: Not Determined
Molecular Weight (g/mole): Not Determined

10. STABILITY AND REACTIVITY

Stability Data: Stable

Hazardous Polymerization: Will Not Occur

Conditions to Avoid None anticipated

Incompatibility (Materials to Avoid) Hydrofluoric acid.

Hazardous Decomposition Products Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).

Additional Guidelines Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure Eye or skin contact, inhalation.

Sympotoms related to exposure

Acute Toxicity

Inhalation

Inhaled crystalline silica in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (IARC, Group 1). There is sufficient evidence in experimental animals for the carcinogenicity of tridymite (IARC, Group 2A).

Breathing silica dust may cause irritation of the nose, throat, and respiratory passages. Breathing silica dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Inhalation of dust may also have serious chronic health effects (See "Chronic Effects/Carcinogenicity" subsection below).

Eye Contact May cause eye irritation
Skin Contact May cause mechanical skin irritation.
Ingestion None known

Chronic Effects/Carcinogenicity

Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling, and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness, and reduced pulmonary function. This disease is exacerbated by smoking. Individuals with silicosis are predisposed to develop tuberculosis.

Cancer Status: The International Agency for Research on Cancer (IARC) has determined that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources can cause lung cancer in humans (Group 1 - carcinogenic to humans) and has determined that there is sufficient evidence in experimental animals for the carcinogenicity of tridymite (Group 2A - possible carcinogen to humans). Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997) in conjunction with the use of these minerals. The National Toxicology Program classifies respirable crystalline silica as "Known to be a human carcinogen". Refer to the 9th Report on Carcinogens (2000). The American Conference of Governmental Industrial Hygienists (ACGIH) classifies crystalline silica, quartz, as a suspected human carcinogen (A2).

There is some evidence that breathing respirable crystalline silica or the disease silicosis is associated with an increased incidence of significant disease endpoints such as scleroderma (an immune system disorder manifested by scarring of the lungs, skin, and other internal organs) and kidney disease.

Toxicology data for the components

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Bentonite	1302-78-9	> 5000 mg/kg (Rat) > 2000 mg/kg (Rat)	No data available	> 5.27 mg/L (Rat)
Crystalline silica, quartz	14808-60-7	> 5000 mg/kg (Rat)	No data available	No data available
Crystalline silica, cristobalite	14464-46-1	> 5000 mg/kg (Rat)	No data available	No data available
Crystalline silica, tridymite	15468-32-3	> 5000 mg/kg (Rat)	No data available	No data available

12. ECOLOGICAL INFORMATION

Ecotoxicological Information

Ecotoxicity Product

Acute Fish Toxicity: Not determined
Acute Crustaceans Toxicity: Not determined
Acute Algae Toxicity: Not determined

Ecotoxicity Substance

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Bentonite	1302-78-9	EC50(72h): > 100 mg/L (freshwater algae)	TLM96: 10000 ppm (Oncorhynchus mykiss) LC50(96h): 16000 - 19000 mg/L (Oncorhynchus mykiss) LC50(24h): 2800 – 3200 mg/L (black bass, warmouth bass, blue gill and sunfish)	No information available	EC50(96h): 81.6 mg/L (Metacarcinus magister) EC50(96h): 24.8 mg/L (Pandalus danae) EC50(48h) > 100 mg/L (Daphnia magna)
Crystalline silica, quartz	14808-60-7	No information available	LL0(96h): 10000 mg/L(Danio rerio) (similar substance)	No information available	LL50(24h): > 10000 mg/L (Daphnia magna) (similar substance)
Crystalline silica, cristobalite	14464-46-1	No information available	LL0(96h): 10000 mg/L(Danio rerio) (similar substance)	No information available	LL50(24h): > 10000 mg/L (Daphnia magna) (similar substance)
Crystalline silica, tridymite	15468-32-3	No information available	LL0(96h): 10000 mg/L(Danio rerio) (similar substance)	No information available	LL50(24h): > 10000 mg/L (Daphnia magna) (similar substance)

12.2. Persistence and degradability

The methods for determining biodegradability are not applicable to inorganic substances.

Substances	CAS Number	Persistence and Degradability
Bentonite	1302-78-9	The methods for determining biodegradability are not applicable to inorganic substances.
Crystalline silica, quartz	14808-60-7	The methods for determining biodegradability are not applicable to inorganic substances.
Crystalline silica, cristobalite	14464-46-1	The methods for determining biodegradability are not applicable to inorganic substances.
Crystalline silica, tridymite	15468-32-3	The methods for determining biodegradability are not applicable to inorganic substances.

12.3. Bioaccumulative potential

Does not bioaccumulate

Substances	CAS Number	Log Pow
Bentonite	1302-78-9	No information available
Crystalline silica, quartz	14808-60-7	No information available
Crystalline silica, cristobalite	14464-46-1	No information available
Crystalline silica, tridymite	15468-32-3	No information available

12.4. Mobility in soil
No information available

12.5. Results of PBT and vPvB assessment
No information available.

Substances	PBT and vPvB assessment
Crystalline silica, quartz	Not PBT/vPvB

12.6. Other adverse effects

13. DISPOSAL CONSIDERATIONS

Disposal Method Bury in a licensed landfill according to federal, state, and local regulations. Substance should NOT be deposited into a sewage facility.

Contaminated Packaging Follow all applicable national or local regulations. Contaminated packaging may be disposed of by: rendering packaging incapable of containing any substance, or treating packaging to remove residual contents, or treating packaging to make sure the residual contents are no longer hazardous, or by disposing of packaging into commercial waste collection.

14. TRANSPORT INFORMATION

US DOT
UN Number: Not restricted.
UN Proper Shipping Name: Not restricted
Transport Hazard Class(es): Not applicable
Packing Group: Not applicable

US DOT Bulk
DOT (Bulk) Not Applicable

Canadian TDG ul0
UN Number: Not restricted.
UN Proper Shipping Name: Not restricted
Transport Hazard Class(es): Not applicable
Packing Group: Not applicable

IMDG/IMO
UN Number: Not restricted.
UN Proper Shipping Name: Not restricted
Transport Hazard Class(es): Not applicable
Packing Group: Not applicable

IATA/ICAO
UN Number: Not restricted.
UN Proper Shipping Name: Not restricted
Transport Hazard Class(es): Not applicable
Packing Group: Not applicable

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code: Not applicable
Special Precautions for User: None

15. REGULATORY INFORMATION

US Regulations

US TSCA Inventory	All components listed on inventory or are exempt.
EPA SARA Title III Extremely Hazardous Substances	Not applicable
EPA SARA (311,312) Hazard Class	Acute Health Hazard Chronic Health Hazard
EPA SARA (313) Chemicals	This product does not contain a toxic chemical for routine annual "Toxic Chemical Release Reporting" under Section 313 (40 CFR 372).
EPA CERCLA/Superfund Reportable Spill Quantity	Not applicable.
EPA RCRA Hazardous Waste Classification	If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.
California Proposition 65	The California Proposition 65 regulations apply to this product.
MA Right-to-Know Law	One or more components listed.
NJ Right-to-Know Law	One or more components listed.
PA Right-to-Know Law	One or more components listed.

Canadian Regulations

Canadian DSL Inventory	All components listed on inventory or are exempt.
WHMIS Hazard Class	D2A Very Toxic Materials Crystalline silica

16. OTHER INFORMATION

The following sections have been revised since the last issue of this SDS
Not applicable

Additional information	For additional information on the use of this product, contact your local Halliburton representative. For questions about the Safety Data Sheet for this or other Halliburton products, contact Chemical Compliance at 1-580-251-4335.
Disclaimer Statement	This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

*****END OF MSDS*****

MSDS Number: **S8234** * * * * * *Effective Date:* ***02/04/05*** * * * * * *Supercedes:* ***11/04/04***

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.

SULFURIC ACID, 52 - 100 %

1. Product Identification

Synonyms: Oil of vitriol; Babcock acid; sulphuric acid
CAS No.: 7664-93-9
Molecular Weight: 98.08
Chemical Formula: H2SO4 in H2O
Product Codes:
J.T. Baker: 5030, 5137, 5374, 5802, 5815, 5858, 5859, 5868, 5889, 5897, 5961, 5971, 5997, 6902, 9671, 9673, 9674, 9675, 9676, 9679, 9680, 9681, 9682, 9684, 9687, 9691, 9693, 9694
Mallinckrodt: 21201, 2468, 2876, 2878, 2900, 2904, 3780, 4222, 5524, 5557, H644, H850, H976, H996, V651, XL003

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Sulfuric Acid	7664-93-9	52 - 100%	Yes
Water	7732-18-5	0 - 48%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR CONTACTED WITH SKIN. HARMFUL IF INHALED. AFFECTS TEETH. WATER REACTIVE. CANCER HAZARD. STRONG INORGANIC ACID MISTS CONTAINING SULFURIC ACID CAN CAUSE CANCER. Risk of cancer depends on duration and level of exposure.

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

Health Rating: 4 - Extreme (Poison)
Flammability Rating: 0 - None
Reactivity Rating: 2 - Moderate
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

Inhalation:
Inhalation produces damaging effects on the mucous membranes and upper respiratory tract. Symptoms may include irritation of the nose and throat, and labored breathing. May cause lung edema, a medical emergency.
Ingestion:
Corrosive. Swallowing can cause severe burns of the mouth, throat, and stomach, leading to death. Can cause sore throat, vomiting, diarrhea. Circulatory collapse with clammy skin, weak and rapid pulse, shallow respirations, and scanty urine may follow ingestion or skin contact. Circulatory shock is often the immediate cause of death.
Skin Contact:
Corrosive. Symptoms of redness, pain, and severe burn can occur. Circulatory collapse with clammy skin, weak and rapid pulse, shallow respirations, and scanty urine may follow skin contact or ingestion. Circulatory shock is often the immediate cause of death.
Eye Contact:
Corrosive. Contact can cause blurred vision, redness, pain and severe tissue burns. Can cause blindness.
Chronic Exposure:
Long-term exposure to mist or vapors may cause damage to teeth. Chronic exposure to mists containing sulfuric acid is a cancer hazard.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician immediately.
Ingestion:
DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Call a physician 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. Excess acid on skin can be neutralized with a 2% solution of bicarbonate of soda. Call a physician immediately.
Eye Contact:
Immediately flush eyes with gentle but large stream of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Call a physician immediately.

5. Fire Fighting Measures

Fire:
Concentrated material is a strong dehydrating agent. Reacts with organic materials and may cause ignition of finely divided materials on contact.
Explosion:
Contact with most metals causes formation of flammable and explosive hydrogen gas.
Fire Extinguishing Media:
Dry chemical, foam or carbon dioxide. Do not use water on material. However, water spray may be used to keep fire exposed containers cool.
Special Information:
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. Structural firefighter's protective clothing is ineffective for fires involving this material. Stay away from sealed containers.

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® or TEAM® 'Low Na+' 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, always add the acid to water; never add water to the acid. When opening metal containers, use non-sparking tools because of the possibility of hydrogen gas being present. 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:
For Sulfuric Acid:
- OSHA Permissible Exposure Limit (PEL) -
1 mg/m3 (TWA)
- ACGIH Threshold Limit Value (TLV) -
0.2 mg/m3(T) (TWA) for sulfuric acid - A2 Suspected Human Carcinogen for sulfuric acid contained in strong inorganic mists.
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 and engineering controls are not feasible, a full facepiece respirator with an acid gas cartridge and particulate filter (NIOSH type N100 filter) may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P particulate filter. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air purifying respirators do not protect workers in oxygen-deficient atmospheres. Where respirators are required, you must have a written program covering the basic requirements in the OSHA respirator standard. These include training, fit testing, medical approval, cleaning, maintenance, cartridge change schedules, etc. See 29CFR1910.134 for details.
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:
Clear oily liquid.
Odor:
Odorless.
Solubility:
Miscible with water, liberates much heat.
Specific Gravity:
1.84 (98%), 1.40 (50%), 1.07 (10%)
pH:
1 N solution (ca. 5% w/w) = 0.3; 0.1 N solution (ca. 0.5% w/w) = 1.2; 0.01 N solution (ca. 0.05% w/w) = 2.1.
% Volatiles by volume @ 21C (70F):
No information found.

Boiling Point:
ca. 290C (ca. 554F) (decomposes at 340C)
Melting Point:
3C (100%), -32C (93%), -38C (78%), -64C (65%).
Vapor Density (Air=1):
3.4
Vapor Pressure (mm Hg):
1 @ 145.8C (295F)
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Concentrated solutions react violently with water, spattering and liberating heat.
Hazardous Decomposition Products:
Toxic fumes of oxides of sulfur when heated to decomposition. Will react with water or steam to produce toxic and corrosive fumes. Reacts with carbonates to generate carbon dioxide gas, and with cyanides and sulfides to form poisonous hydrogen cyanide and hydrogen sulfide respectively.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Water, potassium chlorate, potassium perchlorate, potassium permanganate, sodium, lithium, bases, organic material, halogens, metal acetylides, oxides and hydrides, metals (yields hydrogen gas), strong oxidizing and reducing agents and many other reactive substances.
Conditions to Avoid:
Heat, moisture, incompatibles.

11. Toxicological Information

Toxicological Data:
Oral rat LD50: 2140 mg/kg; inhalation rat LC50: 510 mg/m3/2H; standard Draize, eye rabbit, 250 ug (severe); investigated as a tumorigen, mutagen, reproductive effector.
Carcinogenicity:
Cancer Status: The International Agency for Research on Cancer (IARC) has classified "strong inorganic acid mists containing sulfuric acid" as a known human carcinogen, (IARC category 1). This classification applies only to mists containing sulfuric acid and not to sulfuric acid or sulfuric acid solutions.

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

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Sulfuric Acid (7664-93-9)	No	No	None
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:
When released into the soil, this material may leach into groundwater. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition. When released into the air, this material may be removed from the atmosphere to a moderate extent by dry deposition.
Environmental Toxicity:
LC50 Flounder 100 to 330 mg/l/48 hr aerated water/Conditions of bioassay not specified; LC50 Shrimp 80 to 90 mg/l/48 hr aerated water /Conditions of bioassay not specified; LC50 Prawn 42.5 ppm/48 hr salt water /Conditions of bioassay not specified.
This material may be toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. 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: SULFURIC ACID (WITH MORE THAN 51% ACID)
Hazard Class: 8
UN/NA: UN1830
Packing Group: II
Information reported for product/size: 440LB

International (Water, I.M.O.)

Proper Shipping Name: SULFURIC ACID (WITH MORE THAN 51% ACID)
Hazard Class: 8
UN/NA: UN1830
Packing Group: II
Information reported for product/size: 440LB

15. Regulatory Information

```
--------\Chemical Inventory Status - Part 1\---------------------------------
Ingredient                                    TSCA  EC   Japan  Australia
-----------------------------------------------  ----  ---  -----  ---------
Sulfuric Acid (7664-93-9)                      Yes  Yes   Yes      Yes
Water (7732-18-5)                              Yes  Yes   Yes      Yes

--------\Chemical Inventory Status - Part 2\---------------------------------
                                                      --Canada--
Ingredient                                    Korea  DSL   NDSL  Phil.
-----------------------------------------------  -----  ---   ----  -----
Sulfuric Acid (7664-93-9)                      Yes   Yes   No     Yes
Water (7732-18-5)                              Yes   Yes   No     Yes

--------\Federal, State & International Regulations - Part 1\----------------
                                          -SARA 302-    ------SARA 313------
Ingredient                                RQ    TPQ     List  Chemical Catg.
----------------------------------------  ---   -----   ----  --------------
Sulfuric Acid (7664-93-9)                 1000  1000    Yes        No
Water (7732-18-5)                         No    No      No         No

--------\Federal, State & International Regulations - Part 2\----------------
                                                 -RCRA-    -TSCA-
Ingredient                                CERCLA     261.33     8(d)
----------------------------------------  ------     ------    ------
Sulfuric Acid (7664-93-9)                 1000       No         No
Water (7732-18-5)                         No         No         No


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

Australian Hazchem Code: 2P
Poison Schedule: None allocated.
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: **2** Other: **Water reactive**
Label Hazard Warning:
POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR CONTACTED WITH SKIN. HARMFUL IF INHALED. AFFECTS TEETH. WATER REACTIVE. CANCER HAZARD. STRONG INORGANIC ACID MISTS CONTAINING SULFURIC ACID CAN CAUSE CANCER. Risk of cancer depends on duration and level of exposure.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe mist.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Do not contact with water.
Label First Aid:
In all cases call a physician immediately. 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 re-use. Excess acid on skin can be neutralized with a 2% bicarbonate of soda solution. 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.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 8.
Disclaimer:
****
Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.
****
Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

Attachments
Site Map

bing Maps

A **30 US-9W, Congers, NY 10920**

B **160 N Midland Ave, Nyack, NY 10960**

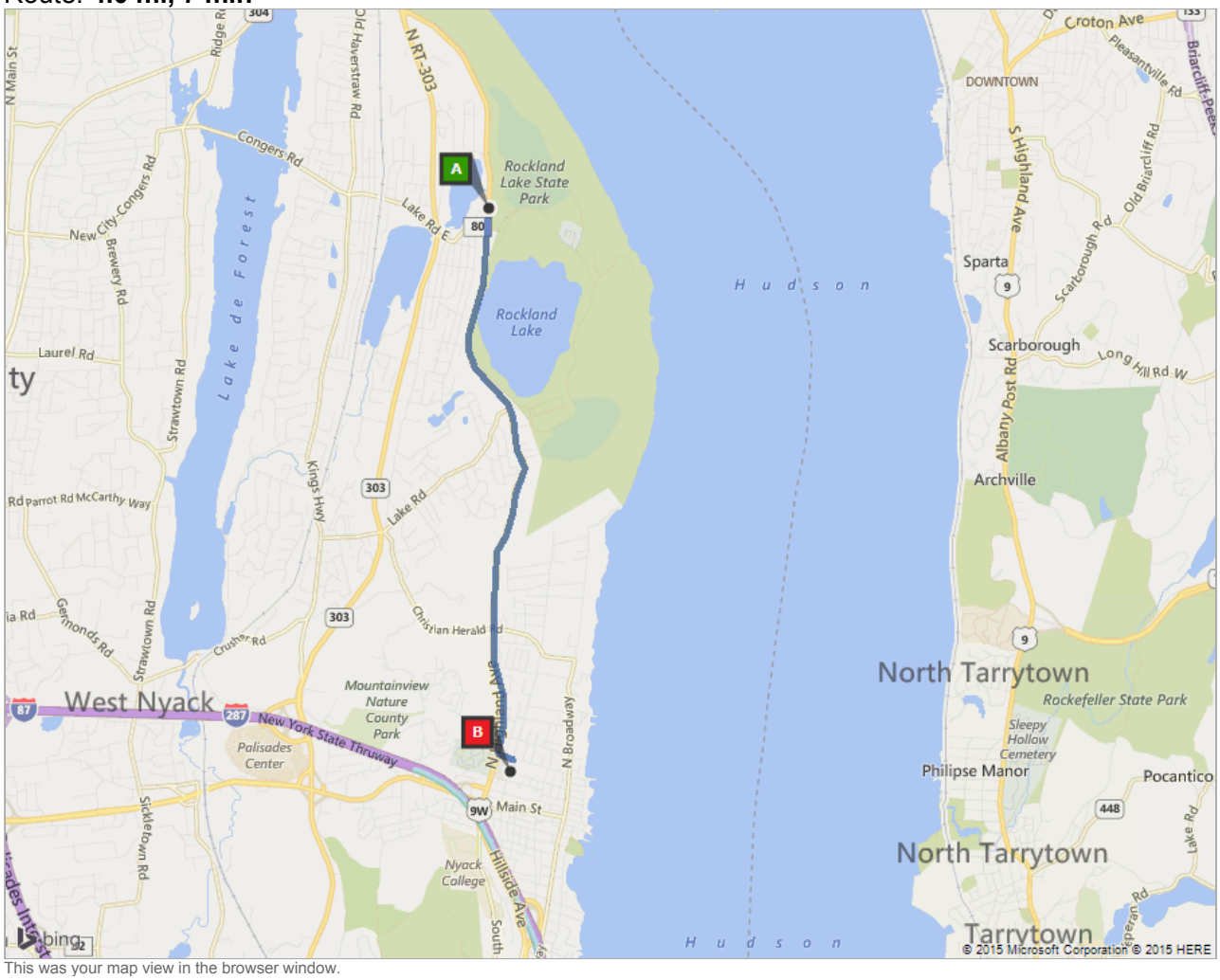
Route: **4.0 mi, 7 min**

NYACK Hospital
160 N Midland Ave
Nyack, NY 10960
(845) 348 2345

On the go? Use **m.bing.com** to find maps, directions, businesses, and more

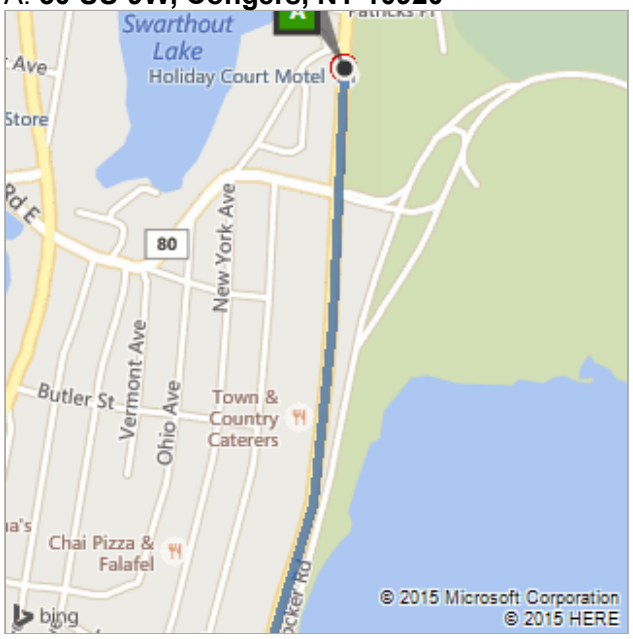
A	**30 US-9W, Congers, NY 10920**	**A–B: 4.0 mi** 7 min
	1. Depart **US-9W** toward Lake Rd E / CR-80	3.8 mi
	2. Turn **left** onto **5th Ave**	0.1 mi
	3. Turn **right** onto **N Midland Ave**	476 ft
B	4. Arrive at **160 N Midland Ave, Nyack, NY 10960** *If you reach Haven Ct, you've gone too far*	

Route: **4.0 mi, 7 min**

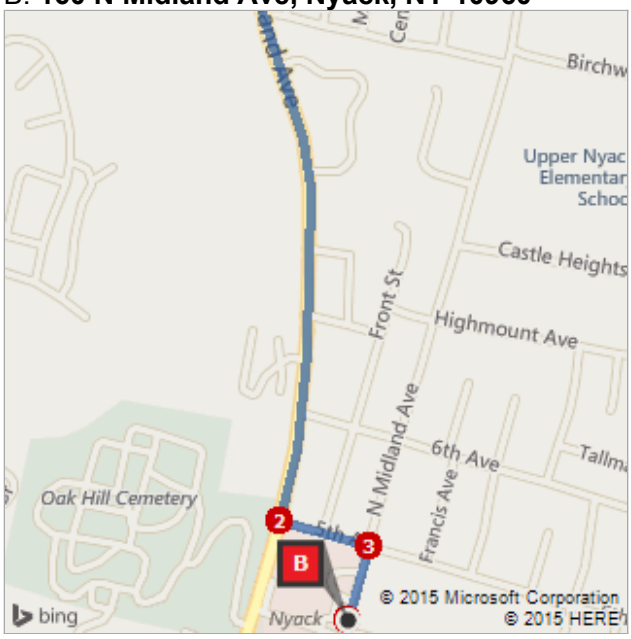


This was your map view in the browser window.

A: **30 US-9W, Congers, NY 10920**



B: **160 N Midland Ave, Nyack, NY 10960**



bing Maps

A **30 US-9W, Congers, NY 10920**

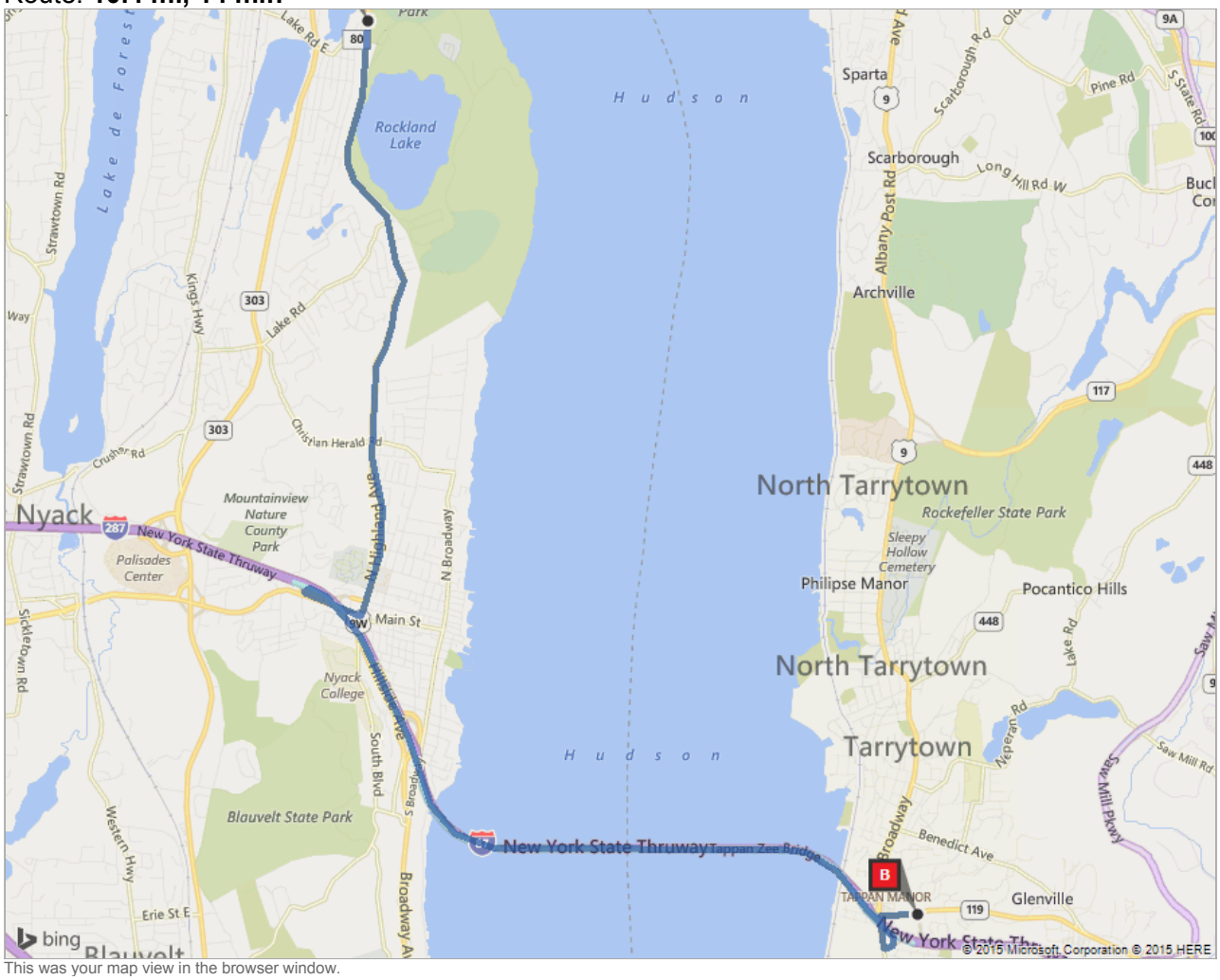
B **155 White Plains Rd, Tarrytown, NY 10591**

Route: **10.4 mi, 14 min**

Urgent Care of Westchester
155 White Plains Rd
Tarrytown, NY 10591
M-F 8am-8pm
(914) 372 7171

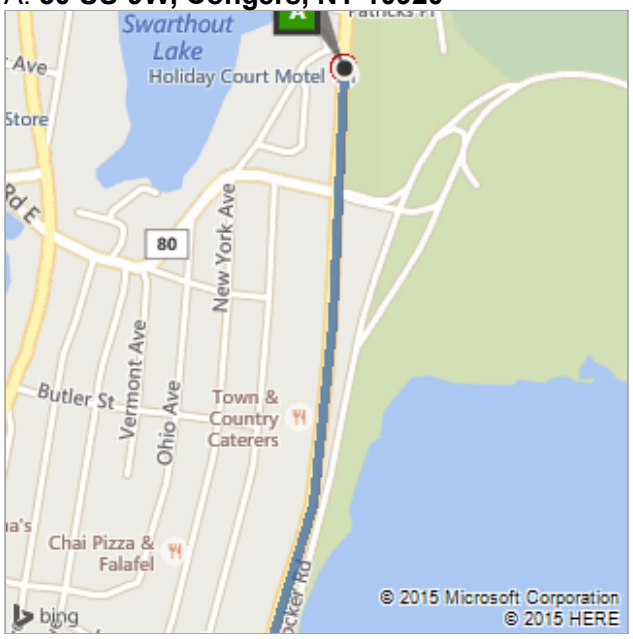
A	**30 US-9W, Congers, NY 10920**	**A–B: 10.4 mi** 14 min
	1. Depart **US-9W** toward Lake Rd E / CR-80	4.2 mi
	2. Turn **right** onto **Main St** *Mobil on the corner*	456 ft
59	3. Road name changes to **RT-59**	0.3 mi
	4. Turn **right** onto **Mountainview Ave** *Shell on the corner*	187 ft
87	5. Take ramp **right** and follow signs for **I-87 South / I-287 East** *Shell on the corner* *Toll road*	4.8 mi
87	6. Keep **right** to stay on **I-87 S / I-287 E / New York State Thruway** *Stop for toll booth*	0.3 mi
	7. At exit **9**, take ramp **right** for **US-9** toward **Sleepy Hollow / Tarrytown**	0.2 mi
	8. Turn **right** onto **US-9 / S Broadway** *Doubletree on the corner*	0.2 mi
	9. Turn **right** onto **RT-119 / White Plains Rd** *Hess Express on the corner*	0.3 mi
B	10. Arrive at **155 White Plains Rd, Tarrytown, NY 10591** *If you reach Meadow St, you've gone too far*	

Route: **10.4 mi, 14 min**



This was your map view in the browser window.

A: **30 US-9W, Congers, NY 10920**



B: **155 White Plains Rd, Tarrytown, NY 10591**

Prepared/Date: BRP 07/26/13
Checked/Date: CHL 07/26/13

HEALTH AND SAFETY PLAN
BRAM MANUFACTURING
CONGERS, NEW YORK

MACTEC

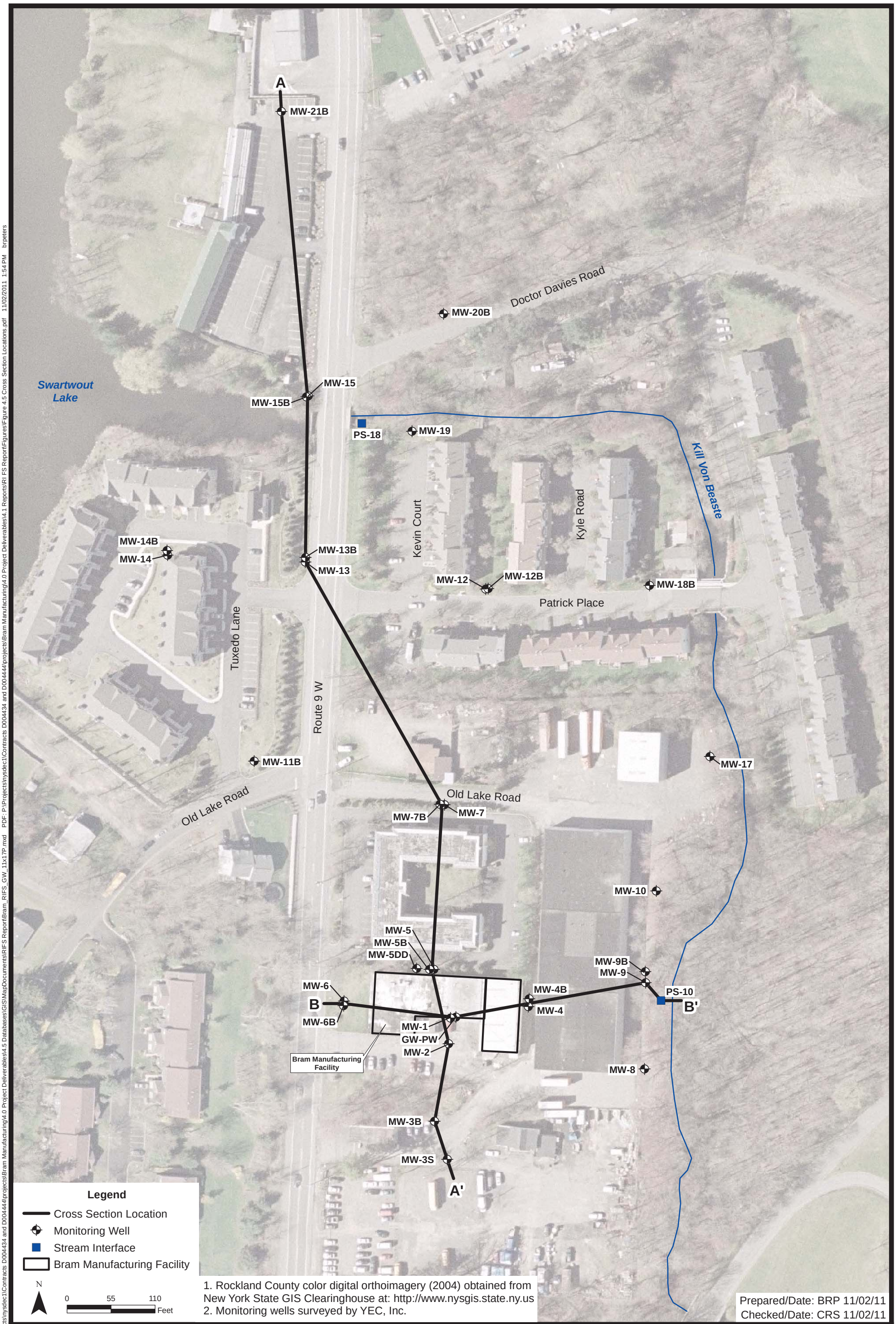
SITE LOCATION MAP

Project 3612132269 Figure 1

Document: P:\Projects
ysdec1\Contracts D004434 and D004444\projects\Bram Manufacturing\4.0 Project Deliverables\4.5 Databases\GIS\MapDocuments\Bram_SiteLocationMap.mxd PDF: P:\Projects
ysdec1\Contract\D007619\Projects\Bram Manufacturing - RD\4.0_Deliverables\4.7_Health_&_Safety\HASP for RD FAP11 - Figures\Figure 1_site location map.pdf 07/26/2013 2:25 PM brian.peters

APPENDIX B

GEOLOGIC CROSS SECTIONS OF SITE



RI/FS REPORT
BRAM MANUFACTURING
CONGERS, NEW YORK

MACTEC

Geologic Cross Section Locations

Project 3612-08-2098 Figure 4.5

Document: P:\Projects\nysdec1\Contracts D004434 and D004444\projects\Bram Manufacturing\4.0 Project Deliverables\4.5 Databases\GIS\MapDocuments\RIFS Report\Bram_RIFS_GW_11x17P.mxd PDF: P:\Projects\nysdec1\Contracts D004434 and D004444\projects\Bram Manufacturing\4.0 Project Deliverables\4.1 Reports\RI FS Report\Figures\Figure 4.5 Cross Section Locations.pdf 11/02/2011 1:54 PM brpeters

A North

A' South

Elevation (ft., MSL)

160
150
140
130
120
110
100
90
80

MW-21B
MW-15
MW-15B
PS-18 (70' East) (2009)
Stream
MW-13
MW-13B
MW-7
MW-7B
MW-5
MW-5B
BRAM
PZ-6
GW-PW
MW-1
MW-2
MW-3B
MW-3S

ND
ND
ND

100
2
ND

38
1,600
250

270
21
ND

230
4
ND

950
16
ND

4,000
65
ND

5,100
37
ND

330
4
ND

4,700
110
ND

ND
ND
ND

30,000
610
19 (2010)

15,000
240
ND (400U)

49,000
810
64

18
ND
ND

1,700
18,000
930

41,000
75
2

2008
18,000
ND (500U)
ND (500U)

110,000
1,100
130

2
3
ND

530
12,000
1,400

510
570
110

710
2800
880

170
240
4

ND
ND
ND

ND
ND
ND

ND
ND
ND

ND
ND
ND

Brown to Reddish Brown fine to coarse Sand with some Silt and Gravel

Till (silty sand with fine gravel)

Dark Reddish Brown Sandstone with Siltstone

Reddish Brown Fine to Coarse Grained Sandstone with some Siltstone commonly fractured

?

KEY – LEGEND

Analytical Data from May 2011 except where noted (results in micrograms per liter).

- Trichloroethene @ 5 ug/L
- Cis-1,2-Dichloroethene @ 5 ug/L
- Vinyl Chloride @ 2 ug/L

Horizontal: 1" = 100'
Vertical: 1" = 10'

Bedrock Surface

Overburden groundwater is approximately 2 to 4 feet below ground surface.

Prepared/Date: JKR 11/4/11
Checked/Date: CRS 11/4/11

BRAM Manufacturing
Congers, New York

MACTEC

Geologic Cross Section A-A' with Select VOC Concentrations
3612082098-02.1
Figure 4.6

PORT2011025a.cdr

B
West

B'
East

KEY – LEGEND

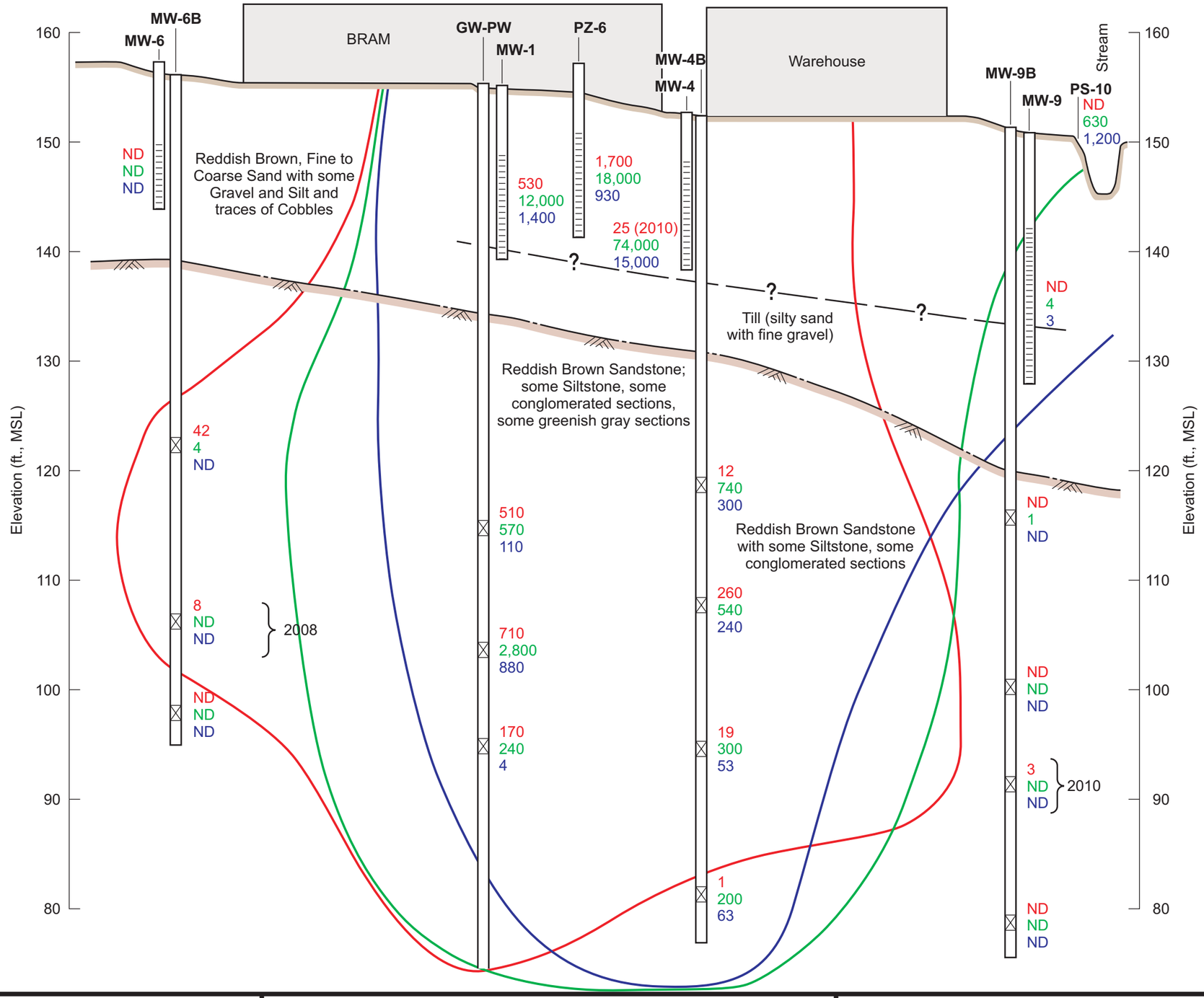
Analytical Data from May 2011 except where noted (results in micrograms per liter).

- Trichloroethene @ 5 ug/L
- Cis-1,2-Dichloroethene @ 5 ug/L
- Vinyl Chloride @ 2 ug/L

Horizontal: 1" = 50'
Vertical: 1" = 10'

Bedrock Surface

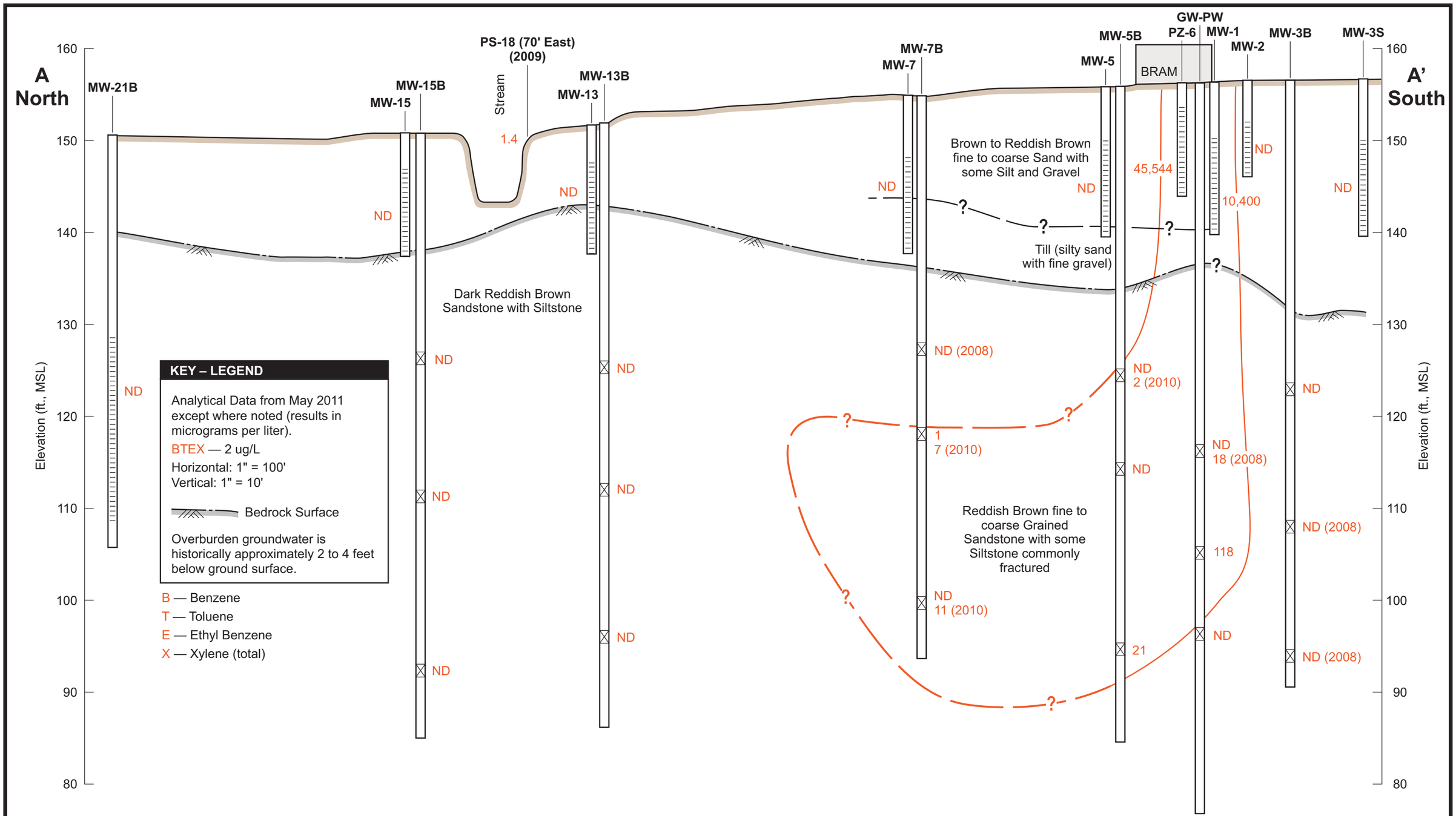
Overburden groundwater is approximately 2 to 4 feet below ground surface.



Prepared/Date: JKR 11/4/11
Checked/Date: CRS 11/4/11

BRAM Manufacturing Congers, New York	MACTEC	Geologic Cross Section B-B' with Select VOC Concentrations 3612082098-02.1 Figure 4.7

PORT2011025a.cdr



Prepared/Date: JKR 11/4/11
Checked/Date: CRS 11/4/11

BRAM Manufacturing
Congers, New York

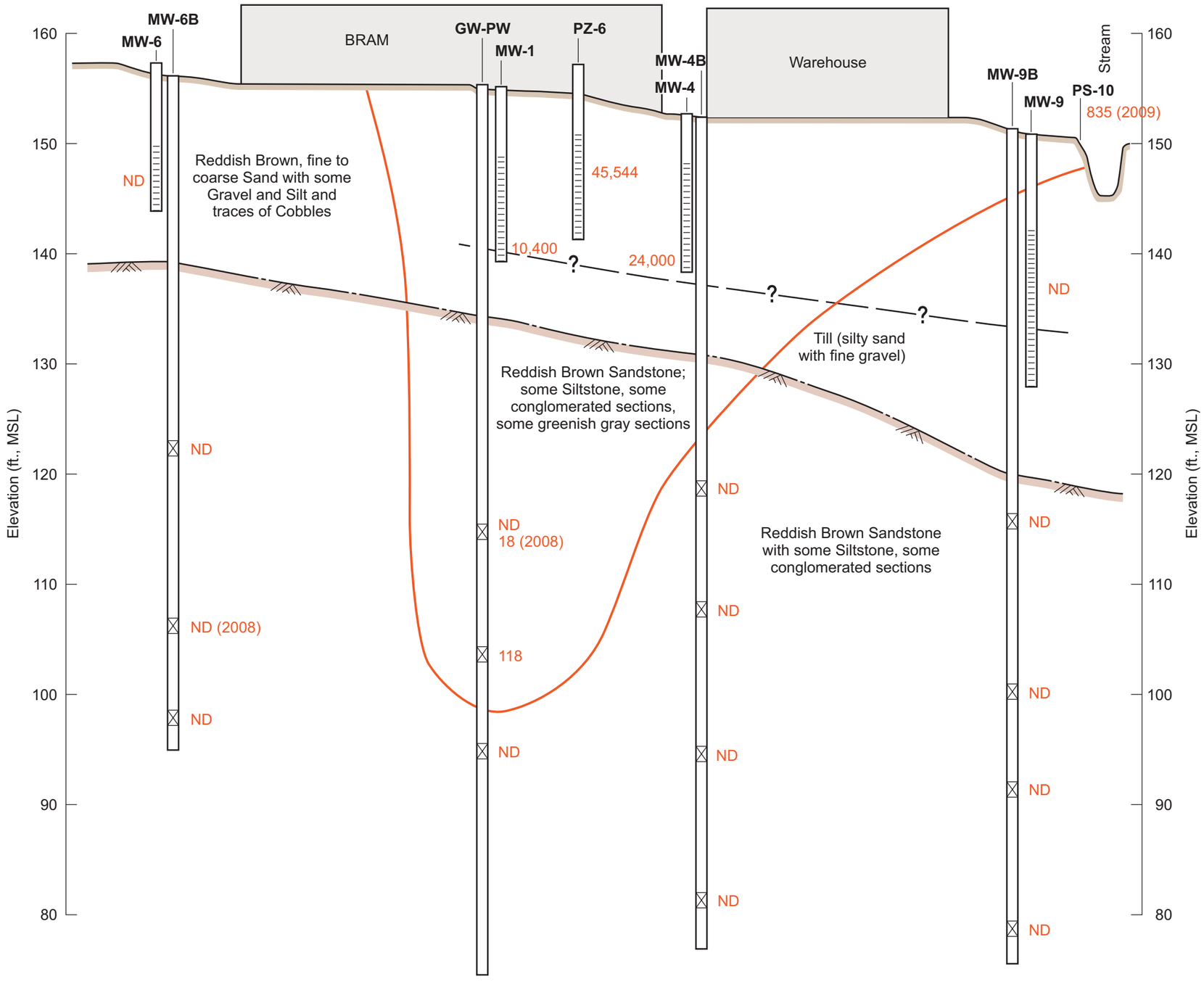
MACTEC

Geologic Cross Section A-A' with BTEX Concentrations
3612082098-02.1
Figure 4.8

PORT2011025a.cdr

B
West

B'
East



KEY – LEGEND

Analytical Data from May 2011 except where noted (results in micrograms per liter).

BTEX — 2 ug/L

Horizontal: 1" = 50'
Vertical: 1" = 10'

Bedrock Surface

Overburden groundwater is historically approximately 2 to 4 feet below ground surface.

B — Benzene
T — Toluene
E — Ethyl Benzene
X — Xylene (total)

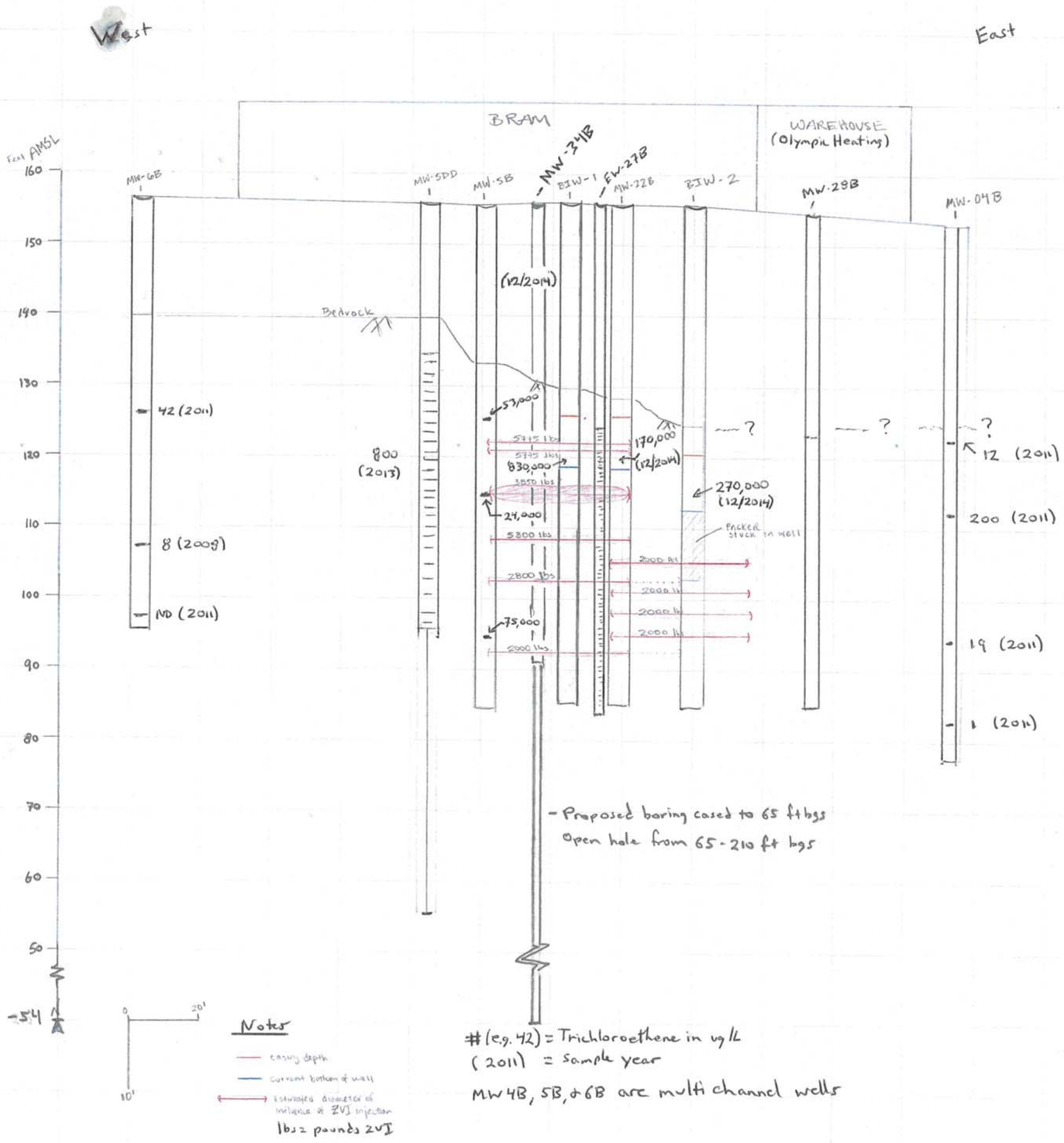
Prepared/Date: JKR 11/4/11
Checked/Date: CRS 11/4/11

BRAM Manufacturing
Congers, New York

MACTEC

Geologic Cross Section B-B' with BTEX Concentrations
3612082098-02.1
Figure 4.9

PORT2011025a.cdr


West
East
BRAM
WAREHOUSE
(Olympia Heating)
Feet AMSL
160
150
140
130
120
110
100
90
80
70
60
50
-54
MW-6B
MW-5DD
MW-5B
MW-34B
EW-27B
MW-22B
BIW-1
BIW-2
MW-29B
MW-04B
Bedrock
42 (2011)
8 (2009)
ND (2011)
800 (2013)
(12/2014)
53,000
5775 lbs
5775 lbs
830,000
3850 lbs
24,000
5300 lbs
2800 lbs
75,000
2000 lbs
170,000
(12/2014)
270,000
(12/2014)
PACKER SEVER in WELL
2000 lbs
2000 lbs
2000 lbs
2000 lbs
?
?
?
12 (2011)
200 (2011)
19 (2011)
1 (2011)
- Proposed boring cased to 65 ft bgs
Open hole from 65-210 ft bgs
0
20'
10'
Notes
casing depth
current bottom of well
estimated diameter of influence of ZVI injection
lbs = pounds ZVI
# (e.g. 42) = Trichloroethene in ug/L
(2011) = sample year
MW4B, 5B, & 6B are multi channel wells

APPENDIX C

BIOTRAP SAMPLING PROCEDURES

Bio-Trap – DNA Sampling Protocol

Sampling Instructions

Storage:

It is important to minimize the amount of time that Bio-Trap Samplers are stored prior to being installed in the field. The physical properties of the Bio-Trap Samplers that make them an ideal medium for collecting microbes also increase the chances of microbial or chemical contamination. Bio-Trap Samplers need to remain sealed and refrigerated (not frozen) until they can be installed in the field.
Note: Clean latex gloves (or similar) should be used at all times when handling Bio-Trap Samplers.

Installation:

- Prior to installing the Bio-Trap Sampler, the monitoring well may need to be purged if it has not been sampled in a while. If purging is necessary, MI recommends that three well volumes be removed to ensure contact with formation water and reduce well bore effect.
- Attach the Bio-Trap Sampler's nylon loop (provided) to a nylon line (not provided) and suspend the Bio-Trap Sampler at a depth where significant contaminant concentrations exist. If no data is available on the vertical distribution of contaminants, then suspend the Bio-Trap Sampler in the middle of the saturated screened interval.
- If large fluctuations in the water level are anticipated during the period of incubation, the Bio-Trap Sampler should be suspended from a float (contact MI for further details). Be sure not to suspend the Bio-Trap in the NAPL zone.
- Once installed, incubation times can vary depending upon the scope of the project (routine monitoring and stable isotope probing (SIP) - 30 days and "baited" - 60 days).

Retrieval:

- Open the monitoring well and pull up the Bio-Trap Sampler. Cut and remove the braided nylon line used to suspend the Bio-Trap Sampler.
- Transfer the recovered Bio-Trap Sampler to labeled (well number and date) zippered bags, seal and then double bag in a larger (one-gallon) zippered bag, immediately place on blue ice in a cooler.
- Repeat the above for all Bio-Trap Samplers from the site. Individual zippered bags containing the Bio-Trap Samplers can be placed in the same one-gallon zippered bag (if there is enough space).
- A chain of custody (COC) form must be included with each shipment of samples.

Hold time for this analysis is 24-48 hours.

Shipping Instructions

Packaging Samples:

1. Samples should be shipped in a cooler with ice or blue ice for next day delivery. If regular ice is used, the ice should be double bagged.
2. A chain of custody form must be included with each shipment of samples. Access our chain of custody at www.microbe.com.

Shipment for Weekday Delivery:

Samples for weekday delivery should be shipped to:

Sample Custodian
Microbial Insights, Inc.
10515 Research Drive
Knoxville, TN 37932
(865) 573-8188

Shipment for Saturday Delivery:

Coolers to be delivered on Saturday must be sent to our FedEx Drop Location. To ensure proper handling the following steps must be taken:

1. FedEx shipping label should be marked under (6) Special Handling, check Hold Saturday.
2. The cooler must be taped with FedEx SATURDAY tape.
3. The shipping label must be filled out with the Drop Location address below. Our laboratory name must be on the address label.
4. You MUST ***notify by email*** customerservice@microbe.com with the tracking number of the package on Friday (prior to 4pm Eastern Time) to arrange for Saturday pickup. Please make sure you write "Saturday Delivery" in the subject line of the message. Without proper labeling and the tracking number, there is no guarantee that the samples will be collected.

Samples for Saturday delivery should be shipped to:

Microbial Insights, Inc.
FedEx Drop Location
10601 Murdock Drive
Knoxville, TN 37932
(865) 300-8053

BIO-TRAP®

ADVANCED DIAGNOSTIC SAMPLERS

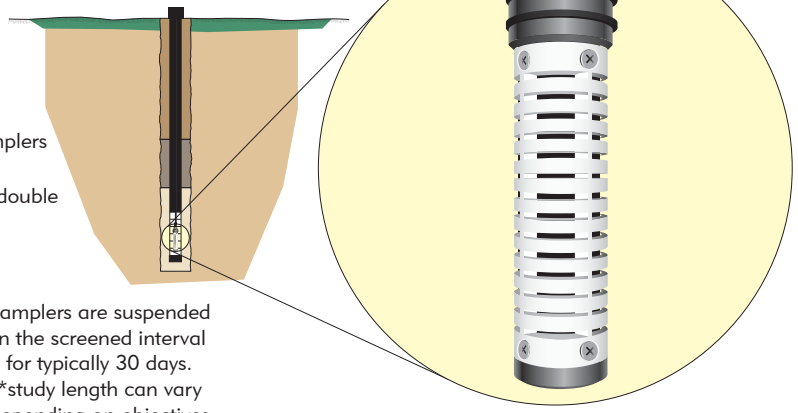
Catch Remediation in the Act… ***Trap It!***

What are Bio-Trap® Samplers?

Bio-Trap® Samplers are passive sampling tools that collect microbes over time for the purpose of better understanding biodegradation potential. The key to the Bio-Trap® approach is a unique sampling matrix, Bio-Sep® beads. The beads are 2–3 mm in diameter and are engineered from a composite of Nomex® and powdered activated carbon (PAC). When a Bio-Trap® Sampler is deployed in a monitoring well, the Bio-Sep® beads adsorb contaminants and nutrients present in the aquifer essentially becoming an *in situ* microcosm with an incredibly large surface area (~600 m^2/g) which is colonized by subsurface microorganisms. Once recovered from a monitoring well (30-60 days after deployment), DNA, RNA, or PLFA can be extracted from the beads for CENSUS® or PLFA assays to evaluate the microbial community.

A modern approach to microbial sampling

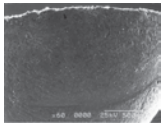
Bio-Trap samplers utilize a passive sampling approach allowing the results to be integrated over time rather than from a single sampling event



Multiple Bio-Trap samplers can be isolated from one another using a double seal cap assembly

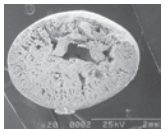
Samplers are suspended in the screened interval for typically 30 days. *study length can vary depending on objectives

Sampling Matrix: Bio-Sep® Beads



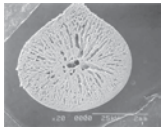
Exterior of Bio-Sep bead

A key to this sampling approach is the use of Bio-Sep® beads as the sampling matrix. The unique properties of these beads allow them to mimic environmental conditions very well.



Interior of Bio-Sep bead

Bio-Sep® beads provide a large surface area within the bead for microbial attachment. Most microbes prefer to be attached to a surface rather than be free floating.



Lactate amended Bio-Sep® bead

Fishin' for microbes! "Baited" Bio-Trap® samplers can be used to evaluate the microbial response to a wide range of amendments (electron donors and acceptors, etc.).

*see reverse for more details

Samplers can be analyzed using a wide variety of analyses including:

Molecular Biological Tools
- CENSUS® (qPCR)
- PLFA
- DGGE
- SIP

Chemical Analysis
Geochemical Parameters
And more!

microbialinsights

www.microbe.com

BIO-TRAP®

ADVANCED DIAGNOSTIC SAMPLERS

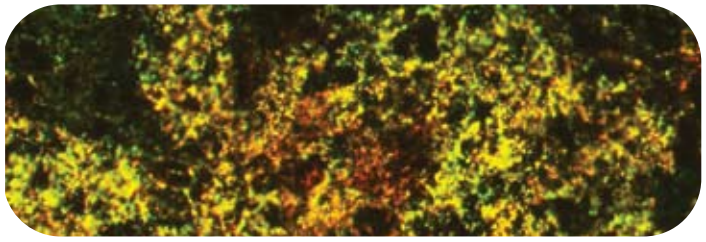
What types of samplers are available?

Bio-Trap samplers are available in a wide variety of configurations that can be tailored to answer your site-specific questions.

Standard: Basic Bio-Trap® Samplers in the simplest terms are a replacement for collecting groundwater samples using a conventional approach. Most microbes prefer to be attached to a surface rather than free floating and this passive sampler provides a large surface area for the microbes to colonize. Results generated using this approach have been shown to minimize the variability associated with traditional sampling approaches. Bio-Traps biofilms have also been shown to directly reflect spatial and temporal changes in aquifer microbial community structure plume which could not be determined from groundwater analysis. Standard Bio-Trap® Samplers are primarily used during site characterization and routine monitoring activities to:

- Quantify specific microbes or contaminant degrading bacteria (e.g. *Dehalococcoides*)
- Evaluate monitored natural attenuation (MNA)
- Compare microbial populations from different sampling points
- Monitor shifts within microbial communities following biostimulation

Standard Bio-Trap® Samplers are designed for microbial analyses using a variety of molecular biological tools but can also be configured for some chemical and geochemical analyses.



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Baited: As the name suggests, Bio-Trap® Samplers can be "baited" with various amendments or compounds to answer site-specific questions. In the past, project managers have been forced to turn to laboratory microcosms or small-scale pilot studies to evaluate bioremediation as a treatment alternative. While microcosm experiments with native site materials can show biodegradation in the laboratory, duplication of *in-situ* conditions is difficult and the results may not extrapolate to the field. Pilot studies are performed on site but are often prohibitively expensive as an investigative tool. Baited Bio-Trap® Samplers are designed to create discrete in situ microcosms that can be used to:

- Evaluate monitored natural attenuation versus enhanced bioremediation
- Compare effectiveness of different amendments (e.g. HRC®, EOS®, sodium lactate, molasses, etc.) designed to stimulate bioremediation
- Prove that biodegradation is occurring (^{13}C-labeled compounds - Stable Isotope Probing)
- Estimate relative rates of degradation for a specific contaminant (i.e. MTBE, TBA etc.)
- Address specific questions such as:
  - Is benzene being degraded at my site?
  - Will sulfate amendments stimulate bioremediation?
  - Will sodium lactate increase the concentration of known dechlorinating bacteria?

Baited Bio-Trap® Samplers can be amended with a number of compounds including:

- Sodium acetate
- Sodium lactate
- Potassium lactate
- HRC®
- Molasses
- Vegetable oil
- EOS®
- Sodium phosphate
- Sulfate
- Nitrate
- Ammonium chloride
- Elemental sulfur
- Calcium carbonate
- Iron (III)
- ^{13}C-labeled contaminants
  - Benzene
  - Toluene
  - Xylene
  - MTBE
  - TBA
  - Chlorobenzene
  - TCE
  - DCE
  - VC
- Fluorinated surrogates for tracing chlorinated compounds
  - TCE
  - DCE
- And more!

APPENDIX D

AQUIFER TEST PROCEDURES

APPENDIX D: AQUIFER TEST PROCEDURES

1.0 AQUIFER PUMPING TESTS

The following subsections describe the set-up and implementation of the aquifer pumping tests to be performed at the Bram Manufacturing site, as described in Subsection 3.6 of the Field Activities Plan (FAP).

1.1 SYNOPTIC GROUNDWATER HEAD MEASUREMENTS

Following installation of the proposed extraction well and piezometer, a water-level "snapshot" will be obtained by measuring head levels in each well of the test area using measurement procedures defined in the QAPP Section 4.7.1 (MACTEC, 2007). A minimum of four snapshots will be conducted – at the start of background water level monitoring, prior to each pumping test, and at the conclusion of the final constant-rate recovery test.

1.2 ANTECEDENT TREND MONITORING AND ATMOSPHERIC DATA COLLECTION

Following the initial synoptic groundwater head measurements, the wells selected for observation during the aquifer test (See Section 3.6 in the Work Plan for list selected wells) will be outfitted with In-Situ Troll™ data loggers. The Troll™ data loggers are self-contained pressure transducers with programmable recording for capture of changes in water levels during the aquifer tests. The data loggers in observation wells will be set to record water levels at logarithmic time intervals. At the end of each phase of testing, the data loggers will be manually stopped and restarted in log-mode (as a new test) prior to the beginning of the next phase of the test (e.g., reset the data logger at beginning of pumping and at the beginning of the recovery phase for both tests). At least one bedrock and overburden monitoring well/piezometer outside the anticipated extraction well's zone of influence will also be monitored as a reference well, for the purposes of evaluating background water level trends prior to, and throughout the duration of, the aquifer tests. The data loggers will be set to record water levels every 10 minutes. Manual measurements with a water level sounder will be made on a daily basis to confirm data logger readings. Data will be retrieved from the data loggers via laptop computer at several intervals throughout the aquifer testing.

In addition, a barometric probe designed for use with the In-situ Hermit data logger will be operated throughout the antecedent trend monitoring and aquifer tests to provide the data necessary for computing barometric well efficiencies to adjust drawdown and recovery data, as necessary. Additional atmospheric data, including measurable precipitation, will be obtained from NOAA's White Plains - Westchester County Airport weather monitoring station (http://w1.weather.gov/obhistory/KHPN.html).

1.3 VARIABLE RATE TEST

A variable rate test will be conducted at the end of the development of the extraction well to obtain an initial estimate of aquifer transmissivity and estimate sustainable short-term well yields. This test will consist of pumping the extraction well at a relatively constant discharge rate for approximately one to two hours, while monitoring the water level drawdown within the well that results from the pumping. The test will be conducted at three different rates in each extraction well (i.e., step-test). The relationship between the pumping rate maintained and the maximum drawdown will be used to approximate the aquifer transmissivity, which will be used in the Theis analytical model to simulate pumping responses and predict a sustainable rate for the constant-rate test.

1.4 CONSTANT-RATE TEST

Following the variable rate test, a 24-hour constant-rate test will be conducted at the extraction wells to calculate transmissivity, storage coefficients, aquifer parameters, and estimates of long-term extraction/pumping rates. The extraction/pumping rate for the constant-rate test will be selected following review of the data produced during the variable rate test. The extraction rate for the test will be the maximum rate possible without causing dewatering of the well during the anticipated 24-hour test duration.

A maximum sustainable rate of groundwater extraction, determined from variable rate test results, will be held constant for a period of up to 24 hours while drawdowns are recorded in surrounding observation wells (see FAP Subsection 3.6). The frequency of water-level data collected by the Troll™ data loggers is approximately 10 readings per log cycle from 0.01 to 1,000 minutes, and will be programmed for each 30 minutes thereafter. The data loggers will be interrogated at least once while the test is running, and data will be transferred to a laptop computer. The data will be reviewed by a MACTEC hydrogeologist to

obtain a preliminary assessment of hydraulic response, and for adjusting shut-down time. Following shut-down, the water levels in each instrumented monitoring well/piezometer will be measured until the water table has recovered to 90% of the drawdown from the static water level. Extraction rates will be monitored with an instantaneous flow meter, as well as with a totalizing flow meter. Depending on observed flow rates, the discharge rate will be verified volumetrically with a calibrated pail and stop watch.

2.0 EVALUATION OF AQUIFER TESTING DATA

Antecedent trend and barometric data will be reviewed to examine influences by external factors that have the potential to cause error in computation of hydraulic properties. If water level data from the observation wells/ piezometers appear to fluctuate in unison with changes in barometric pressure, then the barometric efficiency of the aquifer will be calculated using the method of Todd (1980). The drawdown and recovery data will then be adjusted by converting the change in barometric pressure to an equivalent change in feet of water, multiplying this value by the barometric efficiency, and adding/subtracting this value to/from the measured head to obtain the adjusted water level. If hydrographs indicate a consistent local increase or decrease in head measurements (as evidenced in antecedent trend data and/or background well data), a linear increase/decrease in head per unit of time will be calculated and applied to the observation well/piezometer data following any necessary barometric influence corrections.

2.1 ANALYSIS OF DRAWDOWN AND RECOVERY DATA

MACTEC will analyze data corrected for antecedent trends and/or barometric effects using the AQTESOLV analysis software. AQTESOLV allows the user to select from a wide range of test analysis methods, depending on the physical setting of the test and the water level responses produced by pumping. Test data from both the pumping and recovery phases of the test will be analyzed using several different methods to assess which method is best suited for the test setting and responses. Results from the methods that provide the best fits to test data, while also being appropriate for the test setting, will be presented in a report of results.

REFERENCES

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APPENDIX E

LABORATORY TARGET ANALYTES AND REPORTING LIMITS

Spectrum Analytical
VOC Method Detection Limits and Reporting Limits

Method	Analyte	MDL	PQL	Units
8260C	1,1,1-Trichloroethane	0.5	1	ug/L
8260C	1,1,2,2-Tetrachloroethane	0.42	1	ug/L
8260C	1,1,2-Trichloro-1,2,2-trifluoroethane	0.82	1	ug/L
8260C	1,1,2-Trichloroethane	0.38	1	ug/L
8260C	1,1-Dichloroethane	0.25	1	ug/L
8260C	1,1-Dichloroethene	0.39	1	ug/L
8260C	1,2,3-Trichlorobenzene	0.33	1	ug/L
8260C	1,2,4-Trichlorobenzene	0.26	1	ug/L
8260C	1,2,4-Trimethylbenzene	0.4	1	ug/L
8260C	1,2-Dibromo-3-chloropropane	0.75	1	ug/L
8260C	1,2-Dibromoethane	0.5	1	ug/L
8260C	1,2-Dichlorobenzene	0.33	1	ug/L
8260C	1,2-Dichloroethane	0.41	1	ug/L
8260C	1,2-Dichloropropane	0.61	1	ug/L
8260C	1,3,5-Trimethylbenzene	0.45	1	ug/L
8260C	1,3-Dichlorobenzene	0.29	1	ug/L
8260C	1,4-Dichlorobenzene	0.4	1	ug/L
8260C	1,4-Dioxane	34	100	ug/L
8260C	2-Butanone	2.1	5	ug/L
8260C	2-Hexanone	1.7	5	ug/L
8260C	4-Isopropyltoluene	0.46	1	ug/L
8260C	4-Methyl-2-pentanone	0.82	5	ug/L
8260C	Acetone	2.2	5	ug/L
8260C	Benzene	0.33	1	ug/L
8260C	Bromochloromethane	0.43	1	ug/L
8260C	Bromodichloromethane	0.26	1	ug/L
8260C	Bromoform	0.77	1	ug/L
8260C	Bromomethane	0.8	1	ug/L
8260C	Carbon disulfide	0.34	1	ug/L
8260C	Carbon tetrachloride	0.54	1	ug/L
8260C	Chlorobenzene	0.26	1	ug/L
8260C	Chloroethane	0.48	1	ug/L
8260C	Chloroform	0.33	1	ug/L
8260C	Chloromethane	0.26	1	ug/L
8260C	cis-1,2-Dichloroethene	0.48	1	ug/L
8260C	cis-1,3-Dichloropropene	0.45	1	ug/L
8260C	Cyclohexane	0.71	1	ug/L
8260C	Dibromochloromethane	0.57	1	ug/L
8260C	Dichlorodifluoromethane	0.66	1	ug/L
8260C	Ethylbenzene	0.35	1	ug/L
8260C	Isopropylbenzene	0.38	1	ug/L
8260C	Methyl acetate	0.29	1	ug/L
8260C	Methyl tert-butyl ether	0.24	1	ug/L
8260C	Methylcyclohexane	0.76	1	ug/L
8260C	Methylene chloride	0.41	1	ug/L
8260C	n-Butylbenzene	0.33	1	ug/L
8260C	n-Propylbenzene	0.64	1	ug/L
8260C	Naphthalene	0.8	1	ug/L
8260C	sec-Butylbenzene	0.28	1	ug/L
8260C	Styrene	0.5	1	ug/L
8260C	tert-Butylbenzene	0.37	1	ug/L

Spectrum Analytical
VOC Method Detection Limits and Reporting Limits

Method	Analyte	MDL	PQL	Units
8260C	Tetrachloroethene	0.65	1	ug/L
8260C	Toluene	0.32	1	ug/L
8260C	trans-1,2-Dichloroethene	0.65	1	ug/L
8260C	trans-1,3-Dichloropropene	0.48	1	ug/L
8260C	Trichloroethene	0.36	1	ug/L
8260C	Trichlorofluoromethane	0.54	1	ug/L
8260C	Vinyl chloride	0.5	1	ug/L
8260C	Xylene (Total)	0.36	1	ug/L
522	1,4-Dioxane	0.017	0.07*	ug/L
8260C	1,1,1-Trichloroethane	23	50	ug/Kg
8260C	1,1,2,2-Tetrachloroethane	20	50	ug/Kg
8260C	1,1,2-Trichloro-1,2,2-trifluoroethane	29	50	ug/Kg
8260C	1,1,2-Trichloroethane	23	50	ug/Kg
8260C	1,1-Dichloroethane	19	50	ug/Kg
8260C	1,1-Dichloroethene	25	50	ug/Kg
8260C	1,2,3-Trichlorobenzene	49	50	ug/Kg
8260C	1,2,4-Trichlorobenzene	37	50	ug/Kg
8260C	1,2,4-Trimethylbenzene	17	50	ug/Kg
8260C	1,2-Dibromo-3-chloropropane	41	50	ug/Kg
8260C	1,2-Dibromoethane	23	50	ug/Kg
8260C	1,2-Dichlorobenzene	23	50	ug/Kg
8260C	1,2-Dichloroethane	25	50	ug/Kg
8260C	1,2-Dichloropropane	25	50	ug/Kg
8260C	1,3,5-Trimethylbenzene	24	50	ug/Kg
8260C	1,3-Dichlorobenzene	19	50	ug/Kg
8260C	1,4-Dichlorobenzene	20	50	ug/Kg
8260C	1,4-Dioxane	1700	5000	ug/Kg
8260C	2-Butanone	49	250	ug/Kg
8260C	2-Hexanone	23	250	ug/Kg
8260C	4-Isopropyltoluene	14	50	ug/Kg
8260C	4-Methyl-2-pentanone	21	250	ug/Kg
8260C	Acetone	89	250	ug/Kg
8260C	Benzene	20	50	ug/Kg
8260C	Bromochloromethane	27	50	ug/Kg
8260C	Bromodichloromethane	17	50	ug/Kg
8260C	Bromoform	24	50	ug/Kg
8260C	Bromomethane	77	250	ug/Kg
8260C	Carbon disulfide	19	50	ug/Kg
8260C	Carbon tetrachloride	25	50	ug/Kg
8260C	Chlorobenzene	15	50	ug/Kg
8260C	Chloroethane	89	250	ug/Kg
8260C	Chloroform	22	50	ug/Kg
8260C	Chloromethane	31	50	ug/Kg
8260C	cis-1,2-Dichloroethene	27	50	ug/Kg
8260C	cis-1,3-Dichloropropene	29	50	ug/Kg
8260C	Cyclohexane	25	50	ug/Kg
8260C	Dibromochloromethane	17	50	ug/Kg
8260C	Dichlorodifluoromethane	31	50	ug/Kg
8260C	Ethylbenzene	22	50	ug/Kg
8260C	Isopropylbenzene	20	50	ug/Kg
8260C	Methyl acetate	48	50	ug/Kg

Spectrum Analytical
VOC Method Detection Limits and Reporting Limits

Method	Analyte	MDL	PQL	Units
8260C	Methyl tert-butyl ether	30	50	ug/Kg
8260C	Methylcyclohexane	31	50	ug/Kg
8260C	Methylene chloride	30	50	ug/Kg
8260C	n-Butylbenzene	19	50	ug/Kg
8260C	n-Propylbenzene	16	50	ug/Kg
8260C	Naphthalene	36	50	ug/Kg
8260C	sec-Butylbenzene	14	50	ug/Kg
8260C	Styrene	18	50	ug/Kg
8260C	tert-Butylbenzene	15	50	ug/Kg
8260C	Tetrachloroethene	25	50	ug/Kg
8260C	Toluene	15	50	ug/Kg
8260C	trans-1,2-Dichloroethene	20	50	ug/Kg
8260C	trans-1,3-Dichloropropene	27	50	ug/Kg
8260C	Trichloroethene	14	50	ug/Kg
8260C	Trichlorofluoromethane	43	50	ug/Kg
8260C	Vinyl chloride	30	50	ug/Kg
8260C	Xylene (Total)	13	50	ug/Kg

* Laboratory will calibrate to 0.04 ug/L

Spectrum Analytical
PCB Method Detection Limits and Reporting Limits

Method	Analyte	MDL	PQL	Units
8082	Aroclor-1016	2.5	33	ug/Kg
8082	Aroclor-1221	4.4	33	ug/Kg
8082	Aroclor-1232	2.4	33	ug/Kg
8082	Aroclor-1242	2.5	33	ug/Kg
8082	Aroclor-1248	3.8	33	ug/Kg
8082	Aroclor-1254	4.4	33	ug/Kg
8082	Aroclor-1260	1.8	33	ug/Kg
8082	Aroclor-1262	2	33	ug/Kg
8082	Aroclor-1268	1.6	33	ug/Kg

Spectrum Analytical
Dissolved Gases Method Detection Limits and Reporting Limits

Method	Analyte	MDL	PQL	Units
RSK-175	Methane	2.16	2.2	ug/L
RSK-175	Ethane	3.48	5	ug/L
RSK-175	Ethene	4.58	5	ug/L
RSK-175	Carbon dioxide	18.5	22	ug/L

Spectrum Analytical
Metals Method Detection Limits and Reporting Limits

Method	Analyte	MDL	PQL	Units
6010C	Aluminum	11	200	ug/L
6010C	Antimony	5.1	20	ug/L
6010C	Arsenic	3.9	20	ug/L
6010C	Barium	0.73	200	ug/L
6010C	Beryllium	0.054	5	ug/L
6010C	Cadmium	0.53	5	ug/L
6010C	Calcium	52	800	ug/L
6010C	Chromium	0.25	20	ug/L
6010C	Cobalt	0.36	50	ug/L
6010C	Copper	1.2	30	ug/L
6010C	Iron	47	200	ug/L
6010C	Lead	4.5	10	ug/L
6010C	Magnesium	5.2	500	ug/L
6010C	Manganese	0.61	50	ug/L
6010C	Nickel	1.2	50	ug/L
6010C	Potassium	92	1000	ug/L
6010C	Selenium	7.8	30	ug/L
6010C	Silver	2.7	30	ug/L
6010C	Sodium	15	1000	ug/L
6010C	Thallium	2.4	20	ug/L
6010C	Vanadium	0.16	50	ug/L
6010C	Zinc	3.2	50	ug/L
7470A	Mercury	0.028	0.2	ug/L
SM 2340B	Hardness, Ca/Mg (As CaCO3)	0.3	4	mg/L

Spectrum Analytical
Wet Chemistry Method Detection Limits and Reporting Limits

Method	Analyte	MDL	PQL	Units
300	Chloride	0.15	2	mg/L
300	Nitrogen, Nitrate (As N)	0.064	0.13	mg/L
300	Nitrogen, Nitrite (As N)	0.034	0.13	mg/L
300	Sulfate	0.28	5	mg/L
SM 4500D S2-D	Sulfide	0.03	0.03	mg/L
SM 2320B	Alkalinity, Total (As CaCO3)	20	20	mg/L
SM 2540D	Total Suspended Solids	2.82	5	mg/L
SM 2540C	Total Dissolved Solids	2.56	5	mg/L
Lloyd Kahn	Total Organic Carbon	0.283	1	mg/L
Lloyd Kahn	Total Organic Carbon	99	100	mg/kg