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Division of Environmental Remediation
Remedial Bureau E, 12th Floor
New York State Department of
Environmental Conservation
625 Broadway
Albany, New York 12233-7016

Attention: Mr. Charles T. Gregory, Project Manager

Subject: **2019 Field Activities Plan**
Mohonk Road Industrial Plant (MRIP) Site; Site Number 356023
MACTEC Engineering and Consulting, P.C. Project No. 3611191234

Dear Mr. Gregory:

MACTEC Engineering and Consulting, P.C. (MACTEC), is submitting this Field Activities Plan (FAP) to the New York State Department of Environmental Conservation (NYSDEC) for long-term monitoring and reporting and for the implementation of the recommendations from the 2016 Remedial System Optimization (RSO) report at the Mohonk Road Industrial Plant (MRIP) Site (Site) in the Hamlet of High Falls, Ulster County, New York (Figure 1). This FAP was prepared in response to Work Assignment (WA) No. D007619-48 (NYSDEC, 2019), and in accordance with the April 2011 Superfund Standby Contract No. D007619 between the NYSDEC and MACTEC.

INTRODUCTION

The Site has been identified as a source of volatile organic compounds (VOCs), primarily 1,1,1-trichloroethane (1,1,1-TCA), which have been detected in soil, groundwater, and soil vapor. This FAP presents a technical scope of work for the implementation of the RSO which includes investigations related to optimizing the existing groundwater extraction and treatment system (GWETS) and the viability of installing a new Soil Vapor Extraction (SVE) system utilizing existing

SVE wells. The GWETS investigations will include packer testing of the three operating extraction wells to determine the effectiveness of pumping and a more targeted treatment zone. The SVE pilot study will be conducted to evaluate vapor flow and concentrations and the need for groundwater extraction within the SVE wells. This FAP also presents a technical scope of work for groundwater sampling of 17 monitoring wells, three extraction wells, and five (5) multi-port FLUTe wells located both on-site (near field) and off-site (far field). Work will be conducted in accordance with the NYSDEC Department of Environmental Remediation-10 Guidance (NYSDEC, 2010).

SITE BACKGROUND

The Site is located in the Hamlet of High Falls, Ulster County, New York, approximately seven miles north-northwest of the Village of New Paltz (Figure 1). The Site includes the original MRIP property at 186 Mohonk Road and surrounding properties impacted by the contaminated groundwater plume emanating from the Site.

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

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

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

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

- Extraction of contaminated groundwater in the near field and far field plume to restore the aquifer to its most beneficial use (as a potable water supply), treatment with an air stripper, and discharge of the treated water to the nearby Rondout Creek and Coxing Kill Creek. The "near field plume" refers to that portion of the groundwater plume with total VOC concentrations greater than 1,000 ppb, while the "far field plume" refers to the component of the groundwater plume with 10 ppb to 1,000 ppb total VOCs.
- The construction of a public water supply system to provide potable water to the residences and businesses in the Towns of Marbletown and Rosendale with impacted or threatened private supply wells. The primary water supply for the system will be the Catskill Aqueduct. In addition, the individual granular activated carbon filtration systems currently in use will be operated until the new public water supply system is operational.
- Implementation of a groundwater monitoring program to evaluate the effectiveness of the remedy.
- Institutional controls may be employed to prevent future use of the bedrock aquifer in the impacted or threatened area.
- Excavation of VOC-contaminated soils with concentrations above the cleanup criteria to prevent or minimize cross-media impacts from COCs in soil to groundwater.
- Off-Site disposal of the contaminated soil at appropriately permitted facilities.

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

- Restoring the aquifer to its most beneficial use, i.e., as a source of potable water, and restore it as a natural resource;
- Eliminating further off-MRIP property contaminated groundwater migration; and

- Eliminating inhalation and ingestion of, and dermal contact with, contaminated groundwater associated with the Site that does not meet state or federal drinking water standards.

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

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

In 2015, MACTEC conducted a data gap investigation to better understand the contaminant distribution at the site, address identified data gaps, and provide additional data that can be used to effectively modify the existing remedial measure, if needed. Field activities completed during the data gap investigation included bedrock borehole geophysics, packer groundwater sampling, direct push soil sampling, and test pitting, as well as completion of a site survey. During this field investigation, MACTEC identified the on-site SVE system as an optimization component that required further investigation. Results from the 2015 data gap investigation are presented in the 2016 Remedial Site Optimization Report (MACTEC, 2016).

An SVE system was operated on Site from February 2008 until late 2011 or early 2012 (Figure 3). The system, although reportedly effective at removing contaminant mass under low groundwater conditions, was terminated because of poor recovery during seasonally high water. There is minimal operational data available regarding the former system in terms of air flow, vacuum area of influence, vapor concentrations, or how the vapor was treated prior to discharge. MACTEC believes the SVE system may have been terminated prematurely; this report describes a proposed approach to investigating the SVE system and surrounding subsurface VOC concentrations, which includes testing of an SVE pilot system utilizing dual phase extraction to lower the groundwater level surrounding the SVE wells, exposing more vadose zone and potentially contaminated media.

An SVE pilot-study is proposed to aid in optimizing the full-scale system design and the preparation of remedial system specifications.

FIELD OPERATIONS

The proposed field activities covered in this FAP are being conducted to aid in the complete optimization of the remedial system. This FAP is divided into three sections: Groundwater Sampling, SVE Well Pilot Study and Extraction Well Optimization.

Groundwater sampling will consist of collecting groundwater samples from 17 monitoring wells, three (3) extraction wells, and from up to five (5) FLUTe wells. The SVE pilot study will evaluate the efficacy of reinstating the SVE system and will include a pilot study of dual-phase extraction. Groundwater extraction well optimization will use inflatable packers to test and sample targeted shallower fracture zones within the deep bedrock wells to evaluate the effectiveness of extracting potentially higher concentration groundwater from isolated shallow fractures and will measure the effect that pumping shallow fractures has on the capture zone.

Companion documents to this FAP that will govern the execution of the field activities include:

- Site Specific Health and Safety Plan (Attachment A),
- MACTEC's Program Quality Assurance Program Plan (MACTEC, 2011a) (Attachment B),
- Field Data Records (FDR) (Attachment C),
- Laboratory Reporting Limits and Method Detection Limits (Attachment D), and
- Standard Operating Procedures (SOPs) (Attachment E).

GENERAL FIELD ACTIVITIES

Access and Clearance. The SVE pilot testing will be conducted on the site property, whereas the packer sampling and long term monitoring (LTM) groundwater sampling include both onsite and offsite locations. The NYSDEC will be responsible for coordinating initial Site access. MACTEC will coordinate logistics and access to sampling points with Site building owner(s) and/or tenants.

Health and Safety. A field team orientation meeting will be held on site with MACTEC and subcontractor personnel prior to each phase of work to familiarize field workers with Site history, health and safety requirements, equipment calibration procedures, and all other investigation methods and procedures.

The site-specific Health and Safety Plan (HASP) is provided as Attachment A. MACTEC anticipates that the fieldwork will be conducted in Level D personal protection. Specific investigation activities, utility clearance procedures, and required level of personal protection are set forth in the site-specific HASP. Criteria for upgrading or downgrading the specified level of protection are also provided in the site-specific HASP. Should site conditions pose a threat to those present on site, and/or should site conditions warrant an upgrade from Level D, as defined by the HASP, work will stop and the situation will be reevaluated by the NYSDEC and MACTEC.

Decontamination. Sampling methods and equipment for this field program have been chosen to minimize decontamination requirements, mitigating potential for cross contamination. Disposable sampling equipment will be used as much as practical to minimize decontamination time and water disposal. Non-disposable sampling equipment will be decontaminated before and after the collection of each sample. Decontamination methods and materials are described in detail in Subsection 4.3 of the Quality Assurance Program Plan (QAPP) provided as Attachment B.

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. Decontamination fluids will be containerized during field activities and bled into the existing groundwater treatment system following completion of site activities. Should decontamination fluids exhibit visual or olfactory evidence of contamination, water will be analyzed for site COCs to determine the rate at which it can be treated by the groundwater treatment system.

Investigation Derived Wastes. The only investigation derived waste (IDW) expected to be generated on site during the field activities outlined in this field activities report is purged groundwater extracted from SVE and monitoring wells during all phases of work. This purge water will be containerized on site and bled into the existing groundwater treatment system once the system is returned to service following completion of on-site field activities. It is anticipated that the IDW will contain low enough concentrations of site COCs that it can be easily treated by the groundwater treatment system, but should the IDW show visual or olfactory signs of higher levels of contamination, laboratory analysis of the groundwater will be performed to determine the maximum rate at which the IDW can be bled into the groundwater treatment system without reducing treatment system performance.

SCOPE OF WORK

The following scope of work described the activities associated with the work assignment issued by NYSDEC on January 14, 2019.

GROUNDWATER SAMPLING FOR LONG TERM MONITORING

Baseline Water Level Measurements. Prior to well sampling, a round of water levels will be collected by measuring depth to water at each monitoring well location and recording the information on an FDR found in Attachment C. Water level measurements should also be taken from the five SVE wells proposed for an SVE pilot study, SVE-19, -20, -21, -22, -23, sampling from these wells will not be conducted at this time. All baseline water levels should be collected within the same calendar day.

Groundwater Sampling. Groundwater samples will be collected from 17 monitoring wells, three (3) extraction wells, and various intervals of five (5) FLUTe wells, for a total of 37 sample locations. The monitoring wells to be sampled are listed in Table 1 and the locations are shown on Figure 2. Monitoring wells will be sampled using low-flow sampling procedures as described in Section 4.5.4.3.2 of the Program QAPP (MACTEC, 2011a), if possible.

Field measurements for pH, temperature, specific conductivity, oxidation reduction potential, and dissolved oxygen will be collected through a flow through cell from each monitoring well during pre-sample purging. Turbidity will be measured separately with a turbidity meter. Field measurements and monitoring well sampling activities will be documented using a Low Flow Sampling FDR (Attachment C).

Groundwater Analytical Methods. Groundwater samples will be collected for laboratory analysis as shown on Table 1 and summarized below:

- Up to 25 wells (37 samples, including multiple samples from the FLUTe wells) for VOCs (plus quality control [QC] samples) by USEPA Method 8260;
- Up to 25 wells (37 samples) for analysis of 1,4-dioxane by method 8270D-SIM.

- Up to 20 wells (20 samples) for analysis of polyfluoroalkyl substances (PFAS) by modified Method 537. Samples will be submitted to TestAmerica Buffalo.
    - PFAS samples will not be collected from the five (5) FLUTe wells, as FLUTe tubing is known to be composed of polyvinylidene fluoride, a fluoropolymer known to contain PFAS. The water level indicator required to gauge the water level within each flute port is also coated with Teflon, a known PFAS containing compound. Due to these potential impacts, the lack of PFAS research performed by FLUTe themselves, and a lack of onsite fluorocarbon sources, PFAS sampling will be limited to the traditional monitoring wells installed in the nearfield and farfield.

Groundwater samples will be submitted to Test America: Buffalo Laboratory for analysis. PFAS samples will be shipped from TestAmerica: Buffalo (NY) to TestAmerica: Sacramento (CA) for laboratory analysis and 1,4-dioxane samples will be shipped from TestAmerica: Buffalo (NY) to TestAmerica: Edison (NJ) for laboratory analysis. Results will be reported in a Category B deliverable. The reporting limits, method detection limits and other quality assurance limitations for the various test methods are tabulated in Attachment D. Standard Operating Procedures related to groundwater sampling are included in Attachment E.

Additionally, the long-term sampling program includes sampling monitoring wells and FLUTe wells every four years for monitored natural attenuation parameters. This was last conducted during the 2017 sampling round, and will therefore not be required again until 2021, at which time parameters will include:

- Ferrous Iron by Method 8146 (field screening)
- Total Organic Carbon by Method 415.1
- Nitrate by Method 300
- Nitrite by Method 354.1
- Sulfate by Method 300
- Sulfide by Method 4500
- Methane/Ethane/Ethene by Method RSK-175
- Carbon dioxide by Method RSK 175
- Alkalinity by Method 2320
- Chloride by Method 300

SVE WELL PILOT STUDY

Pilot Study Overview. The SVE pilot-study scope of work has been prepared with consideration of guidance provided in United States Army Corps of Engineers Manual EM 1110-1-4001 – Engineering and Design – Soil Vapor Extraction and Bioventing (USACE, 2002). The proposed scope of work includes a combination of air permeability testing and both stepped-rate and constant-rate testing as defined in Chapter 4 of EM 1110-1-4001.

The SVE pilot study will be generally broken into five phases: mobilization, soil vapor extraction tests (static groundwater conditions), groundwater pumping tests, dual phase pumping tests, and demobilization.

SVE data will be collected during static water table conditions and hydraulically depressed water table conditions and compared to determine if dual-phase extraction optimizes soil vapor capture. The data will be evaluated to determine:

- flow rate versus vacuum to support blower design (using the stepped-rate test described later in this report)
- radius of influence
- initial soil gas concentrations
- potential long-term soil gas concentrations and trends
- condensate production
- water table response to SVE
- groundwater pumping wells necessary to depress footprint area of SVE system
- groundwater pumping rates necessary to depress seasonal high-water table.

Mobilization. During this phase, the SVE pilot system will be delivered and installed by Aztech Environmental Technologies (Aztech). The GWETS will be shut down one week prior to field activities to allow groundwater to return to static levels. Water levels will be measured in surrounding nearfield wells prior to shutting down the GWETS and initially prior to commencing the SVE testing. The SVE system will consist of a trailer mounted SVE unit, which includes:

- portable generator
- vapor/liquid separator
- liquid transfer pump
- 55-gallon liquid storage drum (for containerization of condensed liquid from soil vapor)
- dilution air valve
- particulate filter
- SVE blower with a capacity ranging from 50 cubic feet per minute (cfm) at 80 inches of water (in-H_2O) to 100 cfm at 60 in-H_2O

- vapor-phase activated carbon filters for vapor treatment
- SVE header with five influent points equipped with isolation valves
- gauges
- vapor effluent discharge stack
- controls

Once all the SVE system equipment is on site, SVE manifolds will be laid out and the system will be constructed; SVE headers will be connected to the wells via temporary fernco couplings, such that the headers can be easily removed for future phases of SVE investigation. Each well header will include a fernco connection with ports for measuring pressure and temperature. Temporary power will be supplied by a generator.

SVE Tests Under Static Groundwater Conditions.

Note – This phase of the test will not be conducted if there is less than 5-feet of vadose zone available to extract vapor from. Therefore, if depth to water in the SVE wells is not greater than 27 feet, do not attempt SVE Tests Under Static Groundwater Conditions and skip to SVE Tests Under Pumping Water Conditions.

This phase consists of testing of the SVE system as it exists under non-pumping (of SVE wells) groundwater conditions. It is assumed that pumping from the three groundwater extraction wells does not significantly impact water level within the SVE wells, but to ensure there is no hydraulic connection, completion of this phase should be done with the GWETS off. Prior to the start of this phase:

- A round of groundwater levels will be taken from all SVE wells and nearfield (on site) extraction wells to establish a baseline from which to compare future groundwater levels. Groundwater levels will be recorded on an FDR (Attachment C).
- Once all headers are connected to SVE well heads and the trailer mounted SVE system is ready to operate, the first test can begin.
- With all the usable SVE wells connected and open, the blower can be started. The test should be started with the inline dilution valve 100% open. Subsurface suction pressure will be increased in a step-up fashion by throttling back the dilution valve.
- Step-up variation is to be determined in the field based on subsurface and system operating conditions.
- Each dilution valve setpoint should be sustained for at least 1 hour, with influent vacuum, influent velocity, influent temperature, and influent photoionization detector (PID) readings taken every 15 minutes. Individual well vacuum and PID readings will be taken at the

beginning and end of each 1-hour period. Background PID readings should also be taken from the dilution valve inlet every hour to ensure there is no ambient air contamination that could affect sampling results. A peristaltic pump may be required for sampling of air into the PID to overcome system vacuum. Results of these samples will be recorded on the FDR.

- A combined influent air sample shall be collected for laboratory analysis of VOCs via TO-15 within the first hour of testing, and again when the highest attainable vacuum pressures are met, towards the end of the test. Suma Canisters will be used and the sample shall be collected from a point prior to any open dilution air valves.

Groundwater Pumping Tests at SVE Wells. This phase of testing includes groundwater pumping tests to determine pumping requirements necessary to depress the water table to levels low enough to optimize SVE capture. These results will vary depending the elevation of the water table at the beginning of the test. The objective of this test is to see if lowering the water table has a positive effect on the removal of elevated concentrations of soil vapor and to determine the flow necessary to drop the water level in all SVE wells by at least 5 feet. Based on historic well installation details, all five SVE wells (SVE-19 to 23) are roughly 55 feet in total depth, with 20 feet of casing and Portland cement and bentonite grout extending from the surface into the ground. With seasonal high-water levels at roughly 25 feet below ground surface (bgs) in all SVE wells (based on measurements collected in May 2019), the exposed vadose zone for SVE capture is only 5 feet during months of high water, or less based on influence from SVE vacuum. To double the vadose zone during this time, depth to water measurements taken from all SVE wells while pumping must be at or greater than 30 feet, or five (5) feet lower than static groundwater level. Therefore, this phase of the test will be determine a pumping rate that is required to drawdown groundwater at least five (5) feet. If water levels drawdown quickly at low flows, the test will be conducted to determine the flow rate needed to keep water levels at low as possible.

- The test will begin by verifying the three extraction wells and GWETS are shut down (from previous test); groundwater levels need to be at ambient levels.
- Water level measurements within SVE wells and near field monitoring wells will be measured (using an FDR in Attachment C).
- A pump will then be installed in well SVE-22 at its bottom (i.e., about 50 feet bgs and plumbed to an on-site frac tank or tote.
- Groundwater pumping from SVE-22 will be increased in a step-up fashion, beginning at 0.5 gallons per minute (gpm), until groundwater level within the well reaches equilibrium (i.e. no change in groundwater level over 10-minute period).
- Increase flow rate as necessary based on field observations. If the water level within SVE-22, or any of the surrounding SVE wells, drops to within five feet of the pump (roughly 45 feet below top of riser (bTOR), the flow rate should be reduced or pumping should be

stopped until water level recharges to roughly 35 feet bTOR, in which case the pump can be restarted at a lower flow rate.

- After pumping equilibrium within SVE-22 is reached, all SVE and near field monitoring wells surrounding SVE-22 will be gauged to determine total drawdown.
- If the water level in any SVE well (including SVE-22) while pumping from SVE-22 has not dropped by five (5) or more feet from static equilibrium, another pump will be added as necessary to depress the groundwater to a level low enough for efficient soil vapor extraction.
- The pump located in SVE-22 will remain in place, and a new, identical pump will be installed in whichever SVE well showed the lowest total drawdown from static equilibrium conditions during the SVE-22 pump test; this pump should also be placed at the bottom of the well, pumped at an initial rate of 0.5 gpm, and discharged to an on-site frac tank or tote.
- Once the second pump is in, both pumps should be operated together until groundwater levels reach equilibrium. Should groundwater level within any SVE well drop below 45 feet bTOR, pumping should be stopped until water level rebounds to 35 feet bTOR. Once water level rebounds, flow can be resumed at a lower flowrate than previously extracted.
- Once equilibrium is reached, water levels should be gauged to determine if a third SVE extraction pump is necessary. This process is to continue until each SVE well has an extraction well pump (5 pumps total) or all extraction wells show greater than 5 feet of drawdown from the baseline water level recorded prior to the start of this test. All data collected during this phase of testing will be recorded on an FDR.
- Once groundwater level requirements for all five SVE wells have been met (5+ feet of drawdown), a final round of groundwater measurements should be taken from all SVE and nearfield (on site) extraction wells to determine whether or not groundwater extraction from SVE wells influences water levels within extraction wells.

Note: In the event that water levels in the SVE wells are low (less than 5 feet of water in each well even after the initial test under static groundwater conditions), the groundwater pump tests described above will be conducted at a later date (spring) and the individual SVE well testing described below will be conducted without Dual Phase Extraction.

Dual Phase Extraction Test and Individual SVE Radius of Influence Testing. After determining maximum flow under non-pumping conditions (result of SVE Tests Under Static Groundwater Conditions) and the most efficient pumping speed and wells from which to pump in order to achieve 5 feet of drawdown (results of SVE Test Under Pumping Groundwater Conditions), the next phase of testing will commence. This phase includes dual phase extraction aimed at determining the difference in extracted air VOC concentration, pressure and total airflow between static, non-pumping water conditions and pumping conditions. Lowering the groundwater level within the SVE wells should expose more of the vadose zone, allowing extraction of more soil vapor and capture of more VOCs.

After installation of all groundwater extraction pumps deemed necessary in the previous phase and installation of all SVE headers installed during Tests Under Static Groundwater Conditions, the final phase of testing can begin.

- Initially, water should be pumped from the SVE wells at a rate equivalent to that determined in the previous phase.
- Once the water table is depressed through pumping, the SVE blower can be started. A combined influent air sample should be collected early into this test, prior to increasing blower vacuum. This sample shall be collected for laboratory analysis of VOCs via method TO-15.
- Vapor and water extraction flow rates should start at the maximum flow determined in the earlier stages of testing and increase in a step-up fashion until new maximum flows are achieved.
- Step-up rates should be determined by field personnel based on system and subsurface observations.
- PID readings of influent air should be taken every 15 minutes and a combined air sample shall be taken once the maximum allowable air extraction rate is achieved. This sample shall be collected for laboratory analysis of VOCs via method TO-15. All data collected during this phase of work will be recorded on FDRs.
- After determining the maximum pumping capacity of groundwater from the wells and maximum airflow under depressed groundwater conditions with all SVE wells operating, each individual well will be isolated to evaluate its radius of influence with respect to the other SVE wells.
- With the SVE system operating and the groundwater table depressed, each well will be isolated by closing the valves on the other four SVE headers. The system will be allowed to run for 60 minutes, starting with the dilution air valve open and slowly closing it. The dilution air valve will be closed incrementally every 20 minutes until airflow stabilizes. System measurement and vacuum readings from each of the other four extraction wells will be collected 10 minutes after each dilution valve setpoint change. This is to be completed for each SVE well individually; field measurements and observations will be recorded on an FDR (Attachment C).
- After completion of this phase of testing, the blower can be shut down and the SVE headers can be removed from the well heads in preparation for the next phase of testing. Additionally, another round of groundwater elevations shall be collected to evaluate if the vacuum placed on the system impacted groundwater elevations.

Following completion of the SVE pilot study, all soil vapor air samples collected during the pilot test will be submitted to TestAmerica Laboratory for analysis of VOCs by USEPA method TO-15. Results from these two studies will be compared to determine if depressing the groundwater level within SVE wells impacts concentration of extracted soil vapor. Following completion of the dual phase extraction pilot study, demobilization of the trailer mounted SVE system will be completed, all equipment will be removed from the Site, and the existing GWETS system will be restarted (with the assistance of Aztech).

EXTRACTION WELL OPTIMIZATION

The three operating extraction wells are deep open-hole bedrock borings with the pumps positioned near the bottom of the boreholes. Because the Site is located at the top of a local groundwater divide, the natural vertical hydraulic gradient will tend to be downward from overburden to bedrock and from shallow bedrock to deep bedrock. Pumping from the bottom of the bedrock borehole will enhance the downward vertical gradient and hasten the vertical spreading of contamination. The extraction well optimization testing will focus on pumping isolated fractures that: a) contain relative high concentrations of VOCs compared to other fractures within the borehole (determined previously through borehole geophysical logging and packer sampling), b) are relatively transmissive compared to other fractures within the borehole, and c) are shallow within the borehole so pumping from the fracture should not promote deeper migration of contaminants, and may result in a reversal of the vertical hydraulic gradient within the localized bedrock aquifer. Below are the steps that will be taken to evaluate the effectiveness of targeted fracture pumping.

Baseline Water Level Measurements. Prior to packer testing and sampling, a round of water levels will be collected by measuring depth to water at 12 selected nearfield Site wells and recording the information on an FDR (Attachment C). Measurement should be done with the GWETS off and the water table at static conditions. The following wells will be gauged during the baseline measurements:

- ERT-1
- ERT-2
- ERT-3
- ERT-4
- MW-4
- MW-5B
- MW-5R
- MW-6B
- MW-7B
- MW-7R
- MW-11B
- MW-11C

Following the collection of water level measurements from the 12 selected site wells, transducers will be installed in all but three wells and calibrated to depth. Nine transducers will be required, as transducers will not be installed in extraction wells.

Extraction Well Packer Testing. Packer testing will commence on each of the three operational recovery (extraction) wells (ERT-1, MW-5R, & MW-7R). Testing will be conducted individually on each well. Each test will last up to 72 hours. The current well pump that is in the well will be removed from its pitless adapter. A single inflatable packer will be lowered into the borehole to the target depth as shown below in Table 2 below. The packers will be inflated to a pressure sufficient to hold back the groundwater head within the borehole, per manufacturer's specifications. The drop pipe, constructed of high density polyethylene, will be cut to shorten the depth at which the pump hangs in the well to correspond to the depth shown for the pump in Table 2. Once reconnected to the drop pipe, the pump will be attached to the existing pitless adapter so the discharge water can be conveyed directly to the treatment plant.

Table 2
Packer and Pump Target Depths

Well ID	Pumping Water Level 5/8/19 (ft bTOC)	Target Fracture Zone (ft bTOC)			Target Pump Depth (ft bTOC)			Target Packer Depth (ft bTOC)		
		Upper	-	Lower	Upper	-	Lower	Upper	-	Lower
ERT-1	45.5	114	-	116	119	-	124	125	-	129
MW-5R	52.4	92.5	-	93.5	96	-	101	102	-	106
MW-7R	59.4	93.5	-	99	103	-	108	109	-	113

ft = feet
bTOC = below top of casing

Groundwater sampling of the test well will be conducted via the sampling port in the treatment building. The level transducers will be programmed to turn the pump on and off making sure that the pump remains submerged.

Groundwater samples will be collected periodically following commencement of the test. LTM Baseline sampling, conducted earlier, will be used as baseline for the recovery wells. Flow rate for the recovery well will be recorded hourly on an FDR. Water levels will be recorded in select monitoring wells using pressure transducers and data loggers. Field measurements for pH, temperature, specific conductivity, oxidation reduction potential, and dissolved oxygen will be collected at the sampling port when samples are collected. Once testing is completed on a well, a new drop pipe will be cut so the pump can be placed back in the well at its original depth. Testing on the next recovery well will begin after the water levels have recovered to within 90% of the pre-test static levels.

Groundwater Analytical Methods. Groundwater samples will be collected for laboratory analysis of VOCs by method 8260 as summarized below for each 72 hour test:

- Day 1:
    - Within the first hour of pumping,
    - Approximately 2-3 hours from initial sample,
    - End of first day,
- Day 2 and Day 3:
    - First thing in the morning
    - Mid-day
    - End-of Day
- Day 4:
    - Just before ending the test

Deviations from the above may be required pending on field results once pumping begins. Groundwater samples will be submitted to TestAmerica: Buffalo for analysis of VOCs by method 8260. Laboratory results will be reported in a Category B deliverable. Tentatively identified compounds will not be reported with the VOC analysis.

REPORTING

MACTEC will present the findings of the groundwater sampling, soil vapor extraction pilot study and extraction well packer testing in a letter report to the NYSDEC, which will include discussion of the work performed, supporting field documents, tabulated data results, and figures. The tabulated groundwater data will include comparison to the Class GA groundwater standards (NYS, 1999) and previous groundwater sampling results.

A Data Usability Summary Report (DUSR) will be completed based on NYSDEC DER-10 guidance (NYSDEC, 2010b) and will be included as an attachment to the report. QC limits found in USEPA Region 2 validation guidelines in combination with the referenced analytical methods will be used during the data validation. Raw data checks, calculation checks, and transcription verifications will be performed only if QC issues are noted during the review that require further evaluation. Upon completion of the DUSR, an EQUIS Electronic Data Deliverable will be submitted.
If you have questions on the material provided herein, please contact Jamie Welch, at 207-775-5401.

Sincerely,
MACTEC Engineering and Consulting, P.C.

Welch

Jamie Welch
Senior Engineer

Stephanie [illegible], with permission for

Thomas Gerhard
Staff Engineer

Figures
Tables
Attachment A: Site Specific Health and Safety Plan
Attachment B: MACTEC's Program Quality Assurance Program Plan
Attachment C: Field Data Records
Attachment D: Laboratory Reporting Limits and Method Detection Limits
Attachment E: Standard Operating Procedures (SOPs)

REFERENCES

Lawler, Matusky & Skelly Engineers LLP, 1998. Interim Remedial Measure Underground Tank Removal Report, Mohonk Road Industrial Plant, Site 356023. January, 1998.

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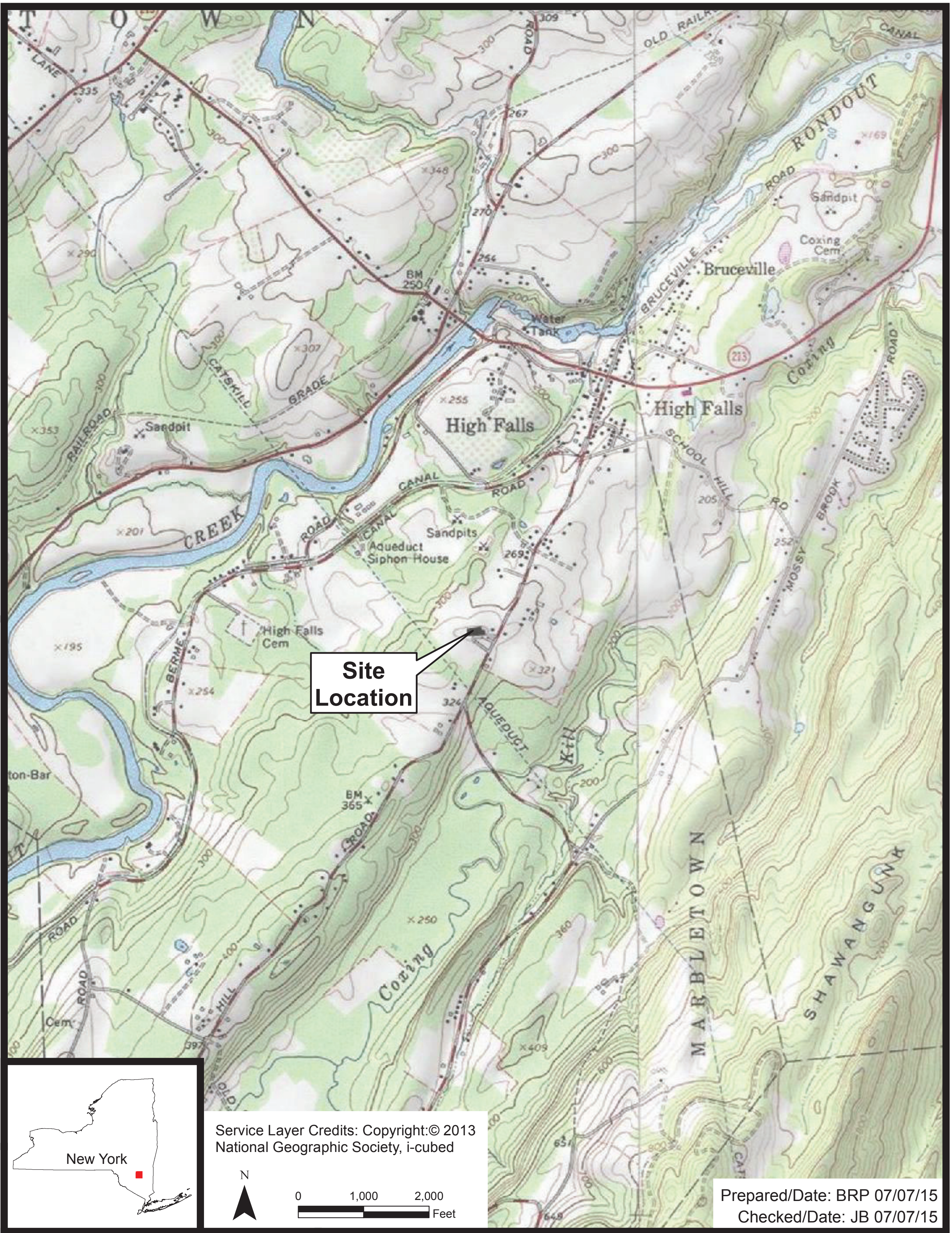
United States Environmental Protection Agency (USEPA), 2000. Record of Decision – Mohonk Road Industrial Plant Superfund Site. March 2000.

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

FIGURES



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

NYSDEC
Mohonk Road Industrial Plant
Marbletown, New York

MACTEC

Site Location Map

Project 3611191234

Figure 1

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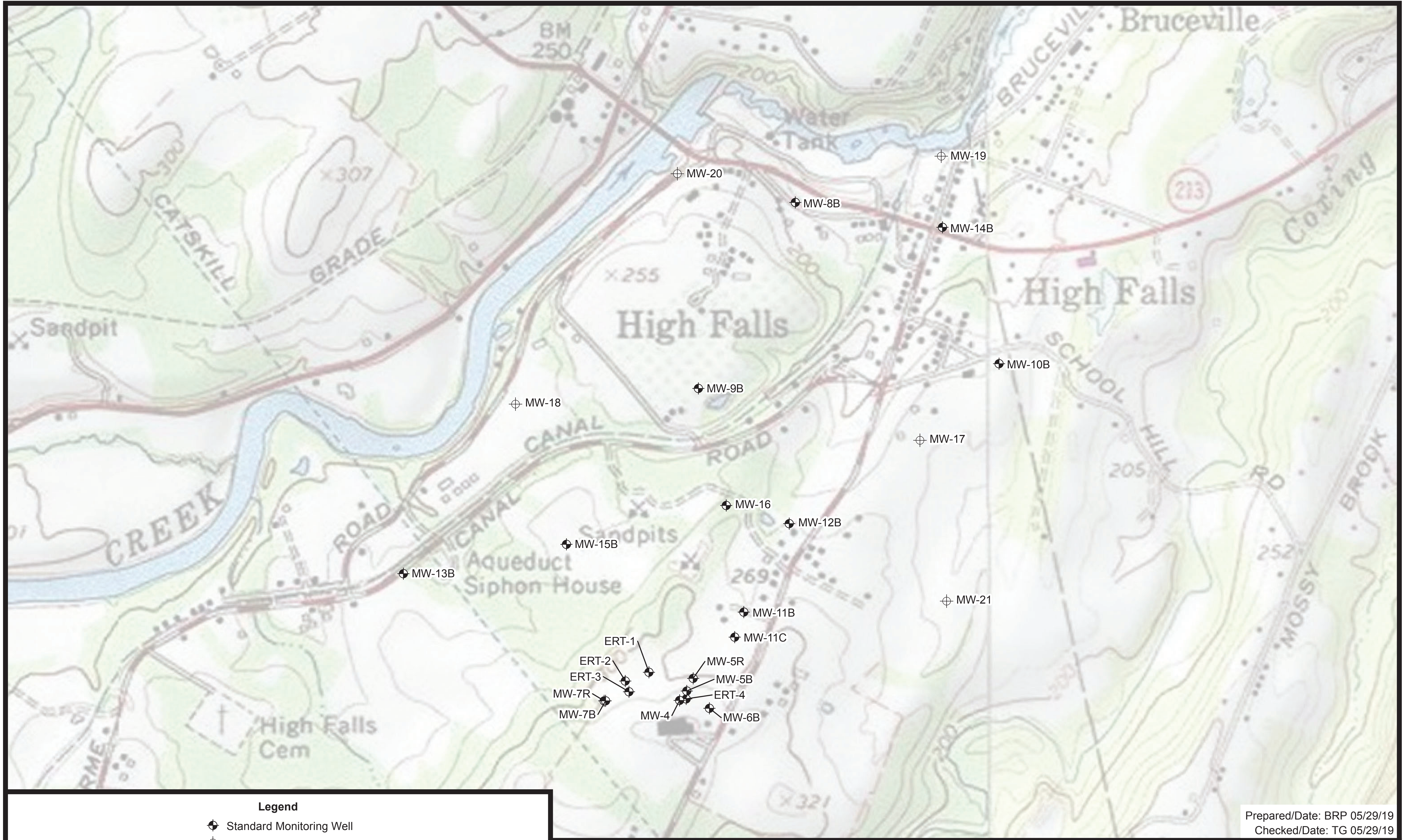

Legend

◆ Standard Monitoring Well

⌖ FLUTe Monitoring Well

N

0 350 700 Feet

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Prepared/Date: BRP 05/29/19
Checked/Date: TG 05/29/19

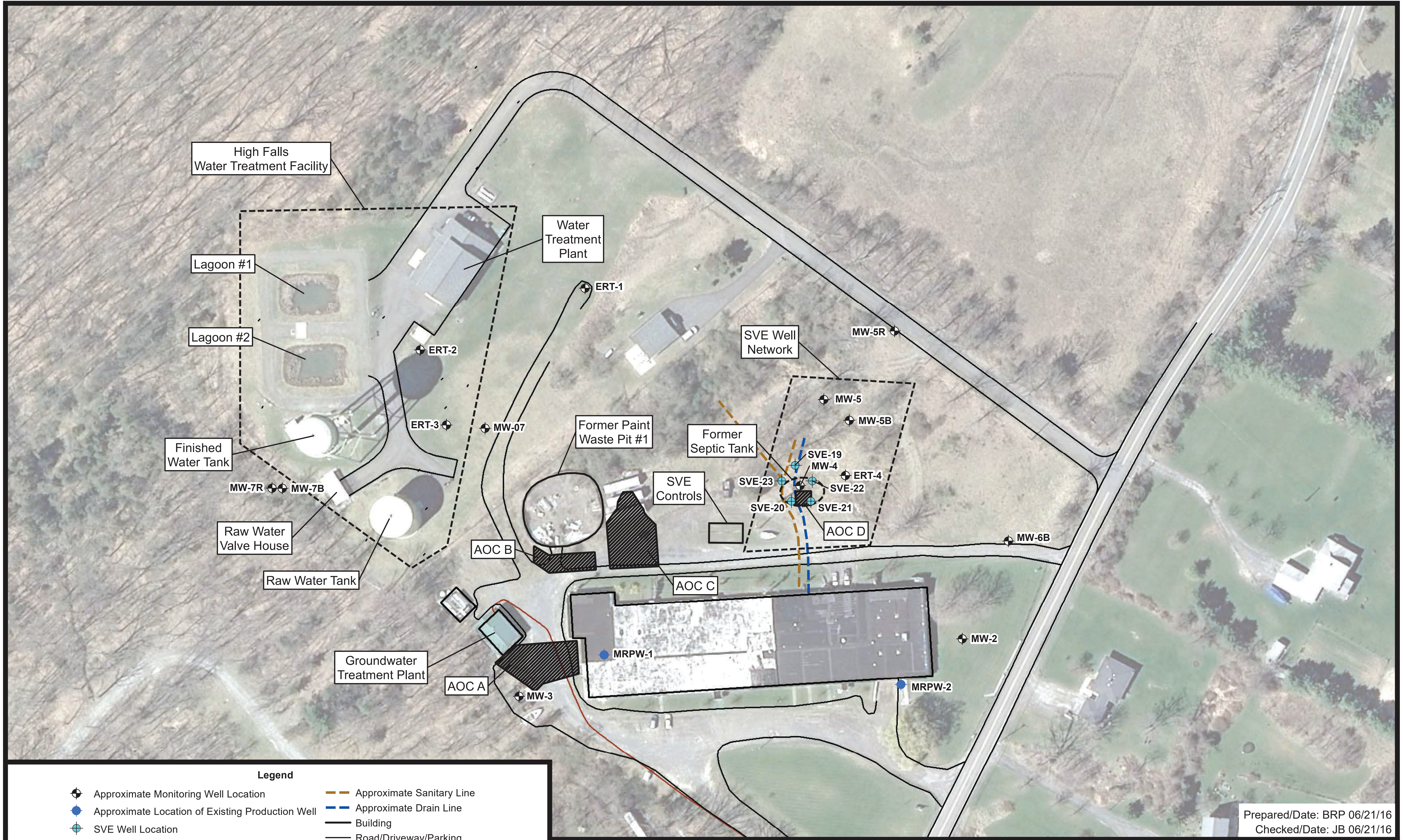
NYSDEC
Mohonk Road Industrial Plant
Marbletown, New York

MACTEC

Well Location Map

Project 3611191234

Figure 2



Legend

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

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

Prepared/Date: BRP 06/21/16
Checked/Date: JB 06/21/16

NYSDEC
Mohonk Road Industrial Plant
Marbletown, New York

MACTEC

Site Layout

Project 3611191234

Figure 3

TABLES

Table 1
Mohonk Road Industrial Plant Site, Monitoring Well Inventory and Sampling Information [1]

Monitoring Well	X Coordinate	Y Coordinate	Sampling Interval		Construction Information			Sampling Requirements (X indicates sample)		Well Location	From 10/26-27/2017 Sampling Event		
			Depth (ft bgs)	Elevation (ft amsl)	Total Depth (ft bgs)	Bottom Elevation (ft amsl)	Top of Casing (ft amsl)	VOCs	PFAS & 1,4 Dioxane		Pump type	Sample Depth (ft BTOR) (10/26/17)	Static Water Level (from TIC)
ERT-1[2]	571897.25	4629866	intake	intake	195	108.94	303.94	X	X	On-site	Extraction well	185	84.3
ERT-2	571843.56	4629843	190	119.81	200	109.81	309.81	X	X	On-site	Submersible	190	88.06
ERT-3	571850.19	4629819	210	105.89	220	95.89	315.89	X	X	On-site	Submersible	210	94.16
ERT-4	571979.5	4629806.5	45	281.67	50	276.67	326.67	X	X	On-site	Submersible	45	40.25
MW-1B	571967.38	4629665	90	243.53	100	233.53	333.53	X	X	Background / Upgradient	Submersible	40	71.95
MW-4	571971.06	4629799	16	313.21	21.5	307.71	329.21	X	X	On-site	Bailer	NA	20.7
MW-5B	571981.81	4629825.5	33	292.3	36.2	289.1	325.3	X	X	On-site	Bailer	NA	36
MW-5R[2]	572003.06	4629852	intake	intake	125	188.63	313.63	X	X	On-site	Extraction Well	115	86.9
MW-6B	572042.38	4629780.5	90	233.95	100	223.95	323.95	X	X	On-site	Bailer	NA	98.15
MW-7B	571794.25	4629797	90	223.93	100	213.93	313.93	Water Level Only		On-site	NA	-	-
MW-7R[2]	571790.75	4629797	intake	intake	180	134.3	314.3	X	X	On-site	Extraction Well	170	90.9
MW-8B	572249.41	4630989.19	90	69.68	100	59.68	159.68	X	X	Perimeter	Submersible	90	29.98
MW-9B	572016.88	4630545	135	113.21	145	103.21	248.21	X	X	Perimeter	Submersible	135	19.44
MW-10B	572734.6	4630604	90	135.64	100	125.64	225.64	X	X	Perimeter	Submersible	90	32.57
MW-11B	572126.19	4630011	171	110.72	181	100.72	281.72	X	X	Mid-Plume	Geosub Submersible	170	54.77
MW-11C	572125	4630007	210	74.58	220	64.58	284.58	X	X	Mid-Plume	Submersible	210	54.77
MW-12B	572234.19	4630222.41	190	68.2	200	58.2	258.2	X	X	Mid-Plume	Impeller	190	24.95
MW-13B[3]	571312.94	4630103	NA	NA	200	21.93	221.93	X	X	Perimeter	NA-Artesian	NA	
MW-14B	572600.32	4630930.34	145	11.67	155	1.67	156.67	X	X	Perimeter	Submersible	145	7.06
MW-15B	571701.56	4630172.5	140	104.89	150	94.89	244.89	X	X	Mid-Plume	Submersible	140	10.49
MW-16	572083.65	4630265.75	80	194.11	93	181.11	274.11	X	X	Mid-Plume	Submersible	80	44.63
MW-17-1	572545.72	4630421.63	47	194.92	57	184.92	241.92	X	1,4 Dioxane Only	Mid-Plume	FLUTe	37-57	-
MW-17-2			102.5	139.42	110	131.92	241.92	X	1,4 Dioxane Only	Mid-Plume	FLUTe	95-110	-
MW-17-3			124	117.92	129	112.92	241.92	X	1,4 Dioxane Only	Mid-Plume	FLUTe	119-129	-
MW-18-1[3]	571579.98	4630508.22	96	108.45	101	103.45	204.45	X	1,4 Dioxane Only	Perimeter	FLUTe	34-49	-
MW-18-2[3]			123	81.45	128	76.45	204.45	X	1,4 Dioxane Only	Perimeter	FLUTe	118-128	-
MW-18-3[3]			140	64.45	145	59.45	204.45	X	1,4 Dioxane Only	Perimeter	FLUTe	135-145	-
MW-19-1[3]	572596.93	4631100.5	41.5	88.38	49	80.88	129.88	X	1,4 Dioxane Only	Perimeter	FLUTe	39-49	-
MW-19-2[3]			87.5	42.38	95	34.88	129.88	X	1,4 Dioxane Only	Perimeter	FLUTe	80-95	-
MW-19-3[3]			187.5	-57.62	195	-65.12	129.88	X	1,4 Dioxane Only	Perimeter	FLUTe	180-195	-
MW-20-1	571966.96	4631057.64	67	135.84	77	125.84	202.84	X	1,4 Dioxane Only	Perimeter	FLUTe	57-77	-
MW-20-2			97.5	105.34	111.5	91.34	202.84	X	1,4 Dioxane Only	Perimeter	FLUTe	86.5-111.5	-
MW-20-3			144	58.84	149	53.84	202.84	X	1,4 Dioxane Only	Perimeter	FLUTe	139-149	-
MW-21-1[3]	572596	4630042	42.75	190.84	48	185.59	233.59	X	1,4 Dioxane Only	Perimeter	FLUTe	33-48	-
MW-21-2[3]			67	166.59	69.5	164.09	233.59	X	1,4 Dioxane Only	Perimeter	FLUTe	54.5-69.5	-
MW-21-3[3]			75.5	158.09	78	155.59	233.59	Flute- Non-operational, sample port damaged (obstructed)			Flute- Non-operational, sample port damaged (obstructed)		
MW-21-4[3]			121.5	112.09	124	109.59	233.59	X	1,4 Dioxane Only	Perimeter	FLUTe	109-124	-
MW-21-5[3]			142.5	91.09	145	88.59	233.59	X	1,4 Dioxane Only	Perimeter	FLUTe	130-145	-
MW-21-6[3]			160.5	73.09	163	70.59	233.59	X	1,4 Dioxane Only	Perimeter	FLUTe	153-163	-

Notes:

1. Data compiled in this table was captured from historic annual groundwater monitoring reports prepared by EPA.
2. Well is currently part of the groundwater extractions and treatment system (GWETS). Sampling locations are is inside the GWETS building.
3. MW-17 through MW-21 are FLUTe wells. MW-18, 19 and 21 are artesian wells.

Prepared by/date: TG 07-02-19
Review by/date: JW 07-02-19

ATTACHMENT A

SITE SPECIFIC HEALTH & SAFETY PLAN

MACTEC, Inc.

MACTEC Short Form HASP

Site: Mohonk Road Industrial Plant Job Number: 3611191234
Street Address: 186 Mohonk Road, Hamlet of High Falls, Marbletown, Ulster County, New York
Proposed Date(s) of Investigation: June-July, 2019
Prepared by: Tom Gerhard Date: 5/28/2019
*Approved by: Jamie Welch Date:
Site Description: The Mohonk Road Industrial Plant (MRIP) site is located on approximately 114 acres in the town of Marbletown, NY. The site is bordered to the southeast by Mohonk Road and large wooded lots in all other directions. A groundwater treatment system consisting of on-site extraction wells and an air stripper is currently in operation to remove volatile organic compounds. The site is active.

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

MACTEC	Other contractor	Task Description
☒	☐	Mobilization/demobilization
☒	☐	Traditional Low Flow Groundwater sampling
☒	☐	Low Flow Groundwater Sampling with Packers
☒	☐	SVE Pilot System Installation and Operation
☒	☐	Soil Vapor Sampling via Inline SVE Sample Ports

Dates of Required Training and Medical Surveillance:

		Names of Field Team*			
		Jerry Rawcliffe	Lauren Tierney	Tom Gerhard	
	Req?	Dates	Dates	Dates	Dates
Medical Surveillance	X	12/12/2018	05/31/2019	05/29/2019	
Site Specific Medical Testing:___________					
40-Hour Initial	X	05/17/1985	07/11/2016	08/21/2017	
8-Hour Supervisor [1, 3]		09/29/1989	09/06/2017	07/09/2018	
8-Hour Refresher	X	03/19/2019	06/20/2018	07/06/2018	
First Aid/CPR [1,2]	X	03/14/2018	2/23/2017	NA	
Hazard Communication [1]	X	11/30/2016	6/16/2017	08/08/2017	

[1] If Applicable
[2] At least one worker must be trained in First Aid/CPR and should receive Blood borne 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	2014 Maximum Groundwater Concentration	PEL/TLV	Fact Sheet Included
1,1,1- TCA	3,000 ug/L	350 ppm	X
1,1-dichloroethene (1,1-DCE)	390 ug/L	1 ppm	X
1,1-dichloroethane (1,1-DCA)	48 ug/L	100 ppm	X
Trichloroethene (TCE)	280 ug/L	10 ppm	X
Tetrachloroethene (PCE)	Not previously sampled	25 ppm	X
Ethylbenzene	Not previously sampled	100 ppm	X
Xylene	Not previously sampled	100 ppm	X

Air Monitoring Action Levels:

PID/FID Reading [1]	Detector Tube [1]	Dust Meter [1]	LEL[2]/O_2 [1]	Action	Level of PPE
≤5 ppm				Work at Level D	
≥5 ppm		Visible Dust		Back off work. Use control measures for nuisance dust (i.e. spray with water), continue to monitor breathing zone with PID and dust meter.	Reassess as level C PPE is required
			≥ 10% LEL	Stop work. Evacuate area.	Consider return with ventilation system and spark proof/intrinsically safe equipment.
			≤19.5% O_2	Stop work and evacuate area	

[1] Sustained readings measured in the breathing zone

[2] Readings at measured at the source (borehole, well, etc.)

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

☒ Mobilization-Demobilization
☒ Handling Compressed Gas Cylinders
☒ Decontamination
☒ Groundwater Sampling
☒ Insect Stings and Bites
☒ Poisonous Plants
☒ Static Water Level Reading
☒ Vehicle Travel
☒ Field Work-General
☒ Power Tools- Electrical
☒ Working with Preservatives
☒ Soil Vapor Sampling

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

Chemicals	MSDS Attached?
HYDROCLORIC ACID (HCL)	☒
NITRIC ACID	☒
SULFURIC ACID	☒
PH4	☒
PH7	☒
CONDUCTIVITY SOLUTION	☒
ORP 240MV SOLUTION	☒

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

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) List Tubes___________________	☐ 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 skies.
- **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 (within 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 (HealthAlliance Hospital)	(845) 331-3131		
Police Department:	911		
Site Health And Safety Officer: Glen Gordon	Office: (207) 828-3348	Cell: (774) 270-0418	
MACTEC Project Manager: Stu Pearson	Office: (207) 828-3426	Cell: (207) 776-4251	
Division EH&S Manager: Cindy Sundquist	Office: (207) 828-3309	Cell: (207) 650-7593	
WorkCare	**(888) 449-7787**		
NYSDEC Project Manager: Charles Gregory	Office: (518) 402-8246		
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) (For SVE Pilot Test)
☒ Eyewash (Note: 15 minutes of free-flowing fresh water) (For SVE and GW Pilot Test)
☐ 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.

Early Injury Case Management Program

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

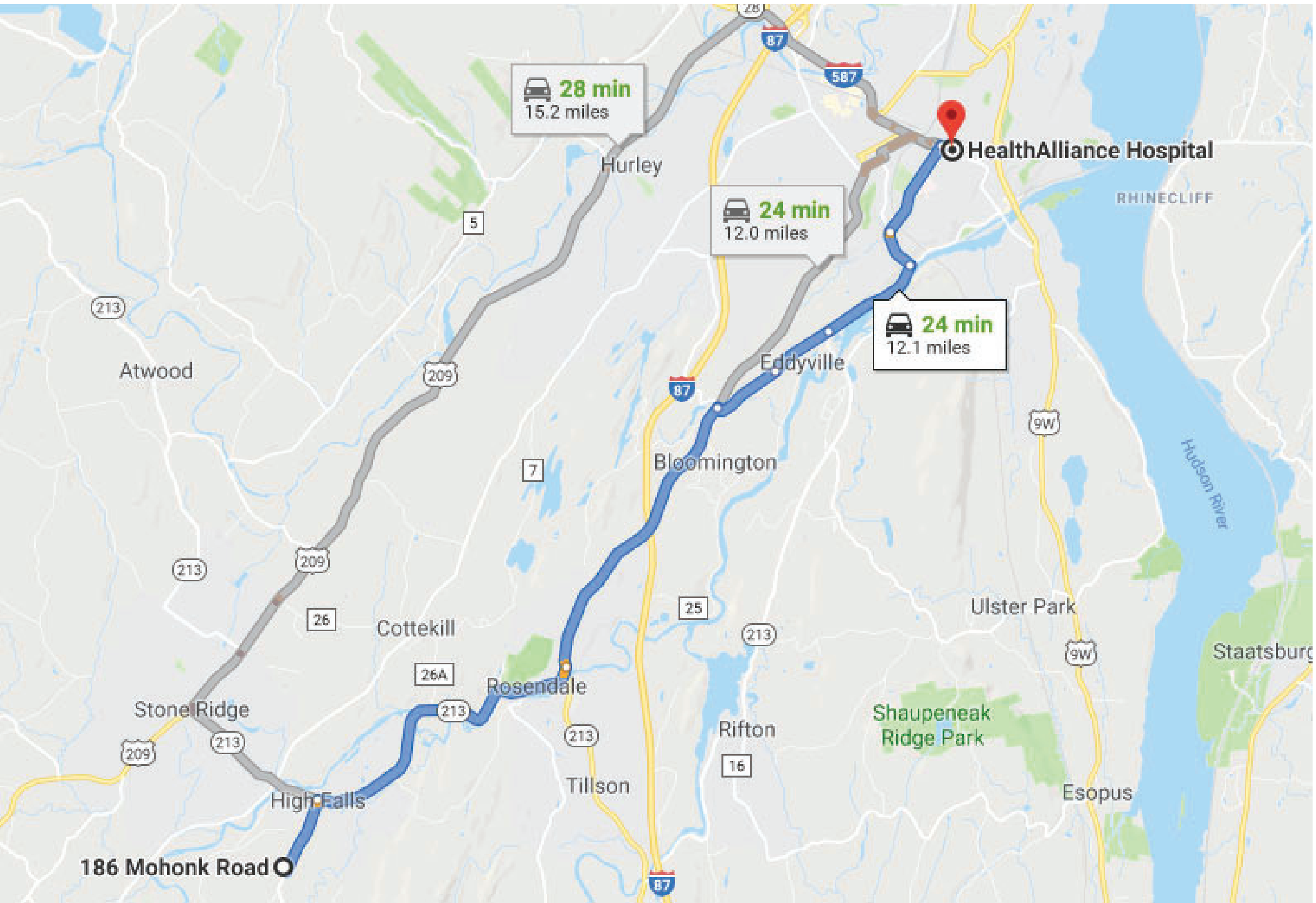
Follow the FAP for other site specific procedures.

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

Name: ______________________________ Date: ________________
Name: ______________________________ Date: ________________
Name: ______________________________ Date: ________________
Name: ______________________________ Date: ________________
Name: ______________________________ Date: ________________
Name: ______________________________ Date: ________________
Name: ______________________________ Date: ________________
Name: ______________________________ Date: ________________

MACTEC Inc.
Short Form HASP
Route to Emergency Medical Facility

PRIMARY HOSPITAL:
Facility Name: HealthAlliance Hospital
Address: 396 Broadway, Kingston, NY 12401
Telephone Number: (845) 331-3131
DIRECTIONS TO PRIMARY HOSPITAL
Head east toward Mohonk Road
Turn left onto Mohonk Road (0.8 miles)
Turn right onto NY-213 E (3.6 miles)
Turn left onto NY-32 N (3.3 miles)
Turn right onto Dewitt Lake Rd (0.8 miles)
Slight left onto Mountain Road (0.7 miles)
Continue onto NY-213 E/Abeel Street (1.2 miles)
Turn left onto Wilbur Ave (0.5 miles)
Turn right onto W O'Reilly St (1.1 miles)
Turn left onto Jansen Ave (423 ft)
Turn left
Turn right (destination on right)



DAILY TAILGATE SAFETY MEETING CHECKLIST

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

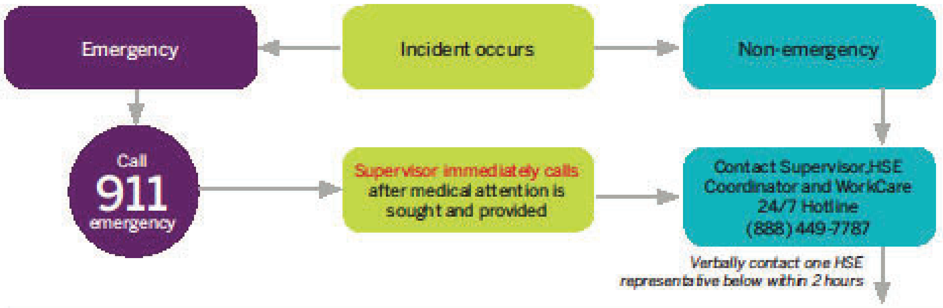
Meeting Conducted by: ______________________ Title: ______________________
Print

Signature: ______________________ Time: ______________________
Print

Incident flow chart

Call immediately

amec foster wheeler



Emergency

Incident occurs

Non-emergency

Call 911 emergency

Supervisor immediately calls after medical attention is sought and provided

Contact Supervisor,HSE Coordinator and WorkCare 24/7 Hotline (888) 449-7787

Verbally contact one HSE representative below within 2 hours

E&I Corporate HSE department contact list

Name/email	Office location	Contact information
Bruce Voss bruce.voss@amecfw.com	Cathedral City, CA	760.202.3737 (office) 951.897.6381 (cell)
Chad Barnes chad.barnes@amecfw.com	Phoenix, AZ	602.733.6000 (office) 480.495.9846 (cell)
Cindy Sundquist cynthia.sundquist@amecfw.com	Portland, ME	207.828.3309 (office) 207.650.7593 (cell) 207.892.4402 (home)
Gabe Sandholm gabe.sandholm@amec.com	Minneapolis, MN	612.252.3785 (office) 206.683.9190 (cell)
John Mazur john.mazur@amec.com	Wilmington, NC	910.444.2978 (office) 910.431.2330 (cell) 910.681.0538 (home)
Lori Dowling lori.dowling@amec.com	Prince George, BC	250.564.3243 (office)
Philip Neville philip.neville@amec.com	Thorold, ON	905.687.6616 (office) 905.380.4465 (cell)
Tim Kihn tim.kihn@amec.com	Edmonton, AB	780.944.6363 (office) 780.717.5058 (cell)
Vladimir Ivensky (can call 24/7) vladimir.ivensky@amec.com	Plymouth Meeting, PA	610.877.6144 (office) 484.919.5175 (cell) 215.947.0393 (home)
Kirby Lastinger kirby.lastinger@amec.com	Lakeland, FL	836-667-2345 x207 (office) 863-272-4775 (cell)

*High potential near misses, subcontractor incidents, regulatory inspections, spills, and property damage should be reported within 60 minutes to one of the above HSE Representatives.
WITHIN 24 HOURS - Local Supervisor, HSE Coordinator, Project HSE Officer, and any applicable safety committees must complete preliminary investigation, along with the initial Incident Analysis Report Form and forward it to the Corporate HSE Department

Rev. Feb15-Hb

Incident Report Forms

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

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

INCIDENT ANALYSIS REPORT (IAR)

Wood E&IS

Confidential - Privileged

Incident Potential Severity
Letter: Select One
Number: Select One
Investigation Level: Select One
Severity Matrix (LINK)

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

Incident Date: ______ Report Date: ______ Incident Assigned to: Select One

---

Section 1 – General Information

Employee Name: ____   Sex: ☐ M ☐ F   Date of Birth: ____ or Age Range: Select One

Job Position: Select One   Hire Date: ____   Time employee began work: _____   Time of incident: ____ ☐ am | ☐ pm

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

Project Name: ____   Project Number: ____   Client: ____

Employee home office: ____ State/Province: ____ Immediate Supervisor: ____   Hours employee worked during last 7 days: ____ hrs

Location: Select One   Is this a Company controlled work site: ☐ Yes ☐ No   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 If "other", specify: ___   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: ___
   ☐ Bleeding? Select One If yes, "First Aider" name: ___   ☐ Contact with blood/infectious material? Select One
   Exposure Control Precautions taken by First Aider (check all that apply):
   ☐ None (If none, contact WorkCare)
   ☐ Immediate Personal Hygiene
   ☐ Eye protection
   ☐ Gloves
   ☐ One-way CPR valve
   ☐ Face mask
   ☐ Previous HBV Immunization
   ☐ Recommended for HBV Immunization
   ☐ Other (describe): ____
   ☐ Blood contaminated work area / surface? If contaminated, describe cleanup/disposal: ___
   ☐ Medical treatment provided (i.e. prescriptions, referrals, etc.). If medical treatment, describe: ___
   ☐ Physical limitations received from physician? If limitations, describe: ___ ☐ Modified Work Offer provided.
   ☐ Second medical opinion? If second opinion, describe: ___
   ☐ Workers Compensation claim filed? If filed, claim number: ___

B. If **property damage**: describe what happened and estimate ($) of damage to all objects involved? ___

C. If **environmental**: Environmental incident category: ☐ Pollution Event ☐ Non-conformance
   Was Regulatory Action Taken: Select One If "Yes" describe: ___
   Type of pollution event: Select One   Type of substance: Select One   Name, CAS#, physical state: ___
   Quantity: ___ Substance Unit: Select One Source of release: Select One If "other", specify: ___
   Duration of Breach: Select One   Receiving Environment: Select One If "other", specify: ___
   Level of Non-conformance: Select One   Describe Non-conformance: ___

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 HSE Manager/IRP with support from location where incident occurred, in accordance with A-Z List of Accident Causes and Glossary of A-Z Causes (click links).

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	_____	_____

Life Saving Rules and Safety Essentials (click links).

Life Saving Rules
Select all applicable breaches of rules or ☐ None

- ☐ Confined Space
- ☐ Working at Height
- ☐ Permit to Work
- ☐ Isolations (energy)
- ☐ Dropped Objects (height)
- ☐ Excavations
- ☐ Personal Security
- ☐ Moving and Energized Equipment
- ☐ Working over or close to water
- ☐ Overhead electricity
- ☐ Driving
- ☐ Suspended Loads

Safety Essentials
Select all applicable breaches of behavioral expectations or ☐ None

- ☐ Always Take Care
- ☐ Follow the Rules
- ☐ Do a Risk Assessment
- ☐ You Must Intervene
- ☐ Manage Any Change
- ☐ Wear the Correct PPE

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 ☐ **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: ___

VEHICLE INCIDENT REPORT (VIR)

Amec Foster Wheeler E&I

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

7. Information on the use of rental and personal vehicles at work and insurance are at the links for **Canada** and **US**.

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 Foster Wheeler's HSE website at:

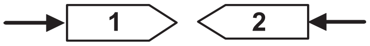
http://ee.amecnet.com/she/sheweb/incident_reporting.htm

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 Foster Wheeler** contractual requirements.
4. **Sign only those statements required by the authorities or as directed by Amec Foster Wheeler** contractual requirements. Do not sign away your or the company's rights.

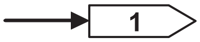
Vehicle Incident Diagram

This or a similar diagram must be completed with all VIRs

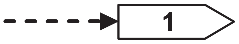
Instructions:

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



(before)



(after)

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.

Indicate North
by Arrow

Prepared by: ______________________ Date: ______________________

GROUND DISTURBANCE INCIDENT REPORT (GDR)

Amec Foster Wheeler E&I

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 the 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 **Link to GDR Root Cause Tip Card**

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

Provide explanation of selected root cause/s:_____

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
- Handling Compressed Gas Cylinders
- Decontamination
- Groundwater Sampling
- Insect Stings and Bites
- Poisonous Plants

- Static Water Level Reading
- Vehicle Travel
- Field Work-General
- Power Tools- Electrical
- Working with Preservatives
- Soil Vapor Sampling

AHA - - Mobilization/Demobilization and Site Preparation Activity Description

Activity/Work Task:	Mobilization/Demobilization and Site Preparation		
Project Location:	Mohonk Road Ind. Plant, High Falls, NY		
Contract Number:			
Date Prepared:	7/03/2012	**Date Accepted:**	
Prepared by (Name/Title):	Ryan Mankowski/Staff Environmental Scientist		
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. Prepare for Site Visit	1A) N/A	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	M

Job Steps	Hazards	Controls	RAC
	1b) Vehicle defects	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	**L**
	1c) Insufficient emergency equipment, unsecured loads	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	**L**
2. Operating vehicles	2a) Collisions, unsafe driving conditions	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	**M**
3. Driving to the jobsite (mobilization)	3a) Dusty, winding, narrow roads	Dusty, winding, narrow roads ▪ Drive confidently and defensively at all times. ▪ Go slow around corners, occasionally clearing the windshield.	**M**

AHA - - Mobilization/Demobilization and Site Preparation
Activity Description

Job Steps	Hazards	Controls	RAC
	3b) Rocky or one-lane roads	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.	**M**
	3c) Stormy weather, near confused tourists	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.	**L**
	3d) When angry or irritated	When angry or irritated: ▪ Attitude adjustment; change the subject or work out the problem before driving the vehicle. Let someone else drive.	**M**
	3e) Turning around on narrow roads	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.	**M**
	3f) Sick or medicated	Sick or medicated: ▪ Let others on the crew know you do not feel well. ▪ Let someone else drive.	**M**
	3g) On wet or slimy roads	On wet or slimy roads ▪ Drive slow and safe, wear seatbelts.	**M**
	3h) Animals on road	Animals on road ▪ Drive slowly, watch for other animals nearby. ▪ Be alert for animals darting out of wooded areas	**M**
4. Gain permission to enter site	4a) Hostile landowner, livestock, pets	Hostile landowner, livestock, pets ▪ Talk to land owner, be courteous and diplomatic ▪ Ensure all animals have been secured away from work area	**L**
5. Mobilization/ Demobilization of	5a) Struck by Heavy Equipment/Vehicles	Struck by heavy equipment: ▪ Be aware of heavy equipment operations.	**M**

AHA - - Mobilization/Demobilization and Site Preparation
Activity Description

Job Steps	Hazards	Controls	RAC
Equipment and Supplies		- 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	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.	**L**
	5c) Overexertion Unloading/Loading Supplies	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.	**M**
	5d) Overexertion Unloading/Loading Supplies	Caught in/on/between: - Do not place yourself between two vehicles or between a vehicle and a fixed object.	**M**
	5e) Slip/Trip/Fall	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.	**L**
	5f) Vehicle accident	Vehicle accident: - Employees should follow AMEC vehicle operation policy and be aware of all stationary and mobile vehicles.	**L**

AHA - - Mobilization/Demobilization and Site Preparation Activity Description

Job Steps	Hazards	Controls	RAC
6. Site Preparation	6a) Slip/Trip/Fall	Slip/Trip/Fall: ▪ Mark all holes and low spots in area with banner tape. Instruct personnel to avoid these areas	L
7. Installation of soil erosion and sediment controls	7a) Overexertion	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.	M
	7b) Struck by Equipment/Supplies	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.	M
8. Driving back from the jobsite	7c) See hazards listed under item #3	See safe work practices under item #3	M

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) Note: When initially entering the site the following PPE must be donned: • Work Uniform or Work Clothes • Hard Hat • Safety Glasses • Steel Toe Boots • Reflective Vests	**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 - Handling Compressed Gas Cylinders

Activity/Work Task:	Handling Compressed Gas Cylinders		
Project Location:	Mohonk Road Ind. Plant, High Falls, NY, ~~Former Unisys Facility~~		
Contract Number:	~~3650140003.02.201~~		
Date Prepared:	**7/29/2014**	**Date Accepted:**	
Prepared by (Name/Title):	Lynne Baumgras		
Reviewed by (Name/Title):	Cynthia Sundquist, CIH, CSP		

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

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

This AHA involves the following:

- Handling compressed gas cylinders that are used in groundwater sampling

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

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
Steel toe work boots, high visibility safety vest	**Training requirements:** Compressed Gas Safety Site Specific HASP Orientation Toolbox safety meeting Task kick-off meeting	Daily inspection of equipment per manufacturer's instructions. Tag cylinders that are damaged or defective and remove from service.

Job Steps	Hazards	Controls	RAC
1. Moving full gas cylinder to work area or to vehicle.	1A) Projectile hazard (if cylinder falls and neck shears off)	1A) Projectile Hazard ▪ Use cylinder cart to transport gas cylinders. ▪ Cylinders are to be secured to the cart ▪ Move gas cylinders only with the protective cap in place. ▪ Move gas cylinders in an upright position ▪ Do not allow cylinders to drop or strike against each other or against hard objects.	L

AHA - Handling Compressed Gas Cylinders

Job Steps	Hazards	Controls	RAC
	1B) Back or muscle strain	1B) Back or muscle strain ▪ Avoid lifting cylinder. ▪ Use materials handling aid (e.g., cart, dolly, etc.) whenever possible ▪ If cylinder must be lifted, use proper lifting techniques (lift with legs, not back, don't reach or use a twisting motion). ▪ Obtain assistance in lifting large cylinders, especially those weighing over 50 lbs	M
	1C) Foot injury	1C) Foot injury ▪ Wear steel toed boots	M
2. Transporting a gas cylinder in a vehicle.	2A) Asphyxiation and/or chemical exposure	2A) Asphyxiation and/or chemical exposure ▪ All gases can create an asphyxiation hazard. Some may also be toxic and/or flammable ▪ Ensure cylinder is NOT leaking (use soapy water to check), valve is tightly closed, regulator removed and cap is secured to cylinder. ▪ Gas cylinders should NOT be transported in the passenger compartment of a vehicle. Cylinders should be transported in a pickup bed, or trailer, secured in an upright position. Note: Calibration gas cylinders (e.g., isobutylene) may be stored in the PID case. ▪ Do not transport with incompatibles	L
	2B) Fire hazard	2B) Fire hazard ▪ Do not leave cylinders in vehicles – especially in extreme temperatures. ▪ Secure in vehicles – away from flammable/combustible materials and ignition sources. ▪ Ensure cylinder is NOT leaking (use soapy water to check), valve is tightly closed, regulator removed and cap is secured to cylinder.	L
	2C) Projectile hazard	2C) Projectile hazard ▪ Secure cylinders tightly to vehicle. ▪ Do not allow cylinders to roll around loosely in vehicle	L
3. Securing a gas cylinder in the field	3A) Back or muscle strain.	3A) Back or muscle strain. ▪ Use mechanical aid (e.g., cart) to move large cylinder, if possible. ▪ If lifting and manual handling is unavoidable, use proper lifting techniques. Protect your back from strain and twisting. ▪ Use two people to handle large cylinders, especially those weighing over 50 lbs	M
	3B) Projectile hazard	3B) Projectile hazard ▪ Ensure tanks are secured tightly to wall of trailer, to a cart, or to a tree, post or other sturdy object, in an upright position. ▪ Do not lay cylinder on it's side.	L
	3C) Fire hazard	3C) Fire hazard ▪ Store flammable gases away from combustible materials (wood, paper, dried grasses, etc.) ▪ Store flammable gases at least 20 feet away from oxidizers or protect with a fire wall ▪ Store away from ignition sources	L

AHA - Handling Compressed Gas Cylinders

Job Steps	Hazards	Controls	RAC
	3D) Chemical exposure	3D) Chemical exposure ▪ Ensure label on cylinder is legible ▪ Ensure valves are tightly closed when not in use ▪ Store away from incompatibles ▪ Review ~~M~~SDS ▪ Wear PPE as identified in HASP.	L
4.	3E) Electrical	3E) Electrical ▪ Ensure cylinders are stored at a location where they cannot become part of an electrical circuit.	
~~4.~~5. Using gas cylinders	4A) Projectile hazard.	4A) Projectile hazard ▪ Ensure cylinder is secured tightly before removing protective cap.	L
	4B) Cylinder may fall when changing cylinders.	4B) Cylinder may fall when changing cylinders. ▪ Ensure BOTH cylinders are secured tightly to the wall or the transport cart.	L
	4C) Leaking Cylinders	4C) Leaking Cylinders ▪ Move all leaking cylinders outdoors, into a well-ventilated area	L
	4D) High pressure gas release	4D) High pressure gas release ▪ Use proper procedures to open and close a cylinder with a regulator attached: ▪ Open cylinder valves slowly and do not open valves all the way. ▪ Open so nozzle is facing away from person ▪ Open valves only by hand unless the cylinder is specifically designed to be opened with a hand tool (keep hand tool with cylinder)	M
~~5.~~6. Returning "empty" gas cylinder to vendor	5A) High pressure gas	5A) High pressure gas ▪ Replace protective cap on the empty gas cylinder before transporting to vendor.	M
	5B) Moving a heavy object	5B) Moving a heavy object ▪ Use proper lifting techniques. Protect your back from strain and twisting. ▪ Get aid when lifting heavy cylinders, especially those weighing over 50 lbs ▪ Use a cart, if possible, to transport cylinders	M

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AHA - Decontamination

Activity/Work Task:	Decontamination		
Project Location:	Mohonk Road Ind. Plant, High Falls, NY		
Contract Number:			
Date Prepared:	8-15-12	**Date Accepted:**	8-15-12
Prepared by (Name/Title):	Kendra Bavor		
Reviewed by (Name/Title):	Kendra Bavor, CSP		

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**

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

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.

AHA - Decontamination

Job Steps	Hazards	Controls	RAC
1. Establish Decontamination Station	1A) Materials Handling	1A) Materials Handling ▪ Use proper lifting techniques ▪ Use mechanical aids, if available, to move heavy items.	L
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.	M
	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).	L
	2C) Slips/Trips/Falls	2C) Slips/Trips/Falls ▪ Be cautious as ground/plastic can become slippery ▪ Use boots or boot covers with good traction	L
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.	L

	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).	**L**
	3C) Slips/Trips/Falls	3C) Slips/Trips/Falls ▪ Be cautious as ground/plastic can become slippery ▪ Use boots or boot covers with good traction	**L**
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)	**M**
	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	**L**

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.
			M

AHA - Decontamination

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
PPE (Safety glasses, gloves (HASP), steel toe work boots, high visibility safety vest, hearing protection.)	**Competent / Qualified Personnel:** See HASP - Name – Position/Employer **Training requirements:** 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 - - Groundwater Sampling
Activity Description

Activity/Work Task:	Groundwater Sampling		
Project Location:	Mohonk Road Ind. Plant, High Falls, NY		
Contract Number:			
Date Prepared:	**11/20/18**	**Date Accepted:**	
Prepared by (Name/Title):	Haley Plante/Environmental Scientist		
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)

	RAC Chart
"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	**E = Extremely High Risk** **H = High Risk**
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.	**M = Moderate Risk** **L = Low Risk**

AHA - - Groundwater Sampling
Activity Description

Job Steps	Hazards	Controls	RAC
1. Mobilization	3A) See JHA Mobilization/Demobilization/Site Preparation	1A) See JHA Mobilization/Demobilization/Site Preparation	L
2. General Site Hazards	2A) See JHA Field Work - General	2A) See JHA Field Work - General	M
	2B) Chemical exposure	2B) Chemical Exposure ▪ Read HASP TO determine air monitoring and PPE needs.	L
3. Calibrate monitoring equipment	4A) Exposure to calibration gases	4A) Exposure to calibration gases ▪ Review equipment manuals ▪ Calibrate in a clean, well ventilated area	L
4. Opening the well cap, taking water level readings	5A) Contact with poisonous plants or the oil from poisonous plants	5A) 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.	L
	5B) Contact with biting insects (i.e., spiders, bees, etc.) which may have constructed a nest in the well cap/well.	5B) 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.	L

AHA - - Groundwater Sampling
Activity Description

	5C) Exposure to hazardous Inhalation and contact with hazardous substances (VOC contaminated groundwater/ soil); liquid splash; flammable atmospheres.	5C) 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.	**M**
	5D) Back strain due to lifting bailers or pumps and from moving equipment to well locations	5D) Back strain ▪ Use mechanical aids when possible, if mechanical aids are not available, use two person lifts for heavy items. ▪ Use proper lifting techniques	**L**
	5E) Foot injuries from dropped equipment	5E) 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	**L**

5. Collecting water samples	6A) Fire/Explosion/Contamination hazard from refueling generators	6A) 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 AHA for Gasoline use	L
	6B) Electrocution	6B) 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.	L

	6C) Exposure to contaminants	6C) 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	**M**
	6D) Infectious water borne diseases	6D) 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	**L**
	6E) Exposure to water preservatives	6E) 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 Working With Preservatives JHA	**M**
	6F) Slips/trips/falls	6F) 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	**M**
	6G) Repetitive Motion and other Ergonomic Issues	6G) 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.	**L**
6. Sample Processing	7A) Contaminated water	7A) 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	**M**
7. Shipping Samples	8A) Freeze burns, back strain, hazardous chemical exposure, sample leakage	8A) 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.	**M**

AHA - - Groundwater Sampling
Activity Description

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 (See project specific HASP)	**Competent / Qualified Personnel:** See HASP (Name – Position/Employer) **Training requirements:** HAZCOM 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:	Insect Stings and Bites		
Project Location:	Mohonk Road Ind. Plant, High Falls, NY		
Contract Number:			
Date Prepared:	**8-15-12**	**Date Accepted:**	**8-15-12**
Prepared by (Name/Title):	Kendra Bavor		
Reviewed by (Name/Title):	Kendra Bavor, CSP		

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

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)

	RAC Chart
"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	**E = Extremely High Risk** **H = High Risk**
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.	**M = Moderate Risk** **L = Low Risk**

AHA - - Activity Title
Activity Description

Job Steps	Hazards	Controls	RAC
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.	L
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. ▪ Prior to approaching protective well casings, observe for any indication of nesting activity ▪ 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).	L
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.	L

AHA - - Activity Title
Activity Description

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
PPE (Safety glasses, gloves (HASP), steel toe work boots, high visibility safety vest, Long sleeved light colored shirt, and long light colored pants.)	**Competent / Qualified Personnel:** See HASP - Name – Position/Employer **Training requirements:** 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 – Poisonous Plants

Activity/Work Task:	Poisonous Plants		
Project Location:	Mohonk Road Ind. Plant, High Falls, NY		
Contract Number:			
Date Prepared:	**3-7-13**	**Date Accepted:**	
Prepared by (Name/Title):	Kendra Bavor, CSP		
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

AHA – Poisonous Plants

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

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

AHA – Poisonous Plants

3A) Contact with poisonous plants	3A) Hand Contact	3A) Hand Contact ▪ Apply IvyX (or similar product) to hands, forearms and other potentially exposed parts of the body, prior to starting work in the morning and again right after lunch. ▪ Leather Gloves must be worn at all times when digging, screening or carrying field equipment. ▪ Leather gloves should be of sufficient length to cover the entire wrist and cuff of the shirt. ▪ Carefully remove gloves, without touching the exterior surface, when taking notes and prior to lunch or restroom breaks. ▪ Gloves that become worn should be replaced immediately. ▪ Do not scratch or rub the face or other exposed skin while wearing gloves. ▪ Workers will apply Tecnu (or similar product) to the hands and forearms immediately after removing their gloves, prior to lunch and again at the end of the day. Tecnu will help cleanse the urushiol oil from the skin before it can be absorbed. Sensitive individuals can also apply prior to showering in the evening.	M
	3B) Arm Contact	3B) Arm Contact ▪ Apply IvyX (or similar product) to hands, forearms and other potentially exposed parts of the body, prior to starting work in the morning and again right after lunch. ▪ Wear light weight, long sleeved shirts as the sleeves will provide a physical barrier between the skin and any urushiol oil encountered. Disposable gauntlets may we worn over arms to keep oil from clothing as well. ▪ Have the sleeves pulled down to the base of the hand, covering the forearm and wrist (all exposed skin). ▪ Workers will apply Tecnu (or similar product) to the hands and forearms immediately after removing their gloves, prior to lunch and again at the end of the day. Tecnu will help cleanse the urushiol oil from the skin before it can be absorbed. Sensitive individuals can also apply prior to showering in the evening.	M
	3C) Leg Contact	3C) Leg Contact ▪ Wear long pants and boots. ▪ Assume boots are contaminated with the urushiol oil and only handle with gloved hands.	M
4) Handling Contaminated Equipment and Clothing	4A) Exposure from Handling Contaminated Equipment	4A) Exposure from Handling Contaminated Equipment ▪ Do not handle any field equipment that may have come in contact with poison ivy/oak/sumac without gloves. ▪ Decontaminate all equipment at the end of each workday with a solution of water and dish soap. ▪ Scrub all surfaces of the screens and shovels with a brush. ▪ Rinse with cool water using a portable garden sprayer.	M
	4B) Exposure from Handling Contaminated Clothing	4B) Exposure from Handling Contaminated Clothing ▪ Wash clothing potentially contaminated with urushiol oil prior to wearing again. ▪ Handle contaminated clothing with gloves as the oil can remain on environmental surfaces for up to 5 years.	M

AHA – Poisonous Plants

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) IvyX lotion (or similar product for precontact Soap and Water after contact (Technu or similar product)	**Competent / Qualified Personnel:** Name – Position/Employer See HASP **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 Decontaminate all tools and clothing to avoid contact with residual oils

AHA - Static Water Level Reading

Activity/Work Task:	Static Water Level Readings		
Project Location:	Mohonk Road Ind. Plant, High Falls, NY		
Contract Number:			
Date Prepared:	**8-15-12**	**Date Accepted:**	**8-15-12**
Prepared by (Name/Title):	Kendra Bavor		
Reviewed by (Name/Title):	Kendra Bavor, CSP		

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

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

AHA - Static Water Level Reading

Job Steps	Hazards	Controls	RAC
1. Work Preparation	1A) Chemical Exposures	1A) Chemical Exposures ▪ See HASP for PPE and air monitoring requirements ▪ Calibrate monitoring equipment ▪ 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. ▪ Decon thoroughly prior to consumption of food, beverage or tobacco.	L
2. Open Well With Hand Tool And Remove Well Cap	2A) Knee Injury Due To Kneeling On Ground	2A) Knee Injury Due To Kneeling ▪ Check the area and remove any rocks or other sharp objects ▪ Kneel on some type of padding or leather glove ▪ Use chemical resistant material to kneel on if surface soil is contaminated.	L
	2B) Injury Due To Using Hand Tools	2B) Injury Due To Using Hand Tools ▪ Wear leather work gloves, when removing cover from well ▪ Be alert to hand position when using hand tools ▪ All hand 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.	L
	2C) Slips/Trips/Falls	2C) Slips/Trips/Falls ▪ Maintain work areas safe and orderly; mark or repair possible tripping hazards. ▪ Always watch your footing. ▪ Horseplay is strictly prohibited ▪ Wear laced boots with a minimum 8" high upper and non-skid Vibram-type soles for ankle support and traction.	L
	2D) Materials Handling – Sprains/Strains	2D) Materials Handling – Sprains/Strains ▪ Clean out dirt and loosen cap with hammer if lid is difficult to open ▪ Use proper tools to open well cover and cap ▪ Use bucket to carry hand tools and equipment in.	L
	2E) Contact With Biting Insects (I.E., Spiders, Bees, Etc.) Which May Have Constructed A Nest In The Well Cap/Well.	2E) 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." ▪ 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.	L

	2F) Struck By Vehicle/Equipment	2F) Struck By Vehicle/Equipment ▪ Be aware of heavy equipment operations that may be working nearby. ▪ 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. ▪ High visibility vests will be worn when workers are exposed to equipment or vehicular traffic.	**L**
3. Insert Probe Into Well and Take Reading	3A) Awkward Postures	3A) Awkward Postures ▪ Use small stool to sit on when sampling if warranted by sampling duration.	**L**
	3B) Chemical Exposures	3B) Chemical Exposures ▪ Wear PPE as identified in HASP ▪ Use monitoring equipment, as outlined in HASP, to monitor breathing zone ▪ Calibrate monitoring equipment ▪ Be familiar with hazards associated with site contaminants. ▪ Decon thoroughly prior to consumption of food, beverage or tobacco.	**L**
4. Replace Well Cap and Cover.	4A) Slips, Trips, Falls	4A) Slips, Trips, Falls ▪ See Section 2C above	**L**
	4B) Injury Due To Using Hand Tools	4B) Injury Due To Using Hand Tools ▪ See Section 2B above	**L**
	4C)	4C)	**L**

AHA - Static Water Level Reading

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
PPE (Safety glasses, gloves (HASP), steel toe work boots, high visibility safety vest)	**Competent / Qualified Personnel:** See HASP - Name – Position/Employer **Training requirements:** 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 - - Vehicle Travel

amec
foster
wheeler

Activity/Work Task:	Vehicle Travel (car or truck)		
Project Location:	Mohonk Road Ind. Plant, High Falls, NY		
Contract Number:			
Date Prepared:	**8/15/2012**	**Date Accepted:**	**8-16-12**
Prepared by (Name/Title):	Ryan Mankowski/Staff Environmental Scientist		
Reviewed by (Name/Title):	Kendra Bavor, CSP		

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)

	RAC Chart
"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	**E = Extremely High Risk** **H = High Risk**
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.	**M = Moderate Risk** **L = Low Risk**

AHA - - Vehicle Travel

Job Steps	Hazards	Controls	RAC
1. Prepare for travel	1A) Distractions - loss of focus	▪ Ensure you have all materials with you necessary to conduct work effort. ▪ 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). ▪ Familiarize yourself with route to destination. ▪ Ensure that a copy of the current insurance certificates and incident reporting procedures/forms are available during travel.	**M**
	1B) Vehicle defects	Inspect vehicle for defects such as: ▪ Inadequate fluids (e.g., fuel, antifreeze, oil, windshield washer) ▪ Worn/flat tires ▪ Windshield wipers loose, worn, or torn ▪ Oil puddles under vehicle ▪ Headlights, brake lights, turn signals not working ▪ Exterior or interior damage (e.g., scratches, dents)	**L**
1.	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 equipped 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. ▪ Ensure parking cones are present, if applicable.	**M**

AHA - - Vehicle Travel

2. Operating vehicles	2A) Collisions, unsafe driving conditions	▪ Drive defensively! ▪ Do not use cruise control during inclement weather. ▪ Do not drive more than 500 miles per day or for extended distances from 11:00pm to 5:00 am. ▪ Do not eat or use tobacco products in the vehicle. ▪ No unrestrained pets or nonwork riders (e.g., hitch hikers, girl friend, mother-in-law) allowed in vehicles. ▪ 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 or use a cell phone. ▪ Try to park so that you don't have to back up to leave. ▪ If backing is 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.	**H**
	2B) Intersections	▪ Proceed carefully through intersections ▪ Ensure that cross traffic has stopped before proceeding, especially if the light has just turned green. Look out for drivers running red lights! ▪ When merging into traffic or turning, ensure vehicles in front have merged/turned (and not stopped) prior to proceeding.	**H**
	2C) Dusty, winding, narrow roads	▪ Go slow around corners, occasionally clearing the windshield.	**M**
	2D) 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.	**L**
	2E) Stormy weather	▪ Inquire about conditions before leaving the office. ▪ Be aware of oncoming storms.	**H**
	2F) When angry or irritated	▪ Attitude adjustment; change the subject or work out the problem before driving the vehicle. Let someone else drive.	**L**
	2G) Turning around on narrow roads	▪ Safely turn out with as much room as possible. ▪ Know what is ahead and behind the vehicle. ▪ Use a spotter if available.	**L**
	2H) Sick or medicated	▪ Let others on the crew know you do not feel well. ▪ Let someone else drive.	**L**
	2I) On wet or slick roads	▪ Drive slow and safe.	**M**

	2J) Animals on road	▪ Drive slowly, watch for other animals nearby. ▪ Be alert for animals darting out of wooded areas	**L**
	2K) Vehicle accident	▪ Employees should follow MACTEC vehicle operation policy and be aware of all stationary and mobile vehicles.	**M/H**
3. Parking at job site	3A) Striking other vehicles, objects	▪ Choose parking spot that is away from other vehicles, if possible. ▪ Choose a spot that will allow the driver to drive forward when leaving the site. ▪ Back into parking spots, or pull through when parking in perpendicular parking spaces (drive forward into angle/herring bone type parking spots). ▪ Place cones in front of and behind company-owned vehicles as applicable.	**M/H**
	3B) Leaving parking spaces	▪ Walk around the vehicle before leaving and identify hazards (low lying objects, location of other vehicles or pedestrians, other vehicles with drivers that may be leaving at the same time, etc. ▪ Collect cones (Company vehicles only) and secure them into their holder. ▪ If backing is unavoidable, use a spotter if a second person is available; if no spotter available, back slowly, checking for other vehicles, pedestrians, etc. ▪ Keep alert!	**L**
4. Driving back from the job site	4A) See hazards listed for “Operating vehicles” Key Work Step	▪ See safe work practices for “Operating vehicles” Key Work Step	**L**
5. Parking at office	5A) Striking other vehicles, objects	▪ See safe work practices for “Striking other vehicles, objects” Hazard/Potential Hazard for “Parking at job site” Key Work Step	**M**
6. End travel	6A) Vehicle defects	▪ Inspect vehicle. ▪ Repair or initiate repair of all vehicle deficiencies that occurred due to the trip.	**L**

AHA - - Vehicle Travel

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
PPE (safety glasses, gloves, steel toe work boots, high visibility safety vest, hearing protection, PFD-See specific project HASP)	**Competent / Qualified Personnel:** See HASP (Name – Position/Employer) **Training requirements:** HazCom Site Specific HASP Orientation Toolbox safety meeting Task kick-off meeting Current Driver's license	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 - Field Work - General

Activity/Work Task:	**Field Work - General**		
Project Location:	Mohonk Road Ind. Plant, High Falls, NY		
Contract Number:			
Date Prepared:	**9/20/2012**	**Date Accepted:**	**10/11/2012**
Prepared by (Name/Title):	Alicia Robinson/ Sr. Scientist		
Reviewed by (Name/Title):	Chad Barnes, Mtn. Group Safety Manager		

Overall Risk Assessment Code (RAC) (Use highest code)	L

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 for general field work.

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

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:** See HASP **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 defective tools and remove from service. Inspect power cord sets prior to use. Inspect all PPE prior to use

AHA - Field Work - General

Job Steps	Hazards	Controls	RAC
1. Prepare For Site Visit	N/A	▪ Obtain and review HASP prior to site visit. ▪ 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.	L
2. Traveling To The Site By Vehicle		See AHA - Mobilization, Demobilization and Site Preparation	L
3. Initial Site Condition Assessment And Walking Around The Site	3A) Poor Communication – General Safety	3A) Poor Communication – General Safety ▪ Develop communication methods (agree on hand signals, warning alarms) with subcontractor and other site personnel. ▪ 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 at all times. ▪ Hold and document Safety Tailgate Meetings. ▪ Establish and communicate work zones, evacuation routes and rally locations.	L
	3B) Insect, Scorpion And Animal Bites And Stings	3B) Insect, Scorpion And Animal Bites And Stings ▪ See - AHA Noxious Insects and Animals	L
	3C) Poisonous Plants	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.	L

AHA - Field Work - General

Job Steps	Hazards	Controls	RAC
		 POISON IVY (Rhus toxicondendron L.) POISON OAK (Rhus diversiloba) POISON SUMAC (Rhus toxicondendron vernix)	
	3D) Chemical Hazards	3D) Chemical 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.	**L**
	3E) High Crime Areas	3E) 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.	**L**
	3F) Operations Conducted At An Active Facility	3F) 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.	**L**
	3G) Remote Locations	3G) Remote Locations ▪ Carry a two-way radio or cell phone with clear signal 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.	**L**
	3H) Personnel Decontamination	3H) Personnel Decontamination ▪ See AHA - Decontamination.	**L**

AHA - Field Work - General

Job Steps	Hazards	Controls	RAC
	3I) Slips / Trips / Falls	3I) Slips / Trips / Falls ▪ 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. ▪ Horseplay is strictly prohibited. ▪ 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. Be aware of surroundings. Avoid muddy areas if possible. ▪ 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. ▪ Slow down and use extra caution around logs, rocks, and animal holes. ▪ Stay back at least 5 feet from excavated areas. Use caution when walking on or around loose soil.	L
	3J) Head Injury	3J) Head Injury ▪ Identify all overhead hazards prior to commencing work operations. ▪ Personnel are 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. ▪ Do not walk or work under scaffolding or other elevated work unless there are guardrails and toe boards in place. ▪ Flag or mark protruding objects at head level. ▪ Inspect rigging prior to each use. ▪ Do not walk under trees in high winds.	L
	3K) Eye Injury	3K) Eye Injury ▪ Wear appropriate safety glasses (tinted for sun and UV protection). ▪ Watch where you walk, especially around trees and brush with protruding limbs.	L
	3L) Foot Injury	3L) Foot Injury ▪ Employees must wear steel toe boots meeting ANSI Standard Z41-1999: Personal Protection - Protective Footwear, or ASTM F2412-2005: Standard Test Methods for Foot Protection, or ASTM F2413-2005. ▪ Wear extra socks or insulated steel toed boots during winter when cold. ▪ Ensure shoes/boots have good traction.	L

AHA - Field Work - General

Job Steps	Hazards	Controls	RAC
4. Oversight During Drilling, Or Construction Operations	4A) Caught In /On / Between Moving Equipment	4A) Caught In /On / Between Moving Equipment ▪ Clear area of obstructions and communicate with all workers involved that drilling is beginning. ▪ Wear appropriate PPE including leather gloves and steel-toed boots (See HASP). ▪ 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), jewelry or loose clothing if working with tools/machinery.	L
	4B) Eye Injury	4B) Eye Injury ▪ See Section 3K above	L
	4C) Foot Injury	4C) Foot Injury ▪ See Section 3L above	L
	4D) Head Injury	4D) Head Injury ▪ See Section 3J above	L
	4E) Chemical Hazards	4E) Chemical Hazards ▪ See Section 3D above	L
	4F) Dust - Particulates (Respiratory)	4F) Dust - Particulates (Respiratory) ▪ Use dust suppression methods. ▪ Stand upwind of point of dust generation.	L
	4G) Slips / Trips / Falls, Twisted Ankles And Knees	4G) Slips / Trips / Falls, Twisted Ankles And Knees ▪ See Section 3I above	L
	4H) Operations Conducted At An Active Facility	4H) Operations Conducted At An Active Facility ▪ See Section 3F above	L
	4I) Injury from Heavy Equipment or Vehicles	4I) Injury from Heavy Equipment or Vehicles ▪ Ground personnel will wear high visibility vests. ▪ All equipment will be equipped with backup alarms. 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 make eye contact with operators before approaching equipment. Operator will acknowledge eye contact by removing his hands from the controls. ▪ Equipment will not be approached on blind sides. Ground personnel will not stand directly behind heavy equipment when it is in operation. ▪ Ground personnel will be aware of the swing radius and maintain an adequate buffer zone. ▪ Ground personnel will stay clear of all suspended loads.	L

Job Steps	Hazards	Controls	RAC
		▪ 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. ▪ 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 front and rear of the vehicle if near moving equipment or vehicles. Set up "Workers in the Road" or similar warning signs and cones to alert traffic. ▪ 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. ▪ 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.	
	4J) Underground Utilities	4J) 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.	**L**
	4K) Back Injuries	4K) Back Injuries - 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.	**L**
		4K) Back Injuries - 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.	**L**

AHA - Field Work - General

Job Steps	Hazards	Controls	RAC
		▪ Ensure that the blade is securely attached to the handle. ▪ 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.	
		4K) Back Injuries - Standing/Static Posture ▪ Change posture on a frequent basis. ▪ Stretch prior to any physical activity.	L
	4L) Overhead Power Lines	4L) 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.	L
	4M) Noise	4M) 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.	L
5. Sampling and Sampling Oversight	5A) Chemical Hazards	5A) Chemical Hazards ▪ See Section 3D above ▪ Calibrate meters in a clean, well ventilated area. ▪ Store calibration gases in well vented area. Ensure chemical labels and warnings are legible.	L

AHA - Field Work - General

Job Steps	Hazards	Controls	RAC
	5B) Decontamination	5B) Decontamination ▪ See AHA - Decontamination	L
	5C) Back Injury - Lifting	5C) Back Injury - Lifting ▪ See Section 4K above	L
	5D) Hand Injury from Use of Hand Tools	5D) Hand Injury from Use of 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. ▪ Ensure guards are in place and are in good condition. ▪ 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. ▪ Use tool in accordance with manufacturers instructions and for its intended purpose. Ensure all workers are trained. ▪ No tampering with electrical equipment is allowed (e.g., splicing cords, cutting the grounding prong off plug, etc.).	L
	5E) Slips/Trips/Falls	5E) Slips/Trips/Falls ▪ See Section 3I above.	L
	5F) Caught In / On / Between	5F) Caught In / On / Between ▪ See Section 4A above	L
	5G) Contact With Electricity	5G) Contact With Electricity ▪ 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.	L

AHA - Field Work - General

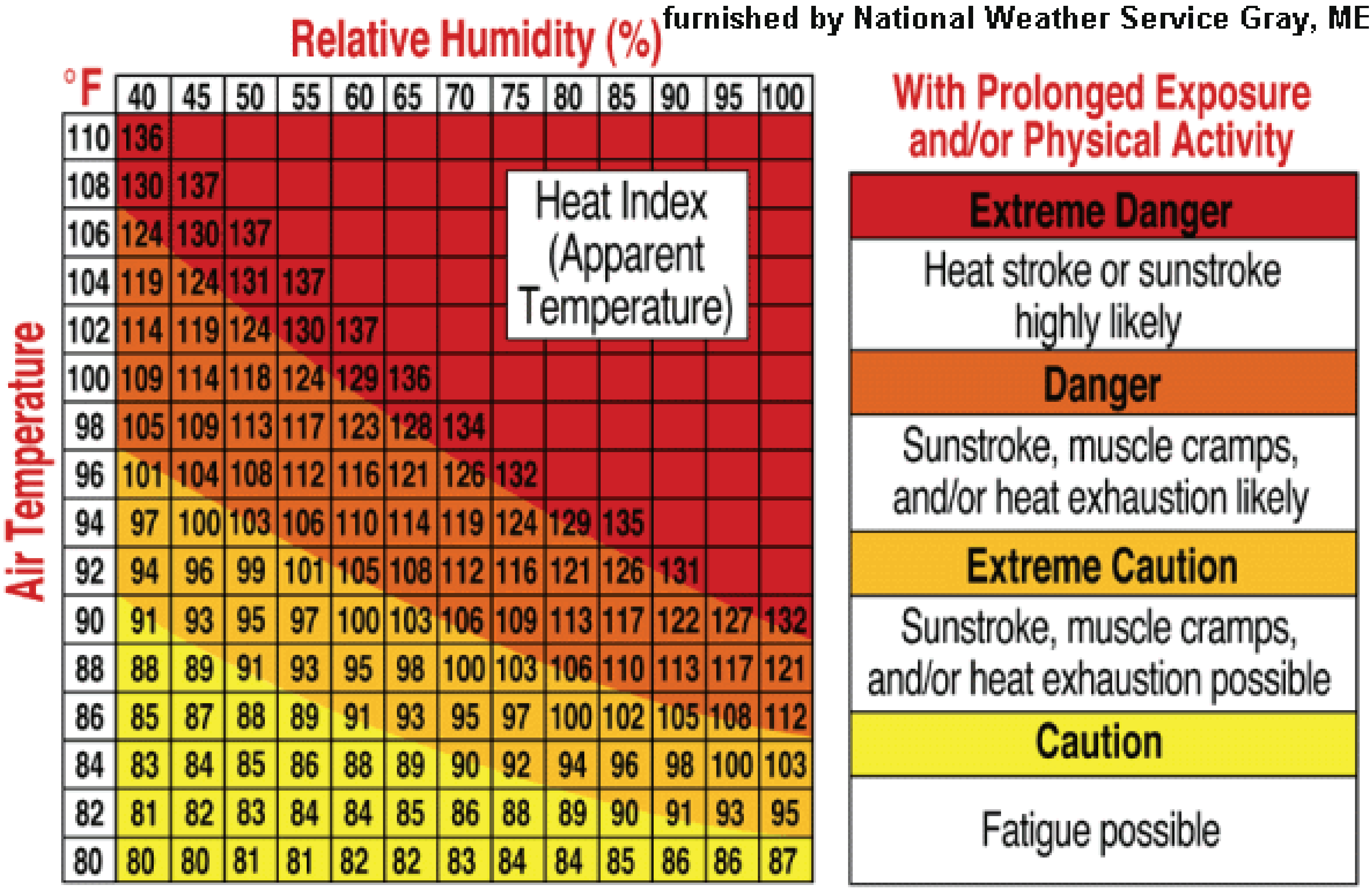
Job Steps	Hazards	Controls	RAC
		▪ All equipment will stay a minimum of 10 feet from overhead energized electrical lines (50 kV). This distance will increase by 4 inches for each 10 kV above 50 kV. Rule of Thumb: Stay 10 feet away from all overhead powerlines known to be 50 kV or less and a minimum of 35 feet from all others.)	
	5H) Equipment Failure	5H) 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.	L
	5I) Fire Protection	5I) Fire Protection ▪ Ensure that adequate number and type of fire extinguishers are present at the site. ▪ Inspect fire extinguishers on a monthly basis – document tag on each extinguisher. ▪ 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.	L
	5J) Confined Space Entry	5J) Confined Space Entry ▪ Confined Space Entry is not incluided in this project. Contact Chad Barnes before entering any confined space.	L
6. IDW pickup oversight	6A) Foot Injury	6A) Foot Injury See Section 3L above.	L
	6B) Chemical Hazards	6B) Chemical Hazards ▪ See Section 3D above.	L
	6C) Back Injury - Lifting	6C) Back Injury - Lifting ▪ See Section 4K above.	L
	6D) Slips/Trips/Falls	6D) Slips/Trips/Falls ▪ See Section 3I above	L
7. Environmental Health Considerations	7A) Severe Weather	7A) Severe Weather ▪ Watch for clouds and incoming weather. ▪ Monitor weather forecasts.	L

AHA - Field Work - General

Job Steps	Hazards	Controls	RAC
		▪ Train workers about weather and appropriate precautions. ▪ Identify a shelter and a safe place in event of tornado etc.	
	7B) Sun	7B) Sun ▪ Keep body protected ▪ Wear sunscreen, wide brimmed hat or hardhat. ▪ Schedule work for cool part of day. ▪ Take breaks in the shade.	L
	7C) Lightning and Thunder	7C) 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.). ▪ 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.	L
	7D) Wind	7D) 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.	L
	7E) Cold Extremes	7E) Cold Extremes 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.	L
	7F) Heat Stress	7F) Heat Stress Take precautions to prevent heat stress	L

Job Steps	Hazards	Controls	RAC
		▪ 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.	
	7G) Wet Bulb Globe Temperature (WBGT) Index	7G) Wet Bulb Globe Temperature (WBGT) Index ▪ 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).	L
		WBGT THRESHOLD VALUES FOR INSTITUTING PREVENTIVE MEASURES	

Job Steps	Hazards	Controls		RAC
		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.	
8. Return to office/home		See AHA - Mobilization/ Demobilization and Site Preparation		🟩 L



furnished by National Weather Service Gray, ME

Relative Humidity (%)

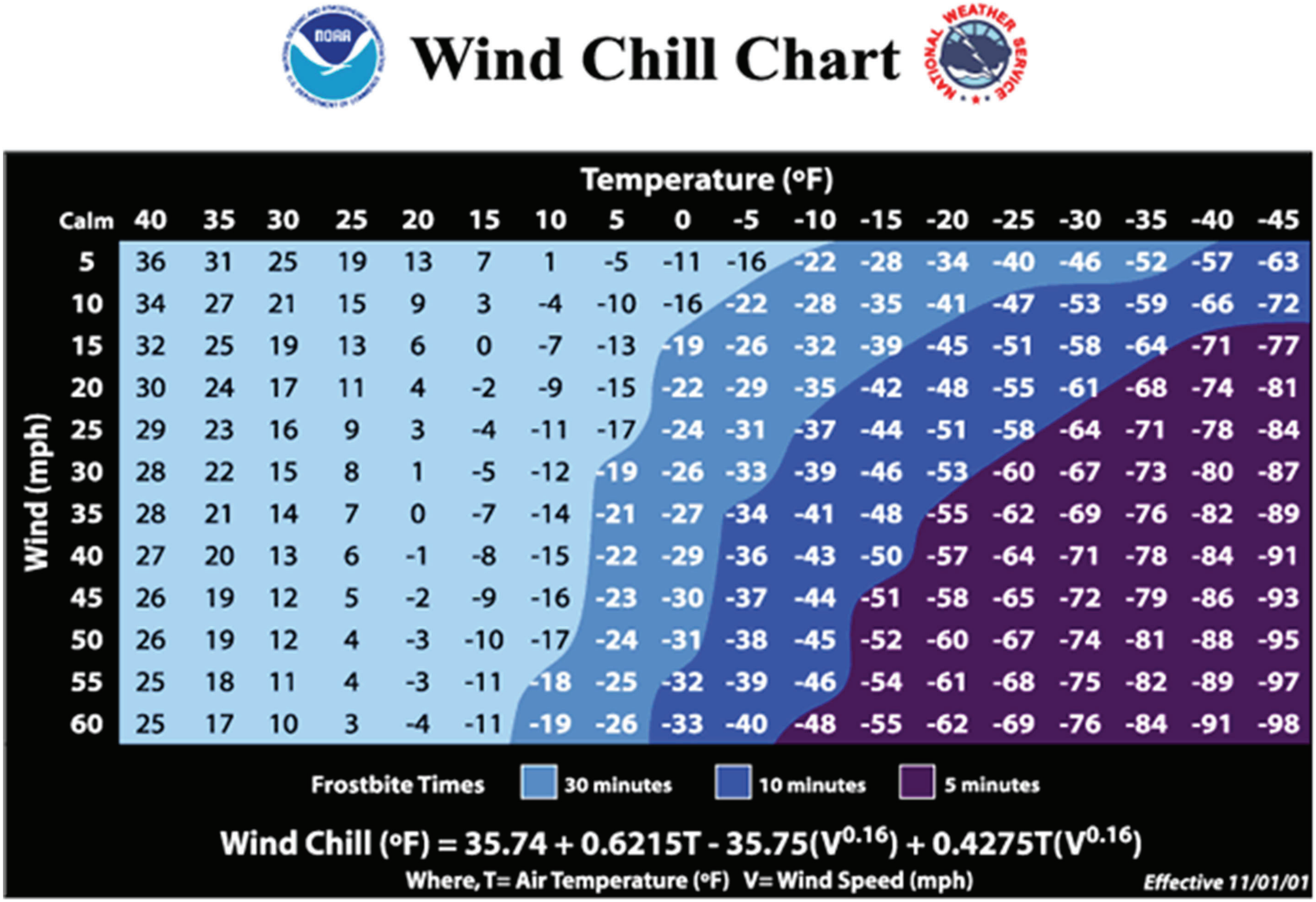
Air Temperature

Heat Index (Apparent Temperature)

°F	40	45	50	55	60	65	70	75	80	85	90	95	100
110	136												
108	130	137											
106	124	130	137										
104	119	124	131	137									
102	114	119	124	130	137								
100	109	114	118	124	129	136							
98	105	109	113	117	123	128	134						
96	101	104	108	112	116	121	126	132					
94	97	100	103	106	110	114	119	124	129	135			
92	94	96	99	101	105	108	112	116	121	126	131		
90	91	93	95	97	100	103	106	109	113	117	122	127	132
88	88	89	91	93	95	98	100	103	106	110	113	117	121
86	85	87	88	89	91	93	95	97	100	102	105	108	112
84	83	84	85	86	88	89	90	92	94	96	98	100	103
82	81	82	83	84	84	85	86	88	89	90	91	93	95
80	80	80	81	81	82	82	83	84	84	85	86	86	87

With Prolonged Exposure and/or Physical Activity

Extreme Danger	Heat stroke or sunstroke highly likely
Danger	Sunstroke, muscle cramps, and/or heat exhaustion likely
Extreme Caution	Sunstroke, muscle cramps, and/or heat exhaustion possible
Caution	Fatigue possible



Wind Chill Chart

Temperature (°F)

Wind (mph)	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
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

AHA – Working w/ Power Tools - Electrical

amec foster wheeler

Activity/Work Task:	Working w/ Power Tools - Electrical		
Project Location:	Mohonk Road Ind. Plant, High Falls, NY		
Contract Number:			
Date Prepared:	**12/07/2012**	**Date Accepted:**	
Prepared by (Name/Title):	Ryan Mankowski/Env. Prof. Tech 1		
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.	**RAC Chart**
"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible	**E = Extremely High Risk** **H = High Risk**
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.	**M = Moderate Risk** **L = Low Risk**

AHA – Working w/ Power Tools - Electrical

Job Steps	Hazards	Controls	RAC
1.Carrying tool to jobsite	1A. Back or muscle strain	1A) Back or muscle strain ▪ Use proper lifting techniques when tools or generators ▪ Use mechanical aids if available ▪ Use 2 person lift for heavy items	M
2. Setting up Work Area	2A. Injury due to encountering branches or debris	2A) Injury due to encountering branches or debris ▪ Inspect work area and clear away any loose wire, rope, branches or other items that may become entangled in tool or cutting head. ▪ Tool should be equipped with trigger style release switch.	L
	2B. Injury due to defective tool	2B) Injury due to defective tool ▪ Inspect tool prior to use to ensure it is safe to use. ▪ If found to be defective or if questionable condition, do not use the tool until serviced. Tag tool out of service	M
3. Using tool	3A. Inexperience	3A) Inexperience ▪ Train all hand tool users in their proper use. ▪ Never allow workers to work alone until they have demonstrated an ability to handle the tool safely.	H
	3B. Electrical shock	3B) Electrical shock ▪ Make sure that tool is in good condition, cord is not frayed or pulling away from the plug or connection. ▪ Do not remove grounding plug or use a tool where the grounding plug has been removed ▪ Avoid working in wet areas. ▪ Ground tools when using generators. ▪ Use a GFCI ▪ Keep tools unplugged when not in use.	H
	3C. Cuts	3C) Cuts ▪ All electric power tools should be unplugged when changing bits, making adjustments, or changing blades. ▪ Guards must remain in place and not "pinned" back. ▪ Push sticks should be used when using jointer or ripping with table saw. ▪ Keep fingers away from cutting blades. ▪ Clamp small stock when using router, drill, saw, or sander. ▪ Check blades regularly and keep in good condition. ▪ Use blade recommended for material being cut. ▪ Never jam saw into work. ▪ Cut green, treated or wet material slowly and with caution	M
	3D. Ear injury	3D) Ear injury ▪ Wear ear protection if required.	M

	3E. Eye injury	3E) Eye injury ▪ Safety goggles (or protective glasses) should be worn at all times. ▪ Look for nails or hard knots before cutting. ▪ Face shield when particles are produced with use of the tool.	**M**
	3.F Entanglement (clothing or cords)	3F) Entanglement (clothing or cords) ▪ Secure all loose clothing and long hair. ▪ Be aware of cord locations and keep away from drill, saw, or sander. ▪ Keep chuck key clear of drill or saw before plugging in. ▪ Electrical hand saws, drills, and corers must have quick release trigger.	**L**
	3.G Electrical grinders	3G) Electrical grinders ▪ Check grinding wheels often. ▪ Do not grind soft material. ▪ Hold small objects with clamp or vise grip.	**L**
	3H. Electrical saws (dust)	3H) Electrical saws (dust) ▪ Operators exposed to dust, as when cutting concrete, tile, treated wood or stone, shall wear approved respirator (mask).	**L**
	3I. Electrical drills	3I) Electrical drills ▪ Inspect drill bits regularly and use the recommended bit for material being drilled.	**M**
	3J. Electrical sanders	3J) Electrical sanders ▪ Inspect sanding surface for nails. ▪ Check sandpaper often. Keep belt centered on belt sander. ▪ Do not sand wet material.	**L**

	3K. Electric Mobile Concrete Coring Machine	3K) Electric Mobile Concrete Coring Machine ▪ Read and understand the Safety and Operating Instructions prior to use. ▪ Inspect tool upon obtaining for proper functionality. ▪ Underground utilities identified and marked. Ensure location(s) is in cleared area. ▪ Ensure generator is and tool is grounded with a GFCI. Keep power cords out of water. Use equipment specified voltage. ▪ Use two person lifting or mechanical means to minimize back injury moving. (unit should have dolly wheels to move once on ground) ▪ Clear path to move equipment. ▪ Keep bystanders well clear of the work area. ▪ Do not apply power until machine is set up and ready to drill ▪ Securely anchor the tool. ▪ Check alignment by lowering drill until about ½ inch from surface with power off. ▪ Do not adjust settings (speed selector when in operation) ▪ Ensure emergency shut offs are readily available and functioning. ▪ Ensure water flow for frictions and dust minimization. Monitor water pressure. ▪ Provide collection and plan for a path of water to avoid ponding, puddles and slips. ▪ Wear safety glasses with side shields, face shield, steel toed safety boots, hearing protection, and wear leather gloves when handling the bit. ▪ Secure laces. Be aware of body parts and tie back loose clothing or long hair. ▪ Allow the bit to cool prior to handling after drilling. ▪ Observe pressure gauges when drilling as an indication of adverse conditions, if available.	**M**

AHA – Working w/ Power Tools - Electrical

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 - - Working with Preservatives

Activity/Work Task:	Working with Preservatives (Acids)		
Project Location:	Mohonk Road Ind. Plant, High Falls, NY		
Contract Number:			
Date Prepared:	**8/15/2012**	**Date Accepted:**	**8-16-2012**
Prepared by (Name/Title):	Ryan Mankowski/Staff Environmental Scientist		
Reviewed by (Name/Title):	Kendra Bavor, CSP		

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

AHA - - Working with Preservatives

Job Steps	Hazards	Controls	RAC
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.	M
	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.	L
	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.	L
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.	L
	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.	M
	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.	L
	2D) Breathing fumes	2D) Breathing fumes ▪ HNO_3 and HCL have high vapor pressure. Always work in a well-ventilated area.	L
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).	L

	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.	**L**
	3C) Skin contact chemical burns.	3C) Skin contact chemical burns. ▪ Wear safety goggles and protective gloves.	**M**
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.	**L**

AHA - - Working with Preservatives

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 (Site project specific HASP)	**Competent / Qualified Personnel:** See HASP (Name – Position/Employer) **Training requirements:** HAZCOM PPE 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 - Soil Vapor Sampling

amec
foster
wheeler

Activity/Work Task:	Soil Vapor Sampling		
Project Location:	Mohonk Road Ind. Plant, High Falls, NY		
Contract Number:			
Date Prepared:	**9/25/2012**	**Date Accepted:**	
Prepared by (Name/Title):	Kendra Bavor, CSP		
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

AHA - Soil Vapor Sampling

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.	
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	
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

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

Chemicals of Concern

1,1,1-TCA
1,1-DCE
1,1-dichloroethane (1,1-DCA)
Trichloroethene (TCE)
Tetrachloroethene (PCE)
Ethylbenzene
Xylene

ATTACHMENT A

CONTAMINANT FACT SHEET

CONTAMINANT FACT SHEET

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

HEALTH HAZARD DATA

Color: Colorless

Physical State:
Solid
Liquid X
Gas

Odor: Chloroform-like

Odor Threshold: 100 ppm

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

IDLH: 700 ppm

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

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

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

AIR MONITORING

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

Checked by: Cindy Sundquist

Date: 4/19/10

PERSONAL PROTECTIVE EQUIPMENT

Recommended Protective Clothing Materials:

Suits	Tychem, Teflon, Viton
Gloves	Teflon, Viton, PE/EVAL Polyvinyl alchohol (Do not use in water)
Boots	Teflon, Viton

Service Limit Concentration (ppm): 1000
1
MUC 1/2 Mask APR=TWA x 10= 1000 ppm
MUC Full-Face APR=TWA x 10= 1000 ppm

FIRE/REACTIVITY DATA

Flash Point: NA

LEL/UEL: 7.5% / 12.5%

Fire Extinguishing Media:

Dry Chemical	X	Foam	X
Water Spray		CO_2	X

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

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

ATTACHMENT A

CONTAMINANT FACT SHEET

CONTAMINANT FACT SHEET

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

HEALTH HAZARD DATA

Color: colorless

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

Odor: chloroform-like

Odor Threshold: 190ppm

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

IDLH: unknown
1,2-DCE 1000 ppm

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

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

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

AIR MONITORING

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

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

PERSONAL PROTECTIVE EQUIPMENT

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

Service Limit Concentration (ppm): 1000

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

FIRE/REACTIVITY DATA

Flash Point: (-2°)F

LEL/UEL: 6.5%/15.5%

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

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

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

ATTACHMENT A

CONTAMINANT FACT SHEET

CONTAMINANT FACT SHEET

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

HEALTH HAZARD DATA

Color: colorless
Physical State: Solid ___ Liquid X Gas ___
Odor: chloroform-like
Odor Threshold: 120 ppm
Vapor Density: 4.0 g/L
Vapor Pressure 182 mmHg
Ionization Potential (IP): 11.06 eV
IDLH: 3000 ppm

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

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

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

AIR MONITORING

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

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

PERSONAL PROTECTIVE EQUIPMENT

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

Service Limit Concentration (ppm): 1000

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

FIRE/REACTIVITY DATA

Flash Point: 2°F

LEL/UEL: 5.4%/11.4%

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

Incompatibilities:
Strong oxidizers and strong caustics

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(urch as barium, lithium, sodium, magnesium, titanium, and eryllium)

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
Water Spray X
Foam 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: 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.

Safety Data Sheets (SDS)
Materials Brought to the Site

HYDROCLORIC ACID (HCL)
NITRIC ACID
SULFURIC ACID
PH4
PH7
CONDUCTIVITY SOLUTION
ORP 240MV SOLUTION

SAFETY DATA SHEET

1. Identification

Product identifier: HYDROCHLORIC ACID

Other means of identification
Synonyms: Muriatic Acid, Hydrogen Chloride, Aqueous
Product No.: 9385, 9538, 9165, V226, V187, V078, V001, 6900, 2624, 2515, H999, H987, H616, 5861, 2062, 5814, 2626, 2612, 5800, 9625, 5587, 9551, 9544, 9539, 9535, 9530, 9529, 5367, H613, 37825, 25496, 20620, H613

Recommended use and restriction on use

Recommended use: Not available.
Restrictions on use: Not known.

Manufacturer/Importer/Supplier/Distributor Information

Manufacturer
Company Name: Avantor Performance Materials, Inc.
Address: 3477 Corporate Parkway, Suite 200
Center Valley, PA 18034
Telephone:
Customer Service: 855-282-6867
Fax:
Contact Person: Environmental Health & Safety
e-mail: info@avantormaterials.com

Emergency telephone number:
24 Hour Emergency: 908-859-2151

Chemtrec: 800-424-9300

2. Hazard(s) identification

Hazard Classification

Physical Hazards	
Corrosive to metals	Category 1
Health Hazards	
Acute toxicity (Oral)	Category 4
Skin Corrosion/Irritation	Category 1
Serious Eye Damage/Eye Irritation	Category 1
Specific Target Organ Toxicity - Single Exposure (Inhalation - vapor)	Category 3

Label Elements
Hazard Symbol:

Signal Word: Danger

Hazard Statement:
May be corrosive to metals.
Harmful if swallowed.
Causes severe skin burns and eye damage.
May cause respiratory irritation.

Precautionary Statement

Prevention: Keep only in original container. Wash thoroughly after handling. Do not breathe dust/fume/gas/mist/vapors/spray. Use only outdoors or in a well-ventilated area. Wear protective gloves/protective clothing/eye protection/face protection. Do not eat, drink or smoke when using this product.

Response: Absorb spillage to prevent material damage. IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. IF ON SKIN (or hair): Remove/take off immediately all contaminated clothing. Rinse skin with water/shower. Wash contaminated clothing before reuse. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISON CENTER or doctor/physician.

Storage: Store locked up. Store in a well-ventilated place. Keep container tightly closed. Store in corrosive resistant container with a resistant inner liner.

Disposal: Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.

Other hazards which do not result in GHS classification: None.

3. Composition/information on ingredients

Mixtures

Chemical Identity	Common name and synonyms	CAS number	Content in percent (%)*
HYDROCHLORIC ACID		7647-01-0	20 - 40%

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First-aid measures

General information: Get medical advice/attention if you feel unwell. Show this safety data sheet to the doctor in attendance.

Ingestion: Call a physician or poison control center immediately. Do not induce vomiting without advice from poison control center. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.

Inhalation: Move to fresh air. Call a physician or poison control center immediately. Apply artificial respiration if victim is not breathing If breathing is difficult, give oxygen.

Skin Contact: Immediately flush with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician or poison control center immediately. Wash contaminated clothing before reuse. Destroy or thoroughly clean contaminated shoes.

Eye contact:	Immediately flush with plenty of water for at least 15 minutes. If easy to do, remove contact lenses. Call a physician or poison control center immediately. In case of irritation from airborne exposure, move to fresh air. Get medical attention immediately.

Most important symptoms/effects, acute and delayed

Symptoms:	Causes severe skin and eye burns. Harmful if swallowed.

Indication of immediate medical attention and special treatment needed

Treatment:	Treat symptomatically. Symptoms may be delayed.

5. Fire-fighting measures

General Fire Hazards:	No data available.

Suitable (and unsuitable) extinguishing media

Suitable extinguishing media:	The product is non-combustible. Use fire-extinguishing media appropriate for surrounding materials.
Unsuitable extinguishing media:	None known.
Specific hazards arising from the chemical:	Fire or excessive heat may produce hazardous decomposition products.

Special protective equipment and precautions for firefighters

Special fire fighting procedures:	Move containers from fire area if you can do so without risk. Use water spray to keep fire-exposed containers cool.
Special protective equipment for fire-fighters:	Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures:	Ventilate closed spaces before entering them. Keep unauthorized personnel away. Evacuate area. Keep upwind. See Section 8 of the SDS for Personal Protective Equipment. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
Methods and material for containment and cleaning up:	Neutralize with lime or soda ash. Absorb spill with vermiculite or other inert material, then place in a container for chemical waste. Dike far ahead of larger spill for later recovery and disposal.
Notification Procedures:	Inform authorities if large amounts are involved.
Environmental Precautions:	Do not contaminate water sources or sewer. Prevent further leakage or spillage if safe to do so.

7. Handling and storage

Precautions for safe handling:	Do not eat, drink or smoke when using the product. Do not get in eyes, on skin, on clothing. Wash hands thoroughly after handling. Do not breathe dust/fume/gas/mist/vapors/spray. Use caution when adding this material to water.

Conditions for safe storage, including any incompatibilities:	Keep container tightly closed. Store in a well-ventilated place. Unsuitable containers: metals.

8. Exposure controls/personal protection

Control Parameters

Occupational Exposure Limits

Chemical Identity	Type	Exposure Limit Values		Source
HYDROCHLORIC ACID	Ceiling	2 ppm		US. ACGIH Threshold Limit Values (2011)
	Ceil_Time	5 ppm	7 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)
	Ceiling	5 ppm	7 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	Ceiling	5 ppm	7 mg/m3	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)

Appropriate Engineering Controls	No data available.

Individual protection measures, such as personal protective equipment

General information:	Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. An eye wash and safety shower must be available in the immediate work area.
Eye/face protection:	Wear safety glasses with side shields (or goggles) and a face shield.
Skin Protection	
Hand Protection:	Chemical resistant gloves
Other:	Wear suitable protective clothing and gloves.
Respiratory Protection:	If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn. Air-purifying respirator with an appropriate, government approved (where applicable), air-purifying filter, cartridge or canister. Contact health and safety professional or manufacturer for specific information.
Hygiene measures:	Provide eyewash station and safety shower. Observe good industrial hygiene practices. Wash hands before breaks and immediately after handling the product. Do not get in eyes. Wash contaminated clothing before reuse. Do not get this material in contact with skin.

9. Physical and chemical properties

Appearance

Physical state:	Liquid
Form:	Liquid
Color:	Colorless
Odor:	Pungent
Odor threshold:	No data available.
pH:	0.1 (1 N aqueous solution)
Melting point/freezing point:	-35 °C

Initial boiling point and boiling range:	48 °C
Flash Point:	Not applicable
Evaporation rate:	No data available.
Flammability (solid, gas):	No data available.
Upper/lower limit on flammability or explosive limits	
Flammability limit - upper (%):	No data available.
Flammability limit - lower (%):	No data available.
Explosive limit - upper (%):	No data available.
Explosive limit - lower (%):	No data available.
Vapor pressure:	14.1 kPa
Vapor density:	No data available.
Relative density:	1.18 (20 °C)
Solubility(ies)	
Solubility in water:	Soluble
Solubility (other):	No data available.
Partition coefficient (n-octanol/water):	No data available.
Auto-ignition temperature:	No data available.
Decomposition temperature:	No data available.
Viscosity:	No data available.

10. Stability and reactivity

Reactivity:	Reacts violently with strong alkaline substances.
Chemical Stability:	Material is stable under normal conditions.
Possibility of Hazardous Reactions:	Hazardous polymerization does not occur.
Conditions to Avoid:	Avoid contact with strong reducing agents. Strong oxidizing agents. Contact with alkalis.
Incompatible Materials:	Acids. Amines. Alkalies. Metals. Reducing agents. Oxidizing agents.
Hazardous Decomposition Products:	Chlorine. hydrogen chloride By heating and fire, corrosive vapors/gases may be formed.

11. Toxicological information

Information on likely routes of exposure

Ingestion:	Harmful if swallowed.
Inhalation:	Causes severe burns.
Skin Contact:	Causes severe skin burns.
Eye contact:	Causes serious eye damage.

Information on toxicological effects

Acute toxicity (list all possible routes of exposure)

Oral

Product:	ATEmix (Rat): 581 mg/kg

Dermal

Product:	No data available.

Specified substance(s):

HYDROCHLORIC ACID LD 50 (Mouse): 1,449 mg/kg

Inhalation

Product: No data available.

Specified substance(s):

HYDROCHLORIC ACID LC 50 (Mouse, 1 h): 1108 ppm
LC 50 (Rat, 1 h): 3124 ppm

Repeated Dose Toxicity

Product: No data available.

Skin Corrosion/Irritation

Product: Causes severe skin burns.

Serious Eye Damage/Eye Irritation

Product: Causes serious eye damage.

Respiratory or Skin Sensitization

Product: Not a skin sensitizer.

Carcinogenicity

Product: This substance has no evidence of carcinogenic properties.

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:
No carcinogenic components identified

US. National Toxicology Program (NTP) Report on Carcinogens:
No carcinogenic components identified

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050):
No carcinogenic components identified

Germ Cell Mutagenicity

In vitro

Product: No mutagenic components identified

In vivo

Product: No mutagenic components identified

Reproductive Toxicity

Product: No components toxic to reproduction

Specific Target Organ Toxicity - Single Exposure

Product: Respiratory tract irritation.

Specific Target Organ Toxicity - Repeated Exposure

Product: None known.

Aspiration Hazard

Product: Not classified

Other Effects: None known.

12. Ecological information

Ecotoxicity:

Acute hazards to the aquatic environment:

Fish

Product: No data available.

Specified substance(s):
HYDROCHLORIC ACID — LC 50 (Western mosquitofish (Gambusia affinis), 96 h): 282 mg/l Mortality

Aquatic Invertebrates

Product: No data available.

Specified substance(s):
HYDROCHLORIC ACID — LC 50 (Green or European shore crab (Carcinus maenas), 48 h): 240 mg/l Mortality
LC 50 (Common shrimp, sand shrimp (Crangon crangon), 48 h): 260 mg/l Mortality

Chronic hazards to the aquatic environment:

Fish

Product: No data available.

Aquatic Invertebrates

Product: No data available.

Toxicity to Aquatic Plants

Product: No data available.

Persistence and Degradability

Biodegradation

Product: Expected to be readily biodegradable.

BOD/COD Ratio

Product: No data available.

Bioaccumulative Potential

Bioconcentration Factor (BCF)

Product: No data available on bioaccumulation.

Partition Coefficient n-octanol / water (log Kow)

Product: No data available.

Mobility in Soil: The product is water soluble and may spread in water systems.

Other Adverse Effects: Large amounts of the product may affect the acidity (pH-factor) in water with possible risk of harmful effects to aquatic organisms.

13. Disposal considerations

Disposal instructions: Discharge, treatment, or disposal may be subject to national, state, or local laws. Since emptied containers retain product residue, follow label warnings even after container is emptied.

Contaminated Packaging: No data available.

14. Transport information

DOT

UN Number:	UN 1789
UN Proper Shipping Name:	Hydrochloric acid
Transport Hazard Class(es)	
Class(es):	8
Label(s):	8
Packing Group:	II
Marine Pollutant:	No

IMDG

UN Number:	UN 1789
UN Proper Shipping Name:	HYDROCHLORIC ACID
Transport Hazard Class(es)	
Class(es):	8
Label(s):	8
EmS No.:	F-A, S-B
Packing Group:	II
Marine Pollutant:	No

IATA

UN Number:	UN 1789
Proper Shipping Name:	Hydrochloric acid
Transport Hazard Class(es):	
Class(es):	8
Label(s):	8
Marine Pollutant:	No
Packing Group:	II

15. Regulatory information

US Federal Regulations

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

None present or none present in regulated quantities.

CERCLA Hazardous Substance List (40 CFR 302.4):

HYDROCHLORIC ACID Reportable quantity: 5000 lbs.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories

☒ Acute (Immediate) ☐ Chronic (Delayed) ☐ Fire ☐ Reactive ☐ Pressure Generating

SARA 302 Extremely Hazardous Substance

Chemical Identity	RQ	Threshold Planning Quantity
HYDROCHLORIC ACID	5000 lbs.	500 lbs.

SARA 304 Emergency Release Notification

Chemical Identity	RQ
HYDROCHLORIC ACID	5000 lbs.

SARA 311/312 Hazardous Chemical

Chemical Identity	Threshold Planning Quantity
HYDROCHLORIC ACID	500lbs

SARA 313 (TRI Reporting)

Chemical Identity	Reporting threshold for other users	Reporting threshold for manufacturing and processing
HYDROCHLORIC ACID	10000 lbs	25000 lbs.

Clean Water Act Section 311 Hazardous Substances (40 CFR 117.3)

HYDROCHLORIC ACID Reportable quantity: 5000 lbs.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130):

HYDROCHLORIC ACID Threshold quantity: 15000 lbs

HYDROCHLORIC ACID Threshold quantity: 5000 lbs

US State Regulations

US. California Proposition 65

No ingredient regulated by CA Prop 65 present.

US. New Jersey Worker and Community Right-to-Know Act

HYDROCHLORIC ACID Listed

US. Massachusetts RTK - Substance List

HYDROCHLORIC ACID Listed

US. Pennsylvania RTK - Hazardous Substances

HYDROCHLORIC ACID Listed

US. Rhode Island RTK

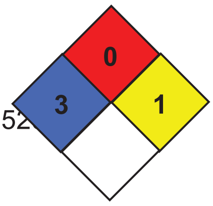
HYDROCHLORIC ACID Listed

Inventory Status:

Australia AICS:	On or in compliance with the inventory
Canada DSL Inventory List:	On or in compliance with the inventory
EU EINECS List:	On or in compliance with the inventory
EU ELINCS List:	Not in compliance with the inventory.
Japan (ENCS) List:	On or in compliance with the inventory
EU No Longer Polymers List:	Not in compliance with the inventory.
China Inv. Existing Chemical Substances:	On or in compliance with the inventory
Korea Existing Chemicals Inv. (KECI):	On or in compliance with the inventory
Canada NDSL Inventory:	Not in compliance with the inventory.
Philippines PICCS:	On or in compliance with the inventory
US TSCA Inventory:	On or in compliance with the inventory
New Zealand Inventory of Chemicals:	On or in compliance with the inventory
Switzerland Consolidated Inventory:	Not in compliance with the inventory.
Japan ISHL Listing:	Not in compliance with the inventory.
Japan Pharmacopoeia Listing:	Not in compliance with the inventory.

16.Other information, including date of preparation or last revision

NFPA Hazard ID



🟥 Flammability

🟦 Health
🟨 Reactivity
⬜ Special hazard.

Hazard rating: 0 - Minimal; 1 - Slight; 2 - Moderate; 3 - Serious; 4 - Severe

Issue Date:	02-02-2015
Revision Date:	No data available.
Version #:	4.0
Further Information:	No data available.
Disclaimer:	THE INFORMATION PRESENTED IN THIS MATERIAL SAFETY DATA SHEET (MSDS/SDS) WAS PREPARED BY TECHNICAL PERSONNEL BASED ON DATA THAT THEY BELIEVE IN THEIR GOOD FAITH JUDGMENT IS ACCURATE. HOWEVER, THE INFORMATION PROVIDED HEREIN IS PROVIDED “AS IS,” AND AVANTOR PERFORMANCE MATERIALS MAKES AND GIVES NO REPRESENTATIONS OR WARRANTIES WHATSOEVER, AND EXPRESSLY DISCLAIMS ALL WARRANTIES REGARDING SUCH INFORMATION AND THE PRODUCT TO WHICH IT RELATES, WHETHER EXPRESS, IMPLIED, OR STATUTORY, INCLUDING WITHOUT LIMITATION<(>,<)> WARRANTIES OF ACCURACY, COMPLETENESS, MERCHANTABILITY, NON-INFRINGEMENT, PERFORMANCE, SAFETY, SUITABILITY, STABILITY, AND FITNESS FOR A PARTICULAR PURPOSE, AND ANY WARRANTIES ARISING FROM COURSE OF DEALING, COURSE OF PERFORMANCE, OR USAGE OF TRADE. THIS MSDS/SDS IS INTENDED ONLY AS A GUIDE TO THE APPROPRIATE PRECAUTIONARY HANDLING OF THE MATERIAL BY A PROPERLY TRAINED PERSON USING THIS PRODUCT, AND IS NOT INTENDED TO BE COMPREHENSIVE AS TO THE MANNER AND CONDITIONS OF USE, HANDLING, STORAGE, OR DISPOSAL OF THE PRODUCT. INDIVIDUALS RECEIVING THIS MSDS/SDS MUST ALWAYS EXERCISE THEIR OWN INDEPENDENT JUDGMENT IN DETERMINING THE APPROPRIATENESS OF SUCH ISSUES. ACCORDINGLY, AVANTOR PERFORMANCE MATERIALS ASSUMES NO LIABILITY WHATSOEVER FOR THE USE OF OR RELIANCE UPON THIS INFORMATION. NO SUGGESTIONS FOR USE ARE INTENDED AS, AND NOTHING HEREIN SHALL BE CONSTRUED AS, A RECOMMENDATION TO INFRINGE ANY EXISTING PATENTS OR TO VIOLATE ANY FEDERAL, STATE, LOCAL, OR FOREIGN LAWS. AVANTOR PERFORMANCE MATERIALS REMINDS YOU THAT IT IS YOUR LEGAL DUTY TO MAKE ALL INFORMATION IN THIS MSDS/SDS AVAILABLE TO YOUR EMPLOYEES.

Version: 2.0
Revision date: 06-04-2014

SAFETY DATA SHEET

1. Identification

Product identifier: NITRIC ACID

Other means of identification
Synonyms: Aqua Fortis, Azotic Acid
Product No.: 9604, V471, V231, V230, V077, 6623, 2712, 2707, 2706, 2704, H988, 5876, 5856, 5801, 5796, 1409, 9761, 9670, 9618, 9617, 9616, 9615, 9612, 9607, 9606, 9601, 9598, 9597, 5371, 20758, 20754, 20752, 20750

Recommended use and restriction on use
Recommended use: Not available.
Restrictions on use: Not known.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer
Company Name: Avantor Performance Materials, Inc.
Address: 3477 Corporate Parkway, Suite 200
Center Valley, PA 18034
Telephone:
Customer Service: 855-282-6867
Fax:
Contact Person: Environmental Health & Safety
e-mail: info@avantormaterials.com

Emergency telephone number:
24 Hour Emergency: 908-859-2151

Chemtrec: 800-424-9300

2. Hazard(s) identification

Hazard classification

Physical hazards

Oxidizing liquids	Category 3
Corrosive to metals	Category 1

Health hazards

Skin corrosion/irritation	Category 1A

Unknown toxicity

Acute toxicity, oral	65 %
Acute toxicity, dermal	65 %
Acute toxicity, inhalation, vapor	100 %
Acute toxicity, inhalation, dust or mist	100 %

Unknown toxicity

Acute hazards to the aquatic environment	65 %
Chronic hazards to the aquatic environment	65 %

Label elements

Hazard symbol:

Signal word: Danger

Hazard statement: May intensify fire; oxidizer.
May be corrosive to metals.
Causes severe skin burns and eye damage.

Precautionary statement

Prevention: Wear protective gloves/protective clothing/eye protection/face protection. Wash hands thoroughly after handling. Keep only in original container. Keep away from heat. Keep/Store away from clothing/combustible materials. Take any precaution to avoid mixing with combustibles. Use only outdoors or in a well-ventilated area.

Response: In case of fire: Use water spray, foam, dry powder or carbon dioxide for extinction. Immediately call a POISON CENTER/doctor. IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. Wash contaminated clothing before reuse. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. IF INHALED: Remove person to fresh air and keep comfortable for breathing. Absorb spillage to prevent material damage.

Storage: Store locked up. Store in corrosive resistant container with a resistant inner liner. Store in a well-ventilated place. Keep container tightly closed.

Disposal: Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.

Other hazards which do not result in GHS classification: None.

3. Composition/information on ingredients

Mixtures

Chemical identity	Common name and synonyms	CAS number	Content in percent (%)*
NITRIC ACID		7697-37-2	65 - 70%

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First-aid measures

General information: Get medical advice/attention if you feel unwell. Show this safety data sheet to the doctor in attendance.

Ingestion: Call a physician or poison control center immediately. Do NOT induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.

Inhalation:	Move to fresh air. Call a physician or poison control center immediately. If breathing stops, provide artificial respiration. If breathing is difficult, give oxygen.
Skin contact:	Immediately flush with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician or poison control center immediately. Wash contaminated clothing before reuse. Destroy or thoroughly clean contaminated shoes.
Eye contact:	Immediately flush with plenty of water for at least 15 minutes. If easy to do, remove contact lenses. Call a physician or poison control center immediately. In case of irritation from airborne exposure, move to fresh air. Get medical attention immediately.

Most important symptoms/effects, acute and delayed

Symptoms: Corrosive to skin and eyes. Causes digestive tract burns. Spray mists may cause respiratory tract irritation.

Indication of immediate medical attention and special treatment needed

Treatment: Treat symptomatically. Symptoms may be delayed.

5. Fire-fighting measures

General fire hazards: Strong oxidizer - contact with other material may cause fire.

Suitable (and unsuitable) extinguishing media

Suitable extinguishing media:	Water spray, fog, CO2, dry chemical, or regular foam.
Unsuitable extinguishing media:	None known.
Specific hazards arising from the chemical:	Oxidizing Contact with combustible material may cause fire. Fire may produce irritating, corrosive and/or toxic gases.

Special protective equipment and precautions for firefighters

Special fire fighting procedures:	Move containers from fire area if you can do so without risk. Use water spray to keep fire-exposed containers cool. Cool containers exposed to flames with water until well after the fire is out.
Special protective equipment for fire-fighters:	Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA. Self-contained breathing apparatus and full protective clothing must be worn in case of fire.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures: Keep unauthorized personnel away. ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Use personal protective equipment. See Section 8 of the MSDS for Personal Protective Equipment. Ventilate closed spaces before entering them. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.

Methods and material for containment and cleaning up:	Keep combustibles (wood, paper, oil, etc.) away from spilled material. Stop leak if possible without any risk. Do not absorb in sawdust or other combustible materials. Absorb spill with vermiculite or other inert material. Collect in a non-combustible container for prompt disposal. Clean surface thoroughly to remove residual contamination. Dike far ahead of larger spill for later recovery and disposal.
Notification Procedures:	Dike for later disposal. Prevent entry into waterways, sewer, basements or confined areas. Stop the flow of material, if this is without risk. Inform authorities if large amounts are involved.
Environmental precautions:	Do not contaminate water sources or sewer. Prevent further leakage or spillage if safe to do so. Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling:	Keep away from combustible material. Do not get in eyes, on skin, on clothing. Wash hands thoroughly after handling. Do not eat, drink or smoke when using the product. Do not taste or swallow. Never add water to acid! Never pour water into acid/base. Dilute by slowly pouring the product into water while stirring.
Conditions for safe storage, including any incompatibilities:	Do not store in metal containers. Store away from heat and light. Keep away from combustible material. Keep containers closed when not in use. Store in a cool, dry place. Keep container in a well-ventilated place.

8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Chemical identity	Type	Exposure Limit values		Source
NITRIC ACID	TWA	2 ppm		US. ACGIH Threshold Limit Values (2011)
	STEL	4 ppm		US. ACGIH Threshold Limit Values (2011)
	STEL	4 ppm	10 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)
	REL	2 ppm	5 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)
	PEL	2 ppm	5 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	TWA	2 ppm	5 mg/m3	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)
	STEL	4 ppm	10 mg/m3	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)

Appropriate engineering controls	No data available.

Individual protection measures, such as personal protective equipment

General information:	Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. An eye wash and safety shower must be available in the immediate work area.
Eye/face protection:	Wear safety glasses with side shields (or goggles) and a face shield.
Skin protection	
Hand protection:	Chemical resistant gloves

Other:	Wear suitable protective clothing.
Respiratory protection:	In case of inadequate ventilation use suitable respirator. Chemical respirator with acid gas cartridge.
Hygiene measures:	Provide eyewash station and safety shower. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing to remove contaminants. Discard contaminated footwear that cannot be cleaned.

9. Physical and chemical properties

Appearance	
Physical state:	Liquid
Form:	Liquid
Color:	Colorless to slightly yellow
Odor:	Pungent
Odor threshold:	No data available.
pH:	1 (0.1 molar aqueous solution)
Melting point/freezing point:	-42 °C
Initial boiling point and boiling range:	122 °C
Flash Point:	Not applicable
Evaporation rate:	No data available.
Flammability (solid, gas):	No data available.
Upper/lower limit on flammability or explosive limits	
Flammability limit - upper (%):	No data available.
Flammability limit - lower (%):	No data available.
Explosive limit - upper (%):	No data available.
Explosive limit - lower (%):	No data available.
Vapor pressure:	6.4 kPa
Vapor density:	2.5
Relative density:	1.41 (20 °C)
Solubility(ies)	
Solubility in water:	Soluble
Solubility (other):	No data available.
Partition coefficient (n-octanol/water):	No data available.
Auto-ignition temperature:	No data available.
Decomposition temperature:	No data available.
Viscosity:	No data available.

10. Stability and reactivity

Reactivity:	Reacts violently with strong alkaline substances.
Chemical stability:	Material is stable under normal conditions.
Possibility of hazardous reactions:	Hazardous polymerization does not occur. Decomposes on heating.
Conditions to avoid:	Reacts violently with strong alkaline substances. Avoid contact with strong reducing agents. Excessive heat. Contact with incompatible materials.
Incompatible materials:	Alcohols. Reducing agents. Metals. Alkalies.
Hazardous decomposition products:	Nitrogen Oxides By heating and fire, corrosive vapors/gases may be formed.

11. Toxicological information

Information on likely routes of exposure

Ingestion:	May cause burns of the gastrointestinal tract if swallowed.
Inhalation:	May cause damage to mucous membranes in nose, throat, lungs and bronchial system.
Skin contact:	Causes severe skin burns.
Eye contact:	Causes serious eye damage.

Information on toxicological effects

Acute toxicity (list all possible routes of exposure)

Oral

Product:	No data available.

Dermal

Product:	No data available.

Inhalation

Product:	No data available.
Specified substance(s):	
NITRIC ACID	LC 50 (Rat, 4 h): 65 mg/l

Repeated dose toxicity

Product:	No data available.

Skin corrosion/irritation

Product:	Causes severe skin burns.

Serious eye damage/eye irritation

Product:	Causes serious eye damage.

Respiratory or skin sensitization

Product:	Not a skin nor a respiratory sensitizer.

Carcinogenicity

Product:	This substance has no evidence of carcinogenic properties.

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:
No carcinogenic components identified

US. National Toxicology Program (NTP) Report on Carcinogens:
No carcinogenic components identified

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050):
No carcinogenic components identified

Germ cell mutagenicity

In vitro
Product: No mutagenic components identified

In vivo
Product: No mutagenic components identified

Reproductive toxicity
Product: No components toxic to reproduction

Specific target organ toxicity - single exposure
Product: None known.

Specific target organ toxicity - repeated exposure
Product: None known.

Aspiration hazard
Product: Not classified

Other effects: None known.

12. Ecological information

Ecotoxicity:

Acute hazards to the aquatic environment:

Fish
Product: No data available.

Specified substance(s):
NITRIC ACID: LC 50 (Fish, 48 h): 100 - 330 mg/l Mortality

Aquatic invertebrates
Product: No data available.

Specified substance(s):
NITRIC ACID: LC 50 (Cockle (Cerastoderma edule), 48 h): 330 - 1,000 mg/l Mortality
LC 50 (Green or European shore crab (Carcinus maenas), 48 h): 180 mg/l Mortality

Chronic hazards to the aquatic environment:

Fish
Product: No data available.

Aquatic invertebrates
Product: No data available.

Toxicity to Aquatic Plants
Product: No data available.

Persistence and degradability

Biodegradation
Product: Expected to be readily biodegradable.

BOD/COD ratio
Product: No data available.

Bioaccumulative potential
Bioconcentration factor (BCF)
Product: No data available on bioaccumulation.

Partition coefficient n-octanol / water (log Kow)

Product:	No data available.

Mobility in soil:	The product is water soluble and may spread in water systems.
Other adverse effects:	The product may affect the acidity (pH-factor) in water with risk of harmful effects to aquatic organisms.

13. Disposal considerations

Disposal instructions:	Discharge, treatment, or disposal may be subject to national, state, or local laws.
Contaminated packaging:	Since emptied containers retain product residue, follow label warnings even after container is emptied.

14. Transport information

DOT

UN number:	UN 2031
UN proper shipping name:	Nitric acid
Transport hazard class(es)	
Class(es):	8, 5.1
Label(s):	8, 5.1
Packing group:	II
Marine Pollutant:	No

IMDG

UN number:	UN 2031
UN proper shipping name:	NITRIC ACID
Transport hazard class(es)	
Class(es):	8, 5.1
Label(s):	8, 5.1
EmS No.:	F-A, S-Q
Packing group:	II
Marine Pollutant:	No

IATA

UN number:	UN 2031
Proper Shipping Name:	Nitric acid
Transport hazard class(es):	
Class(es):	8, 5.1
Label(s):	8, 5.1
Marine Pollutant:	No
Packing group:	II

15. Regulatory information

US federal regulations

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

None present or none present in regulated quantities.

CERCLA Hazardous Substance List (40 CFR 302.4):

NITRIC ACID	Reportable quantity: 1000 lbs.

Superfund amendments and reauthorization act of 1986 (SARA)

Hazard categories

☒ Acute (Immediate) ☒ Chronic (Delayed) ☒ Fire ☐ Reactive ☐ Pressure Generating

SARA 302 Extremely hazardous substance

Chemical identity	RQ	Threshold Planning Quantity
NITRIC ACID	1000 lbs.	1000 lbs.

SARA 304 Emergency release notification

Chemical identity	RQ
NITRIC ACID	1000 lbs.

SARA 311/312 Hazardous chemical

Chemical identity	Threshold Planning Quantity
NITRIC ACID	500lbs

SARA 313 (TRI reporting)

Chemical identity	Reporting threshold for other users	Reporting threshold for manufacturing and processing
NITRIC ACID	10000 lbs	25000 lbs.

Clean Water Act Section 311 Hazardous Substances (40 CFR 117.3)

NITRIC ACID	Reportable quantity: 1000 lbs.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130):

NITRIC ACID	Threshold quantity: 15000 lbs

US state regulations

US. California Proposition 65

No ingredient regulated by CA Prop 65 present.

US. New Jersey Worker and Community Right-to-Know Act

NITRIC ACID	Listed

US. Massachusetts RTK - Substance List

NITRIC ACID	Listed

US. Pennsylvania RTK - Hazardous Substances

NITRIC ACID	Listed

US. Rhode Island RTK

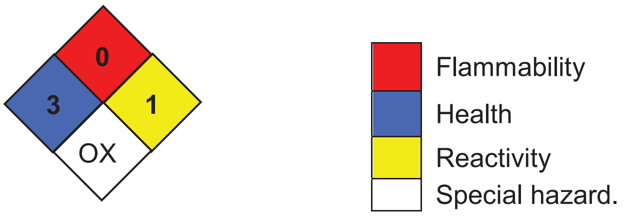
NITRIC ACID	Listed

Inventory Status:

Australia AICS:	On or in compliance with the inventory
Canada DSL Inventory List:	On or in compliance with the inventory
EINECS, ELINCS or NLP:	On or in compliance with the inventory
Japan (ENCS) List:	On or in compliance with the inventory
China Inv. Existing Chemical Substances:	Not in compliance with the inventory.
Korea Existing Chemicals Inv. (KECI):	On or in compliance with the inventory
Canada NDSL Inventory:	Not in compliance with the inventory.
Philippines PICCS:	On or in compliance with the inventory
US TSCA Inventory:	On or in compliance with the inventory
New Zealand Inventory of Chemicals:	On or in compliance with the inventory
Japan ISHL Listing:	Not in compliance with the inventory.
Japan Pharmacopoeia Listing:	Not in compliance with the inventory.

16.Other information, including date of preparation or last revision

NFPA Hazard ID



Hazard rating: 0 - Minimal; 1 - Slight; 2 - Moderate; 3 - Serious; 4 - Severe
OXY: Oxidizer

Issue date:	06-04-2014
Revision date:	No data available.
Version #:	2.0
Further information:	No data available.

Disclaimer:

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SAFETY DATA SHEET

1. Identification

Product identifier: Sulfuric Acid

Other means of identification
Product No.: 9661, 3780, 9704, 9682, V648, V225, V186, V008, 6902, 2900, 2879, 2878, 2877, 2874, 6163, H996, H976, 5859, 2876, 5815, 5802, 9691, 9690, 9684, 9681, 9675, 9674, 9673, 9671, 5557, 5374, 21208, 21201

Recommended use and restriction on use

Recommended use: Not available.
Restrictions on use: Not known.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer
Company Name: Avantor Performance Materials, Inc.
Address: 3477 Corporate Parkway, Suite 200
Center Valley, PA 18034
Telephone:
Customer Service: 855-282-6867
Fax:
Contact Person: Environmental Health & Safety
e-mail: info@avantormaterials.com

Emergency telephone number:
24 Hour Emergency: 908-859-2151

Chemtrec: 800-424-9300

2. Hazard(s) identification

Hazard classification

Physical hazards

Corrosive to metals	Category 1

Health hazards

Skin corrosion/irritation	Category 1
Serious eye damage/eye irritation	Category 1
Carcinogenicity	Category 1A
Specific target organ toxicity - single exposure	Category 3

Environmental hazards

Acute hazards to the aquatic environment	Category 3

_**Label elements**

Hazard symbol:

Signal word: Danger

Hazard statement:	May be corrosive to metals. Causes severe skin burns and eye damage. May cause respiratory irritation. May cause cancer if inhaled. Harmful to aquatic life.

Precautionary statement

Prevention:	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Keep only in original container. Wash thoroughly after handling. Do not breathe dust/fume/gas/mist/vapors/spray. Use only outdoors or in a well-ventilated area. Wear protective gloves/protective clothing/eye protection/face protection.
Response:	IF exposed or concerned: Get medical advice/attention. Absorb spillage to prevent material damage. Immediately call a POISON CENTER or doctor/physician. IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. IF ON SKIN (or hair): Remove/take off immediately all contaminated clothing. Rinse skin with water/shower. Wash contaminated clothing before reuse. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
Storage:	Store locked up. Store in corrosive resistant container with a resistant inner liner. Store in a well-ventilated place. Keep container tightly closed.
Disposal:	Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.

Other hazards which do not result in GHS classification:	None.

3. Composition/information on ingredients

Substances

Chemical identity	Common name and synonyms	CAS number	Content in percent (%)*
SULFURIC ACID		7664-93-9	90 - 100%

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First-aid measures

General information:	Get medical advice/attention if you feel unwell. Show this safety data sheet to the doctor in attendance.
Ingestion:	Call a physician or poison control center immediately. Do NOT induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.
Inhalation:	Move to fresh air. Call a physician or poison control center immediately. Apply artificial respiration if victim is not breathing If breathing is difficult, give oxygen.

Skin contact:	Immediately flush with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician or poison control center immediately. Wash contaminated clothing before reuse. Destroy or thoroughly clean contaminated shoes.
Eye contact:	Immediately flush with plenty of water for at least 15 minutes. If easy to do, remove contact lenses. Call a physician or poison control center immediately. In case of irritation from airborne exposure, move to fresh air. Get medical attention immediately.

Most important symptoms/effects, acute and delayed

Symptoms:	Corrosive to skin and eyes.

Indication of immediate medical attention and special treatment needed

Treatment:	Treat symptomatically. Symptoms may be delayed.

5. Fire-fighting measures

General fire hazards:	In case of fire and/or explosion do not breathe fumes.

Suitable (and unsuitable) extinguishing media

Suitable extinguishing media:	Foam, carbon dioxide or dry powder.
Unsuitable extinguishing media:	Do not use water as an extinguisher.
Specific hazards arising from the chemical:	Fire may produce irritating, corrosive and/or toxic gases.

Special protective equipment and precautions for firefighters

Special fire fighting procedures:	Move containers from fire area if you can do so without risk. Fight fire from a protected location. Use water SPRAY only to cool containers! Do not put water on leaked material. Cool containers exposed to flames with water until well after the fire is out.
Special protective equipment for fire-fighters:	Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures:	Keep unauthorized personnel away. Keep upwind. Use personal protective equipment. See Section 8 of the MSDS for Personal Protective Equipment. Ventilate closed spaces before entering them. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
Methods and material for containment and cleaning up:	Neutralize spill area and washings with soda ash or lime. Absorb spill with vermiculite or other inert material, then place in a container for chemical waste. Clean surface thoroughly to remove residual contamination. Dike far ahead of larger spill for later recovery and disposal.
Notification Procedures:	Dike for later disposal. Prevent entry into waterways, sewer, basements or confined areas. Stop the flow of material, if this is without risk. Inform authorities if large amounts are involved.

Environmental precautions: Do not contaminate water sources or sewer. Prevent further leakage or spillage if safe to do so. Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling: Do not get in eyes, on skin, on clothing. Do not taste or swallow. Wash hands thoroughly after handling. Do not eat, drink or smoke when using the product. Use caution when adding this material to water. Add material slowly when mixing with water. Do not add water to the material; instead, add the material to the water. Do not handle until all safety precautions have been read and understood. Obtain special instructions before use. Use personal protective equipment as required.

Conditions for safe storage, including any incompatibilities: Do not store in metal containers. Keep in a cool, well-ventilated place. Keep container tightly closed. Store in a dry place.

8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Chemical identity	Type	Exposure Limit values	Source
SULFURIC ACID - Thoracic fraction.	TWA	0.2 mg/m3	US. ACGIH Threshold Limit Values (2011)
SULFURIC ACID	REL	1 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)
	PEL	1 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	TWA	1 mg/m3	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)

Appropriate engineering controls: No data available.

Individual protection measures, such as personal protective equipment

General information: Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. An eye wash and safety shower must be available in the immediate work area.

Eye/face protection: Wear safety glasses with side shields (or goggles) and a face shield.

Skin protection

Hand protection: Chemical resistant gloves

Other: Wear suitable protective clothing.

Respiratory protection: In case of inadequate ventilation use suitable respirator. Chemical respirator with acid gas cartridge.

Hygiene measures: Provide eyewash station and safety shower. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing to remove contaminants. Discard contaminated footwear that cannot be cleaned.

9. Physical and chemical properties

Appearance

Physical state:	Liquid
Form:	Liquid
Color:	Colorless
Odor:	Odorless
Odor threshold:	No data available.
pH:	0.3 (1 N aqueous solution)
Melting point/freezing point:	3 °C
Initial boiling point and boiling range:	337 °C
Flash Point:	Not applicable
Evaporation rate:	No data available.
Flammability (solid, gas):	No data available.
Upper/lower limit on flammability or explosive limits	
Flammability limit - upper (%):	No data available.
Flammability limit - lower (%):	No data available.
Explosive limit - upper (%):	No data available.
Explosive limit - lower (%):	No data available.
Vapor pressure:	No data available.
Vapor density:	No data available.
Relative density:	1.84 (20 °C)
Solubility(ies)	
Solubility in water:	Miscible with water.
Solubility (other):	No data available.
Partition coefficient (n-octanol/water):	No data available.
Auto-ignition temperature:	No data available.
Decomposition temperature:	No data available.
Viscosity:	No data available.

10. Stability and reactivity

Reactivity:	Reacts violently with strong alkaline substances.
Chemical stability:	Material is stable under normal conditions.
Possibility of hazardous reactions:	Hazardous polymerization does not occur. Material reacts with water.
Conditions to avoid:	Moisture. Heat. Contact with incompatible materials.
Incompatible materials:	Water. Cyanides. Strong oxidizing agents. Strong reducing agents. Metals. Halogens. Organic compounds. Potassium.
Hazardous decomposition products:	Oxides of sulfur.

11. Toxicological information

Information on likely routes of exposure

Ingestion:	May cause burns of the gastrointestinal tract if swallowed.
Inhalation:	May cause damage to mucous membranes in nose, throat, lungs and bronchial system.
Skin contact:	Causes severe skin burns.
Eye contact:	Causes serious eye damage.

Information on toxicological effects

Acute toxicity (list all possible routes of exposure)

Oral

Product:	No data available.

Dermal

Product:	No data available.

Inhalation

Product:	No data available.
Specified substance(s):	
SULFURIC ACID	LC 50 (Guinea pig, 8 h): 0.03 mg/l LC 50 (Rat, 1 h): 347 mg/l

Repeated dose toxicity

Product:	No data available.

Skin corrosion/irritation

Product:	Causes severe skin burns.

Serious eye damage/eye irritation

Product:	Causes serious eye damage.

Respiratory or skin sensitization

Product:	Not a skin sensitizer.

Carcinogenicity

Product:	May cause cancer.

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:

SULFURIC ACID	Overall evaluation: 1. Carcinogenic to humans.

US. National Toxicology Program (NTP) Report on Carcinogens:

SULFURIC ACID	Known To Be Human Carcinogen.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050):
No carcinogenic components identified

Germ cell mutagenicity

In vitro

Product:	No mutagenic components identified

In vivo

Product:	No mutagenic components identified

Reproductive toxicity

Product:	No components toxic to reproduction

Specific target organ toxicity - single exposure

Product:	Respiratory tract irritation.

Specific target organ toxicity - repeated exposure

Product:	None known.

Aspiration hazard

Product:	Not classified

Other effects:	No data available.

12. Ecological information

Ecotoxicity:

Acute hazards to the aquatic environment:

Fish

Product:	No data available.
Specified substance(s):	
SULFURIC ACID	LC 50 (Starry, european flounder (Platichthys flesus), 48 h): 100 - 330 mg/l Mortality LC 50 (Western mosquitofish (Gambusia affinis), 96 h): 42 mg/l Mortality

Aquatic invertebrates

Product:	No data available.
Specified substance(s):	
SULFURIC ACID	LC 50 (Common shrimp, sand shrimp (Crangon crangon), 48 h): 70 - 80 mg/l Mortality LC 50 (Aesop shrimp (Pandalus montagui), 48 h): 42.5 mg/l Mortality

Chronic hazards to the aquatic environment:

Fish

Product:	No data available.

Aquatic invertebrates

Product:	No data available.

Toxicity to Aquatic Plants

Product:	No data available.

Persistence and degradability

Biodegradation

Product:	There are no data on the degradability of this product.

BOD/COD ratio

Product:	No data available.

Bioaccumulative potential

Bioconcentration factor (BCF)

Product:	No data available on bioaccumulation.

Partition coefficient n-octanol / water (log Kow)

Product:	No data available.

Mobility in soil:	The product is water soluble and may spread in water systems.
Other adverse effects:	The product contains a substance which is harmful to aquatic organisms. The product may affect the acidity (pH-factor) in water with risk of harmful effects to aquatic organisms.

13. Disposal considerations

Disposal instructions:	Discharge, treatment, or disposal may be subject to national, state, or local laws.

Contaminated packaging: Since emptied containers retain product residue, follow label warnings even after container is emptied.

14. Transport information

DOT

UN number: UN 1830
UN proper shipping name: Sulfuric acid
Transport hazard class(es)
Class(es): 8
Label(s): 8
Packing group: II
Marine Pollutant: No

IMDG

UN number: UN 1830
UN proper shipping name: SULPHURIC ACID (with more than 51% acid)
Transport hazard class(es)
Class(es): 8
Label(s): 8
EmS No.: F-A, S-B
Packing group: II
Marine Pollutant: No

IATA

UN number: UN 1830
Proper Shipping Name: Sulphuric acid
Transport hazard class(es):
Class(es): 8
Label(s): 8
Marine Pollutant: No
Packing group: II

15. Regulatory information

US federal regulations

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

None present or none present in regulated quantities.

CERCLA Hazardous Substance List (40 CFR 302.4):

SULFURIC ACID Reportable quantity: 1000 lbs.

Superfund amendments and reauthorization act of 1986 (SARA)

Hazard categories

☒ Acute (Immediate) ☒ Chronic (Delayed) ☐ Fire ☐ Reactive ☐ Pressure Generating

SARA 302 Extremely hazardous substance

Chemical identity	RQ	Threshold Planning Quantity
SULFURIC ACID	1000 lbs.	1000 lbs.

SARA 304 Emergency release notification

Chemical identity	RQ
SULFURIC ACID	1000 lbs.

SARA 311/312 Hazardous chemical

Chemical identity	Threshold Planning Quantity
SULFURIC ACID	500lbs

SARA 313 (TRI reporting)

Chemical identity	Reporting threshold for other users	Reporting threshold for manufacturing and processing
SULFURIC ACID	10000 lbs	25000 lbs.

Clean Water Act Section 311 Hazardous Substances (40 CFR 117.3)
SULFURIC ACID Reportable quantity: 1000 lbs.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130):
SULFURIC ACID Threshold quantity: 10000 lbs

US state regulations

US. California Proposition 65
SULFURIC ACID Carcinogenic.

US. New Jersey Worker and Community Right-to-Know Act
SULFURIC ACID Listed

US. Massachusetts RTK - Substance List
SULFURIC ACID Listed

US. Pennsylvania RTK - Hazardous Substances
SULFURIC ACID Listed

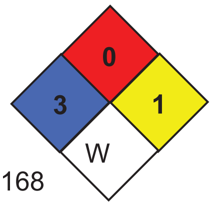
US. Rhode Island RTK
SULFURIC ACID Listed

Inventory Status:

Australia AICS:	On or in compliance with the inventory
Canada DSL Inventory List:	On or in compliance with the inventory
EU EINECS List:	On or in compliance with the inventory
EU ELINCS List:	Not in compliance with the inventory.
Japan (ENCS) List:	On or in compliance with the inventory
EU No Longer Polymers List:	Not in compliance with the inventory.
China Inv. Existing Chemical Substances:	On or in compliance with the inventory
Korea Existing Chemicals Inv. (KECI):	On or in compliance with the inventory
Canada NDSL Inventory:	Not in compliance with the inventory.
Philippines PICCS:	On or in compliance with the inventory
US TSCA Inventory:	On or in compliance with the inventory
New Zealand Inventory of Chemicals:	On or in compliance with the inventory
Switzerland Consolidated Inventory:	Not in compliance with the inventory.
Japan ISHL Listing:	Not in compliance with the inventory.
Japan Pharmacopoeia Listing:	Not in compliance with the inventory.

16.Other information, including date of preparation or last revision

NFPA Hazard ID



🟥 Flammability
🟦 Health

🟨 Reactivity
⬜ Special hazard.

Hazard rating: 0 - Minimal; 1 - Slight; 2 - Moderate; 3 - Serious; 4 - Severe
W: Water-reactive

Issue date:	06-11-2014
Revision date:	No data available.
Version #:	1.1
Further information:	No data available.
Disclaimer:	THE INFORMATION PRESENTED IN THIS MATERIAL SAFETY DATA SHEET (MSDS/SDS) WAS PREPARED BY TECHNICAL PERSONNEL BASED ON DATA THAT THEY BELIEVE IN THEIR GOOD FAITH JUDGMENT IS ACCURATE. HOWEVER, THE INFORMATION PROVIDED HEREIN IS PROVIDED “AS IS,” AND AVANTOR PERFORMANCE MATERIALS MAKES AND GIVES NO REPRESENTATIONS OR WARRANTIES WHATSOEVER, AND EXPRESSLY DISCLAIMS ALL WARRANTIES REGARDING SUCH INFORMATION AND THE PRODUCT TO WHICH IT RELATES, WHETHER EXPRESS, IMPLIED, OR STATUTORY, INCLUDING WITHOUT LIMITATION<(>,<)> WARRANTIES OF ACCURACY, COMPLETENESS, MERCHANTABILITY, NON-INFRINGEMENT, PERFORMANCE, SAFETY, SUITABILITY, STABILITY, AND FITNESS FOR A PARTICULAR PURPOSE, AND ANY WARRANTIES ARISING FROM COURSE OF DEALING, COURSE OF PERFORMANCE, OR USAGE OF TRADE. THIS MSDS/SDS IS INTENDED ONLY AS A GUIDE TO THE APPROPRIATE PRECAUTIONARY HANDLING OF THE MATERIAL BY A PROPERLY TRAINED PERSON USING THIS PRODUCT, AND IS NOT INTENDED TO BE COMPREHENSIVE AS TO THE MANNER AND CONDITIONS OF USE, HANDLING, STORAGE, OR DISPOSAL OF THE PRODUCT. INDIVIDUALS RECEIVING THIS MSDS/SDS MUST ALWAYS EXERCISE THEIR OWN INDEPENDENT JUDGMENT IN DETERMINING THE APPROPRIATENESS OF SUCH ISSUES. ACCORDINGLY, AVANTOR PERFORMANCE MATERIALS ASSUMES NO LIABILITY WHATSOEVER FOR THE USE OF OR RELIANCE UPON THIS INFORMATION. NO SUGGESTIONS FOR USE ARE INTENDED AS, AND NOTHING HEREIN SHALL BE CONSTRUED AS, A RECOMMENDATION TO INFRINGE ANY EXISTING PATENTS OR TO VIOLATE ANY FEDERAL, STATE, LOCAL, OR FOREIGN LAWS. AVANTOR PERFORMANCE MATERIALS REMINDS YOU THAT IT IS YOUR LEGAL DUTY TO MAKE ALL INFORMATION IN THIS MSDS/SDS AVAILABLE TO YOUR EMPLOYEES.

HI 7004
Buffer Solution pH 4.01

Safety Data Sheet

According to Regulation (EC) No. 1907/2006
OSHA Regulation 29 CFR 1910.1200
Canadian Regulation SOR/88-66

Revision Date: 2016-02-17
Reason for Revision: Section 3, 15 updated

SECTION 1: IDENTIFICATION OF THE PRODUCT AND COMPANY

Product Name: HI 7004 Buffer Solution pH 4.01

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

Additional Product Codes: HI 7004/1G HI 7004/1L HI 7004L HI 7004L/C HI 7004M HI 7004P/5 HI 7004M/S HI 7004/120ML HI 7004/1LB HI 7004C HI 7004LB HI 7004M-0 HI 7004W

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 OSHA Regulation 29 CFR 1910.1200.
Non-hazardous product as specified in Canadian Regulation SOR/88-66.
Non-hazardous product as specified in Regulation (EC) 1272/2008.

SECTION 3: COMPOSITION AND COMPONENT INFORMATION

Component:	EC No:	CAS No:	Hazard Class:	Phrases:	Concentration:
Water	231-791-2	7732-18-5	-	-	> 95%
Other components, disclosure not required according to Regulation (EC) No. 1907/2006	-	-	-	-	< 5%

SECTION 4: FIRST AID MEASURES

After Inhalation:	Remove to fresh air. Call a physician if breathing becomes difficult.
After Skin Contact:	Wash affected 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

Engineering:

Maintain general industrial hygiene practice.

Personal Protective Equipment:

As appropriate to quantity handled.

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

Industrial Hygiene:

Change contaminated clothing. Wash hands after working with substance.

SECTION 9: PHYSICAL/CHEMICAL PROPERTIES

Appearance:	Colorless or red liquid	**Odor:**	Odorless	**Density at 20°C:**	1.0 g/cm³
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***

Product Toxicity

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

Potential Health Effects:

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.

Component Toxicity

Acute Toxicity:	***Chronic Toxicity:***
Not Available	Not Available

Additional Data:

Not Available

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 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***

Complies with European Regulations (EC) No. 1907/2006 and No. 1272/2008.
Complies with OSHA Regulation 29 CFR 1910.1200.
Complies with Canadian Regulation SOR/88-66.
All chemical substances in this product are listed on the TSCA Inventory.

SECTION 16: ***OTHER INFORMATION***

Text of phrases under Section 3

NA

Revision Information

Revision Date:	2016-02-17
Supersedes edition of:	2013-04-01
Reason for revision:	Section 3, 15 updated
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 7007

Buffer Solution pH 7.01

Safety Data Sheet

According to Regulation (EC) No. 1907/2006
OSHA Regulation 29 CFR 1910.1200
Canadian Regulation SOR/88-66

Revision Date: 2016-02-17
Reason for Revision: Section 3, 15 updated

SECTION 1: IDENTIFICATION OF THE PRODUCT AND COMPANY

Product Name: HI 7007 Buffer Solution pH 7.01

Application: pH Buffer Solution. ± 0.01 @ 25°C/77°F

Additional Product Codes: HI 7007/1G HI 7007/1L HI 7007L HI 7007L/C HI 7007M HI 7007P/5 HI 7007/120ML HI 7007AN HI 7007C HI 7007LB HI 7007M/S HI 7007QC

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 OSHA Regulation 29 CFR 1910.1200.
Non-hazardous product as specified in Canadian Regulation SOR/88-66.
Non-hazardous product as specified in Regulation (EC) 1272/2008.

SECTION 3: COMPOSITION AND COMPONENT INFORMATION

Component:	***EC No:***	***CAS No:***	***Hazard Class:***	***Phrases:***	***Concentration:***
Water	231-791-2	7732-18-5	-	-	> 95%
Other components, disclosure not required according to Regulation (EC) No. 1907/2006	-	-	-	-	< 5%

SECTION 4: FIRST AID MEASURES

After Inhalation:	Remove to fresh air. Call a physician if breathing becomes difficult.
After Skin Contact:	Wash affected 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

Engineering:

Maintain general industrial hygiene practice.

Personal Protective Equipment:

As appropriate to quantity handled.

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

Industrial Hygiene:

Change contaminated clothing. Wash hands after working with substance.

SECTION 9: PHYSICAL/CHEMICAL PROPERTIES

Appearance:	Colorless or green liquid	***Odor:***	Odorless	***Density at 20°C:***	1.0 g/cm^3
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

Product Toxicity

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

Potential Health Effects:

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.

Component Toxicity

Acute Toxicity:	***Chronic Toxicity:***
Not Available	Not Available

Additional Data:

Not Available

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 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

Complies with European Regulations (EC) No. 1907/2006 and No. 1272/2008.
Complies with OSHA Regulation 29 CFR 1910.1200.
Complies with Canadian Regulation SOR/88-66.
All chemical substances in this product are listed on the TSCA Inventory.

SECTION 16: OTHER INFORMATION

Text of phrases under Section 3

NA

Revision Information

Revision Date:	2016-02-17
Supersedes edition of:	2013-04-01
Reason for revision:	Section 3, 15 updated
Legend	NA: Not Applicable ND: Not Determined

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

HI 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/cm^3
Melting Point:	NA	**Boiling Point:**	> 100 °C	**Solubility:**	Soluble
pH at 20° C:	~ 7	**Explosion Limit:**	NA	**Flash Point:**	NA
Thermal Decomp.:	NA				

SECTION 10: STABILITY AND REACTIVITY

Conditions to be Avoided:

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

Hazardous Polymerization:

Will not occur.

Further Information:

Not available

Hazardous Decomposition Products:

In the event of fire: See section 5.

Substances to be Avoided:

The generally known reaction partners of water

SECTION 11: TOXICOLOGICAL INFORMATION

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

In Case of Inhalation:

In Case of Skin Contact:

In Case of Eye Contact:

In Case of Ingestion:

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

SECTION 12: ECOLOGICAL INFORMATION

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

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

SECTION 13: DISPOSAL CONSIDERATIONS

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

SECTION 14: TRANSPORTATION INFORMATION

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

SECTION 15: REGULATORY INFORMATION

Labeling according to EC Directives:

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

R-phrases:

S-phrases:

Contains:

SECTION 16: OTHER INFORMATION

Text of R-phrases under Section 3

Revision Information

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

Legend

NA: Not Applicable
ND: Not Determined

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

HI 7021

ORP Solution for Platinum and Gold Electrodes

Safety Data Sheet

According to Regulation (EC) No. 1907/2006
OSHA Regulation 29 CFR 1910.1200
Canadian Regulation SOR/88-66

Revision Date: 2013-06-14
Reason for Revision: Regulation (EC) No. 1272/2008 Compliance

SECTION 1: IDENTIFICATION OF THE PRODUCT AND COMPANY

Product Name: HI 7021 ORP Solution

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

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

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.
Non-hazardous product as specified in OSHA Regulation 29 CFR 1910.1200.
Non-hazardous product as specified in Canadian Regulation SOR/88-66.
Non-hazardous product as specified in Regulation (EC) 1272/2008.

SECTION 3: COMPOSITION AND COMPONENT INFORMATION

Aqueous Solution

SECTION 4: FIRST AID MEASURES

After Inhalation:	Remove to fresh air.
After Skin Contact:	Wash affected 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 with liquid-absorbent material. 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

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/cm^3
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 Polymerization:

Will not occur.

Further Information:

Not available

Hazardous Decomposition Products:

None

Substances to be Avoided:

The generally known reaction partners of water

SECTION 11: TOXICOLOGICAL INFORMATION

Product Toxicity

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

Component Toxicity

Acute Toxicity:	Chronic Toxicity:
Not Available	Not Available

Additional Data:

Not Available

SECTION 12: ECOLOGICAL INFORMATION

No environmental hazard.

Further Data: Can be safely disposed off as 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

Complies with European Regulations (EC) No. 1907/2006 and No. 1272/2008.
Complies with European Council Directives 67/548/EEC and 1999/45/EC.
Complies with OSHA Regulation 29 CFR 1910.1200.
Complies with Canadian Regulation SOR/88-66

SECTION 16: OTHER INFORMATION

Text of phrases under Section 3

NA

Revision Information

Revision Date:	2013-06-14
Supersedes edition of:	2012-06-01
Reason for revision:	Regulation (EC) No. 1272/2008 Compliance
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.

ATTACHMENT B

MACTEC QUALITY ASSURANCE PROGRAM PLAN

FIELD ACTIVITIES PLAN
&
QUALITY ASSURANCE PROGRAM PLAN

NYSDEC ENGINEERING SERVICES CONTRACT
NUMBER D007619

Submitted to:

New York State Department of Environmental Conservation
Albany, New York

Submitted by:

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

June 2011
Version 1

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Approved by:
MACTEC Engineering and Consulting, P.C.

Chris Ricardi

William J. Weber, P.E.
Program Manager

Christian Ricardi, NRCC-EAC
Quality Assurance Manager

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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

ARF	Analysis Request Form
ASP	Analytical Services Protocol
ASTM	American Society for Testing and Materials
AVS	Acid Volatile Sulfide
CADD	Computer Aided Design
cc	cubic centimeter
CLP	contract laboratory program
COC	chain of custody
CS	Contract Specialist
DI	deionized
DO	dissolved oxygen
DQOs	Data Quality Objectives
DUSR	data usability summary report
EDD	electronic data deliverable
EDS	Electronic Document Standards
ELAP	Environmental Laboratory Approval Program
EM	electromagnetic
FAP	Field Activities Plan
FDR	Field Data Record
FOL	Field Operations Leader
ft	foot/feet
GIS	Geographic Information System
GPR	ground penetrating radar
GPS	Global Positioning System

GLOSSARY OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

GSSI	Geophysical Survey Systems, Inc.
HASP	Health and Safety Plan
HDPE	high density polyethylene
Hg	mercury
HSA	hollow stem auger
I.D.	inside diameter
ID	identification
K	hydraulic conductivity
L	liter
LCS	laboratory control samples
LNAPL	light nonaqueous phase liquid
MACTEC	MACTEC Engineering and Consulting, P.C.
mg	milligram(s)
MGP	maximum allowable gauge pressure
ml	milliliter
MS	matrix spike
MSD	matrix spike duplicate
NAPL	nonaqueous phase liquid
NTU	nephelometric turbidity unit
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O.D.	outside diameter

GLOSSARY OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

ORP	oxidation reduction potential
oz.	ounce
PAH	polynuclear aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PID	photoionization detector
PM	project manager
PPE	personal protective equipment
PS	Procurement Specialist
psi	pounds per square inch
PVC	polyvinyl chloride
QA	quality assurance
QAO	Quality Assurance Officer
QAPP	Quality Assurance Program Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
RPD	relative percent difference
RQD	rock quality data
SDG	sample delivery group
SEM	Simultaneously Extracted Metals
SOP	standard operating procedure
SOW	statement of work
SVOC	semivolatile organic compound
TAL	target analyte list
TC	terrain conductivity
TCL	Target Compound List

GLOSSARY OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

TED	Technical Environmental Database
TICs	tentatively identified compounds
µg	microgram
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
VOA	volatile organic analysis
VOC	volatile organic compound
WA	work assignment

1.0 PROGRAM OBJECTIVES AND DESCRIPTION

1.1 PURPOSE

The purpose of this Field Activities Plan (FAP) / Quality Assurance Program Plan (QAPP) is to define responsibilities and authorities for data quality, and to prescribe requirements for assuring that the field exploration activities undertaken by MACTEC Engineering and Consulting, P.C. (MACTEC) for the New York State Department of Environmental Conservation (NYSDEC) are planned and executed in a manner consistent with established program-wide quality assurance (QA) objectives and the Engineering Services Contract D007619.

The FAP/QAPP provides guidance and specifications to ensure that:

- samples are obtained under controlled conditions using appropriate and documented procedures;
- samples are identified uniquely and controlled through sample tracking systems and chain-of-custody (COC) protocols;
- field determinations and laboratory analytical results are of known quality and are valid and consistent through using approved methods, preventive maintenance, calibrations, analytical protocols, quality control (QC) measurements, reviews, audits, and correcting out-of-control situations;
- calculations and evaluations are accurate, appropriate, and consistent throughout the project;
- data are validated and their use in calculations is documented; and
- records are retained as documentary evidence of the quality of samples, applied processes, equipment, and results.

1.2 SCOPE

This document has been prepared in support of all work assignments issued under MACTEC's Engineering Services Contract No. D007619. The requirements of this FAP/QAPP apply to all MACTEC and subcontractor activities undertaken, unless otherwise stipulated in the project-specific FAP associated with a given Work Assignment (WA).

The organizational responsibilities and interactions outlined in Section 2 of this document extend to quality-related controls and activities. The content and format of the FAP/QAPP is based on:

- Engineering Services Contract No. D007619
- DER-10: Technical Guidance for Site Investigation and Remediation - Issued 05/03/2010, and
- *Guidance for Quality Assurance Project Plans* - *EPA QA/G-5 (EPA/240/R-02/009)* prepared by the United States Environmental Protection Agency (USEPA) (USEPA, 2002).

The FAP/QAPP consists of 15 sections, as follows:

Section 2	Program Organization and roles of the MACTEC project team
Section 3	QA objectives
Section 4	Sampling procedures
Section 5	Sample custody
Section 6	Calibration procedures
Section 7	Analytical procedures
Section 8	Data reduction, validation, and reporting
Section 9	Internal QC
Section 10	Audits
Section 11	Preventative maintenance
Section 12	Data assessment
Section 13	Corrective action
Section 14	Reports to management

Section 15 Sustainability and green remediation

1.3 CONTRACT SUMMARY

MACTEC has been retained by the NYSDEC to conduct field investigation and remedial activities at various inactive hazardous waste sites in New York State (NYS). Under the contract, work assignments are issued that may require the performance of some, or all, of the following services:

- Site Characterization
- Phased Remedial Investigation/Feasibility Study
- Remedial Design
- Engineering Services During Construction
- Analytical QA/QC Activities
- Site Response Activities / Interim Remedial Measures
- Site Management
- Citizen Participation Activities
- Health and Safety Plan (HASP) Review
- Potentially Responsible Party and Third Party Oversight
- Soil Vapor Intrusion

Particular sections of the FAP/QAPP will apply to the above work elements. Specific FAP/QAPP requirements that apply to a given work assignment will be identified in the project-specific FAP to be developed for each unique site.

2.0 PROGRAM ORGANIZATION AND RESPONSIBILITIES

2.1 ORGANIZATION

MACTEC operates using a multi-disciplinary team-based system. Under this system, personnel representing both engineering and scientific disciplines are assigned to teams and groups organized by similar client focus. The administrative personnel for the NYSDEC contract are the MACTEC Program Manager and Project Managers (PM). A Principal Professional who is responsible for project technical quality and acceptability is associated with each project and technical task. Task Leaders, Site Managers, and key technical staff are assigned to NYSDEC work assignments based on project scope and technical disciplinary needs. Resources are available from throughout the entire MACTEC organization and include engineers, QA specialists, geologists, hydrogeologists, physicists, chemists, risk assessors, and data managers. Individuals with specialized skills assigned to other teams, groups, or offices within MACTEC may join a NYSDEC project team as needed.

This portion of the FAP/QAPP addresses MACTEC's NYSDEC Program organization and specifically outlines QC coordination and responsibilities. Those individuals assigned to a project or task are responsible for conducting project work by using the resources assigned to the project management organization. In this way, resources through MACTEC are available to each project, but responsibility for initiating services and for ensuring acceptable results remains within the project organization. This responsibility carries with it the authority to initiate, modify, and stop activities, as appropriate. It is the Program Manger and Principal Professionals role to assist the PM, Task Leaders, and Site Managers in meeting project goals while providing an independent evaluation of product quality.

Figure 2.1 illustrates the overall program organization and principal lines of communication and authority.

2.2 SPECIFIC RESPONSIBILITIES

The responsibilities of the MACTEC project positions and support organizations are summarized below.

Corporate Officer. The Corporate Officer is William J. Weber, P.E. Mr. Weber is responsible for establishing a contract for the services to be performed, for committing the corporate resources necessary to conduct the program work activities, and for supplying corporate-level input for problem resolution.

Program Manager. The NYS Engineering Services Contract Program Manager is William J. Weber, P.E. The Program Manager has overall responsibility to organize and set operating procedures with NYSDEC.

Project Manager. The PM, named in the project-specific FAP, is responsible for day-to-day technical administration of the project and will be the primary contact for the NYSDEC on each Work Assignment. The PM will be responsible for:

- initiating project activities;
- identifying project staff, equipment, and other resource requirements;
- interfacing with the NYSDEC PM on all cost, contractual, personnel, and other administrative matters;
- provide program FAP/QAPP to individuals assigned to the project and ensure program procedures are followed;
- provide program generic HASP and project-specific safety documents to individuals assigned to the project and ensure program procedures are followed;
- monitoring task activities, and adjusting efforts on resources, as required, to help assure that existing budgets, schedules, and work programs are maintained;
- distributing copies of standard procedures and the project-specific planning documents (FAP) to all appropriate personnel involved in the project;
- providing regular briefings on the status of the project and preparation of monthly reports showing both technical progress and cost status;

- providing assurance that project technical and financial records are kept according to the requirements of the NYSDEC and MACTEC; and
- implementing subcontracting as required

Task Leaders and Site Managers. The Task Leaders and Site Managers are responsible for:

- the appropriateness, adequacy, and timeliness of the technical and engineering services provided;
- obtaining copies of the project-specific FAP and program FAP/QAPP, and any other applicable project planning documents, and ensuring implementation of procedures described in these documents;
- obtaining copies of the project-specific HASP and project-specific safety documents and ensuring implementation of procedures described in these document
- developing the technical approach and level of effort required to address each of task/subtask;
- the day-to-day conduct of the work, including the integration of the input of supporting disciplines and subcontractors (i.e., drilling or laboratory subcontractors);
- ongoing QC during performance of the work; and
- the technical integrity as well as the clarity and usefulness of all project work products.

Task Leaders and Site Managers will be identified in the project-specific FAP.

Principal Professional. A key component in the review process is the designation of a Principal Professional that will serve as technical leader for each project. The Principal Professional will provide guidance on the technical aspects of the project. This is accomplished through periodic reviews of the services designed to incorporate the accumulated experience and corporate policy of the firm and to meet the objectives of the program as established by NYSDEC. The Principal Professional provides input to project deliverables by conducting technical reviews while work is in progress. The Principal Professional along with the Quality Assurance Officer (QAO) serves as a resource for the PM in evaluating the magnitude of identified QC problems and supporting the development of appropriate corrective action.

Quality Assurance Officer. The QAO, Christian Ricardi, has responsibility for establishing, overseeing, and auditing specific procedures for documenting and controlling analytical and field data quality. Many of the procedures will be implemented by other individuals. The QAO works with the PM, Task Leaders, and Site Managers to verify that established MACTEC and NYSDEC protocols are followed.

Responsibilities of the QAO include:

- overseeing and coordinating analytical work;
- monitoring the QA and QC activities of the laboratory for conformance with approved policies, procedures, and sound practices, and authorize improvements as necessary;
- supervising/mentoring project staff on the preparation of data usability summary report and data validation report;
- informing the PM, Task Leaders, Site Managers, and/or subcontract laboratory management of nonconformance to the approved QC program;
- completing system audits when included in the scope of project activities;
- Reviewing project records, logs, standard procedures, project plans, and analytical results to verify records are complete and maintained in a retrievable fashion;
- distributing copies of standard procedures and the FAP/QAPP to all appropriate personnel involved in the project; and
- assuring that sampling and analysis is conducted in a manner consistent with the FAP/QAPP.

Procurement Specialist. The Procurement Specialist (PS), Peggy Franklin, aids and assists the PM, Task Leaders, and Site Managers with procuring subcontractors and subcontract terms and conditions issues.

Contract Specialist. The Contract Specialist (CS), Theresa Casavant, aids and assists the PM, Task Leaders, and Site Managers with compliance with contract terms and conditions, including cost allowability, invoicing, monitoring budgets, maintaining employee NSPE-grade lists, administering subcontracts, and meeting minority/women-owned business enterprise goals.

2.3 PERSONNEL QUALIFICATIONS AND TRAINING

Assignment of technical staff is completed by MACTEC with regard to appropriate qualifications in the technical areas relevant to the project and any associated QC techniques. This involves an assessment of individual qualifications and a resolution of training needs prior to the commencement of data generation/manipulation activities. Training typically consists of one or more of the following activities:

- general briefings covering all aspects of QA program and project plans;
- specific briefings on Program and project-specific FAPs;
- specific briefings on individual QA and QC procedures or activities;
- required reading of pertinent QA-related documents; and
- participation in USEPA-approved and other training courses.

MACTEC personnel involved with hazardous waste site investigations are required to attend an approved 40-hour health and safety course prior to working on hazardous waste sites. In addition, personnel are required to attend annual 8-hour, refresher health and safety training courses designed to review: (1) health and safety requirements and principles; (2) sampling procedures; (3) documentation procedures; (4) operational procedures; and (5) safety equipment use and function.

MACTEC will staff projects with capable, trained personnel. MACTEC typically uses a cross-section of junior-, middle-, and senior-level personnel to implement field sampling and investigation programs. By using this cross-section, personnel are placed in a position of responsibility to which they can respond.

2.4 SUPPORT SERVICES

To conduct certain WAs, MACTEC will retain subcontractors (selected considering price and technical qualifications) to perform specialized services, including sample analysis, drilling, surveying, and engineering consulting services. Before MACTEC enters into a subcontract relationship, MACTEC evaluates the potential subcontractor. Such evaluations may include visiting the subcontractors' business unit and conducting facility audits. MACTEC may conduct pre-bid meetings to explain potential tasks, site conditions that may be encountered, and the importance of each task to the project. MACTEC evaluates proposals both technically and financially, and then recommends selection to the NYSDEC.

Contract documents are thoroughly discussed with the subcontractor, and are complete and detailed, including scopes of work, payment terms and conditions, penalties for poor performance, and applicable prime contract flow down clauses. Before awarding any work, MACTEC will confirm the subcontractors' ability to accomplish the work on the required schedule. As work is to be awarded, and as it continues, MACTEC will confirm schedules and commitments. MACTEC requires periodic subcontractor progress reports (e.g., drillers' daily quantity sheets and documentation of internal technical reviews). Subcontractors must contact MACTEC if they anticipate difficulty in adhering to scope, schedule, or budget. For technical issues, the subcontractor's primary point of contact within MACTEC is the PM; for subcontract terms and conditions issues, it is the PS; and for payment issues, it is the CS. The procedural steps MACTEC follows to effect subcontractor corrective action are listed in Table 2.1.

3.0 QUALITY ASSURANCE OBJECTIVES

3.1 PROGRAM DATA QUALITY OBJECTIVES

This FAP/QAPP covers all work completed by MACTEC under the Engineering Services Contract and is applicable to site investigation activities that are completed in the State of New York. Site investigation activities will be completed in accordance with NYSDEC regulations and guidelines. Regulations and guidelines provided by the USEPA may also be applied. When planning and implementing project-specific investigations the MACTEC project team will incorporate requirements and procedures described in the following documents into their planning documents and technical evaluations of site conditions:

- DER-10 “Technical Guidance for Site Investigation and Remediation”; New York Department of Environmental Conservation; Division of Environmental Remediation; May 2010.
- 6 NYCRR PART 375 “Environmental Remediation Program”; New York Department of Environmental Conservation; Division of Environmental Remediation; October 2006.
- Title 6, Part 371 “Identification and Listing of Hazardous Wastes”; New York Codes, Rules, and Regulations; September 2006.
- Title 6, Part 700-705 “Water Quality Regulations Surface Water and Groundwater Classifications and Standards”; New York Codes, Rules, and Regulations; August 1999.
- Technical and Operational Guidance Series (TOGs) 1.1.1. “Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations”; New York Department of Environmental Conservation; Division of Water; June 1998.
- USEPA 542-S-02-001 “Ground-Water Sampling Guidelines for Superfund and Resource Conservation and Recovery Act (RCRA) project Managers”; United State Environmental Protection Agency (USEPA); Office of Solid Waste and Emergency Response; May 2002.
- “Analytical Services Protocols (ASP)”; New York Department of Environmental Conservation; June 2000; revised July 2005.
- “Guidance for Evaluating Soil Vapor Intrusion in the State of New York”; New York State Department of Health (NYSDOH); October 2006.
- “Draft Procedures for Collection and Preparation of Aquatic Biota for Contaminant Analysis”; New York State Department of Environmental Protection; Division of Fish, Wildlife, and Marine Resources; Bureau of Habitat; October 2002.

3.2 IDENTIFICATION OF PROJECT DATA QUALITY OBJECTIVES

Project Data Quality Objectives (DQOs) will be established during the development of project-specific FAPs to specify the quality of data and project specific goals for each particular data collection activity. The DQO will be established to ensure that data collected can support project-specific decisions. The DQOs are the starting point in the design of the investigation. DQOs are based on the concept that the intended use of the data determines the quality and type of the data required. DQOs are established based on site conditions, project objectives, and available measurement systems. The DQO process matches sampling and analytical capabilities to the data targeted for specific uses and ensures that the quality of the data does not underestimate project requirements.

During the development of project-specific FAPs, the guidance documents identified in Section 3.1 will be used to establish sampling and analytical testing goals. The MACTEC project team will evaluated site historical information and data, and recommend a plan for each site. Each project-specific FAP will include detailed descriptions of the following information:

- Project site description, history, and previous investigations/reports
- Site investigation objectives/goals
- Planned explorations and sampling procedures
- Summaries of proposed samples for all media at the site, as well as sample locations
- Summary of analytical methods, target analytes, and detection limits, as well as number and type of QA/QC samples
- Data quality goals for each sampling task
- Applicable standards, criteria and guidance values for groundwater, surface water, sediment, soils, and soil vapor/indoor air

3.3 ANALYTICAL DATA QUALITY LEVELS

During the development of project-specific FAPs the analytical program for field samples will be established. The plan will specify analytical methods, analyte detection limits, data reporting requirements, and data review and reporting procedures.

For the purposes of this FAP/QAPP, the data quality levels described below will be used for the NYSDEC program:

Level I - Field Screening. This level is characterized by the use of portable instrumentation that can provide real time data to assist in the optimization of sampling point locations and for health and safety monitoring. Data can be generated indicating the presence or absence of certain contaminants, especially volatiles, at sampling locations. These measurements may include hand held photoionization detector (PID) for volatile organic compounds (VOC) monitoring, and instruments used for measuring temperature, pH, specific conductance, dissolved oxygen (DO), and turbidity during water sampling. Calibration and data recording procedures for the field testing instruments are described in Section 6.

Level II - Field Analysis. This level is characterized by the use of portable analytical instruments of field test kits that can be used on-site or in mobile laboratories stationed near a site. A detailed description of field analytical procedures will be included in each project-specific FAP. Depending on the project field analysis objectives, types of contaminants, sample matrix, and analytical procedure either qualitative or quantitative data will be obtained. The data quality goal will be specified. For sampling tasks requiring quantitative results, split samples for off-site laboratory analysis will be collected to evaluate the accuracy of the field analytical data. The split sample process and data comparison goals will be identified in the FAPs.

Level III - Laboratory Analysis. Subcontract laboratory-generated data obtained using USEPA or NYSDEC-approved procedures. Laboratory services will be completed in accordance with the NYSDEC ASP. Analytical methods may include a MACTEC subcontracted lab using USEPA Contract laboratory Program (CLP) Statement of Work (SOW) methods, USEPA SW-846 (USEPA, 1996), USEPA drinking water (500 series) methods and waste water methods (600 series) [40 CFR Part 136], Methods for the Chemical Analysis of Waters and Wastes (USEPA, 1993b), Standard Method (APHA, 1998), American Society for Testing and Materials (ASTM) procedures, or other approved testing procedures. Analyses will be completed by a with the NYSDOH Environmental Laboratory Approval Program (ELAP) certification. For Level III work, a NYSDEC Data Usability Summary Report is generated as described in Section 8.

Level IV – Laboratory Analysis using CLP Routine Analytical Services. These data represent laboratory analytical results developed using a CLP contract and supported by a rigorous QA program, supporting documentation, and data validation procedures. These data are typically used to support enforcement/litigation activities. Level IV data would include CLP Target Compound List (TCL) VOCs, semivolatile organic compounds (SVOCs), pesticides/polychlorinated biphenyls (PCBs), and Target Analyte List (TAL) inorganics.

Level V - Non-standard Methods. This level is used for the analysis of non-standard sample matrices (i.e., biota, waste, etc.). The level also applies when non-conventional parameters, method-specific detection limits, or modification of existing methods are required. None standard methods will be identified and described in the project FAPs.

3.4 PRECISION, ACCURACY, REPRESENTATIVENESS, COMPLETENESS, COMPARABILITY

To establish the quality goals for analytical data, data quality refers to a degree of uncertainty with respect to precision, accuracy, representativeness, completeness, and comparability. Specific objectives for each of these characteristics are established to develop sampling protocols, and to identify applicable documentation, sample handling procedures and measurement system procedures.

3.4.1 Precision

Precision is defined as the agreement among individual measurements of the same chemical constituent in a sample, obtained under similar conditions. Field precision will be expressed as relative percent difference (RPD) of field duplicates:

$$\frac{(X_1 - X_2)}{X_1 + X_2/2} \times 100 = RPD$$

where,

RPD = relative percent difference between duplicate results
X1 and X2 = results of duplicate analyses
$|X1 - X2|$ = absolute difference between duplicates X1 and X2

Field duplicates take into account the level of error introduced by field sampling techniques, field conditions, and analytical variability. The RPD of field duplicates will be calculated by MACTEC in order to evaluate the sample precision.

3.4.2 Accuracy

Accuracy is defined as the degree to which the analytical measurement reflects the true concentration level present. Accuracy will be measured as percent recovery for spiked analyses including laboratory control samples (LCS), surrogates spikes, and matrix spikes.

A spike is a sample to which predetermined quantities of standard solutions of certain target analytes are added prior to sample extraction/digestion and analysis.

Accuracy can also be evaluated using the recovery of surrogate spikes in the organic analyses. These spikes consist of organic compounds which are similar to the analytes of interest in chemical composition, extraction, and chromatography, but which are not normally found in environmental samples. These compounds are spiked into all blanks, standards, and samples prior to analysis.

Percent recoveries of the LCS, surrogate, and matrix spikes will be reported by the laboratory for all analytes associated with the samples. Variations from 100 percent recovery may be due to method extraction and analysis efficiency, matrix interferences, laboratory spike handling procedures, or sample heterogeneities between replicates. The percent recovery of the spikes can be calculated from the following equation:

$$\frac{X - B}{T} \times 100 = REC$$

where,

X = measured amount in sample after spiking
B = background amount in sample
T = amount of spike added

Accuracy is difficult to evaluate for the entire data collection activity, especially the sampling component. Field and trip blanks will be used in addition to the matrix and surrogate spiked samples to evaluate data accuracy in the investigations.

3.4.3 Representativeness

Representativeness expresses the degree to which sample data depict existing site conditions. Measurements will be made so that analytical results are representative of the media (e.g., soil, water, and sediments) and conditions being measured, to the extent possible. Representative data are collected by establishing standardized procedures for identification of sample locations and sampling techniques, and the collection of a sufficient number of samples. Sampling protocols are designed to collect representative samples of the media. Sample handling protocols (e.g., storage, transportation, holding time, sample preservation) are selected to protect the representativeness of the collected sample during shipment to the laboratory. Proper documentation will establish that protocols have been followed and sample identification and integrity are assured. Sample collection and handling will be in accordance with the standard procedures contained in Section 4 and Section 5.

QC blanks including laboratory method blanks and field QC blanks are also collected to determine if samples have been contaminated during sample collection or lab analysis. If evidence of sample contamination is found during data review, results for detected of contaminants may be removed from the final data set.

3.4.4 Completeness

The characteristic of completeness is a measure of the amount of valid data obtained compared to the amount that was expected. The completeness of data generated during each sampling task will be evaluated by the MACTEC project team when data review is completed and sample data are considered final. It may be impossible to collect samples that were proposed in the project FAPs due to problems encountered during the field sampling event. For example, multiple depth soil sample collection from a boring may be specified, but the boring may be terminated for technical reasons prior to reaching the specified depth. Samples may be lost or destroyed during sample handling or shipment to the laboratory. Data may be qualified during the completion of data usability summary reports (DUSR) or data validation reports described in Section 8. In some cases results may be qualified estimated (J) or rejected (R). Interpretations on missed sample location results, lost samples, and qualified data will be evaluated by the MACTEC project team after each site investigation sampling event. If data are missing from critical locations, or if qualification of data has an unacceptable impact on the usability of results relative to the project DQOs, then a decision may be made with the NYSDEC PMs to recollect samples.

3.4.5 Comparability

The characteristic of comparability reflects: (1) the internal consistency of measurements made at the site, (2) the expression of results in units consistent with other organizations reporting similar data, and (3) the confidence with which one data set can be compared to other similar measurements. The use of subcontract laboratories that have NYSDOH ELAP certification is a QA step designed to ensure that laboratories will produce chemical data that meet standards for testing for work within New York. Use of USEPA and other standard analytical methods used in the environmental testing industry provides another level of QA that results will be comparable to industry standards.

4.0 SAMPLING PROCEDURES

This section of the FAP/QAPP outlines typical field activities and sampling procedures completed at individual project sites. Specific procedures to be followed for a particular project will be referenced in the project-specific FAP. If additional sampling procedures are to be used that are not listed in this section, they will be described in detail in the project-specific FAP.

4.1 SAMPLE LABELS AND RECORDS

Sample labels will be prepared, to the extent feasible prior to initiation of work, using a computerized labeling system. Each sample may require several labels for the different containers, depending on the analysis to be performed.

Identification of samples collected during the field investigation will be accomplished with a code indicating sample type, sample identification, depth of sample (if applicable), and designation of duplicate samples. Soil, groundwater, and sediment samples will be labeled using the sample ID, as follows:

Digits 1 to 6	Site Code - six number NYSDEC code to identify the site (http://www.dec.ny.gov/cfmx/extapps/derexternal/index.cfm?pageid=3)
Digits 7, 8	Sample Type - two letter code to identify sample media AA - Ambient Air Sample BA - Basement Air Sample BS - Test Boring Soil Sample BW - Screened-auger Groundwater Sample CD - Septic System/Sump Catch Basin Sludge Sample CL - Septic System/Sump Catch Basin Liquid Sample DL - Drum Liquid

DS - Drum Solids or Sludge

FA - First Floor Air Sample

GS - GeoProbe® Soil Sample

GV - GeoProbe® Soil Vapor Sample

GW - GeoProbe® Water Sample

IA - Indoor Air Sample

MW - Monitoring Well Groundwater Sample

PS – Pore Water Sample

PW – Private Well Sample

QD - Source Water Blank

QS - Sampler Blank (i.e., Rinsate Blank)

QT - Trip Blank

RC – Rock Chip

SD - Sediment Sample

SS - Surface Soil Sample and/or Subslab Soil Vapor Sample

SW - Surface Water

TP - Test Pit Soil Sample

TW - Test Pit Water Sample

WT - Waste Sample

Digits 9,10,11	Horizontal Sample Locator - three numbers to identify sample location. Example: 202
Digits 12,13,14	Depth of Sample Below Reference Surface – Example (1): 001 equals 1 foot (ft) in depth; Example (2): 025 equals 25 ft in depth. For BS samples, the depth indicated is assumed to be the top of a 2-ft, split-spoon sample. The designation 000 will be used for BS samples collected from 0 to 2 ft below ground surface.

All samples obtained from the ground surface will be designated 000 and from drums will be designated XXX.

Digits 15/16(optional)	D - duplicate sample F - sample collected for field laboratory analysis or a filtered groundwater sample collected for analytical laboratory analysis MS - Matrix Spike MD - Matrix Spike Duplicate

Acceptable sample codes include 828072MW101025 (a groundwater sample collected from Erdle Perforating Site (Site Code 828072 from MW-101 at 25 ft in depth), 828072QT001 (a trip blank), and 828072BS101029 (a sample collected from soil boring BS-101 at 29 ft in depth).

At the time the sample is obtained a field data record (FDR) sheet and field logbook entries will be completed. The FDRs for specific types of sampling are discussed and illustrated in Subsections 4.4 and 4.5. The sample record documentation will include:

- a plan of the site with the sample location;
- sample label numbers;
- a description of the sample site;
- other physical descriptors of the sample site, if appropriate (e.g., stream width, groundwater depth, etc.);
- photographs of the sample site may be taken showing the sampling equipment and/or unusual conditions (orientation of photograph must be shown on sketch map, and photo number recorded in field notebook); and
- COC documentation (see Section 5).

4.2 SAMPLE CONTAINER AND PRESERVATION REQUIREMENTS

Sample integrity is maintained by using containers and preservation methods that are specific to the media sampled and analytical parameters. Sample containers and preservation methods specified in NYSDEC ASP protocols are summarized in Table 4.1. Any project-specific variation or addition to the sample containers and preservation methods outlined in this table will be specified in the project-specific FAP.

4.2.1 Preparation of Sample Containers

Sample containers will be provided by the laboratory and are pre-prepared according to USEPA protocols. QC records for the bottles used will be maintained by the laboratory.

4.2.2 Sample Preservation

Sample preservation for water samples will be completed in accordance with requirements described in the ASP Exhibit I (NYSDEC, 2005). Steps to maintain the in situ characteristics required for analysis may include storage of samples at 4 degrees Celsius, pH adjustment, and chemical fixation. Specific sample and container preservation requirements are summarized in Table 4.1 for the most commonly used methods. Holding times specified in the ASP Exhibit I are based on time of sample receipt at the laboratory. Holding times specified on Table 4.1 have been modified to begin at the time of sample collection. If pre-preserved sample containers are provided by the laboratory, extra preservation material should be available in the field in cases where additional material is needed to achieve the necessary pH.

Sample preservation and holding times for soils are based on guidelines provided in the ASP, referenced USEPA methods, or USEPA guidance documents.

Soil samples collected for VOC analysis will be preserved in the field in accordance with USEPA Method 5035 (USEPA, 1996) unless otherwise directed by the NYSDEC PMs.

4.3 DECONTAMINATION PROCEDURES

Equipment to be decontaminated during the project may include: (1) drill rig, direct push (GeoProbe®), backhoe, truck, or trailer; (2) tools; (3) monitoring equipment; and (4) sample collection equipment.

All decontamination will be done by personnel in protective gear appropriate for the level of decontamination as determined in the project-specific HASP. The project-specific FAP will designate where equipment decontamination will be performed on site (e.g., at a central decontamination station at an established site or at individual exploration locations).

4.3.1 Large Equipment

MACTEC anticipates that large equipment such as drill rigs, direct push (GeoProbe®), backhoes, trucks, and trailers may potentially be contaminated during field activities. Large equipment requiring decontamination will be cleaned with a portable, high-pressure steam cleaner. Personnel performing this activity will use the same level of health and safety personal protection required for invasive exploration activities plus splash protection.

4.3.2 Tools and Sampling Equipment

Contaminated tools and sampling equipment will be dropped into a plastic pail, tub or other container. The tools will be brushed off, rinsed, and transferred into a second pail to be carried to further decontamination stations where they will be washed with a Liquinox ®, or equivalent soap and water solution, rinsed with clean potable water, and finally rinsed with deionized water. Tools such as wrenches, split-spoons, etc., may be decontaminated between exploration locations with a high-pressure steam cleaner instead of washing. Sampling equipment, such as bailers, will be wrapped in aluminum foil after cleaning to prevent contamination before next use.

4.3.3 Monitoring Equipment

When monitoring equipment is being used under conditions where it may become contaminated, the equipment will be protected as much as possible from contamination by draping, masking or otherwise covering as much of the instrument as possible with plastic without hindering the operation of the unit. For example, the PID can be placed in a clear plastic bag which allows reading of the scale and operation of the knobs. The sensor on the PID can be partially wrapped, keeping the sensor tip and discharge port clear.

Any contaminated equipment will be taken from the drop area and the protective coverings removed and disposed of in the appropriate containers. Any direct or obvious contamination will be brushed or wiped with a disposable paper wipe. The units will then be wiped off with damp disposable wipes and dried. The units will be checked, standardized, and recharged, as necessary, for the next day's operation. They will then be prepared with new protective coverings.

4.3.4 Sample Handling/Shipping Areas

Sample containers will be wiped clean at the sample site, taken to the decontamination area to be further cleaned, as necessary, and transferred to a clean carrier. The samples will be checked off against the COC record. The samples will then be stored on ice in a secure area prior to shipment.

Sample handling areas will be cleaned/wiped down daily using disposable wipes. Disposable wipes will not be used on any equipment that comes in contact with samples. For final cleanup, all equipment will be disassembled and decontaminated. Any equipment which cannot be satisfactorily decontaminated will be disposed (e.g., glassware, covers for surfaces).

The management of disposal of liquid and solid wastes generated during decontamination is presented in Subsection 4.9.

4.4 FIELD INVESTIGATION TECHNIQUES AND PROCEDURES

Prior to any investigation activities, MACTEC and the contracted subcontractor, if applicable, will work closely with the NYSDEC, the Site property owner, the neighboring property owners, and utility companies to obtain access to the exploration locations and clear utility lines.

4.4.1 Utility Clearance

Subsurface sampling will require the clearing of underground utilities. Once boring locations have been identified, they will be marked in the field with white paint, flags, or stakes and One Call (Dig-Safely New York) will be notified by the subcontractor performing the work (at least three days prior to the field work). The list of utilities that are members of the One Call System should be identified, and the municipality of the project site called to determine if there are any other utilities in the area that are not covered. Any additional utilities identified should be contacted directly to request clearance. A list of contacted utilities and their responses will be maintained in the field and responses for each utility contacted should be documented.

Prior to starting intrusive work, locations will be visited and reviewed for proper markings. If a utility did not respond saying they have no utilities in the area and the locations are not marked, then the utility will be contacted directly for clearance prior to performing any intrusive work.

The chart below shows the color system used by the utilities for marking and identifying the various types of utilities potentially present.

⬜	**WHITE -** Proposed Excavation
🩷	**PINK -** Temporary Survey Markings
🟥	**RED -** Electric Power Lines, Cables, Conduit and Lighting Cables
🟨	**YELLOW -** Gas, Oil, Steam, Petroleum or Gaseous Materials
🟧	**ORANGE -** Communication, Alarm or Signal Lines, Cables or

🟧	Conduit
🟦	**BLUE -** Potable Water
🟪	**PURPLE -** Reclaimed Water, Irrigation and Slurry Lines
🟩	**GREEN -** Sewers and Drain Lines

All discussions with utilities and subcontractors with respect to utility clearance will be documented in the field log book. If the excavation will cause the removal or disturbance of markings, offset marks will be establish in order to maintain reference points for the underground utilities. The field leader will make sure all workers are aware of established offsets.

For work conducted on private property, MACTEC and its subcontractor will check as-built drawings and interview key personnel (e.g., maintenance) at the project site to help locate underground utilities at proposed locations. Personnel must also be aware that drawings may be in error or may not be representative of actual locations. If the utility companies will not come onto the private property, MACTEC or its subcontractor will arrange for a private utility clearance company to visit the site prior to intrusive work.

If live utilities are known to be present in the area of the intrusive work, MACTEC will move the location to the extent possible. If it is not possible to move locations, MACTEC or its subcontractor will use non-destructive means to drill/excavate (e.g., hand dig, soil vacuum, water jet, and/or air knife) until it is safe to proceed with equipment. If electric power lines could be present, hand digging/auguring will not proceed unless the workers are wearing electrically, insulated gloves.

In addition to the above items, the following items in the area of intrusive work should also be noted:

- Overhead power -where does it come from? Does it go down a utility pole and underground?
- Are there trench patches in the pavement?
- Is there trench settlement in grassy ground?
- Look for utility manholes in the street, opening covers will provide directional assessment of utilities as well as size, depth, and use
- Look for valve risers in the pavement (water, gas)

Field personnel will evaluate the various information and confidence level in the data obtained on utility locations. If the field personnel are not confident that all utilities have been located, intrusive work will not proceed without discussing with the MACTEC and NYSDEC PM.

4.4.1 Geophysical Methods

Geophysical methods are remote-sensing techniques that provide information about subsurface conditions. Geophysical surveys can be used to identify buried objects or features such as utility lines/pipes, former disposal trenches or pits, buried debris and/or waste material. This information is used to plan locations of explorations including test pits, borings, and monitoring wells. Geophysical techniques commonly used as part of field investigations include (but not limited to) ground penetrating radar (GPR), magnetometry, and terrain conductivity (TC). Using more than one individual survey technique in a given area provides for correlation of anomalous features and lends for a more comprehensive interpretation. The principles, instrumentation, methodology, and techniques of data evaluation of GPR, magnetometry, and TC are presented in the following subsections.

4.4.1.1 Ground Penetrating Radar

GPR uses high frequency radio waves to investigate the presence of subsurface objects and structures by measuring reflections from any interface where there is a significant change in the dielectric constant. Typical applications for GPR include delineating the boundaries of buried waste materials and perimeters of abandoned landfills; finding steel reinforcement bars and voids in concrete structures; recording the depth of geological interfaces, bedrock, and coal seams; locating and mapping buried utilities; profiling lake bottoms; and determining glacial ice stratification and thickness.

Principles. Energy is radiated downward into the subsurface from an antenna that is pulled slowly across the ground at speeds varying from about 0.25 to 5 miles per hour, depending on the amount of detail desired and the nature of the target. The radio wave energy is reflected from surfaces where there is a contrast in the electrical properties of subsurface materials. These surfaces may be naturally occurring geologic horizons (e.g., soil layers, changes in moisture content, voids and fractures in bedrock) or manmade (e.g., buried utilities, tanks, drums). The reflected energy is processed and displayed on a continuous strip chart recording of distance versus time (i.e., where time can be thought of as proportional to depth).

The time required for the electromagnetic (EM) pulse to traverse the path down to and back from the reflecting medium is measured in nanoseconds (one nanosecond = $1x10^{-9}$ seconds). The two-way travel time is proportional to the depth of burial of the reflecting medium and is dependent on the dielectric properties of the medium through which the EM pulse travels. The dielectric properties of a medium are related to the moisture content and composition of a material. Figure 4.1 depicts the relationship between a single EM pulse generated by the controller and the resulting strip chart recording that would result from many such EM pulses.

The depth of penetration of a GPR system is highly site specific, and depends on (1) the soil types at the site, (2) moisture conditions, and (3) the frequency of the antenna (i.e., lower frequencies penetrate deeper resulting in less resolution).

Instrumentation. The radar system consists of a control unit, an antenna assembly (i.e., transmitter/receiver), and a recording device for analog field recordings. A digital recording unit may also be present for further data processing after field activities are completed. The antenna transmits EM pulses of short duration into the ground. The pulses are reflected from geologic or manmade surfaces and are picked up by the receiver, which transmits the signals to the control unit for processing and display. Shallow objects appear near the top of the strip chart recording (i.e., less time elapsed between the outgoing pulse and the return of reflected energy), whereas deeper objects appear farther down the recording (i.e., more time elapsed). MACTEC generally uses a GSSI (Geophysical Survey Systems, Inc., North Salem, N.H.) SIR 3000 utility locator.

Methodology. GPR surveys are usually performed by establishing a grid of parallel lines across a site and towing the radar antenna along each of these survey lines, usually in the same direction. The spacing and orientation of the grid lines depends on the orientation, if any, of the target features and the required resolution, factors that will be specified in the project-specific FAP. For determination of geologic features or to detect large targets, surveys are typically performed with line spacing ranging from 5 to 20 ft, or greater.

The position of the antenna along the survey lines is annotated by vertical marks (i.e., "tick marks") placed on the instrument output by a device controlled by the operator. The tick marks correspond with distance along a cloth measuring tape, pin flags, or other physical markers at the site.

Data Evaluation. The propagation velocity of the EM pulse depends upon the relative dielectric permittivity of the material through which the pulse travels. The relative dielectric permittivity is a measure of the degree to which a medium can resist the flow of the EM pulse -- the higher the relative permittivity, the lower the resistance to flow, and vice versa. For most earth materials and rocks, the relative dielectric permittivity does not exceed 10 and is always greater than unity, the value for a vacuum. Table 4.2 gives typical permittivity values for commonly encountered materials. The dielectric permittivity is related to the propagation velocity by the formula:

$$e_r = (c/V_m)^2$$

where,

c = propagation velocity in free space ($3\text{x}10^8$ meters per second or approximately 1 ft per nanosecond)

V_m = the propagation velocity through a material.

It follows that

$$(e_r)^{½} = c/V_m \text{ or } 1/V_m = (e_r)^2/c$$

Since c is approximately equal to 1 ft/ns, then $1/V_m$ is approximately equal to $(e_r)^{½}$.

Final results are values of nanoseconds per ft (one-way travel time). These formulas give a method for estimating the propagation velocity for a medium; therefore, the depth to a reflecting horizon if the soil conditions are known. If soil conditions are unknown or their properties cannot be estimated accurately enough, a reflector of known depth can often be used to calibrate the GPR recordings to site conditions.

4.4.1.2 Magnetometry

Magnetometry uses local variations in the earth's magnetic field to locate buried ferromagnetic objects such as drums, tanks, pipes, and cables. Typically a single 55-gallon drum can be detected at depths of up to 15 ft and large drum deposits or large tanks can be detected at depths of 65 ft or more assuming minimal magnetic interference in the vicinity of the target(s). Calculations of the mass or size of detected objects generally yield only approximate results.

Magnetic surveys are impractical in areas where metal pipes, fences, railroad tracks, metal buildings, and other ferrous metal artifacts are abundant. Proper selection of equipment and survey techniques can alleviate some of these problems.

Principles. All materials subjected to a magnetic field, including the magnetic field of the earth, will develop an induced magnetization, the intensity of which is proportional to the applied magnetic field and the magnetic susceptibility of the material. Ferromagnetic materials, such as iron or steel, have high magnetic susceptibilities.

Induced magnetization in an object produces a local magnetic field which either reinforces (i.e., positive magnetic susceptibility) or reduces (i.e., negative magnetic susceptibility) the external applied field. The variations in an otherwise uniform magnetic field caused by the presence of an object are called magnetic anomalies. Observations of such anomalies can be used to infer the presence of such objects.

In magnetometry, one measures local variations in the earth's magnetic field along a traverse or across an area on the surface. Because the intensity of the earth's magnetic field depends in part on the magnetic susceptibility of subsurface materials, a knowledge of variations in field intensity provides an indication of variations in the distribution of materials with different magnetic susceptibilities. In particular, magnetometry can detect the anomalies caused by buried ferromagnetic objects and other natural features which may be of interest in hydrogeologic site investigations.

Instrumentation. Magnetometer surveys will be conducted using a proton precession magnetometer with vertical gradiometer capability. A vertical gradiometer has a dual sensor mounted on a vertically oriented staff which simultaneously measures the total field at each sensor. The gradient is the difference between the values recorded at the upper and lower sensors divided by the distance between them, typically one-half of one meter. In a proton precession magnetometer, a strong magnetic field is applied to a proton-rich fluid (e.g., kerosene) which realigns the protons. The field is then turned off and the frequency of the signal generated by the protons as they realign themselves with the earth's magnetic field is dependent upon, and thus a measure of, the strength of the field at that point.

Methodology. Magnetic measurements are generally made along a grid pattern or in a series of parallel lines across the survey area. The spacing of the grid or lines depends on the size and depth of the objects sought and will be specified in the project-specific FAP. Because of the phenomena of temporal magnetic drift, a magnetic survey usually includes establishing a base station at which magnetic measurements are made at regular intervals. These measurements may later be used to correct all total field survey data for temporal differences due to drift and also act as a QA/QC check on the function of the instrument. Theoretically, it is not necessary to correct vertical gradient measurements for temporal drift because any variation affects the two sensors equally.

In the field, the operator should avoid any sources of high magnetic gradients such as power lines, buildings, and any large iron or steel objects. The operator should also avoid carrying any unnecessary metal articles.

Data evaluation. Field data are recorded in the instrument as a series of data blocks which can be transferred to a computer for processing and evaluation. Each data block contains the total field values for each sensor, the "X" and "Y" coordinates for the measurement are input by the user, the date and time, and several parameters that permit an evaluation of data quality. The total field values are recorded in gammas. The intensity of the earth's magnetic field is approximately 60,000 gammas at the poles and 30,000 gammas at the equator.

For typical manmade iron or steel objects, one may quantify the approximate depth of burial and the amount of metal that produces an observed magnetic anomaly. The intensity or size of the anomaly (I) can be expressed as:

$$I = M/r^n$$

where,

M = magnetic moment of the source

r = depth to the source and,

n = is a measure of the rate of decay with distance, n = 3 for a dipole source and 2 for a monopole source.

Assuming a dipole source, the weight of a metal object in pounds, can be expressed as:

$$(Ir^3)/M$$

where,

M = magnetic moment per pound of iron, varying from approximately 175 to 1,750

r = depth in ft below the sensor

I = anomaly amplitude in gammas.

4.4.1.3 Terrain Conductivity

TC surveys use measurements of the electrical conductivity of a hydrogeologic section to (1) characterize the conductivity of subsurface materials, (2) delineate the extent of contaminant plumes with high concentrations of dissolved electrolytes, and (3) map large concentrations of buried wastes with a degree of saturation, containerization, or inherent electrical properties distinct from the surrounding soil matrix.

Principles. The instrumentation consists of a transmitter and receiver. When a measurement is made, the transmitter is energized by an alternating current that produces a magnetic field, designated as the primary field, H_p. This artificial magnetic field induces small electric currents to flow in the earth which, in turn, produce a secondary magnetic field, H_s, which is made up of two components, quadrature and in-phase components.

The secondary magnetic field is related to the transmitter/receiver separation and to the operating frequency of the transmitter, both of which are selected by the operator. The ratio of the quadrature phase of the secondary field to the primary field (H_s/H_p) is linearly proportional to the TC under most conditions. This ratio is measured by the receiver and converted into conductivity values in units of milliohms per meter.

Field measurements may be recorded on a digital data logger, which is capable of recording simultaneously both the quadrature phase and in-phase components of the induced magnetic field. The quadrature phase component gives the ground conductivity value in milliohms per meter. The in-phase component is more sensitive to metallic objects and hence is useful for looking for buried tanks and drums. Data from the in-phase component may be thought of as being equivalent to a metal detector survey.

Instrumentation. Three instruments manufactured by Geonics, Ltd., of Mississauga, Ontario are commonly used for EM surveying: an EM-31 or EM 34-3, and EM-61. The GSSI Profiler EMP-400 is another common EM surveying instrument. These instruments are rapid-reconnaissance exploration tools used to assess the conductivity values for soil, rock, and waste materials.

The most commonly used instrument, the Geonics EM-31, is a single-piece model operable by one person, with a fixed coil spacing of 12 ft. This provides an effective sampling depth of up to 18 ft. The Geonics EM 34-3 is a dual coil model, operable by two people, with variable coil spacings of 33, 66, and 321 ft. This provides for an effective sampling depth of up to nearly 200 ft. Each instrument can be used in either the horizontal dipole or vertical dipole mode. Selection of the operational dipole mode depends on the depth of sampling desired and the desired sensitivity of the instrument to materials at various depths, relative to the transmitter-receiver coil separation. The EM-61 is a time domain metal detector which detects both ferrous and non-ferrous materials. The Profiler EMP-400 is build on many of the same principles as the EM-31 and EM-61

Methodology. TC surveys are generally conducted on a grid system of parallel lines across the site area. Measurements are taken at grid points. The spacing of the lines depends on the resolution required and will be specified in the project-specific FAP. At each grid point the meter reading is recorded and the apparatus is moved to the next site grid location.

For the dual coil method (Model EM-34), the selected inter-coil spacing must be achieved prior to recording the data. In addition, the two coils must be coplanar. In the horizontal dipole mode, the coils are oriented vertically, where as in the vertical dipole mode, the coils are oriented horizontally.

Data Evaluation. Although it is difficult to define the thickness and "true" conductivity of individual subsurface layers, the instrument measures very precisely the "apparent" conductivity of a volume of underlying earth materials. The apparent conductivity value is made up of the sum of the contributions from each layer that is "sampled" by the transmitter-receiver array. The volume, therefore the depth, of earth materials sampled increases with increasing separation between the transmitter and receiver.

A comparison of the relative responses for vertical and horizontal dipoles is illustrated in Figure 4.2. The vertical axis describes the relative contribution to the secondary magnetic field, arising from a thin layer at a given depth, z. The horizontal axis shows how this response varies as a function of the ratio (z/s), where "z" is the depth of the thin layer described previously and "s" is the transmitter/receiver separation.

As illustrated in Figure 4.2, in the vertical dipole mode, the contribution to the secondary magnetic field from near-surface materials is very small but reaches a maximum at a depth "z" of approximately 0.4. The contribution is significant, although diminished, at a depth of 1.5. This depth represents the effective depth of exploration in the vertical dipole mode.

In the horizontal dipole mode, the contribution to the secondary magnetic field arising from near-surface materials is a maximum and decreases with increased depth. The contribution is also significant at a depth of about 0.75s. This depth represents the effective depth of exploration in the horizontal dipole mode.

4.4.2 Test Pits

Test pits or trenches are designed to allow exploration of subsurface contamination and the nature of near-surface soils. The locations of test pits will be planned in advance and rationale presented in the project-specific FAP, with provisions for the field scientist to modify plans in response to unanticipated site conditions. Test pitting will be conducted at the levels of personal protection specified in the project-specific HASP.

Test pits will be excavated using a backhoe. The field scientist will record the following information on the Test Pit Record (see Figure 4.3) and in the field logbook:

- site name and location;
- names of contractor, backhoe operator, and sampler;
- date and time of excavation;

- depth, width, length, and orientation of trench;
- sample number, depth, and type for all samples;
- approximate water level, after stabilization;
- soil description;
- results of any field screening;
- list of any photographs taken;
- date and type of backfill; and
- any other pertinent observations (staining, odor, etc.).

Test pit samples will be collected from the middle of the backhoe bucket, without requiring the field scientist to enter the excavation. Samples will be collected using the following procedures:

1. Excavate to the dimensions required by the field scientist.
2. Test pit excavation may be terminated due to groundwater seepage into the excavation or encountering obstructions, utility lines, or waste containers. Depending on the conditions encountered, it may be possible to continue excavating more slowly and carefully, rather than to terminate the exploration.
3. The backhoe operator will remove the material from the test pit, under the direction of the field scientist, and deposit excavated soil on plastic sheets in order to minimize contamination of surface soils.
4. When the bucket is brought to the surface, the contents will be screened for VOCs with a PID and examined for visible signs of contamination.
5. Samples will be obtained from the middle of the bucket and placed in the appropriate jars using a clean stainless steel trowel or spatula. Samples may also be collected from the test pit walls by using an extendable hand tool.
6. Excavated soils will be back-filled into the excavation and tapped down into place with the backhoe bucket.

Sample containers will be checked for complete and accurate labeling and COC procedures will be initiated.

The test-pitting subcontractor will decontaminate his backhoe bucket between excavations following the procedures described in Subsection 4.3.1.

4.4.3 Exploratory Drilling

A MACTEC representative will be present during the drilling of borings and installation of monitoring wells. The field scientist will maintain drilling logs and collect appropriate samples. Soil borings will be described on the soil boring log (Figure 4.4) and bedrock coring will be described on the Rock Coring Log form (Figure 4.5). Soils will be described using the Unified Soil Classification System (USCS) (Figure 4.6). A qualified drilling subcontractor will supply the necessary type and number of drilling rigs capable of performing drilling techniques appropriate for the existing subsurface conditions. The boring methods employed at a given site are selected based on known subsurface conditions. MACTEC has prepared detailed drilling specifications that govern the drilling subcontractor's effort. These specifications are modified and issued on a project-specific basis to reflect the needs of each project.

4.4.3.1 Auger Borings

One of the most commonly used drilling methods use of hollow-stem augers (HSA), utilizing coupled lengths of continuous flight augers to bring cuttings upward as the auger string is rotated and advanced into the ground. MACTEC routinely specifies 4.25-inch inside diameter (ID) HSA drilling at sites where overburden is composed of sand or silt, and cobbles, boulders, or rubble are not expected to be encountered. The hollow-stem allows for collection ahead of the augers using a split-spoon sampler or other device, and is large enough for installation of 2-inch ID monitoring wells inside the annular space of the casing. Auger sections are usually 5 ft in length and are attached directly to each other with bolts or with bolted collars. During drilling, the open end of the auger can be blocked as it advances to prevent soil from entering the hollow stem. No drilling fluids are used under normal circumstances. More commonly, the soil is allowed to pack into the open end a few inches. After the auger is advanced to the desired sampling level, the sampling tool is inserted through the hollow stem and driven. Techniques for subsurface soil sampling are presented in Subsection 4.5.1.1.

The advantages of the HSA technique include:

- simplicity of procedure;
- low risk of personnel exposure;
- can be used to obtain soil samples from a wide range of subsurface conditions;
- drilling fluids are generally not required; and
- availability of equipment.

The disadvantages of the HSA technique are:

- difficulty in penetrating excessively cobbled or bouldered soils; and
- difficulty in sampling granular soil below the water table since, without drill fluids, there is no practical means to maintain hydrostatic equilibrium in the borehole. When the plug is withdrawn, water and sediment from outside the augers may enter the borehole, potentially causing contamination and difficulty in sampling undisturbed soil below the bottom of the augers.

4.4.3.2 Drive and Wash Drilling Method.

This method, which will be approved prior to use by the NYSDEC PM, involves advancing casing, as required, and washing-out the soil to the bottom of the casing with a chopping bit to the desired sampling depth. The casing can be advanced by either spinning or hammering (pounding) the casing with a 300-pound hammer. The borehole may be stabilized with the casing, water, or drilling mud, and open samplers, such as the split-or solid-spoon type are driven into the undisturbed soil at the bottom of the borehole.

Drive and wash is most commonly used in soils which do not contain large cobbles and boulders, or cemented horizons. The wash boring method involves the introduction of drilling water and/or drilling mud to the borehole. The use of these materials and this method is not preferred in environmental investigations since the introduction of drilling fluids can alter the chemical composition of the groundwater adjacent to the borehole, and may have an adverse effect on groundwater quality analyses on groundwater samples from monitoring wells installed in the completed borehole. If it is necessary to use this technique to advance a borehole, the field scientist should determine the source and quality of the drilling water to be used in the boring process. The field scientist should not authorize the use of on-site or nearby groundwater or surface water bodies as the source of the drilling water, unless the proposed source has been sampled and analyzed for the full suite of contaminants considered likely to be present in the groundwater beneath the site. In all cases where drilling water or drilling mud are used to advance a borehole, the field scientist should consider obtaining a sample of the drilling fluid for potential analysis, at the discretion of the PM and QAO.

Records of each exploration shall be made on the Test Boring Log (Figure 4.4) and in a field logbook.

4.4.3.3 Cased Borings

In washed casing methods (driven or spun), the boring is advanced by first driving or spinning the casing (i.e., smooth sided, threaded, flush joint pipe) into the soil to the desired depth and then clearing out to a maximum depth of three inches below the bottom of the casing using a rollerbit and rod through which water is pumped as the bit is advanced. Where driven casing is used, the lead casing is equipped with a bit called the drive shoe. Spun casing uses a spin shoe. MACTEC commonly specifies 4-inch ID washed casing in tight, heavy soils such as clay, soil containing cobbles, boulders, or rubble through which augers could not be advanced, or in borings that are planned to be advanced through the overburden into bedrock.

Driven casing is advanced using the blows of a 300-pound hammer falling 24-inches. Hammer blows are recorded for each 12 inches of penetration. In cohesive soils, the inner bit may be advanced further than 3-inches ahead of the casing, and then the casing advanced. During washing of the casing and advance of the roller bit and rod, water will not be recirculated, to prevent cross-contamination unless specified in the project-specific FAP. Management and disposal of the wash water and soil cuttings will be in accordance with Subsection 4.9 or specified in the project-specific FAP. As washed borings are advanced, special care shall be taken to note and record the depth where drilling fluid is lost if this occurs, the depth of an apparent change in soil type, consistency, or color, as can be detected practically while advancing the boring, or other details about the progress of the boring.

The advantages of this drilling technique are:

- simplicity of procedure;
- low risk of personnel exposure;
- can be used to obtain soil samples from a wide range of subsurface conditions;
- can be used to obtain samples from depths greater than 100 ft; and
- availability of equipment.

The disadvantages of cased borings arise from the need to use a drilling fluid. When sampling pervious soils, drilling fluids can permeate ahead of the casing. This can result in contamination of the underlying pervious soils if drilling fluids are recirculated.

4.4.3.4 Rotary Technique

This method is a variation of the wash boring technique, utilizing a rotary drill bit, rather than a chopping bit. It is employed primarily in advancing and cleaning the borehole to the required sampling depth, and is used in conjunction with air, water, or mud to bring the cuttings to the ground surface. This is the method generally preferred for exploratory test borings in the geotechnical consulting industry. This method is commonly used in environmental investigations when test borings are expected to encounter dense tills and coarse granular deposits (such as gravels), or are expected to terminate at depths exceeding thirty ft below the ground surface.

The primary disadvantage of this technique for environmental investigations is the introduction of drilling water or drilling mud. The use of air rotary drilling rigs is usually not appropriate for environmental investigations unless filters are used because the cuttings brought to the ground surface are ejected into the air adjacent to the drilling rig.

4.4.3.5 Rock Coring

Some rock core drilling may be required to complete monitoring well installations at specific sites. Bedrock drilling will be conducted with 4.0-inch ID flush joint casing. Continuous rock core will be collected using H rock coring equipment. The H rock coring device consists of a diamond drilling bit and core tube with inner core barrel. After a length of core drilling is complete, the core barrel is retrieved from the borehole. The core is extruded directly into wooden core boxes for description and storage.

The field scientist will take custody of the rock core after it is extruded from the core barrel. The length of rock core will be described using the procedures outlined below and recorded on the Rock Coring Log (Figure 4.5) and in the field logbook.

1. Scan the core with a PID and record any measurements.
2. Determine the percent recovery from measurement of length of core retrieved versus the length of drill bit advancement (i.e., the core run).
3. Visually examine the core and record its characteristics (including: lithology, petrography, color (wet), layering, fracture spacing, joints, presence of fossils, and visual evidence of possible contamination.
4. Determine rock quality data (RQD). RQD is determined as the total length of rock core segments greater than four inches in length versus the total length of drill bit advancement. RQD is calculated in percent.

4.4.3.6 GeoProbe®/Direct Push Sampling

A direct push sampling system may be used to conduct soil, groundwater, and/or soil vapor sampling and to assess contamination in the vadose zone and saturated overburden. This technology can be used to collect either final data for reports or screening data that can be used to optimize the future location of soil borings and monitoring well installations. The most common vendor of direct push technology is GeoProbe® Systems, and for the purposes of this document, direct push systems and geoprobe may be used interchangeably. The direct-push explorations shall be completed by a qualified direct-push subcontractor, and directed by a qualified field person. Collection of associated samples is outlined in following Sections.

Direct push drilling technique consist of a hydraulic ram unit, usually mounted on a small vehicle (ATV, cargo van, or pick-up truck) that advances small diameter drill rods to obtain overburden soil or groundwater samples or install piezometers. Advantages in environmental investigations include low cost, maneuverability and access to irregular terrain, minimization of investigation derived wastes. Disadvantages include depth limitations and small sample volumes.

The direct push device may employ either dual tube methodology which allows the collection of subsurface soil samples through an outer casing that is set to maintain the integrity of the boring or single-rod method that collects soil into a sleeve liner (e.g., macrocore) within the lead rod.

In the dual-tube method borings are advanced by simultaneously driving an outer stainless steel casing and inner Lexan® tube into the ground. Upon reaching the desired penetration depth, the inner Lexan® tube is extracted to collect the discrete subsurface soil samples, leaving the outer casing in place. To sample the next interval of soil, a new length of Lexan® tubing is then inserted into the outer casing (already in the ground) attached to a length of drive pipe, and another length of outer casing is attached to the top of the outer casing that is already in the ground.

In the single-rod method, ¾-inch diameter rods are advanced in 4-ft sections. The lead section is fitted with an inner polyethylene sleeve. When the top of the desired sampling interval is reached, a tool is used to unlock the drive point and the rod is driven ahead to obtain the soil sample. The entire drill rod is retrieved and the liner removed for characterization. The process is then repeated to collect the next desired sample.

The following materials will be available, as required, during the subsurface soil sampling:

- Health and safety equipment;
- Direct push sampling equipment;
- decontamination equipment as specified in the FAP/QAPP;
- Stainless steel trowels or spatulas;
- Aluminum Foil;
- Paper Towels;
- Measuring device;
- Appropriate sample containers and forms, and personal protective equipment (PPE);
- PID;
- Acetate field knife (if liner sleeves are used to collect the soil samples);
- Field notebook.

The following procedures will be employed to collect subsurface soil samples:

1. Identify sample locations from the project-specific FAP and note the locations in field notebook by obtaining ties to physical features.
2. Don the appropriate PPE.
3. Set up an equipment cleaning station, and decontaminate equipment as described in the FAP/QAPP. Use new, clean materials when decontamination is not appropriate (e.g., disposable gloves and dedicated drive points). Document the decontamination procedure in the field notebook.
4. Assemble the appropriate direct-push sampling apparatus or other direct push tool.
5. Drive the sampling tools to the appropriate sampling zone and collect a sample base on the type of direct-push method being used.
6. Retrieve the sample.

7. Screen for VOCs using the PID. Collect the needed soils for laboratory analysis per requirements of the project-specific FAP. Measure and describe the sample lithology on the boring log (Figure 4.4) using the USCS (Figure 4.6).
8. Evaluate the sample for the presence of visible non-aqueous phase liquid (NAPL). Document samples interpreted to contain visible NAPL with photograph, and record observations in field notebook.
9. Decontaminate non-disposable equipment or tools that may have come into contact with subsurface soil in accordance with the FAP/QAPP.
10. Discard all disposable equipment used during sampling activities in a designated location.
11. Record all other appropriate information in the field notebook.
12. Identify the next sequential boring location, move to that location and return to step 2.

Records of each exploration shall be made on a Soil Boring Log (Figure 4.4) and in the field logbook.

4.4.4 Monitoring Well/Piezometer Installation.

The objectives for each monitoring well and/or piezometer may vary from site to site and from well to well. The objectives will be clearly defined in the project-specific FAP before the monitoring system is designed. Monitoring wells serving different purposes require different types of construction. The objectives for installing monitoring wells may include:

- determining groundwater flow direction and velocity;
- sampling or monitoring for contaminants;
- determining aquifer characteristics (e.g., hydraulic conductivity (K) testing); and
- performing site remediation (e.g., injection or recovery wells).

In cases where only groundwater flow or velocities are to be determined, piezometers, cluster wells, or well points may be used.

Well Materials. Well riser pipe materials are specified by diameter, type of materials, and thickness of pipe. Well screens require an additional specification of slot size. Well specifications will be presented in the project-specific FAP.

The selection of well material depends on the method of drilling, the type of contamination expected, natural water quality, and anticipated depth. Cost may also be a consideration. The two most-commonly used materials are polyvinyl chloride (PVC) and stainless steel. PVC is generally preferred to stainless steel because it is light-weight, less expensive, non-corrosive, and generally easier to work with. However, PVC may deteriorate in the presence of ketones, aromatics, alkyl sulfides, and some chlorinated hydrocarbons. In such cases stainless steel may be preferred.

When the aquifer is bedrock, a well screen may not be necessary; the well is simply an open hole in bedrock. Unconsolidated materials such as sands, clay, and silts, require a well screen. The screen slot size should be selected to retain 90 percent of the filter pack material or in-situ aquifer material, after development (Driscoll, 1989). The gradation of the filter pack material will be selected based on the gradation of the native soils within the screened interval. A screen slot size of 0.010-inches is generally used when a screen is necessary and site conditions are not known.

The thickness of pipe depends on the strength required for the well. In general, larger diameter pipe requires greater thickness to maintain adequate strength. Similarly, driven well points require greater strength, and therefore greater thickness, than wells installed inside drilled borings.

Well Design. The well depth and diameter are tailored to the specific monitoring needs of each site and generally depends on the purpose of the monitoring system and the geologic setting. The decision concerning the depth of placement and length of the well screen is based on the following information:

- aquifer depth, thickness, and characteristics (e.g., permeability and specific yield);
- anticipated depth, thickness, and characteristics (e.g., density relative to water) of the contaminant plume;
- head distribution and estimated flow in the aquifer; and

- fluctuation in groundwater levels.

In most situations, screen lengths are 5 to 10 ft.

Standard well IDs are 2, 4, 6, or 8 inches. For most groundwater monitoring and sampling programs, a 2-inch ID well is preferred. Pumping tests for determining aquifer characteristics may require larger diameter wells; however, in situ K testing can be performed during drilling or after well installation in small diameter wells. Other considerations in selecting well diameters include the types and size of the sampling equipment, and any in situ instrumentation that may be used in the well. In general, the borehole diameter should be at least 4 inches larger than the well riser pipe diameter to provide an annular space of at least 2 inches for placement of filter pack, seal, and grout or backfill.

Well Installation. Monitoring well installation details will be recorded in the field logbook and on a Monitoring Well Construction Diagram (Figures 4.7 and 4.8).

Materials placed in the annular space between the borehole and the riser includes filter pack, bentonite seal, and grout. In general, all of these materials may be installed using a tremie pipe placed in the annular space. In shallow wells, these materials may be emplaced from the ground surface, but the rationale and procedures must be described in the project-specific FAP.

The filter pack is usually a fine to medium uniform sand. The exact filter pack gradation should be chosen to retain approximately 60 percent of the aquifer material after well development (Driscoll, 1989). The filter pack is installed around the well screen and extending 2 to 3 ft above the top of the screen. At least 2 ft of bentonite pellets will be placed above the filter pack.

The bentonite expands by absorbing water and serves to isolate the screened interval from the rest of the annular space and the formation. If the bentonite seal is above the water table, care must be taken to adequately hydrate the pellets before proceeding with well construction. If the seal is below the water table the bentonite slurry may be tremied into place.

Grout is placed from the top of the bentonite to the ground surface. Grout generally consists of a cement-bentonite mixture or Portland cement. The grout minimize the possibility of surface run-off reaching the screened interval and replaces material removed from the boring during drilling thereby minimizing hole collapse and subsidence around the well.

In certain cases, the borehole may be drilled to a depth greater than the well installation depth. For these cases, the well is backfilled to the desired depth with bentonite and sand is placed between the bottom of the well and the bentonite.

Well sections and all materials coming in contact with the well must be cleaned before installation. The screen and well-riser pipe can be placed in the boring either manually or using the rig to hold the pipe, depending on the weight of the well. The pipe is lowered and sections added until desired screen depth is reached. No glues or solvent-cement will be used in well construction monitoring wells. When the screen and riser are in place, the filter pack, bentonite seal, and grout are installed using tremie pipes. The well is completed with a vented PVC cap.

When the well is completed and grouted to the surface, a protective steel casing is often placed over the top of the well. This casing generally has a hinged cap and must be able to be locked to prevent vandalism. The protective casing is larger in diameter than the well and is set over the well into the wet grout or is concreted in place. Protective casings can be above ground or flush-mounted. Above ground protective casings will have weep holes to allow drainage. Special care must be taken with flush-mounted installations to ensure that surface drainage does not enter the well. The protective casing and surface cement should extend below the frost line to prevent heaving.

Well Development. Well development is a process of pumping or purging a new monitoring well, designed to stabilize and increase the permeability of the filter pack around the well screen and to restore the permeability of the formation which may have been reduced by drilling operations. The selection of the well development method will be made by the site hydrogeologist based on the drilling methods, well construction and installation details, and the site geology. Monitoring wells should be allowed to set for a minimum of 24 hours before well development to allow for the seal and grout to set. Any equipment introduced into the well will be decontaminated in accordance with the procedures presented in the FAP/QAPP. Water levels will be taken from each well before and after development. To avoid aeration of the filter pack, the water level will not be allowed, to the extent feasible, to fall below the top of the filter pack during development.

Well development may be accomplished using one of several methods including:

- Overpumping, which uses a pump (e.g., submersible or peristaltic) or compressed air (i.e., air lift) to remove water from the well.
- Surge block which uses a plunger, the approximate diameter of the well, to agitate water in and out of the screen. No water is removed from the well.
- Compressed air which develops a well by either backwashing (i.e., forcing water out of the well and reducing pressure to let water flow back in) or surging (i.e., releasing a large volume of air suddenly into an open well below the water table producing a strong surge due to resistance of water head, friction, and inertia). Water is pumped from the well using airlift.

Well development will continue until the turbidity of the discharge water is 50 nephelometric turbidity units (NTUs) or less. Field measurements of turbidity, temperature, pH, and specific conductivity will be recorded for each well volume removed. If the turbidity of the development water is not less than 50 NTUs within a reasonable amount of time, 2 to 3 hours or as specified in the project-specific FAP, field personnel will provide the field data to the Field Operations Leader (FOL) or PM who will contact the NYSDEC PM for guidance on how to proceed. An average of two weeks should be allowed between development and subsequent sampling or water level measurements to allow the aquifer to re-equilibrate.

Well development will be documented in the field notebook and on the Well Development Record (Figure 4.9).

4.5 SAMPLING TECHNIQUES

The rationale for each sampling site location will be identified in the project-specific FAP. For meaningful evaluation of the sample analytical results, it is important that the actual location of the samples be properly documented. If possible, sampling sites will be marked in the field with stakes or flagging. All sampling site locations will be referenced on a base map and on sampling records.

The location and distribution of contaminants at a given site are a function of many factors, including but not limited to:

- site operation or waste disposal practices;
- site design;
- site closure;
- waste characteristics;
- site topography and surface drainage;
- climate; and
- site hydrogeology.

The development of a sampling program requires consideration of the factors listed above and the scope and objectives of the project. Development of a sampling plan to evaluate the distribution and magnitude of contamination at a specific site requires at a minimum:

- an assessment of the site conditions;
- evaluation of the methodology and results of any previous sampling and analysis programs which may have been completed at the site; and
- definition of the scope and objectives of the project.

The techniques described herein are those normally employed by MACTEC. They have been selected to provide a practical and efficient means of obtaining samples in a manner consistent with safety protocols and QA/QC requirements. Additionally, they employ equipment that is normally available for use.

All samples collected will be logged in the field at the time of sampling by the field scientist.

At the time samples are obtained, the following must be recorded by the sampler in the field logbook and/or on sample data sheets:

- sample site location (e.g., grid coordinates baseline station and offset, or the location plotted on a map or aerial photograph);
- sample type;
- date and time of sampling;
- project and sample designations;
- sample identification; and
- analyses requested.

For laboratory samples, the sampler must initiate COC procedures and describe the sample site in adequate detail to allow the analytical results to be properly interpreted and, if necessary, to allow collection of additional samples from the same sample location. MACTEC uses labels and standardized record forms to expedite this process and ensure uniformity of records. The sampling protocols and recordkeeping requirements for the types of samples described in the following pages vary according to the sampling techniques. Additional requirements may also be established on a project-specific basis.

4.5.1 GeoProbe® Sampling

A GeoProbe® sampling rig may be used at the site to collect soil, groundwater, or soil vapor samples. The project objectives and DQOs for the GeoProbe® sampling will be described in the project-specific FAPs.

4.5.1.1 GeoProbe® Subsurface Soil Sampling.

The qualified field person shall collect soil samples for physical and analytical testing and geologic classification during completion of soil borings and direct push explorations. The soil samples shall be collected from pre-determined sampling intervals or, whenever subsurface conditions warrant. The latter condition shall be determined by the qualified field person.

The samples for laboratory analysis shall be collected using a split-spoon (soil borings) or sampling probe with disposable acrylic liner (direct push). The collection of the samples shall be in accordance with the following procedures:

1. Remove the rods and sampler from the borehole/exploration. Open the sampler by unscrewing the cutting shoe and retrieve the liner containing the soil sample. In the case of direct push explorations cut open the acetate liner. Recovered soils contained in the sampler shall be characterized using the USCS, as described previously.
2. Scan the soil sample with a PID and record measurements.
3. Collect sample for chemical analysis as described for Surface Soil Sampling.
4. Decontaminate the sampling device.
5. Record the boring lithology on a Soil Boring Log (Figure 4.4).

Information regarding sample location, depth, and character shall be recorded on the Soil Boring Log (Figure 4.4).

4.5.1.2 GeoProbe® Groundwater Sampling.

A direct-push sampling system (e.g., GeoProbe® or equivalent) may be used to obtain discrete groundwater grab samples.

A direct-push system advances a steel probe assembly to the desired depth. Groundwater samples are collected by allowing formation water to flow into a slotted probe tip or wire rapped stainless steel screen. Water within the probe is purged and sampled from inside the rod assembly using small-diameter tubing and a low-flow rate sampling pump, or a small-diameter bailer. The collection of groundwater grab samples via the direct-push method is dependent on sufficient saturated thickness of overburden soils and an adequate rate of inflow through the probe tip.

Sequential (vertical profile) sampling may be performed by driving the probe assembly to a predetermined depth and collecting a sample. Following sample collection, an additional section of riser is connected, and the sampling device is driven to the next sampling interval, where another sample is collected. Non-dedicated pumps and tubing shall be decontaminated and dedicated tubing shall be discarded between sample collection intervals.

A groundwater grab sample also may be collected from a small-diameter well that has been installed in a direct-push boring.

Groundwater sample collection data shall be recorded on the Groundwater Grab Sample Field Record log sheet (Figure 4.10) and in the field logbook.

4.5.1.3 GeoProbe® Soil Vapor Sampling.

Soil vapor samples will be collected using a GeoProbe® sampling device to evaluate the potential vapor migration of contaminants from the groundwater. Field data and observations will be recorded on the GeoProbe® Soil Vapor Sampling Record (Figure 4.11) and, if appropriate, the Soil Vapor Probe Construction Diagram (Figure 4.12).

The GeoProbe® rods will be pushed to the desired sampling depth (expected to be below the rain infiltration line, but above the water table fringe zone). Soil vapor collected just above the water table will give an indication of the possible vapor migration from potentially contaminated groundwater.

Procedure for GeoProbe® Soil Vapor Sample Collection

Soil vapor samples will be collected from the GeoProbe® points using either the GeoProbe® PRT system, or through open GeoProbe® rods. To sample through the open rods, the rods are pushed down to the target depth and then pulled back slightly, allowing a disposable point to drop off the bottom and expose the bottom of the open (hollow) rods to the soil. The rods will be sealed with O-rings at the joints and have a 1/4-inch tubing attached to the top for vapor purging and sample collection. To sample with the GeoProbe® PRT system, a specialized point is attached to the end of the GeoProbe® rods. The PRT point is also exposed to the soil by allowing a disposable tip to drop off the bottom of the rods when the rods are backed out slightly. This PRT point allows a ¼-inch tubing to be threaded directly to the bottom of the rods, for a small discrete sample point. The tubing is run to the surface and connected directly to the sample collection device. In addition, for both techniques the outside of the rods will be sealed at the ground surface with pre-hydrated bentonite. Approximately 1 liter of soil vapor, plus the volume of the tubing or rods, will be purged using a personal air monitoring pump before collecting samples. During the soil vapor purge, vapors will be screened with a PID. In addition, helium leak tests will be conducted on a subset of samples to ensure samples are representative of sub-surface conditions and not outdoor ambient air. Helium leak tests will be conducted by encapsulating the sample point (such as with a bucket sealed to the ground surface with bentonite), while allowing the tubing to be purged from outside the encapsulated area. The encapsulated area will be filled with helium, but care will be taken not to pressurize the enclosure. The soil vapor sample port will be tested for helium breakthrough with a portable monitoring device (such as the Radiodetection MGD-2002 Multi-Gas Locator) both before and after collection of the soil vapor sample. If greater than 10 percent of the tracer gas is detected in the screening sample, the sample point seal will be enhanced and the procedure repeated. Soil vapor samples will be collected with either 1.4-liter SUMMA®-type canisters with flow valves (set to approximately 20 minutes per sample), or with Tedlar bags (Tedlar bags may be filled using either a Vac-U-Chamber®, or with a syringe with a three way valve).

SUMMA® canister sample collection

- Place SUMMA® canister adjacent to the temporary sampling port.
- Record SUMMA® canister serial number on sampling summary form and COC.
- Record sample identification on canister identification tag, and record on sampling summary form and COC.
- Remove plastic cap canister fitting.
- Open and close canister valve.
- Record gauge pressure on sample summary form and COC. Gauge pressure must read >25 inches Mercury (Hg). Replace SUMMA® canister if gauge pressure reads <25 inches Hg.
- Connect canister to silastic tubing already connected to the subsurface probe.
- Open canister valve and in-line stainless steel valve to initiate sample collection.
- Record date and local time (20-minute basis) of valve opening on sampling summary form and COC.
- Take digital photograph of SUMMA® canister and surrounding area.
- Upon completion of 20 minute sample collection, record gauge pressure on sampling form and COC.
- Record date and local time (20 minute basis) of valve closing on sampling form and COC.
- Close canister valve.
- Disconnect silastic tubing and recap pressure gauge.
- Remove SUMMA® canister from sample collection area.
- Remove temporary probe from hole. Fill hole with a quick drying hydraulic cement.

Tedlar bag sample collection using Vac-U-Chamber®

The sampling line will be connected to a Vac-U-Chamber® Tedlar bag sampling box containing a one liter Tedlar sample bag. The external pump is then connected to the purge port and the soil vapor sampling probe will be purged for two minutes prior to sample collection. After purging the system, the external pump is connected to the vacuum port and the Tedlar bag is allowed to inflate. Upon complete inflation of the Tedlar bag, as observed through the Vac-U-Chamber® viewing window, the Tedlar bag valve is closed and the sample is labeled with the unique sampling location identification code. Upon completion of sampling, the rods and slotted screen are removed from the vapor point and decontaminated. For QC purposes, one duplicate sample will be collected for every twenty sample locations. If QC samples are collected, the duplicate sample will be collected by inserting a tee connector in the sampling line and filling two Tedlar bags from one probe at the same time.

<u>Tedlar bag sample collection using syringe with a three way valve</u>

The sampling line will be connected to the bottom port of a three way valve system. A 60 to 100 milliliter (ml) syringe is then connected to the top purge port. The sampling line valve and the purge port are opened and the syringe is filled. The sampling line valve is then closed and the side port is opened. The syringe is this emptied and the side port is closed. A one liter Tedlar sample bag is connected to the three way valve side port. The sampling line valve and the purge port are opened and the syringe is filled again. The sampling line valve is then closed and the side port is opened. The contents of the syringe are then purged into the Tedlar bag. This process is continued until the Tedlar bag has been filled.

4.5.2 General Soil Sampling Methodology

Development of a soil/sediment sampling plan to evaluate the distribution and magnitude of contamination at a specific site requires at a minimum:

- an assessment of the site conditions;
- evaluation of the methodology and results of any previous sampling and analysis programs which may have been completed at the site; and
- definition of the scope and objectives of the project.

A number of techniques have been developed to obtain samples from various depths below the ground surface. The techniques described herein are those normally employed by MACTEC. They have been selected to provide a practical and efficient means of obtaining samples in a manner consistent with safety protocols and QA/QC requirements. Additionally, they employ equipment that is normally available for use.

The selection of sampling techniques to be employed at a given site is based upon the depth from which samples must be obtained, the types of exploration, and/or the nature of the soils to be sampled. The sampling techniques are categorized by the depths or the types of explorations from which they are obtained:

- surface soil samples, from depths of less than 6 inches (or at depths designated in the project FAP;
- subsurface soil samples from test borings and GeoProbe® explorations at variable depths; and
- sediment samples from depths of less than 6 inches (see Subsection 4.5.4).

All soil samples collected will be logged in the field at the time of sampling by the field scientist. Soils shall be classified in accordance with the USCS, Figure 4.6. Soil samples will be described fully on the appropriate sampling logs (Figures 4.3, 4.4, 4.13 and 4.14).

At the time samples are obtained, the following must be recorded by the sampler in the field logbook and/or on sample data sheets:

- sample site location (e.g., grid coordinates baseline station and offset, or the location plotted on a map, site plan or aerial photograph determined using appropriate measurement methods);
- sample type and depth;
- date and time of sampling;
- project and sample designations;
- sample identification; and
- analyses requested.

For laboratory samples, the sampler must initiate COC procedures and describe the sample site in adequate detail to allow the analytical results to be properly interpreted and, if necessary, to allow collection of additional samples from the same sample location. MACTEC uses labels and standardized record forms to expedite this process and ensure uniformity of records. The sampling protocols and recordkeeping requirements for the types of samples described in the following pages vary according to the sampling techniques. Additional requirements may also be established on a project-specific basis.

4.5.2.1 Collection of Soil Samples for VOC Analysis

The purpose of this section is to outline the steps associated with field preservation of soil samples for volatile organic analysis (VOA) in accordance with USEPA Method 5035A (USEPA, 1996). Specific steps and details are described for the primary tasks of sample container preparation, soil sample collection, sample container management and documentation, sample analysis, and target compound quantitation.

Soil and sediment samples will be preserved in water or sodium bisulfate solution (low concentration) and methanol (high concentration) at the time of sample collection. Soils will be obtained from sampling devises (i.e., hand augers, split spoons or other auger sample collection apparatus, GeoProbe® cores) using plastic syringe samplers used to reduce exposure of samples to air. Approximately 5 grams of soil for low concentration VOC and 10 grams of soil for high concentration VOC vials will be immediately transferred to a vial containing a pre-measured amount of preservation fluid. Vials will be transported to the laboratory for analysis using procedures specified in the FAP/QAPP.

- For low concentration VOCs, two vials will be collected at each location. Vials are preserved with a sodium bisulfate solution or frozen within 48 hrs of collection. When freezing water preserved samples, vials should rest on their side to prevent glass from cracking during freezing.
- For VOCs, one high concentration methanol vial will be collected at each location.
- For locations selected for matrix spike analysis, the number of vials will be tripled (6 low and 3 high concentration vials).

Equipment and Supplies

- 40 ml glass VOA vial Teflon lined silicone septa lids filled with preservatives by the laboratory and pre-weighed.
- 20 ml plastic sampling syringe
- analytical balance capable of weighing to 0.1 gram
- utility knife
- stainless steel spatula
- vial storage cooler
- water resistant sample labels
- water proof marker
- Field Data Record

Sample Container Preparation

Sample containers used for the collection of off-site VOA samples will be prepared in advance at the off-site laboratory. Container preparation by the off-site laboratory will include attaching labels, adding preservation fluid, weighing sample containers, and recording all information necessary to document container preparation and to calculate sample weight and target analyte concentrations during subsequent sample analyses. Developing and implementing the exact procedures for container preparation will be the responsibility of the contract laboratory. The following requirements are provided to the contract laboratory for incorporation into the off-site laboratory procedures:

1. Containers will be prepared for each VOA sample.
2. The sample container will consist of a wide mouth glass vial appropriate for VOA soil samples. The container must contain a Teflon lined cap with an air tight silicone or phenolic septa.
3. A water resistant sample label will be attached to each container. Each sample container will be assigned a unique sample container tracking number that is marked on the container label with permanent waterproof ink. The label will have room for field samplers to record sample identification (ID), date sampled, time sampled, and initials.

4. Low concentration VOA vials will contain a stirring bar and 5 mL of water. High concentration VOA sample containers will be filled with 10 ml of purge and trap grade methanol. The lot number of the methanol must be recorded. If possible, the laboratory will use a single methanol lot for the preparation of all VOA containers, or the laboratory should use as few lots as necessary for the program.
5. Sample container caps will be firmly capped to create an air-tight seal. Containers will be weighed and container weights will be recorded to the nearest 0.1 gram. No other tape or packaging material will be added to the containers. The laboratory will mark the approximate level of the methanol on the vial with a permanent marker. Containers will be stored in a designated location that does not contain other environmental samples or standards until shipment to the field. Containers will be shipped to the field office.
6. The laboratory will maintain container preparation records. Record keeping can be done using a bound notebook or preprinted forms. Records must contain all information necessary to document container preparation steps and calculate soil weights for each sample. These records will be submitted as laboratory notebook records with the analytical data deliverable packages. At a minimum the following information must be recorded:
    - preparation dates
    - container tracking number for each container
    - manufacturer and lot number of the containers
    - methanol supplier and lot number
    - pre-sampling weight of container and methanol (with cap and label on) recorded to the nearest 0.1 gram
    - signature or initials of the individual preparing the containers
    - additional fields for entering the post-sampling weight of container and the calculated weight of soil added to the container during sampling
    - signature or initials of individual recording and calculating final weights
7. Containers will be stored at the field office in a dedicated area away from samples of sources of contamination. After sample collection and shipment to the laboratory, containers will be re-weighed by the off-site laboratory sample manager and the weights will be recorded into the container preparation records for use in calculating the actual soil weights for each sample.
8. **A separate sample vial filled with soil will be submitted for percent moisture determination in association with each soil sample that is collected from any location where only a VOC sample is collected.** The moisture sample will be collected using the same technique as the preserved sample. The laboratory will homogenize the sample (without decanting standing water) prior to collecting an aliquot for moisture determination.

9. Samples will be analyzed in accordance with purge and trap procedures specified in the analytical method specified in the project-specific FAP. **The laboratory will shake VOC high concentration samples as described in the referenced analytical methods prior to taking a methanol aliquot for analysis.**

<u>Sample Collection</u>

Sample collection will be performed with a disposable plastic syringe. The appropriate volume of soil collected in the syringe will be estimated prior to sampling to collect the appropriate weight of soil specified in Section 2.0. Field personnel will make note of preservation fluid levels on the sample containers to ensure no significant loss had occurred. Field personnel are responsible for ensuring that sample containers remain on ice at all times. The specific steps and details for soil sample collection are outlined below:

1. Using a clean utility knife or other sharp knife carefully cut of the tapered end of the 20 ml plastic sampling syringes. Take care to remove the tapered portion without removing significant portions of the body or tube of the syringe. Sampling syringes are disposable and are not to be reused after collecting a sample.
2. Transport sample containers in cooler with bagged ice. Keep sample containers in individual zip lock bags.
3. Obtain PID readings from the sample surface.
4. Samples are collected by capturing a representative sample within the sampling syringe and transferring the soil to the VOA vial. **For low concentration VOCs, two vials will be collected at each location. One high concentration methanol vial will be collected at each location (see method summary).** If samples are collected using split spoons or a GeoProbe ® sampler, samples will be collected from the soil core immediately upon opening the sampling devise. If samples are collected from hand augers samples will be collected from within the auger core. For surficial sediments or test pits, samples will be collected directly from the sampling location substrate. Push/advance the sampling syringe into the center of the sample core/location filling the soil sampling syringe to the target level volume. Pull the syringe plunger back further to apply suction on the soil sample which will help it to remain in the syringe during removal. Separate the syringe sample from the remaining soil. Remove the syringe. If the proper volume of soil is not present, repeat the procedure until the proper volume of soil has been collected. If necessary, use a stainless steel spatula to fill the syringe with the needed soil volume. If rocks are present in the sample it may be necessary to extrude the sample from the sleeve, select a portion of the core sample that is void of large rocks, and then advance the sampling syringe. If

possible, the sample volume should consist of sand, silt or clay and contain very few rocks or pebbles.

> **Note: If matrix spike/matrix spike duplicate (MS/MSD) samples are required, additional sample volume is necessary. Low Level Concentrations require 2 vials of deionized (DI) water and 1 vial of Methanol. Methanol is used to screen the sample. These screening results are interpreted and the appropriate analysis is performed.**

5. Remove a sample container from the cooler. Carefully extrude the soil sample from the syringe into the sample container. This task should be done slowly and carefully to insure that the preservation fluid does not splash from the sample container. A second vial used for moisture determination will be collected for all soils collected below standing water or at any location where only VOC samples are collected. The samples will be collected using the same sample syringe and coring technique used for the actual field sample. The sample jars will be labeled "percent moisture determination for VOA" with the sample label also containing all other sample information including sample ID, date and time sampled, and sampler initials. The laboratories will be instructed to homogenize the VOA percent moisture sample in the jar prior to removing an aliquot for moisture determination to simulate actual sample moisture added to the methanol vials.
6. Syringes should be discarded immediately after extruding sample from syringe; do not reuse. If split samples are collected, care must be taken to make the samples equally representative (i.e., collected from the same part of the soil core).
7. Replace container cap as soon as possible.
8. With permanent waterproof ink fill out the sample container label with the following information: date, time, location, depth of sample, sample ID code, sample type (i.e., regular, duplicate, matrix spike, matrix spike duplicate), and sampler initials. The approximate level of the methanol will be marked on the sample vial. <u>Do not tape over the sample container label.</u>
9. Make sure the sample container lid is screwed down tightly. <u>If necessary wipe excess soil from the mouth of the container to get an air-tight seal.</u> Place the sample container back into the zip lock bag. Place the container and bag into the cooler taking care that the sample container remains upright. Keep samples on ice until they are submitted to the sample manager.
10. Complete the appropriate FDR and release the samples to the sample manager.

<u>4.5.2.2 Surface Soil Sampling</u>

Shallow soil sampling provides samples of surface and near surface soils suitable for chemical analysis. Shallow soil samples are usually obtained by using one of the following devices:

- split-spoon sampler
- hand auger or corer
- trowel or spoon
- spade
- GeoProbe®

The split-spoon sampler is described in detail in Subsection 4.5.1.1. Two distinct types of hand augers are available: a cup-type auger and a screw-type auger. Use of either device is generally limited to the upper portion of the soil profile (i.e., less than 5 ft). These augers are best suited for obtaining composite samples from relatively shallow depths and in relatively loose soils. Use of trowels or spades is straightforward but usually limited to sampling very shallow depths (i.e., less than 18 inches).

Soil samples can be either grab or composite, depending on the objective of the sampling program described in the project-specific FAP. In grab sampling, the soil jar is filled directly. In composite sampling, several methods are available:

- Samples can be composited over depth at a single location.
- Samples can be composited laterally, in which one sample comprises several, usually three or four, soil specimens from the same depth in the vicinity of the sampling site.

During composite sampling, several depths or locations are selected and a stainless steel bucket is filled with samples from all locations. The material is then mixed and put into appropriate containers. Samples for VOCs are not mixed. A specific location is chosen and the sample is placed immediately in the appropriate containers with as little agitation or disturbance as possible.

Immediately after taking a sample, COC procedures are initiated and the Surface Soil Sample Data Record (Figure 4.13) is completed. Information recorded on the FDR will include the sample type, depth, date, time and sample identification. Any special observations (staining, odor, etc.) will also be recorded in the "Notes" portion of the FDR.

4.5.2.3 Subsurface Soil Sampling

Sampling during soil boring allows collection of soil samples from depths greater than 5 ft below ground surface. Borings are advanced using a variety of methods including HSA, drive-and-wash casing, or spun-and-wash casing methods. The boring method chosen is based on subsurface conditions and the method will be specified in the project-specific FAP.

Split-spoon Soil Sampling. Soil boring samples are taken from undisturbed soil at the bottom of the boring with a split-spoon sampler. This sampler consists of a split steel tube or sample barrel threaded at both ends. A sharpened drive shoe secures the bottom of the barrel and an adaptor secures the top. The adaptor is threaded to connect directly to the drill rods and contains a check valve (Figure 4.15). The split-spoon is driven into undisturbed soil below the casing using the standard penetration test (ASTM-D-1586-99) (ASTM, 1999) (Figure 4.15 and Figure 4.16). The standard penetration test consists of driving a 2-inch outside diameter (OD), 2-ft split spoon 24 inches into the soil at the end of the drilling rods using a 140-pound hammer dropped 30-inches. Blows per ft are recorded as a SPT-N value defined as total blows for the penetration from 6 to 18 inches. If the split-spoon is to be driven greater than 24 inches, or will be larger than 2-inch OD, this will be specified in the project-specific FAP.

After the sampler has been driven, it is withdrawn from the borehole and the sampler is opened by removing the drive shoe and adaptor. The field scientist will take custody of the sampling device as soon as it is withdrawn from the borehole. The sample will be collected and documented in the field logbook and on the Soil Boring Log (Figure 4.4) in accordance with the following procedures:

1. Scan the soil with a PID and record field measurements.
2. Visually examine the sample and record its characteristics (e.g., texture, color, consistency, moisture content, layering and other pertinent data) and classify using the USCS (ASTM-D-2488-09a, ASTM-D2487-10) (ASTM, 2009, 2010), Figure 4.6.
3. Remove the portion(s) of the sample selected for chemical analysis and place into appropriate containers using a clean spatula. Soil intended for VOC analysis should be placed in the

appropriate wide-mouth glass jar and capped as quickly as possible. The containers should be filled as near to capacity as possible to minimize volatilization of the sample into the container headspace. Soil intended for other types of analyses should be placed in appropriate containers and capped.

4. Place the remainder of the sample in an 8- or 16-ounce (oz) reference jar if specified in the project-specific FAP. This sample portion will be used for headspace PID measurement and for any physical materials testing that is required.
5. Discard excessively disturbed or loose material found in the sampler that may not be representative of the interval sampled. This material will be discarded in the same manner as the drill cutting at each boring location.
6. Decontaminate the sampling device in accordance with the procedures specified in Subsection 4.3.2.

In some instances, there may be no analytical samples collected from a given boring. In these instances, steps 2 and 3 of the procedure listed above are omitted and the sample is placed in one or more reference jars.

Immediately after the samples are collected, the boring log is also updated by the field scientist. Boring logs may be completed by the driller but for purposes of completeness and documentation a separate boring log is also compiled by the MACTEC field scientist. The boring log includes interpretations of subsurface materials and conditions encountered, sample locations, PID readings, and other notes pertinent to how the boring was conducted or conditions encountered during sampling, such as staining, odor, etc. The boring log will be completed in a site field logbook and/or on a Soil Boring Log (Figure 4.4).

The sampler must exercise considerable care while collecting samples for analysis. Some methods for sample collection are described below.

1. Obtain samples from undisturbed soil below the casing or auger. This is accomplished by monitoring or checking the drill crew's measurements, observing the sampling process and examining the sample once it is retrieved.
2. Carefully remove and discard portions of the sample that are suspected to be contaminated by contact with the casing, auger, or drilling fluids.

3. Conserve sample volume since under certain soil conditions it may be difficult or impossible to achieve good sample recovery with split-spoons.

Procedures employed to minimize cross-contamination during test boring sampling operations include the following:

- Samples are taken immediately after the boring is advanced to the desired sampling depth.
- The sampling tools are decontaminated prior to taking each sample.
- The drilling contractor is not permitted to use oil, grease or other petroleum-based lubricants on the drill rods, casing or sampling tools. Use of any other lubricants will be documented.
- The drilling technique and procedures to be used, particularly the use of drilling fluids, are carefully evaluated for each site.

4.5.3 Methanol Extracted Rock Chip Sampling

The analysis of rock chip samples collected from fracture zones within rock core samples provides data that may be used to evaluate the distribution of VOCs in rock matrix and potential presence of product in the fracture zones. This method of sampling is used in conjunction with rock core drilling techniques. Rock chip samples are usually obtained by using the following devices:

- Drill equipment – rig, core barrel, etc.
- Clean tested water supply
- Pre-weighed 8 or 12 oz clear wide mouth jars (or appropriate size to accommodate core)
- 40 ml amber vials/sample labels/tape
- Purge and trap grade methanol
- Syringes and pipettes
- Balance
- Notebook/field book/rock core logs
- 6 foot folding rule
- Rock hammer and coal chisel
- Core boxes

- Indelible markers
- Stainless steel bowl
- Cooler, ice, zip lock bags, paper towels
- Chain of custody forms/seals

Rock core samples retrieved from a borehole are examined for the presence of natural hydraulically active fractures. The face of a selected fracture is chipped away using a rock hammer, chisel, or rock saw, depending on the nature of the cored bedrock fracture material. Following extraction of the fractured rock interval from the drilling core barrel (depending on the nature of the fracture use of a rock saw may or may not be required), selected fracture face material (i.e. natural fracture rock chips) will be chipped away from the fracture face, pulverized into smaller flakes, and placed in a 8 oz clear wide mouth sample jar or collected in a stainless steel bowl and immediately transferred to a sample jar. The same method is appropriate for sampling rock matrix in proximity to fracture surfaces. Approximately 50 grams of the fractured rock material will be collected. The sample container will be capped. The sample will be weighed to determine the weight of the rock chips/fragments. Final weight will be recorded in the field notebook. The jar will be re-opened and approximately 50 ml of purge and trap grade methanol will be introduced into each sample jar. If necessary, a larger volume of methanol will be used to cover the rock fragments. Caps will be added to the sample jars. The methanol volume will be recorded in the field notebook. The sample will be agitated for one to two minutes and then allowed to sit. After several hours the sample will be re-agitated for approximately one minute and then be allowed to bathe in the methanol for a period of 24-48 hours.

After allowing the sample to soak for 24 to 48 hours, a disposable pipette will be used to collect an aliquot of methanol from the wide mouth sample jar. Approximately 20 ml of the methanol will be transferred to a 40 ml vial and cap (avoiding stirring up the fine particles in the vial). The sample identification information will be recorded on the sample label and attached to the vial.

Samples will be analyzed by purge and trap analysis using USEPA Method 8260B procedures developed for high concentration soils. Sample collection data along with the analytical results from the laboratory will be used to determine total mass of target compounds present in the fracture zone. Detection levels will be approximately 5 micrograms (µg)/core sample for target VOCs reported by the laboratory. The following calculation will be used to determine total mass of a detected target compound:

Mass of Compound (µg) = (A * B * C)/D

A = Concentration of Aqueous Analysis in micrograms per liter (µg/L)
B = Purge and trap purge volume in L
C = Volume of methanol used during sample collection in ml
D = Volume of methanol extract used during analysis in ml

Detection limit example:

5 µg = (1 µg/L * .005 L * 100 ml)/.1 ml
The sample jars should be stored at less than 20 degrees Celsius and should be disposed of if exposed to any volatile vapors or fumes (i.e. gasoline, diesel).

Information and data such as; date, boring ID, overburden thickness, total depth, and other details will be recorded in the field logbook. The sample collection information will be used in calculations of volumes of VOCs present in the rock core.

4.5.4 General Water Sampling Methodology

The location and distribution of contaminants at a given site are governed by many factors, including:

- site operation or waste disposal practices;
- site design;

- site closure;
- waste characteristics;
- site topography and surface drainage;
- climate; and
- site hydrogeology.

Development of a water sampling plan that will effectively reveal the distribution and magnitude of contamination at a specific site requires:

- an assessment of the factors listed above;
- evaluation of the methodology and results of any previous sampling and analysis program which have been completed at the site; and
- definition of the scope and objectives of the project.

4.5.4.1 Surface Water Sampling

The technique for surface water sampling must be selected after addressing such items as:

- depth of water body;
- flow rate;
- stratification;
- specific gravity/solubility of anticipated analytical parameters;
- seasonal variations; and
- analytical parameters of interest.

The exact location of each surface water sample will be established in the field at the time of sampling. General sampling areas will be presented in the project-specific FAP. If surface water samples are to be collocated with sediment samples, surface water samples should always be collected before the sediment sample. The sample site will be noted on a site plan or aerial photograph and marked in the field with flagging and/or a wooden stake. The stake will be labeled with the sample site number.

The sample will be taken in the following manner:

1. Collect the sample from the surface water body by immersing a clean sample bottle. If a stream is being sampled, collect the sample while facing upstream with the opening of the sampling device oriented upstream but avoiding floating debris.
2. Or, directly fill the appropriate sample containers from a sampling device if one is needed.
3. Measure the following parameters, if possible, in the water body, not the sample:

    - PID reading;
    - temperature;
    - pH;
    - specific conductance;
    - elevation of significant surface water bodies; and
    - any other project-specific field measurements required.

    If direct measurement is not possible, measure these parameters from water remaining in the sampling device or another sample bottle. This information will be recorded on the Surface Water and Sediment FDR (Figure 4.14), sample labels will be completed, and COC procedures will be initiated.
4. Complete the sample data record and field logbook entry. Include any observations of special conditions such as color, odor, etc.

4.5.4.2 Pore Water Sampling

Pore water samples will be collected to locate contamination in groundwater discharge areas (i.e. ponds, steams, etc) in regions down gradient of suspected source areas. Impacted groundwater may then be traced up gradient from the discharge areas to the contaminant source. Pore water samples are usually collected using the following items:

- Peristaltic pump capable of a flow rate between 50 and 500 ml/minute and appropriate power supply.

- Field probe and flow-through cell (e.g., YSI) for measuring pH, temperature, conductance (and/or specific conductance), DO and oxidation-reduction potential (ORP) of groundwater, and a turbidity meter.
- DO meter
- Pore water sampling device, a 3/8-inch stainless steel slotted tip probe consisting of two parts; a strengthening rod and the pore water sampler, or a hollow tube with small holes in the tip to allow groundwater to percolate through.
- Calibration solutions for the field probes
- Water level tape
- Tubing, connections and tools as appropriate
- Graduated cylinder and stopwatch
- Groundwater grab FDR
- PPE
- Decontamination supplies (e.g., DI water, Liquinox soap, paper towels)
- Sample containers and cooler (provided by the laboratory)
- Ice for sample preservation
- Clean plastic sheeting, paper towels and miscellaneous supplies

The exact location of each pore water sample will be established in the field at the time of sampling. General sampling areas will be presented in the project-specific FAP. The sample site will be noted on a site plan or aerial photograph and marked in the field with flagging and/or a wooden stake. The stake will be labeled with the sample site number.

The sample will be taken in the following manner:

1. The pore water sampling device is inserted into the river/stream bed location to a desired depth, deep enough as to ensure the sample collected will contain only groundwater and no surface water.
2. The strengthening rod is then removed from the pore water sampling device, and the pore water sampler is then connected to the peristaltic pump using the appropriate tubing.
3. The pump is then turned on, allowing for the removal of particulate.

4. The DO concentrations will then be measured and compared to the associated surface water DO concentrations to ensure that the representative sample is not surface water.
5. Low flow purging and sampling protocol is not required, but may be conducted if desired.
6. During purging, collect at least one set of field parameters (turbidity, D.O., specific conductivity, temperature, pH, ORP) using a flow through cell (the flow through cell cannot be used for turbidity measurements and the sample for turbidity measurement must be collected prior to entering the flow through cell).
    - Turbidity (+/- 10% for values >10 NTU)
    - DO (+/- 10%)
    - Specific conductivity (+/- 3%)
    - Temperature (+/- 10%)
    - pH (± 0.1 unit)
    - ORP (± 10 millivolts)
7. During purging and sampling the tubing should remain filled with water.
8. Disconnect the tubing from the flow through cell to collect the analytical samples. Water samples for laboratory analyses must not be collected after water has passed through the flow through assembly. Fill sample containers directly from the tubing without alterations to the pumping rate.
9. The VOC fraction shall be collected first. The VOC sample container shall be completely filled without air space within the container. The remaining samples shall be collected for polynuclear aromatic hydrocarbons (PAHs), PCBs, metals, and any other fraction specified in the project-specific FAP for the sample location.
10. For subsequent sampling efforts, duplicate the pump intake depth and final purge rate from the initial sampling event (use final pump dial setting information).
11. The pore water sampling device and associated strengthening rod will be decontaminated appropriately before further use (See Section 4.3)
12. Complete the Low flow Groundwater Sampling Record (Figure 4.17) after each pore water sample is collected. Include any observations made during sampling such as color, odor, etc., in the field logbook and field sample data record.

4.5.4.3 Groundwater Sampling

Sampling of groundwater monitoring wells will proceed from the upgradient or background wells to the downgradient or potentially contaminated wells, as best as can be determined. Appropriate groundwater sampling techniques will be identified in the project-specific FAP, and approved in advance by NYSDEC. The following activities shall be performed immediately prior to purging each well:

1. Check the well for proper identification and location.
2. Measure and record the height of the protective casing above ground surface.
3. After unlocking the well and removing any well caps, measure and record the ambient and well-mouth organic vapor levels using a PID.
4. Measure and record the distance between the top of the well and the top of the protective casing.
5. Using the electronic water level meter, measure and record the static water level in the well and the depth to the well bottom to the nearest 0.01 ft. Measurements will be referenced from the top of the well riser as opposed to the protective casing, when feasible. The point of measurement and the depth to water will be recorded in the logbook and Groundwater Sample Data Records (Figure 4.10 and Figure 4.17). The water level meter is decontaminated upon removal as described in Subsection 4.3.3. In areas where light non-aqueous phase liquids (LNAPLs) are anticipated, an interface probe will be used to measure the thickness of free product present.
6. Calculate the volume of water in the well. Volume in gallons for a well equals 0.041 times the square of the ID of the well riser, in inches, times the depth of water, in ft. Volume calculations are detailed on the Groundwater Sample Data Record.

4.5.4.3.1 Groundwater Sampling Using Three Purged Well Volumes

The following steps outline the purging and sample collection activities for purged well volume sampling.

Upon completion of the measurements and calculations described in Section 4.5.2.2., sampling will commence in the sequence listed below, utilizing the appropriate purging technique (1a, 1b, or 1c):

1. Lower the pump intake into the well. For shallow groundwater situations, the pump intake will be lowered to the top of the well screen to begin purging (see Step No. 2). Modifications to this setup may be used in certain situations:

   a. If the well screen is very large, and pumping from the top is impractical, the pump intake will be lowered to the approximate mid-point of the screened portion of the well.
   b. If the well is situated in tight formations such as tills, clays or rock, the purging of the well will be performed from near the top of the well screen. As the water level in the well is lowered by purging, the pump is also lowered.
   c. If the well is in a highly productive aquifer, purging will progress by purging at intervals in the well screen, from the top of the water column downward, to avoid leaving stagnant water in the well.

   To avoid aeration of the sandpack, the water level will not be allowed, to the extent feasible, to fall below the top of the filter pack during purging except possibly in tight formations (see 1b above), where purging the well (and sandpack) dry can be unavoidable. The selection of the pump to be used for well purging will be presented in project-specific FAP, and approved in advance by NYSDEC.

Considerations in pump selection are depth to water, the level of contamination anticipated, site access, and cost. Readily available choices include peristaltic pumps (good for shallow groundwater depths), disposable submersible pumps, such as a Whale® pump (good for moderate groundwater depths and contamination), and stainless steel/Teflon® submersible pumps, such as the Redi-Flow® (good for most applications). Teflon bailers may also be used (good for shorter water columns).

1. Purge the well. Monitor the field parameters, pH, temperature, turbidity, and specific conductivity, and measure the volume of groundwater being pumped. In situ parameters may be monitored in a beaker filled from the pump discharge or in-line with the pump discharge. Purging of the standing well water is considered complete when any of the following is achieved:
   - a minimum of three well volumes has been purged,
   - the well has been pumped dry and allowed to recharge.
2. Record the in situ parameters, temperature, pH, specific conductivity, and turbidity in the field logbook and Low flow Groundwater Sampling Record (Figure 4.17).
3. After purging, the pump intake or the bailer will be lowered to the middle of the screened interval or mid-point of the static water level. If the analysis to be performed is for LNAPLs, then the bailer will be lowered to the top of the water column for sample collection.
4. Collect the sample(s). VOC samples are filled directly from a bailer or pump discharge with as little agitation as possible. Other samples can be placed directly into the appropriate container from the bailer or pump discharge.

5. Remove the pump or bailer from the well and decontaminate the pump, tubing or bailer by flushing with the decontamination fluid specified in Subsection 4.3.3, or dispose.
6. Complete the Low flow Groundwater Sampling Record (Figure 4.17) after each well is sampled. Include any observations made during sampling such as color, odor, etc., in the field logbook and field sample data record.
7. Secure the well cap and lock.

4.5.4.3.2 Low Flow Groundwater Sampling.

The following steps outline the purging and sample collection activities for low-flow sampling. Data will be recorded on the Low flow Groundwater Sampling Record (Figure 4.17). Pumps and probes may differ depending on the well diameter, groundwater constituents and depth to groundwater, but generally, sampling will require the following equipment:

- Peristaltic, bladder or inertial pump capable of a flow rate between 50 and 500 ml/minute and appropriate power supply. The pump type will principally depend on the depth to water and well diameter. Bladder pumps are preferred; peristaltic pumps are acceptable only for wells where the depth to water is less than about 25 ft; Inertail pumps are only recommended for narrow diameter wells that cannot be sampled using a bladder or peristaltic pump.
- Field probe and flow-through cell (e.g., YSI) for measuring pH, temperature, conductance (and/or specific conductance), DO and ORP of groundwater, and a standalone turbidity meter (e.g. Hach).
- Calibration solutions for the field probes
- Water level tape
- Tubing, connections and tools as appropriate
- Graduated cylinder and stopwatch
- Ring stand setup
- 5-gallon bucket and funnel for purge water
- Low flow groundwater FDR
- PPE
- Decontamination supplies (e.g., DI water, Liquinox soap, paper towels)
- Sample containers and cooler (provided by the laboratory)
- Ice for sample preservation

- Clean plastic sheeting, paper towels and miscellaneous supplies

Field parameter measurements shall be made using instrumentation and a commercially manufactured flow through cell. Dedicated high density polyethylene (HDPE) tubing shall be used. Further details on the low-flow purging and sampling procedure are presented in the "USEPA Region 1 - New England Low Stress (low-flow) Purging and Sampling Procedures for the Collection of Ground Water Samples from Monitoring Wells", Revision 3, January 19, 2010 (USEPA, 2010a). Sample collection information shall be recorded on the Low Flow Groundwater Sampling Record (Figure 4.17). The pH stabilization criteria of +/-0.2 units specified in this subsection shall not take precedence over the pH stabilization criteria of +/- 0.1 units specified in the USEPA guidance. The USEPA guidance shall be used for purging and sampling procedures only.

Sampling will be conducted using the following procedure:

1. Determine target depth for location of the pump intake. Target depth should be the portion of the screened interval that intersects the zone of highest K. If the zone of highest K is unknown, or if the screen is placed within homogenous material, then the target depth shall be the midpoint of the saturated screen length. Primary flow zones should be identified in wells with screen lengths longer than 10 ft.
2. Measure and record the depth to water. Care should be taken to minimize disturbance of the water column within the well during pre-sample measurements.
3. Decontaminate pump prior to use (if pumps are dedicated then this applies to the initial effort only). Attach appropriate length of dedicated HDPE tubing or mark the tubing at the appropriate point so that when the pump and tubing are lowered into the well, and the mark is at the top of the well riser, the pump shall be located at the target depth within the screened interval.
4. Carefully lower the pump to the predetermined target depth. Start the pump at a purge rate low enough to achieve 0.3 ft of drawdown or less based on historical data. If sampling the well for the first time, start the pump at the lowest possible setting (or approximately 100-ml per minute) and slowly increase the speed until discharge occurs. Check water level. Adjust pump speed until there is little or no drawdown (less than 0.3 ft) if possible. If stabilized drawdown cannot be achieved, use the no-purge method described later in this section.
5. Monitor and record pumping rate and water levels every 3 to 5 minutes (or as appropriate) during purging. Record any adjustments to pumping rates.
6. During purging, monitor field parameters using a flow through cell (the flow through cell cannot be used for turbidity measurements and the sample for turbidity measurement must be

collected prior to entering the flow through cell). Purging is considered complete and sampling may begin when the field parameters have stabilized. Stabilization is considered to be achieved when three consecutive readings, taken at 3 to 5 minute intervals, are within the following limits:

- Turbidity (+/- 10% for values >10 NTUs if turbidity is greater than 10 and well is not stable, continue purging well for up to two hours, collect sample and document on field data record and in log book (collection of a filtered sample for metals analysis may be necessary if turbidity is greater than 50 NTUs).)
- DO (+/- 10% for values greater than 0.5 milligram per liter (mg/L). If three dissolved oxygen values are < 0.5 mg/L, consider the values stabilized)
- Specific conductivity (+/- 3%)
- Temperature (+/- 3%)
- pH (± 0.1 unit)
- ORP (± 10 millivolts)

7. The final purge volume must be greater than the stabilized drawdown volume plus the tubing extraction volume.
8. During purging and sampling the tubing should remain filled with water.
9. Disconnect the tubing from the flow through cell to collect the analytical samples. Water samples for laboratory analyses must not be collected after water has passed through the flow through assembly. Fill sample containers directly from the tubing without alterations to the pumping rate.
10. The VOC fraction shall be collected first. The VOC sample container shall be completely filled without air space within the container. The remaining samples shall be collected for PAHs, PCBs, metals, and any other fraction specified in the project-specific FAP for the sample location.
11. For subsequent sampling efforts, duplicate the pump intake depth and final purge rate from the initial sampling event (use final pump dial setting information).
12. If using non-dedicated equipment, remove the pump and decontaminate by flushing with the decontamination fluid specified in Subsection 4.3.3, or dispose. Obtain and record a depth to bottom of well measurement before closing the well.
13. Complete the Low flow Groundwater Sampling Record (Figure 4.17) after each well is sampled. Include any observations made during sampling such as color, odor, etc., in the field logbook and field sample data record.
14. Secure the well cap and lock.

4.5.4.3.3 Groundwater sampling using aqueous diffusion samplers

This procedure is designed to permit the collection of representative groundwater samples for analysis of VOCs. Groundwater sampling using aqueous diffusion samplers will be conducted using the procedures described below and in accordance with the User's Guide for Polyethylene-Based Passive Diffusion Bag Samplers to Obtain Volatile Organic Compound Concentrations in Wells (Vroblesky, 2001).

Aqueous diffusion samplers are constructed by sealing de-ionized water in polyethylene tubing (1-millimeter thickness is typical). Tubing sizes vary, but can be up to 2-feet long. Samplers can be acquired pre-filled with laboratory de-ionized water, or assembled by the sampler. If assembled by the sampler, on option is to seal the de-ionized water in the polytubing by using a heat seal device. One end of the polytube is rolled over onto itself several times then heat is applied to seal this end. The polytube is then filled with de-ionized water. The top end (unsealed end) of the tube is then rolled over onto itself until there is no headspace in the polytube; heat is then applied to seal this end. Care is taken to ensure that no headspace or air bubbles are present in the tube prior to sealing the top end. The samplers are weighted with stainless steel weights, and a stainless steel line is attached to the top of the sampler for placement and retrieval.

The sampling generally uses the following equipment/items:

- Well construction data, location map, and field data from the previous sampling event,
- Diffusion sampler filled with de-ionized water and weight attached to bottom,
- Stainless steel cable of the required length for setting and attaching the sampler,
- Field probe and flow-through cell (e.g., YSI) for measuring pH, temperature, conductance (and/or specific conductance), DO and ORP of groundwater, and a standalone turbidity meter (e.g. Hach),
- Calibration solutions for the field probes,
- Water level tape (0.01-ft accuracy),
- Field Data Record,
- PPE,

- Decontamination supplies (e.g., DI water, Liquinox soap, paper towels),
- Sample containers and cooler (provided by the laboratory),
- Ice for sample preservation, and
- Clean plastic sheeting, and miscellaneous supplies.

Sampling will be conducted using the following procedures:

1. Enter the following information in the field logbook and FDR, as appropriate, prior to installation of the diffusion sampler: date and time of sampler installation, depth of sampler, and total depth of well.
2. Attaching weight to the base of the sampler and stainless steel line to the top of the sampler.
3. Install the sampler at the predetermined depth, attaching the top of the line to a secure location at the ground surface and the well cap should be replaced to ensure surface water does not enter the well. The depth of the sampler will be determined prior to installation, based on previous sampling data or previously collected aqueous diffusion samplers.
4. Allow the sampler to equilibrate for approximately 14 days. Return after no less than 14 days to retrieve the sampler. Samplers can remain in the well for longer than 14 days, if necessary.
5. Enter the following information in the field logbook and FDR, as appropriate, during retrieval of diffusion sampler: date and time of sampler retrieval, analytical method, and quality assurance/quality control data as necessary.
6. Retrieve the diffusion sampler from the well and note any observations on the FDR (possible tears, iron build up, etc.).
7. After retrieving sampler, install an in-well water quality parameter meter such as a YSI 556 or equivalent. Remove the line and weight, and make a diagonal cut toward the top of the sampler. The diagonal cut allows easier filling of the sample containers. A dealer supplied discharge device may also be used.
8. Begin filling the volatile organic compound sample containers from the diagonal cut or discharge device by allowing the water to flow gently down the inside of the container with as little agitation or minimal aeration as possible.
9. Label each sample container upon filling. Placed sample containers into a cooler with ice.
10. After sample collection is complete, record water quality parameter readings and then remove the water quality meter from the well. Cap and lock the well.
11. Complete remaining portions of the FDR after each well is sampled, including sample date and time (time of retrieval from the well), well sampling sequence, types of sample bottles

used, sample identification numbers, preservatives used, parameters requested for analysis, and field observations of the sampling event.

4.5.4.4 Domestic Well Sampling

Domestic wells will be sampled using the same procedures described for groundwater monitoring wells, with the exception of using in-place plumbing equipment. Prior to any sampling, MACTEC personnel will contact the well owner and complete a Groundwater Usage Survey (Figure 4.18). The information provided on the survey will be used to identify downgradient domestic wells.

The sampling point at each domestic well location will be determined at the time of sampling and will be as close to the pump as practical. When possible, samples will be taken up-line from aerators, softeners, or filtering systems. If there is no outlet available up-line from the water treatment system, attempts will be made to by-pass the system, if possible.

When the necessary information is available, the purge volume will be calculated to ensure purging of one storage volume, based on pressure tank volume, before sampling. If such information is unavailable, the tap will be opened and the water will be allowed to run for a minimum of fifteen minutes and until the pH and temperature stabilize. Sample containers will be filled directly from the tap or faucet. Samples will be collected as described for monitoring well samples, except that samples collected for inorganic analyses will not be filtered so that the samples will accurately represent the quality of water ingested by residents.

4.5.5 General Sediment Sampling Methodology

Sediment sampling procedures are designed to obtain representative samples of the sediment from streams, lakes, ponds, wetlands, and lagoons for chemical analysis.

The exact location of each sediment sample will be established in the field at the time of sampling. Sediment sampling points are often collocated with surface water samples. Sediment samples should always be collected after the surface water sample. Sediments in shallow water conditions may be collected without the use of a boat if agitation of sediment prior to collection can be avoided.

Sediment samples will be collected in the following manner:

1. Select the sample location, identify it on a Site map, and set the wooden stake, as close as practicable, onshore. For offshore sampling locations, temporary buoys may be set or the location may be located with global positioning system (GPS).
2. Verify sediment sampling point is within the depositional area identified during the initial Site reconnaissance.
3. Remove large stones and plant debris that are not an integral component of this sediment media. Exercise caution to avoid disturbing the sediments at the sampling point.
4. Use a gravity corer, hand corer, hand auger, trowel, Ponar® dredge, or other equivalent equipment to collect sediment samples. A stainless steel spoon and bowl may be used for locations that are shallow (i.e., less than 6-inches). If the water is shallow enough, push the gravity corer or hand auger directly into the substrate until approximately one inch or less of the sampling device is above the sediment/water interface. If the substrate is hard or coarse, the corer may be rotated gently while it is pushed to facilitate greater penetration and reduce core compaction.
5. Remove the sampling apparatus gently from the sediment to avoid losing the sample, and rise to the surface.
6. Hold the sampling device above the water to allow residual surface water to run off the device. When water is no longer running off the device, transfer the sediment sample to a stainless steel bowl. Collect a minimum of 500 grams of sediment at each location. For example, with the gravity corer, one tube with a 4-inch-long core, 2-inch outside diameter, and wall thickness of 1/8-inch is adequate for one sample, as the volume of each core would be approximately 750 ml. For other tube sizes and core lengths, the number of tubes necessary can be calculated by using the formula for the volume of a cylinder (i.e., $\pi r^2 h$).
7. Sediment samples may have high percent moisture content. Prior to transferring sample aliquots to appropriate containers, standing water should be decanted from the stainless steel bowl.
8. If sediment samples are scheduled for VOC analysis, collect this parameter first. Do not homogenize the sample at this point. For VOC sample collection, preserved (methanol) or unpreserved sampling techniques may be used. The use of preserved sampling techniques is preferred, but unpreserved sampling technique may be used if requested by the NYSDEC PM. The technique to be used will be identified in the project-specific FAP.

Preserved Collection - Advance a latex free, medical grade 10 cubic centimeter (cc) plastic syringe, designed to reduce the exposure of the sediment sample to air, directly into the sediment core or contents in the stainless steel bowl. Transfer the sediment sample into the pre-labeled, pre-preserved and pre-weighed vial and replace the cap. Do not attach any labels or tape to the pre-weighed sample vials. The volume of sediment collected will depend on the volume of methanol. An approximate equal volume of sediment and methanol will be added to the sample vials. Collect an additional sediment jar for percent solids determination. Label this additional jar "VOC percent solid" and the same sample information as the original sample.

Unpreserved Collection – Transfer the sediment sample using a stainless steel spoon or spatula directly to a 2 oz sample container. Fill the sample container completely to reduce the exposure of the sediment sample to air and cap.

9. If Acid Volatile Sulfide: Simultaneously Extracted Metals (AVS:SEM) will be collected, collect the AVS:SEM sample in air-tight syringes to prevent exposure of sediments to oxygen during sample collection and storage. The field samplers will collect approximately 10 grams of sample in each syringe. The filled syringe will be capped immediately. The laboratory must keep the sample in the syringe until introduction to the apparatus. The sample will remain capped until the AVS:SEM apparatus is set up and purged to eliminate oxygen. The sample syringe will be opened and sediment will be immediately transferred to the apparatus. Sample weight will be determined by calculation by weighing the syringe before and after sample transfer.
10. After the AVS:SEM sample has been collected, homogenize the sediment within the stainless steel bowl with a stainless steel spoon so that each sample aliquot is representative of the whole. Take care to ensure that sufficient sediment is present in the stainless steel bowl to fill all of the associated sample fractions (containers) and duplicate fractions, if necessary. Collect the remaining sample fractions (e.g., SVOCs, PCBs, and metals) using a stainless steel spoon and transfer the sediment into the sample containers.

Sediment sampling information is recorded on the Surface Water Sediment FDR (Figure 4.14) and/or in the logbook.

4.5.6 General Air Sampling Methodology

Air sampling work will be performed in accordance with DER-10 Technical Guidance for Site Investigation and Remediation (NYSDEC, 2010a), DER-13 Strategy for Evaluating Soil Vapor Intrusion at Remedial Sites in New York (NYSDEC, 2006a), and the NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York (NYSDOH, 2006).

Substructure soil vapor, soil vapor, and/or ambient air sampling may be used to evaluate human exposure to VOCs through vapor intrusion. Field data from the collection of air samples will be recorded on a field data form (Figure 4.19).

4.5.6.1 24-Hour Substructure Soil Vapor Sampling

Substructure soil vapor samples will be collected from beneath residential, commercial, industrial, institutional, and multiuse buildings using SUMMA® type air canisters equipped with metering flow controllers for the purpose of collecting a "time-averaged" soil vapor sample. This technique is intended for 24-hour sample collection and may be collected in conjunction with indoor air samples. In some instances, 20-minute grab soil vapor samples will be permitted to identify potential VOC contamination beneath the slab (See Subsection 4.5.5.2). Substructure soil vapor samples may be collected from one of the following areas:

Area 1) Subslab soil vapor sample obtained via a temporary installed sampling port through apparent vapor barrier (such as floor slab or plastic liner); or

Area 2) Air sample obtained from crawl space or basement without an apparent vapor barrier.

Substructure soil vapor grab sampling will require the following equipment:

- Documentation of access permission from the owner to complete the sampling
- 6-liter, stainless steel, pre-evacuated SUMMA®-type canister - laboratory provided
- Pressure gauge with integrated 24-hour metering valve - laboratory provided
- Two, 9/16-inch, open-end wrenches
- PID – part per billion range -for screening crawl space/cracks
- Utility Knife
- Electric hammer drill with 1-inch and 3/8-inch diameter drill bits
- Two 50-ft long electrical extension cords
- ¼-inch O.D. Teflon® tubing

- ¼-inch stainless steel valve and stainless steel "tee" type fitting
- 60 cc polyethylene syringe for purging tubing
- 1-inch diameter laboratory grade rubber stopper with ¼-inch port
- Unscented beeswax, pan, and heat plate, or other NYSDEC approved seal.
- Quick-drying expansive Portland cement
- Wristwatch
- Digital camera
- Flashlight
- Indoor Air Quality Questionnaire and Building Inventory Form (Appendix A)
- COC form - laboratory provided

Procedure for Substructure Soil Vapor Sample Collection:

The procedures for substructure soil vapor sample collections will be dependent on location category. During the occupant/owner interview and building survey the lowest accessible portion of the building (e.g., crawl space, basement, or first floor of slab-on-grade construction) will be observed to assess which substructure sampling area category is applicable. The steps provided below should be considered a general guidance on the collection of substructure soil vapor samples for each location category; the sequence can be modified as needed based on site- or project-specific conditions at the time of sample collection.

Area 1: Subslab soil vapor sample obtained via temporary installed sampling port through apparent vapor barrier (i.e. floor slab or plastic liner).

1. **Select and prepare the sample collection point.**
   - Conduct interview with occupant/owner. Complete Indoor Air Quality Questionnaire and Building Inventory Form (Appendix A).
   - Observe the condition of the building floor slab for apparent penetrations such as concrete floor cracks, floor drains, or sump holes.
   - Note the floor conditions on the sampling form and select a potential location or locations for a temporary subsurface probe.

- The location or locations should be central to the building away from foundation walls and apparent penetrations.
- Review the proposed location or locations with the occupant/owner describing how the sampling port or ports will be installed.
- After receiving' permission from the occupant/owner, mark the proposed location(s) and describe the location(s) on the sampling form.
- Using the PID, screen indoor air in the area of floor penetrations such as concrete floor cracks, floor drains, or sump holes. Record the indoor air PID readings on the sampling form.

2. Installation of temporary subsurface sample point

- Drill a 1-inch diameter hole about to 2 inches into the concrete slab using an electric hammer drill.
- Extend the hole through the remaining thickness of the slab using a 3/8-inch drill bit. Extend the hold about three inches into the subslab material using either the drill bit or a steel probe rod. Sweep hole to remove excess dust.
- Insert a section of ¼-inch O.D. Teflon® tubing to the bottom of the floor slab. Seal the annular space between the 1-inch hole and 1/4-inch tubing by seating a tapered laboratory-grade rubber plug perforated with a 1/4-inch hole into the probe hole and if necessary capping the stopper with a beeswax seal, or other seal approved by the NYSDEC. The beeswax will be melted with an electric heat plate.
- Connect the ¼ -inch Teflon® tubing to a stainless steel valve using compression fittings. Open the in-line valve and purge the probe tubing using a polyethylene 60 cc syringe. Close the valve, remove and cap the syringe, and connect the ¼-inch Teflon® tubing and in-line valve to a SUMMA®-type canister. The air/soil vapor syringe will be discharge out of doors. For duplicate sample locations connect a second canister before purging by installing a 1/4-inch stainless steel "tee" fitting between the probe discharge tubing and the stainless steel valve.

3. Preparation of 24-hour SUMMA®-type canister and collection of sample

- Place SUMMA®-type canister adjacent to the temporary sampling port.
- Record SUMMA®-type canister serial number on sampling summary form and COC.
- Record sample identification on canister identification tag, and record on sampling summary form and COC.
- Remove brass plug from canister fitting.
- Install pressure gauge/metering valve on canister valve fitting and tighten. If pressure gauge has additional (2nd) fitting, install brass plug from canister fitting into gauge fitting and tighten.
- Open and close canister valve.
- Record gauge pressure on sample summary form and COC. Gauge pressure must read >25 inches Hg. Replace SUMMA®-type canister if gauge pressure reads <25 inches Hg.
- Remove brass plug from gauge fitting and store for later use.
- Connect subsurface probe to end of in-line particular filter via ¼-inch O.D. Teflon® tubing and "swagelok®-type" fittings.
- Open canister valve and in-line stainless steel valve to initiate sample collection.
- Record date and local time (24-hour basis) of valve opening on sampling summary form and COC.
- Take digital photograph of SUMMA®-type canister and surrounding area.

4. Termination of 24-hour sample collection

- Revisit SUMMA®-type canister approximately at end of sample collection period (e.g., 24 hours after initiation of sample collection) and record gauge pressure on sampling form and COC.
- Record date and local time (24-hour basis) of valve closing on sampling form and COC.
- Close canister valve.
- Disconnect Teflon® tubing and remove pressure gauge / flow valve from canister.

- Reinstall brass plug on canister fitting and tighten.
- Remove SUMMA®-type canister from sample collection area.
- Remove temporary probe and rubber stopper and fill the hole with a quick drying hydraulic cement. Finish flush with floor surface.

Area 2: Air sample obtained from crawl space or basement without an apparent vapor barrier.

1. **Select and prepare the sample collection point**
    - Conduct interview with occupant/owner. Complete Indoor Air Quality Questionnaire and Building Inventory Form (Appendix A).
    - Observe the area for the apparent presence of items or materials that may potentially produce or emit VOCs and interfere with analytical laboratory analysis of the collected sample. Record relevant information on Building Inventory Form and document with digital photographs.
    - Using the PID, screen indoor air in the location intended for sampling and in the vicinity of potential VOC sources (i.e. paints, glues, household cleaners, dry cleaned clothes, etc.) to assess the potential gross presence of VOCs. Record PID readings on the sampling form. Items or materials exhibiting PID readings shall be considered probable sources of VOCs and, given approval of the owner or occupant, will be removed prior to sampling. If practical, sampling will be rescheduled for 24-hours later.

2. **Preparation of 24-Hour SUMMA®-type canister and collection of sample**
    - Place SUMMA®-type canister at breathing zone height (approximately 3 to 5 ft above basement floor or about 1 ft above floor of crawl space). Canister can be placed on a stable surface, such as a table or bookshelf, or affixing to a wall or ceiling support with nylon rope. Avoid placing canisters near windows or other potential sources of drafts and air supply vents.
    - Record SUMMA®-type canister serial number on sampling summary form and COC.
    - Record sample identification on canister identification tag, and record on sampling summary form and COC.
    - Remove brass plug from canister fitting.

- Install pressure gauge / metering valve on canister valve fitting and tighten. If pressure gauge has additional (2nd) fitting, install brass plug from canister fitting into gauge fitting and tighten.
- Open and close canister valve.
- Record gauge pressure on sample summary form and COC. Gauge pressure must read >25 inches Hg. Replace SUMMA®-type canister if gauge pressure reads <25 inches Hg.
- Remove brass plug from gauge fitting and store for later use.
- Open canister valve to initiate sample collection.
- Record date and local time (24-hour basis) of valve opening on sampling summary form and COC.
- Take digital photograph of SUMMA®-type canister and surrounding area.

3. Termination of 24-hour sample collection

- Revisit SUMMA®-type canister approximately at end of sample collection period (e.g., 24 hours after initiation of sample collection) and record gauge pressure on sampling form and COC.
- Record date and local time (24-hour basis) of valve closing on sampling form and COC.
- Close canister valve.
- Remove pressure gauge / flow valve from canister.
- Reinstall brass plug on canister fitting and tighten.
- Remove SUMMA®-type canister from sample collection area.

4. Preparation and shipment of sample to analytical laboratory

- Pack SUMMA®-type canister in shipping container, note presence of brass plug installed in tank fitting.
- Complete COC and place requisite copies in shipping container.
- Close shipping container and affix custody seal to container closure.

Quality Assurance/Quality Control (QA/QC) samples:

The collection of QA/QC samples will include the submittal of blind sample duplicates to the analytical laboratory for analyses of target compounds. Area 2- type duplicate samples will be collected "side-by-side" over the same time interval. Area 1- type duplicate samples will be obtained using a stainless steel "tee" type fitting and 1/4-inch O.D. Teflon®- tubing connected to the same subsurface probe.

4.5.6.2 Substructure Soil Vapor Grab Sampling

Substructure soil vapor grab samples will be collected from beneath residential, commercial, industrial, institutional, and multiuse buildings with an apparent vapor barrier using SUMMA® type air canisters equipped with metering flow controllers. This technique is intended for 20 minute sample collection. Substructure soil vapor grab samples may be collected from a temporary installed sampling port through an apparent vapor barrier (such as floor slab or plastic liner).

Substructure soil vapor grab sampling will require the following equipment:

- Documentation of access permission from the owner to complete the sampling
- 1.4-liter, stainless steel, pre-evacuated SUMMA® canister - laboratory provided
- Pressure gauge with integrated 20-minute metering valve - laboratory provided
- PID
- Utility Knife
- Electric hammer drill with 3/8-inch diameter drill bit
- Two 50-ft long electrical extension cords
- ¼-inch O.D. Teflon® tubing
- ¼-inch stainless steel valve and stainless steel "tee" type fitting
- 3/16-inch I.D. silastic tubing
- 60 cc polyethylene syringe for purging tubing
- Quick-drying hydraulic cement

- Wristwatch
- Digital camera
- Flashlight
- Dust pan and broom
- Indoor Air Quality Questionnaire and Building Inventory Form (Appendix A)
- COC form - laboratory provided

Procedure for 20-Minute Substructure Soil Vapor Grab Sample Collection

During the occupant/owner interview and building survey the lowest accessible portion of the building (e.g., crawl space, basement, or first floor of slab-on-grade construction) will be observed to assess applicability of sampling technique (i.e., Is there a vapor barrier?). The steps provided below should be considered a general guidance on the collection of substructure soil vapor samples; the sequence can be modified as needed based on site- or project-specific conditions at the time of sample collection.

Selection and preparation of sample collection point

A. Conduct interview with occupant/owner. Complete the Indoor Air Quality Questionnaire and Building Inventory Form (Appendix A).

B. Observe the condition of the building floor slab for apparent penetrations such as concrete floor cracks, floor drains, or sump holes. Note the floor conditions on the sampling form and select a potential location or locations for a temporary subsurface probe. The location or locations should be central to the building away from foundation walls and apparent penetrations. Review the proposed location or locations with the occupant/owner describing how the sampling port or ports will be installed. After receiving' permission from the occupant/owner, mark the proposed location(s) and describe the location(s) on the sampling form.

C. Using the PID, screen indoor air in the area of floor penetrations such as concrete floor cracks, floor drains, or sump holes. Record the indoor air PID readings on the sampling form.

Installation of temporary subsurface sample point

A. Drill a 3/8-inch diameter hole through the thickness of the slab. Extend the hold about two inches into the subslab material using either the drill bit or a steel probe rod.

B. Insert a section of 1/4-inch O.D. Teflon® tubing to the bottom of the floor slab. Seal the annular space between the 3/8-inch hole and 1/4-inch tubing with either a beeswax seal, or with a NYSDEC approved putty/seal (i.e. non-VOC emitting play dough). The beeswax will be melted with an electric hot plate.

C. Connect the 1/4-inch Teflon® tubing to a stainless steel valve using 3/16-inch ID silastic tubing. Open the in-line valve and purge the probe tubing using a polyethylene 60 cc syringe (purging with a PID is also acceptable if no indoor air samples are to be collected). Close the valve, remove and cap the syringe, and connect the silastic tubing to the in-line valve on the SUMMA® canister. The air/soil vapor syringe will be discharge out of doors if indoor air samples are to be collected. For duplicate sample locations connect a second canister before purging by installing a 1/4-inch stainless steel "tee" fitting between the probe discharge tubing and the stainless steel valve.

Preparation of 20-minute SUMMA® canister and collection of sample

A. Place SUMMA® canister adjacent to the temporary sampling port.

B. Record SUMMA® canister serial number on sampling summary form and COC.

C. Record sample identification on canister identification tag, and record on sampling summary form and COC.

D. Remove plastic cap canister fitting.

E. Open and close canister valve.

F. Record gauge pressure on sample summary form and COC. Gauge pressure must read >25 inches Hg. Replace SUMMA® canister if gauge pressure reads <25 inches Hg.

G. Connect canister to silastic tubing already connected to the subsurface probe.

H. Open canister valve and in-line stainless steel valve to initiate sample collection.

I. Record date and local time (20-minute basis) of valve opening on sampling summary form and COC.

J. Take digital photograph of SUMMA® canister and surrounding area.

Termination of 20-minute sample collection

A. Upon completion of 20 minute sample collection, record gauge pressure on sampling form and COC.

B. Record date and local time (20 minute basis) of valve closing on sampling form and COC.

C. Close canister valve.

D. Disconnect silastic tubing and recap pressure gauge.

E. Remove SUMMA® canister from sample collection area.

F. Remove temporary probe from hole. Fill hole with a quick drying hydraulic cement. Finish flush with floor surface.

4.5.6.3 Indoor Air Sampling

Indoor air samples will be collected from residential, commercial, industrial, institutional, and multiuse buildings. This technique is intended to be a general directive for the collection of indoor air samples using SUMMA®-type air canisters equipped with metering flow controllers for the purpose of collecting a "time-averaged" indoor air sample. This procedure is intended for 24-hour sample collection and may be collected in conjunction with 24 hour substructure soil vapor sampling. Indoor air data will be recorded on a field data form (Figure 4.19).

For the purposes of evaluating the potential vapor migration from soils and groundwater into indoor air, samples will be collected from the lowest usable area of the building. Indoor air samples may be collected from one of the following areas:

1. Unfinished basement or unfinished first floor of slab-on-grade building;
2. Finished basement or finished first floor of slab-on-grade building; or
3. First floor living area above a dirt-floored crawl space or unfinished basement.

Indoor air sampling will require the following equipment:

- Documentation of access permission from the owner to complete the sampling
- 6-liter, stainless steel, pre-evacuated SUMMA®-type canister - laboratory provided
- Pressure gauge with integrated 24-hour metering valve - laboratory provided
- Two, 9/16-inch, open-end wrenches
- PID – part per billion range detector for screening indoor air
- Wristwatch
- Digital camera
- Indoor Air Quality Questionnaire and Building Inventory Form (Appendix A)
- COC form -laboratory provided

Procedure for Indoor Air Sample Collection

The following section provides a general guidance on the collection of indoor air samples; the sequence can be modified as needed based on site specific conditions at the time of sample collection.

Selection and Preparation of indoor air sample collection area

A. Conduct interview with occupant/owner. Complete Indoor Air Quality Questionnaire and Building Inventory Form (Appendix A).

B. Observe the area for the apparent presence of items or materials that may potentially produce or emit VOCs and interfere with analytical laboratory analysis of the collected sample. Record relevant information on Building Inventory Form and document with digital photographs.

C. Using the PID, screen indoor air in the location intended for sampling and in the vicinity of potential VOC sources (i.e. paints, glues, household cleaners, dry cleaned clothes, etc.) to assess the potential gross presence of VOCs. Record PID readings on the sampling form. Items or materials exhibiting PID readings shall be considered probable sources of VOCs and, given approval of the owner or occupant, will be removed prior to sampling. If practical, sampling will be rescheduled for 24-hours later.

Preparation of SUMMA®-type canister and collection of indoor air sample

A. Place SUMMA®-type canister at breathing zone height (approximately 3 to 5 ft above floor). Canister can be placed on a stable surface, such as a table or bookshelf, or affixing to a wall or ceiling support with nylon rope. Avoid placing canisters near windows or other potential sources of drafts and air supply vents.

B. Record SUMMA®-type canister serial number on sampling summary form and COC.

C. Record sample identification on canister identification tag, and record on sampling summary form and COC.

D. Remove brass plug from canister fitting.

E. Install pressure gauge / metering valve on canister valve fitting and tighten. If pressure gauge has additional (2nd) fitting, install brass plug from canister fitting into gauge fitting and tighten.

F. Open and close canister valve.

G. Record gauge pressure on sample summary form and COC. Gauge pressure must read >25 inches Hg. Replace SUMMA®-type canister if gauge pressure reads <25 inches Hg.

H. Remove brass plug from gauge fitting and store for later use.

I. Open canister valve to initiate sample collection.

J. Record date and local time (24-hour basis) of valve opening on sampling summary form and COC.

K. Take digital photograph of SUMMA®-type canister and surrounding area.

Termination of indoor air sample collection

A. Revisit SUMMA®-type canister approximately at end of sample collection period (e.g., 24 hours after initiation of sample collection) and record gauge pressure on sampling form and COC.

B. Record date and local time (24-hour basis) of valve closing on sampling form and COC.

C. Close canister valve.

D. Remove pressure gauge / flow valve from canister.

E. Reinstall brass plug on canister fitting and tighten.

F. Remove SUMMA®-type canister from sample collection area.

Preparation and shipment of sample to analytical laboratory

A. Pack SUMMA$^{®}$-type canister in shipping container, note presence of brass plug installed in tank fitting.
B. Complete COC and place requisite copies in shipping container.
C. Close shipping container and affix custody seal to container closure.

Quality Assurance/Quality Control (QA/QC) samples:

The collection of QA/QC samples will include the submittal of blind sample duplicates to the analytical laboratory for analyses of target compounds. Duplicate samples will be collected "side-by-side" over the same time interval.

4.5.6.4 Ambient Air Sampling

Ambient (outdoor) air samples will be collected in the vicinity of residential, commercial, industrial, institutional, and multiuse buildings. This technique is intended to be a general directive for the collection of ambient air samples using SUMMA$^{®}$-type air canisters equipped with metering flow controllers for the purpose of collecting a "time-averaged" ambient air sample. This procedure is intended for 24-hour sample collection. Ambient air sampling information will be recorded on the FDR (Figure 4.19).

Ambient air sampling will require the following equipment:

- Documentation of access permission from the owner to complete the sampling
- 6-liter, stainless steel, pre-evacuated SUMMA$^{®}$-type canister - laboratory provided
- Pressure gauge with integrated 24-hour metering valve - laboratory provided
- Two, 9/16-inch, open-end wrenches
- PID – part per billion range detector for screening air
- Wristwatch

- Digital camera
- Indoor Air Quality Questionnaire and Building Inventory Form (Appendix A)
- COC form - laboratory provided

Procedure for Ambient (outdoor) Air Sample Collection

The following section provides a general guidance on the collection of ambient air samples; the sequence can be modified as needed based on site specific conditions at the time of sample collection.

Selection and Preparation of ambient sample collection area

A. Conduct interview with occupant/owner. Complete Indoor Air Quality Questionnaire and Building Inventory Form. (Appendix A).

B. Choose an area for sample collection that is upwind of the property (properties) being assessed, if possible. Collect sample away from wind breaks, if possible.

C. Observe the area for the apparent presence of items or materials that may potentially produce or emit VOCs and interfere with analytical laboratory analysis of the collected sample (i.e. fuel tanks, gasoline, paint storage, etc.). Record relevant information on Building Inventory Form and document with digital photographs.

D. Using the PID, screen ambient air in the location intended for sampling to assess the potential gross presence of VOCs. Record PID readings on the sampling form.

Preparation of SUMMA® canister and collection of ambient sample

A. Place SUMMA®-type canister approximately 5 ft above ground (or equivalent to the mid-point of the ground story of the building(s). Canister can be placed on a stable surface, or suspended from structure with nylon rope.

B. Record SUMMA®-type canister serial number on sampling summary form and COC.

C. Record sample identification on canister identification tag, and record on sampling summary form and COC.

D. Remove brass plug from canister fitting.

E. Install pressure gauge/metering valve on canister valve fitting and tighten. If pressure gauge has additional (2nd) fitting, install brass plug from canister fitting into gauge fitting and tighten.

F. Open and close canister valve.

G. Record gauge pressure on sample summary form and COC. Gauge pressure must read >25 inches Hg. Replace SUMMA®-type canister if gauge pressure reads <25 inches Hg.

H. Remove brass plug from gauge fitting and store for later use.

I. Open canister valve to initiate sample collection.

J. Record date and local time (24-hour basis) of valve opening on sampling summary form and COC.

K. Take digital photograph of SUMMA®-type canister and surrounding area.

Termination of ambient sample collection

A. Revisit SUMMA®-type canister approximately at end of sample collection period (e.g., 24 hours after initiation of sample collection) and record gauge pressure on sampling form and COC.

B. Record date and local time (24-hour basis) of valve closing on sampling form and COC.

C. Close canister valve.

D. Remove pressure gauge / flow valve from canister.

E. Reinstall brass plug on canister fitting and tighten.

F. Remove SUMMA®-type canister from sample collection area.

Preparation and shipment of sample to analytical laboratory

A. Pack SUMMA®-type canister in shipping container, note presence of brass plug installed in tank fitting.

B. Complete COC and place requisite copies in shipping container.

C. Close shipping container and affix custody seal to container closure.

Quality Assurance/Quality Control (QA/QC) samples:

The collection of QA/QC samples will include the submittal of blind sample duplicates to the analytical laboratory for analyses of target compounds. Duplicate samples will be collected "side-by-side" over the same time interval.

4.6 DRUM SAMPLING

Sampling personnel will develop an exclusion zone at the drum location in accordance with the project-specific HASP. The work area will be cleared of all physical hazards. Plastic sheeting will be used around the drums to protect the ground surface during sampling. Sample jars will be labeled in accordance with the project-specific FAP. Sampling will be performed at the level of personal protection specified in the project-specific HASP. Due to the potential release of hazardous gases, MACTEC will only sample drums already open to the atmosphere and will not open drums or perform remote sampling. The ambient air conditions in and around the drums will be monitored using a PID.

Documentation in the field logbook should begin with a visual inspection of the drum, noting any holes, markings and weak spots. Any readings detected with the PID should be recorded. A description of the drum contents should be recorded (color, consistency, etc.).

Solids can be sampled from the drums using several methods: a bucket auger, hand auger, or hand scoop; if the drums are open to the atmosphere. When the drum has been sampled, all sampling equipment should be decontaminated as described in the project-specific HASP.

4.7 AQUIFER CHARACTERIZATION

Aquifer testing activities include water level measurements and in situ K testing. These tests are designed to characterize groundwater flow patterns and to assess aquifer characteristics.

4.7.1 Water Level Measurements

Groundwater level measurements can be made in monitoring wells, private or public drinking water wells, piezometers, or open boreholes. Water level measurements in monitoring wells should be made before purging and evacuation for groundwater sampling.

The procedures for water level measurements are:

1. Check the well for proper identification and location.
2. Measure and record the height of protective casing from ground surface to check for settlement or heave.
3. After unlocking the well and removing any well caps, measure and record the ambient and well-mouth organic vapor levels using a PID. This level will be recorded in the field notebook and the appropriate health and safety actions taken, in accordance with the project-specific HASP.
4. Measure and record the distance between the top of the well riser and the top of the protective casing to check for heave or settling.
5. Using an electronic water level meter (or similar measuring device), measure and record the static water level in the well and the depth to the well bottom to the nearest 0.01 ft. Measurements will be referenced from the top of the well riser, as opposed to the protective casing, when feasible. An interface probe will be used in areas where LNAPLs are anticipated. (The water level meter should be decontaminated after use according to the procedures specified in Subsection 4.3.3).

All well measurements will be recorded, along with the date and time of measurement, in the field notebook. Every well will have a clearly established reference point of known elevation, normally a painted mark on the upper edge of the riser pipe.

4.7.2 Hydraulic Conductivity Testing

In situ K testing is designed to provide information about aquifer characteristics by measuring aquifer response to stress, such as a sudden fall or rise in water levels. The most common form of K testing is called a slug test. Slug tests yield approximate values for K; representative of the portion of aquifer within a small radius directly adjacent to the well boring that is stressed.

There are two kinds of slug tests, rising-head and falling-head tests. In a falling-head test, the operator induces a rise in the water level and records the water level return to static. In a rising-head test, the water level in the well is suddenly lowered and the water level rise to static is recorded. Rising-head tests are preferred in wells with screens that straddle the water table. Either rising- or falling-head tests may be performed in wells completed below the water table. The type of tests to be run will be specified in the project-specific FAP.

Prior to beginning the test, the static water level will be measured and recorded using the procedures for obtaining water levels presented in Subsection 4.7.1.

To begin the test, there are several ways to induce a rise or fall in water levels including:

- introduction of a cylindrical mass, or slug, into the well that displaces a volume of water and raises the water level above static;
- removal of the slug, after aquifer equilibration, effectively lowering the water level below static level;
- addition of a volume of water to the well raising the water level; or
- removal of a volume of water by pumping and lowering the water level.

Choice of a method depends on several factors, most concerning the level of contaminants in the well. Pumping to lower the water level is less desirable if the purged water will require containerization due to contaminant concentrations. In such cases, introduction of a slug is preferred, taking proper precautions to minimize cross-contamination between wells. The purpose of the well is also important in choosing a method. Water should not be added to a well that will be sampled for chemical analysis. Well design also should be considered. The method of inducing stress in the aquifer will be specified in the project-specific FAP.

The water level return to static can be measured using an electronic water level meter or a pressure transducer connected to a data logger. Readings should be taken at least every half minute for the first 10 minutes, every 5 minutes for the period of 10 to 50 minutes, every 10 minutes for the period 50 to 100 minutes, every 30 minutes for the period of 100 minutes to 5 hours, and every hour for the period 5 to 24 hours. The pressure transducer with data logger is the preferred method and is required for wells with high K values and short recovery times. The data logger can be set to record data several times a second. Recovery data should be recorded until the well recovers 90 percent of its static water level.

When using a pressure transducer and data logger, all input parameters for equipment operation will be recorded in the field notebook and on an Aquifer Testing Completion Checklist (Figure 4.20). Test data from the data logger will be downloaded to a computer disk either in the field or upon return to the office.

The following additional information is required to reduce the test data and derive a value for the K:

- initial drawdown (i.e., difference between static water level and the level after stressing);
- well screen and riser diameter;
- effective length of the screened interval; and
- borehole diameter.

In water table wells where the head changes occur in the sandpack/screen interval during aquifer testing or where permeability of the sandpack is much greater than the formation, the riser radius (r) approaches the borehole radius (R) and the length (L) varies over the duration of the test. In order to avoid selection of an inappropriate value of riser radius and resulting permeability underestimates, compensation for the extra void space is necessary. The "effective radius (r_e)", derived from the radii of the borehole (R) and riser (r), and the porosity of the sandpack (n), should be considered as:

$$r_e = [r^2\,(1\text{-}n) + nR^2]^{1/2}$$

The value of L (length of sandpack) should also be adjusted accordingly (Bouwer, et al., 1976; Palmer and Paul, 1987).

The data will be reduced using the AQTESOLV software package (Geraghty & Miller, 1991). This program utilizes either Bouwer and Rice (1976) or Cooper, Bredehoeft, and Papadopulos (1976) methodologies for slug test data reduction. The output of the AQTESOLV program is a graph of data with a fitted curve and K or transmissivity value. Any other data reduction method to be used will be specified in the project-specific FAP.

4.7.3 Packer Testing

Water pressure tests or "packer tests" are in situ tests performed to measure the permeability of a specific zone in a bedrock borehole. Water pressure tests are used to estimate bedrock permeabilities for hydrogeologic studies and in estimating grouting and dewatering requirements for construction purposes.

Packer tests may be done during the advancement of the borehole or after drilling is completed. Packer tests are usually conducted in NW-size (i.e., 3-inch) boreholes, but can be conducted in boreholes of a larger size. The test involves placing expandable packers, either mechanical or pneumatic in a borehole. A pneumatic packer assembly is preferred because it is easier to use and provides a more positive seal. A section of the borehole, usually five ft in length, is sealed off with the packers. Water is then pumped through the zone between the packers at a known pressure. The rate of flow into the formation is measured with a flow meter. The apparent gross permeability of the test zone is calculated using the data obtained in the test.

Methodology.

1. Flush the borehole with clean water to remove cuttings. Measure the depth of the borehole, and check for caving. Be sure that an adequate reserve of water is available to avoid running out of water during a test.
2. Determine the test zone. The test section length should be a minimum of 5 times the diameter of the borehole. Avoid placing the packer in a zone of fractured rock or in the bottom of the casing because leakage will occur. Keep the rock core or drilling logs handy to refer to during the test.
3. Determine Maximum Allowable Gauge Pressure (MGP) according to the formula below (U.S. Bureau of Reclamation, 1977). In order to avoid hydrofracturing (i.e., loosening) the rock mass, do not exceed MGP during testing.

$$MGP\ (psi) = (Z)(K)$$

where,

Z = depth in ft from top of the upper packer to ground surface
K = 0.5 pounds per square inch (psi)/ft

4. Prior to the start of actual permeability testing, the packer system should be tested for leakage by installing the packer in a piece of steel casing and conducting the test as if it was being done in the borehole. The water pressure must not exceed maximum packer inflation pressure. Check the hose for leaks. Check the water meter to assure that it is working properly.
5. If possible, determine the static water level in the borehole prior to the installation of the packer.
6. Assemble and install the packer equipment in the borehole. Measure each rod and top of coupling as it goes into the hole. Be sure rods are tightened to prevent leakage at the joints; Teflon® tape may be helpful. Number the rods for easy tracking of the packer location for sequential tests. Lower the equipment to the location of the deepest test. Figures 4.21, 4.22, and 4.23 depict arrangement of equipment.
7. Before performing the first test, bleed air out of the lines by forcing water through the packer system assembly before the packers are inflated. Inflate both packers to at least 150 psi. Double packers are usually spaced five ft apart, but spacing can be varied to meet specific test requirements.

8. Before starting the test, record the following information in the field logbook and Packer Test Log (Figure 4.24).

   - test number;
   - test section;
   - hole size;
   - height of pressure gauge above ground surface;
   - ground surface elevation; and
   - depths to rock surface, groundwater, bottom of boring, bottom of upper packer to top of lower packer.

9. Test should be conducted in three steps: The first at one-half the MGP with packers at 150 psi; the second at full MGP with packers at 150 psi; and the third at full MGP with the packers at 170 psi.

   a. Step 1, One-half MGP at 150 psi on Packers. Pump water into the system and record observations of gauge pressure and water meter at 30 second intervals until a constant rate of flow is reached.

   b. Step 2, Full MGP at 150 psi on Packers. Pump water into system and record observations of gauge psi pressure and water meter at 30 second intervals until a constant rate of flow is reached

   c. Step 3, Full MGP at 170 psi on Packers. Increase pressure on packers by 20 psi. Pump water into the system and record observations of gauge pressure and water meter at 30 second intervals until a constant rate of flow is reached. The results of Steps 2 and 3 should be similar. If they are not, Step 3 should be repeated, increasing the packer pressure by an additional 20 psi until consistent results are achieved. Do not exceed the maximum packer pressure (220 psi).

   d. For all test steps, record water levels in the casing during test, if the water level rises during the test, the packers may not be sealed and the test results may be suspect. Measurements of doubtful accuracy must be noted, along with a description of the questionable aspects. If possible, testing should be continued until accurate data is obtained. It may be necessary to move the packer assembly a short distance to obtain an adequate seal.

10. If leakage of water from the packed section into the surrounding rock is so great that the MGP cannot be reached, run the pump at its full capacity with the bypass valve closed. Record the amount of water pumped into the test section, at 30-second intervals, with associated pressure readings.

11. Upon completion of the test, deflate the packers and move to the next test depth. Complete log sheets (Figure 4.23).
12. The same test methodology may be used with a single packer. Single packer tests are conducted as the borehole is advanced using the bottom of the borehole in place of the second packer.

Resolution of Common Packer Test Problems

<u>Packers move up out of the hole at the start of the test</u>. Occasionally, particularly in low permeability rocks, the packer assembly may lift out of the hole due to the water pressure. Observers should stay clear of the top of the borehole to avoid injury. It may be helpful to deflate and re-inflate the packers to obtain a more positive seal in the borehole. Also, the rig drive head can be placed over the top of the swivel to help to hold the packers in place during the testing.

<u>Pumping excessive amounts of water into the formation</u>. In certain types of hydrogeologic or contaminant investigations, large quantities of water should not be pumped into the aquifer as this may impact local groundwater quality. If this is a concern, packer tests should be avoided. Alternatively, falling or rising head tests may be performed or geophysical borehole data may be obtained.

<u>Jamming of the packers in the borehole</u>. Packers may become caught in the borehole for two reasons: (1) caving of the formation amount the packers, or (2) failure of the packers to deflate. In the later case, it is generally advisable to re-inflate and deflate the packers a second time to try and remedy the problem. Forcibly removing the packers from the hole should be avoided as they may become permanently lodged or damaged. In some instances it may be helpful to pump water through the system to help lubricate the equipment for removal. Packer tests in soft, broken or cavernous formations should be attempted with great caution.

Malfunctioning water meter. Water meters are sensitive instruments and are subject to malfunctions due to clogging by debris or mechanical failure. It is important to check the water meter prior to use to be certain that it is working properly. Generally, it is best to place the water meter in a horizontal position, particularly for low flow measurements. It is also important to determine what the units of the meter dial are prior to use, as they are often poorly marked.

Data Evaluation. Compute the rock mass K. Additional data required for each test are as follows: (1) depth of hole at time of each test; (2) depth to bottom of top packer; (3) depth to top of bottom packer; (4) depth to water level in borehole at frequent intervals; (5) elevation of piezometric level; (6) length of test section; (7) radius of hole; (8) length of packer; (9) height of pressure gauge above ground surface; (10) height of water swivel above ground surface; and (11) description of material tested. Item 4 is important since a rise in water level in the borehole may indicate leakage from the test section.

The formulas used to compute the K from pressure test data are:

$$K = C \frac{Q}{2(\prod)LH} \ln \frac{L}{r} \qquad L \geq 10r$$

$$K = C \frac{Q}{2(\prod)LH_T} \ln \frac{L}{2r} \qquad 10r \succ L \succ r$$

where,

K = hydraulic conductivity (ft/day)
Q = constant rate of flow into the hole (gallons per minute)
L = length of the test section (ft)
H_T = differential head on the test section ($H_g + H_p$ in ft)
r = radius of the borehole (ft)

C = Conversion factor for K in units of ft/day C equals 1.928×10^2

Note: Hg is equal to elevation head (distance from swivel to static water level). Hp is equal to pressure head calculated in ft from pressure gauge. For the unsaturated condition (i.e., static water is below bottom of lower packer), Hg is equal to distance in ft from swivel to center of test section.

These formulas provide only approximate values of K since they are based on several simplifying assumptions and do not take into account the flow of water from the test section back to the borehole (U.S. Bureau of Reclamation, 1968). Because of the heterogenous and anisotropic nature of water bearing rock formations, K value is referred to as apparent gross K. However, they give values of the correct magnitude and are suitable for practical purposes. The following listing provides a general grouping of rock mass K.

ROCK MASS HYDRAULIC CONDUCTIVITY

Hydraulic Conductivity Grouping	Range of Results
Very Low, equivalent to clay	Less than 1×10^{-4} ft/day
Low, equivalent to silt	1×10^{-4} to 1×10^{-2} ft/day
Medium, equivalent to fine sand	1×10^{-2} to 10^{-1} ft/day
High, equivalent to sand	1×10^{-1} to 1×10^{1} ft/day
Very High, equivalent to clean sand or gravel	More than 1×10^{1} ft/day

4.8 SURVEYS

Depending on the site and accuracy needed, surveys of site features and/or sampling locations may be conducted using either 1) a New York registered surveyor, 2) GPS receiver, 3) three point ties to known structures/points, or 4) approximation based on coordinate correct orthophotograph (i.e., within a geographic information system (GIS)). Survey requirements will be described in the project-specific FAP. Descriptions of surveys using registered land surveyors and GPS receivers are described in the following sub-sections.

4.8.1 Elevation and Location Survey

Elevation and location surveys will be conducted by a New York-registered professional land surveyor.

Elevations will be referenced to mean sea level, 1983 General Adjustment and will be measured at 0.01 ft for monitoring well casings and 0.1 ft for ground surfaces. Horizontal locations will be tied into the NYS Plane Coordinate system, to the nearest 0.1 ft.

The actual surveying techniques and the required equipment to be employed, and the required accuracy and precision, are dependent upon the field conditions and the nature of the sampling stations and/or techniques to be employed. All field measurements shall be performed at least once and re-measured (i.e., checked) at least once. All survey observations and measurements shall be properly recorded by the designated member of the survey crew in bound field books, in accordance with the requirements of these guidelines.

Any calibrations performed upon surveying equipment in connection with this work shall be properly documented with regard to personnel, date, instrument number, calibration readings, procedures and standards employed, adjustments made, comments and/or observations, etc.

All analysis employed in the reduction of field data, calculations, production of maps/drawings, etc. shall follow commonly-accepted professional survey practices which are appropriate for the task at hand, including all appropriate procedures for QC to check and review the work. Computer programs used to reduce data shall have first been certified to yield repeatable results within the required limits of accuracy. All office calculations, data reduction, map making, etc. shall be performed in a neat, sequential, and logical order to facilitate future review.

The installed locations of all benchmarks, baselines and monuments shall be appropriately documented on a base map to indicate their relative locations. Benchmarks will be described with respect to their construction and location, on map, in addition to their grid coordinates.

Survey deliverable formats will be specified in the project-specific FAP. Depending on the site, deliverables may consist of an electronic table (i.e. Excel) with the location identification, horizontal location (x,y), and vertical elevation (z). If maps/drawings are required, final maps will be submitted in Adobe PDF format with an electronic signature. Drawings shall also be submitted in AutoCAD 2010 format or later and shall incorporate the use of model space/paper space sheet file formatting. One plotted sheet formatted per dwg file. Model files will coordinate correct and logically formatted for effective layer control of data. All entities shall be globally controlled by layer and sheet files shall be formatted to plot with acad.ctb as distributed with the Autodesk software. In the event that another .ctb file is used, it shall be submitted with the drawings. Whether submitting with Acad.ctb, or other, all entities will have lineweight controlled with the lineweight setting and not by color assignment. Model files containing objects created as intelligent, civil3d or TINN, to name a couple, shall maintain their intelligence when delivered.

If required, paper copies of the final maps will also be submitted in the specified map size. If one sheet is not sufficient, the mapped area may be divided into sections, one per sheet, and appropriate references and match lines provided. Maps shall be of a suitable scale to show appropriate detail clearly. Although this varies with the size of the site mapped, appropriate map scales generally range from 1 inch = 50 ft to 1 inch = 200 ft. The scale used will be clearly shown on the map both graphically (e.g., bar scale) and numerically (e.g., 1 inch = 50 ft). Each map will also indicate a true north meridian, preferably oriented toward the top of the page, and will be provided with appropriate borders, legends, title boxes, notes, data references and means of identifying author, checkers, etc.

The following paragraphs summarize specific surveying requirements appropriate to various sampling locales.

Borings and Test Pits. Horizontal locations and ground surface elevations for borings and test pits are indicated on boring/test pit logs and may be used to construct geologic sections or profiles. Horizontal locations should be staked to the nearest ft, and ground surface elevations measured to 0.1 ft.

Monitoring Wells and Piezometers. In general, horizontal location, well riser elevation, and ground surface elevation criteria for wells and piezometers are similar to those of test pits or borings. However, the surveyor should measure and mark the elevation of the top of the riser to 0.01 ft as this point will be used as a reference to measure precise groundwater elevations. For monitoring wells, pumping wells, and piezometers, a permanent mark will be made on the riser, protective casing, or other point of reference both for surveying purposes and to enable reproducible depth to water measurements.

Surface Water Sampling. When grab samples are obtained from the edges of surface water bodies, the samplers should install a location stake at the shoreline marked with the station number and coordinates, if appropriate. This stake may also be used as a reference point for measuring the water surface elevation (to the nearest 0.01 ft). In certain cases, this may not be required, since the sampler can estimate and mark the appropriate location and elevation directly on a Site Topographic Map or Orthophoto Map. Such locations do not require great location accuracy (within several ft), since they are usually only indicated graphically on the Site Map.

When samples are to be taken within the surface water body away from the shoreline, better horizontal control is usually required. Sampling locations are determined by the sampler using on-shore baselines or ranges.

Surface Soil/Waste Sampling. Measurement and layout requirements for obtaining a single grab sample of soil or waste are comparable to those for obtaining surface water grab samples from the shoreline. Where a composited sample is to be collected from a sampling grid, the surveyors must stake out the grid, and indicate the station number(s), coordinates or orientation of the grid, and ground elevation(s) on the stakes. Generally, a precision of no better than the nearest ft for location, and 0.1 ft for elevation will suffice from grab or grid surface sampling.

4.8.2 Global Positioning Survey

GPS is a geographic data collection system which uses satellites to locate positions and log time. The system can be used as a data capture or in navigation mode to assist in geographic referencing for returning to points previously entered.

GPS typically consist of a portable receiver, a base station receiver, data loggers, processing software, and a field computer. Data can be collected in point, line, or area format. The datum and coordinate system used can be specified to the nature of the job and application. For differential correction, used to correlate a known steady position relative to the rover - mobile data collection unit, a fixed community base station within 300 miles of the survey can be employed or a field operated base station unit can be used.

Accuracy is determined by several factors including the type of equipment. Sub-meter accuracy systems are most often used. A few constraints for acquiring sub-meter accuracy are based on the satellite geometry - the arrangement and number of satellites in 'view' of the position, the altitude of the satellites, and the satellite's health. Signal strength can be affected by buildings blocking the satellite's signal or a dense tree canopy that can weaken the signal will also limit the accuracy of the survey. Another consideration is Position Dilution of Precision which needs to be within a specified range to acquire high accuracy. The amount of time at each position increases the accuracy of the fix by allowing more positions to be logged. Timing and careful planning can remedy or limit the affects to most signal strength problems.

Post processing of collected GPS data is recommended to increase the accuracy of the surveyed data. Data can then be transferred onto an existing computer aided design (CADD) map or used to construct a site map within a GIS. Typical environmental applications include generating real time site maps, wetland delineation, mapping soil boring locations, groundwater grab sample locations, and mapping surface water/sediment sampling locations.

4.9 MANAGEMENT OF INVESTIGATION-DERIVED WASTES

Specific procedures for handling contaminated environmental materials and contaminated, disposable, personal safety equipment will be presented in the project-specific FAP and/or HASP. In general, MACTEC is responsible for collecting, controlling, and staging hazardous materials generated during field investigations. Manifest signature and ultimate disposal are the responsibility of the NYSDEC; however, MACTEC may assist in the planning and coordination of these activities, if required.

Contaminated soil and water will be handled in accordance with NYSDEC guidance documents unless otherwise specified in the project-specific FAP.

4.9.1 Soil Disposal

DER-10 distinguishes between soils from on-site locations and from off-site locations that are not known to be contaminated.

Alternatives for on-site disposal of non-hazardous soils include:

- backfill inside test borings not completed as monitoring wells;
- collect and dispose on-site (after characterization);
- temporarily store on-site for on plastic sheeting and covered with plastic prior to off-site disposal;
- transport from off-site areas to site (without need to manifest or contract with licensed hauler)

Non-hazardous waste can also be transported off-site to a solid waste management facility.

Hazardous soils can be transported off-site to a properly permitted treatment, storage, or disposal facility. Prior to shipping for off-site disposal, representative samples of waste material will be analyzed to establish requirements for the proper management and disposal of wastes. These materials will be transported by a licensed hauler and accompanied by the proper manifests.

All of these disposal alternatives are subject to precautions listed in DER-10, including the general requirement that the soils be handled and disposed of in “a manner that does not pose a threat to health and the environment." Overall, handling and disposal of drill cuttings and other soil will be identified and addressed in the project-specific FAP.

4.9.2 Water Disposal

Investigation generated water/fluid (i.e. well development and purge water) is to be containerized upon production. Containerized water is to be managed and discharged/disposed of as outlined in DER-10, and pursuant to applicable guidance and regulations. Containers shall be labeled and securely staged in an area with secondary containment. NAPL shall not be released to the ground surface, but may be decanted and combined in one container, providing it all comes from monitoring wells associated with the same site.

The contents of the containers will be properly treated or disposed of if any of the following are noted: 1) visual evidence of contamination such as color, sheen, or free product/NAPL, 2) olfactory evidence of contamination, or 3) concentrations of contaminants above groundwater standards at levels of concern are known to be present in the monitoring wells based on historic sampling. Treatment or disposal will be at 1) a permitted facility (either on-site or off-site), or 2) at an on-site treatment unit brought to the site, properly designed to handle the water/fluids, where a permit waiver has been granted by the NYSDEC.

If none of the above are noted, groundwater can be recharged to unpaved ground into the same groundwater unit, within, or directly adjacent to a source area in a manner that does not result in surface water runoff. The water may also be added to the influent of a remedial treatment system designed to treat water, if one is operational at the Site. Overall, the management and disposal of groundwater will be specified in the project-specific FAP.

5.0 SAMPLE CUSTODY PROCEDURES

5.1 GENERAL

MACTEC has established a program of sample COC that is followed during analytical sample handling activities in both field and laboratory operations. This program is designed to assure that each sample is accounted for at all times. To maintain this level of sample monitoring, computer-generated sample container labels and shipping manifests are normally employed. Field data sheets and COC records must be completed by the appropriate sampling and laboratory personnel for each sample. The objectives of the MACTEC COC program are to ensure:

- samples are uniquely identified;
- samples are collected for all scheduled analyses;
- the correct samples are analyzed for requested analyses and are traceable to their records;
- descriptions of important sample characteristics and field observations are recorded;
- samples are protected from loss and/or are identified if damaged;
- alteration of samples (e.g., filtration, preservation) is documented;
- a forensic record of sample integrity is established;
- sample security is maintained; and
- relevant field information is recorded including location, sample number, date and time, identification of field samples, and individuals collecting the samples.

The COC protocol followed by the sampling crews involves the following steps:

- documenting procedures and amounts of reagents added to the sample during sample preparation and sample preservation;
- recording sampling locations, sample bottle identification, and specific sample collection procedures on the appropriate forms;
- using pre-prepared sample labels that contain all information necessary for effective sample tracking; and

- completing standard FDR forms to establish analytical sample custody in the field before sample shipment (see Subsection 4.5).

Prepared labels are normally developed for each sample to be collected. Each label is numbered to correspond with the appropriate sample(s) to be collected.

The COC record is used to document sample-handling information (i.e., sample location, sample identification, and number of containers corresponding to each sample number). The following information is recorded on the COC record:

- project reference;
- the site location code, sample identification number, date of collection, time of collection, sample bottle number, preservation, and sample type, number of containers, sample matrix;
- the names of the sampler(s) and the person shipping the samples;
- serial number of custody seals and shipping cases;
- the date and time that the samples were delivered for shipping;
- analyses required; and
- the names of those responsible for receiving the samples at the laboratory.

An example of a COC is shown in Figure 5.1. This type of COC is completed in triplicate. Two copies accompany the analytical samples to the laboratory; another is kept by the sample crew leader and maintained in the project file. The third copy is sent back with the analytical data package. In the case of computer generated COCs, the original COC is shipped with the samples to the laboratory. When this shipment is received by the laboratory, the COC is signed by the laboratory and returned with the test results as part of the data package submittal.

5.2 ANALYTICAL SAMPLE TRACKING

Tracking of samples commences at the time of sample collection. A project-specific database of anticipated sample collection is created as COCs are received from the field. The FOL will contact the laboratory to verify:

- analytical program;
- turnaround time;
- laboratory internal identification numbers; and
- COC for shipped samples

MACTEC uses the computerized tracking database to verify the completeness of data packages and electronic deliverables. Missing information is pursued by the project chemist, technical project leader, and QAO.

5.2.1 Field Sample Tracking System

The purpose of this section is to outline the steps associated with computerized field sample tracking of analytical samples collected during remedial investigations. This section includes computerized procedures applicable to tracking samples from label production through shipping samples to the lab with a completed COC. Specific steps and details are described for the primary tasks of initial sample creation, label production, post sample collection data entry and creation of COC for shipping to lab.

Additional manual sample tracking procedures and chain of custody forms may be used during investigations. The procedures described in this section only address those tasks that will use the computerized sample tracking program.

Equipment and Supplies

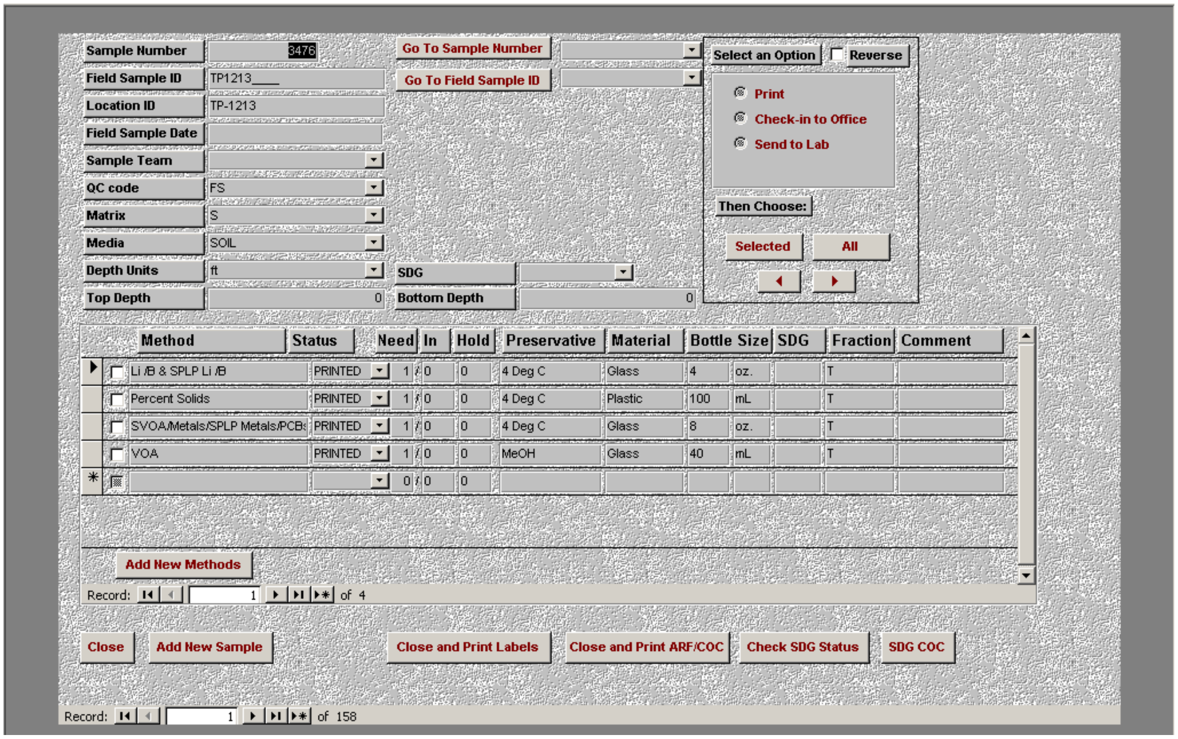
- PC Computer with Windows
- MS Access 97 or greater (2003 preferred)
- Copy of the MACTEC Field Sample Tracking Program
- Compatible Printer
- Avery 5260 Labels

5.2.1.1 Field Sample Tracking Program Overview

To start the Field Sample Tracking Program, "double-click" the Field Sample Tracking Program shortcut on your computer desktop. This will start Access and load the Field Sample Tracking Program. When it starts you will see the main form you will use for creating labels and tracking samples (Figure 5.2). From here you can add new samples, add methods to samples, print labels, track the status of samples, print COCs, and assign samples to a Sample Delivery Group (SDG).

The upper area of the form contains information about the sample such as by whom, when and where it was collected. Below the sample information is a box containing the analysis method information for the sample. Each analysis will have a method name, status, bottle information SDG and fraction. **The status field is used to track where in the sample collecting and shipping process the analysis is located**. It will change at every step of the sample tracking process.

You can also move through the samples using the form navigation buttons at the bottom of the form. The left and right arrows will jump you one sample forward or backward and the arrows with a line will take you to the first or last sample, respectively. The arrow with an asterisk is the Add New Sample Button, which will be used later. There are also 2 buttons that allow you to quickly navigate the samples if you know the Field Sample ID or the sample number.



Sample Number	3476
Field Sample ID	TP1213____
Location ID	TP-1213
Field Sample Date	
Sample Team	
QC code	FS
Matrix	S
Media	SOIL
Depth Units	ft
SDG	
Top Depth	0
Bottom Depth	0

	Method	Status	Need	In	Hold	Preservative	Material	Bottle Size		SDG	Fraction	Comment
☐	Li /B & SPLP Li /B	PRINTED	1	0	0	4 Deg C	Glass	4	oz.		T	
☐	Percent Solids	PRINTED	1	0	0	4 Deg C	Plastic	100	mL		T	
☐	SVOA/Metals/SPLP Metals/PCBs	PRINTED	1	0	0	4 Deg C	Glass	8	oz.		T	
☐	VOA	PRINTED	1	0	0	MeOH	Glass	40	mL		T	
☐			0	0	0							

Record: 1 of 4

Record: 1 of 158

Figure 5.2: Field Sample Tracking Program - Main Form

To jump to a sample if you know the Field Sample ID, enter it in the text box next to the Go To Field Sample ID button (or select it from the drop down) and press the button. Note that this will take you to the first occurrence of the field Sample ID, if it happens to be listed more than once.
To jump to a sample if you know the Sample Number, enter it in the text box next to the Go To Sample Number button (or select it from the drop down) and press the button.

To the right of the sample information is a box containing radio selection buttons, two buttons labeled “Selected” and “All” and two buttons with arrows. The two buttons with arrows can be used to move to the next sample forward or backward in the list. The radio selection and the “Selected” and “All” buttons are used to change the status field for a method. Their use will be explained in the following sections.

5.2.1.2 Initial Sample Creation

This step can be done for the majority of the samples using the sample information found in the project-specific FAPs. Individual samples can be created as necessary (see Figure 5.2).

- Press the Add New Sample Button
- Enter the Field Sample ID, Location ID and Sample Date if known.
- Select Sample Team, QC Code, Matrix and Media from drop down selections
- Add new methods (see add new methods section)

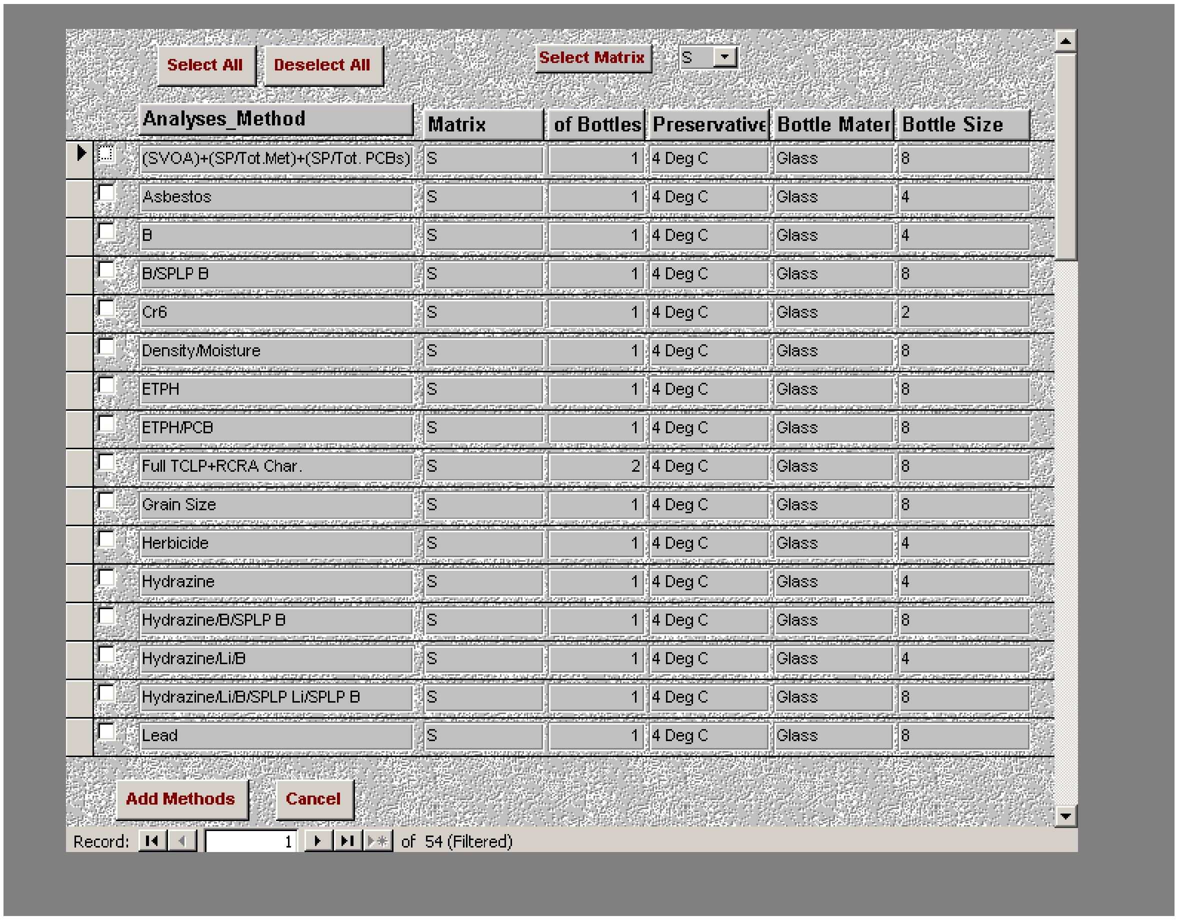
Underline spaces may be used if sample depth is a part of the Field Sample ID, but is unknown at the time of the sample creation. The correct Field Sample ID can be entered after the sample is collected. After the sample is created, the analytical methods needed are added. The Field Sample Tracking Program method list is dependent on Matrix, so make sure Matrix has been selected before adding methods to a sample.

- Press the Add New Methods Button – this will open a selection form (see Figure 5.3).
- Select methods to add to the sample by checking the box to the left of method name.
- When you have selected all methods you wish to add, press the Add Methods Button.

You will return to the Field Sample Tracking Screen and the added methods will now be in the method box. Their status is initially set to “NEW”.

5.2.1.3 Label Production

Methods that will have labels printed need to have a status of “PRINT”. For methods with a Status of “NEW” use the following procedures:



Select Matrix: S

	Analyses_Method	Matrix	of Bottles	Preservative	Bottle Mater	Bottle Size
☐	(SVOA)+(SP/Tot.Met)+(SP/Tot. PCBs)	S	1	4 Deg C	Glass	8
☐	Asbestos	S	1	4 Deg C	Glass	4
☐	B	S	1	4 Deg C	Glass	4
☐	B/SPLP B	S	1	4 Deg C	Glass	8
☐	Cr6	S	1	4 Deg C	Glass	2
☐	Density/Moisture	S	1	4 Deg C	Glass	8
☐	ETPH	S	1	4 Deg C	Glass	8
☐	ETPH/PCB	S	1	4 Deg C	Glass	8
☐	Full TCLP+RCRA Char.	S	2	4 Deg C	Glass	8
☐	Grain Size	S	1	4 Deg C	Glass	8
☐	Herbicide	S	1	4 Deg C	Glass	4
☐	Hydrazine	S	1	4 Deg C	Glass	4
☐	Hydrazine/B/SPLP B	S	1	4 Deg C	Glass	8
☐	Hydrazine/Li/B	S	1	4 Deg C	Glass	4
☐	Hydrazine/Li/B/SPLP Li/SPLP B	S	1	4 Deg C	Glass	8
☐	Lead	S	1	4 Deg C	Glass	8

Record: 1 of 54 (Filtered)

Figure 5.3: Field Sample Tracking Program - Selection Form

- Navigate to a sample you wish to print labels for.
- Set the Radio button in the upper left box to “Print”.
- If you wish to print labels for all methods for the sample, press the All Button.
- If you wish to print less than all of the methods, check the box next to the method name you wish to print. When you have selected the methods you wish to print, press the Selected button.

Repeat this process for all samples that you wish to print labels for. In addition, you can manually change the status to “PRINT” for any method by using the drop down selector in the status field. This may be done to reprint labels that have already been printed before. When you have finished identifying all of the methods that need to print labels, press the Close and Print Labels Button.

Press the Print Labels and Return to Main Form Button that appears. A preview of the labels to be printed will appear for your review. If it looks satisfactory, press the print icon and close the preview. The labels will start printing on the printer containing the Avery 5260 Labels. If the print preview on the screen is not satisfactory, just close the preview.

A Message box with the Choice “Change PRINT Status of Analyses” will appear. Choose the CHANGE button if you samples have printed to your satisfaction. This will change the method status to “PRINTED”. If you choose “KEEP” the status will remain at “PRINT” and the methods will show up in the next batch of labels. Use this option if you find an error in your preview, experience a printer error, or just wanted to print a test page of labels.

5.2.1.4 Post Sampling Data Entry

After a sample is collected in the field, it needs to be recorded as “Checked in to the Office” (or field trailer or where ever the field tracking computer is being operated).

For methods with a Status of “PRINTED” use the following recipe:

- Navigate to a sample you wish to check in.
- Enter information about sample date and time in the sample collection section.
- Enter information about sample depth, if appropriate.
- Set the Radio button in the upper right box to “Check-in to Office”.
- If you wish to check in all methods for the sample, press the “All” Button.

If you wish to check in less than all of the methods, check the box next to the method name you wish to check in. When you have selected the methods you wish to check in, press the “Selected” button. Edit the In field of a method if less than the number of required bottles has returned – if necessary (due to bottle breakage, less than enough sample material). Repeat this process for all samples that you wish to check in. In addition, you can manually change the status to “IN LAB” using the drop down selector in the status field.

5.2.1.5 Off-Site Laboratory Samples

Sample containers will be weighed by the off-site laboratory sample manager immediately upon receipt at the off-site laboratory. The sample manager will record the container identification number and post-sampling container weight on the chain of custody. A trip blank will accompany each shipment of samples to the off-site laboratory. The trip blank will consist of a sample container with methanol prepared by the off-site laboratory for the same analytical method as the field samples.

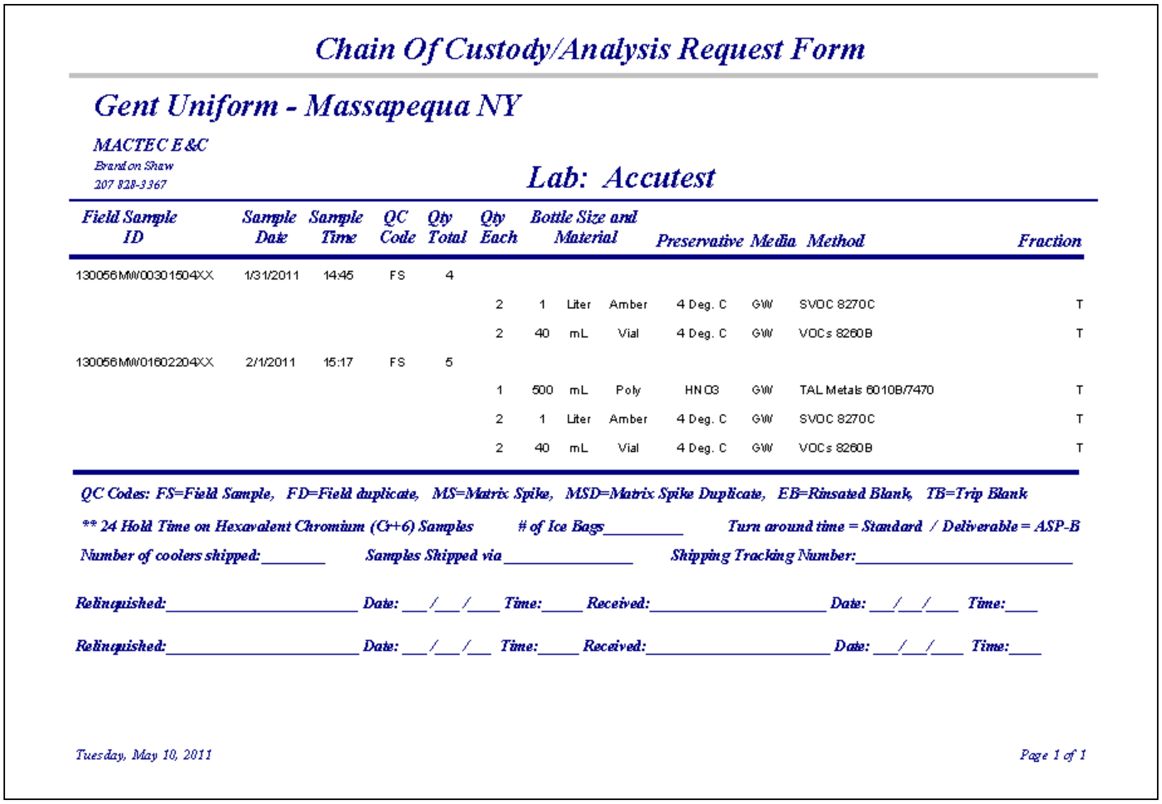
5.2.1.6 COC Production and Sample Shipping

For methods with a Status of “IN LAB” use the following procedure:

- Navigate to a sample you wish to ship to a lab.
- Set the Radio button in the upper right box to “Send to Lab”.
- If you wish to ship all methods for the sample, press the “All” Button.
- If you wish to ship less than all of the methods, check the box next to the method name you wish to ship. When you have selected the methods you wish to ship, press the “Selected” button.

Repeat this process for all samples that you wish to ship to a lab. In addition, you can manually change the status to “SHIP” using the drop down selector in the status field. When you have finished identifying all of the methods that need to be shipped to a lab, press the Close and Print Analysis Request Form (ARF)/COC Button.

Press the Print COC/ARF and Return to Main Form Button that appears. A preview of the COC/ARF to be printed will appear for your review. If it looks satisfactory, press the print icon and close the preview (see Figure 5.4 for an example of a printed COC). If not satisfactory, just close the preview.



Chain Of Custody/Analysis Request Form

Gent Uniform - Massapequa NY

MACTEC E&C
Brandon Shaw
207 828-3367

Lab: Accutest

Field Sample ID	Sample Date	Sample Time	QC Code	Qty Total	Qty Each	Bottle Size and Material			Preservative	Media	Method	Fraction
130056MW00301504XX	1/31/2011	14:45	FS	4								
					2	1	Liter	Amber	4 Deg. C	GW	SVOC 8270C	T
					2	40	mL	Vial	4 Deg. C	GW	VOCs 8260B	T
130056MW01602204XX	2/1/2011	15:17	FS	5								
					1	500	mL	Poly	HNO3	GW	TAL Metals 6010B/7470	T
					2	1	Liter	Amber	4 Deg. C	GW	SVOC 8270C	T
					2	40	mL	Vial	4 Deg. C	GW	VOCs 8260B	T

QC Codes: FS=Field Sample, FD=Field duplicate, MS=Matrix Spike, MSD=Matrix Spike Duplicate, EB=Rinsated Blank, TB=Trip Blank

*** 24 Hold Time on Hexavalent Chromium (Cr+6) Samples* *# of Ice Bags__________* *Turn around time = Standard / Deliverable = ASP-B*

Number of coolers shipped:________ *Samples Shipped via ________________* *Shipping Tracking Number:___________________________*

Relinquished:________________________ Date: ___/___/____ Time:_____ Received:______________________ Date: ___/___/____ Time:____

Relinquished:________________________ Date: ___/___/___ Time:_____ Received:_______________________ Date: ___/___/____ Time:____

Tuesday, May 10, 2011 *Page 1 of 1*

Figure 5.4: Field Sample Tracking Program – Example Chain of Custody Record

A Message box with the Choice "Change Status of Analyses from SHIP to SHIPPED" will appear. Choose the CHANGE button if you samples have printed to your satisfaction. This will change the method status to "SHIPPED". If you choose "KEEP" the status will remain at "SHIP" and the methods will show up in the next batch of COC/ARF to ship. Use this option if you find an error in your preview or just wanted to print a COC/ARF test page.

5.3 ANALYTICAL SAMPLE SHIPPING

Packing. Sample containers are generally packed in metal or hard plastic, insulated coolers for shipment. Bottles are packed tightly to minimize motion. Styrofoam, vermiculite, and "bubble pack" are suitable packing material for most instances. Ice is placed in double Ziploc® bags and added to the cooler along with all paperwork which is sealed in a separate Ziploc® bag. The cooler top is then taped shut. The samples are shipped to the laboratory together with the COC documents and the ARFs.

Shipping. The standard procedure for shipping environmental samples to the analytical laboratory is as follows:

1. All shipping of environmental samples collected by MACTEC personnel must be done through FedEx, or equivalent overnight delivery service. Receipts are retained as part of the COC documentation. Samples will be shipped to the laboratory within 24 to 48 hours of sampling unless other arrangements are made with the laboratory.
2. If prompt shipping and laboratory receipt of the samples cannot be guaranteed, (e.g., Sunday arrival), the samplers will be responsible for proper storage and custody of the samples until adequate shipping arrangements can be made.

The site leader keeps the laboratory informed of all field sampling activities. This communication is critical to allow the laboratory enough time to prepare for the sample shipment arrival.

6.0 CALIBRATION PROCEDURES

6.1 CALIBRATION PROCEDURES FOR LABORATORY EQUIPMENT

The calibration procedures used by the contract laboratories are specified by the referenced analytical methods and the NYSDEC ASP (NYSDEC, 2005) and are addressed in the QA documents for the laboratory subcontractor.

6.2 CONTROL OF MEASURING AND TEST EQUIPMENT

Inspection, measurement, and test equipment shall be controlled, calibrated, adjusted, and maintained at prescribed intervals. Critical spare parts will be kept on inventory to minimize downtime. Calibration shall be performed against certified equipment having known valid relationships to nationally recognized standards. If no national standard exists, the basis for calibration shall be documented.

The method and interval of calibration shall be defined and shall be based on equipment type, stability characteristics, required accuracy, and other considerations affecting measurement control. Special calibration shall be performed when accuracy of the equipment becomes suspect. When inspection, measurement, or test equipment are found to be out of tolerance, an evaluation shall be made of the validity and acceptability of previous inspection or test results. If any inspection, measurement, or test equipment is consistently found to be out of calibration, it shall not be made available for use. Records shall be maintained and equipment shall be suitably marked to indicate calibration status.

6.3 FIELD INSTRUMENT CALIBRATION

Each piece of equipment will be calibrated daily prior to use or as specified by the manufacturer. In addition, field instruments will be calibrated at the end of the day to monitor instrumental drift subsequent to field activities. Field instruments used to measure water quality parameters for groundwater and surface water should be calibrated following procedures outlined in the USEPA Region 1 Calibration of Field Instruments SOP, Revision 2, dated January 19, 2010 (USEPA, 2010b). Calibration procedures and corrective actions are summarized on Table 6.1. Calibration data are recorded on a Field Instrumentation QA Record (Figure 6.1). The manufacturer and lot number of all standards will be noted on the field instrument QA record. The types of field measurements that may be made include but are not limited to the following:

- pH;
- specific conductance;
- temperature;
- DO;
- organic vapors; and
- turbidity.

7.0 ANALYTICAL PROGRAM

7.1 SELECTION OF PARAMETERS

Laboratory analyses will be scheduled based on historical information regarding potentially hazardous material disposal, previous site information, the determination of data objectives, and NYSDEC criteria. Specific parameters will be outlined in the project-specific FAP.

7.2 SELECTION OF PROCEDURES

The detailed sampling program and associated analytical methods will be documented in the project-specific FAP. The subcontract laboratory analytical procedures to be used for this program will be selected from the NYSDEC ASP (NYSDEC, 2005).

The uses of on-site field screening procedures may also be incorporated into field investigation programs. Target analytes and field screening procedures will be defined in the project FAPs.

7.2.1 Off-site Subcontract Laboratory Analytical Methods

Off-site subcontract laboratory methods will be identified in the project FAPs. The analytical parameters listed below represent methods that are commonly used during site investigation projects.

<u>USEPA SW-846</u>

- VOCs by Method 8260
- SVOCs by Method 8270
- Pesticides by Method 8081
- PCBs by Method 8082
- Organophosphorus Pesticides by Method 8141

- Herbicides by Method 8151
- Metals by Methods 6010 and 6020
- Cyanide by Method 9010 or 9012
- Toxicity Characteristics Leaching Procedure 1311
- RCRA Characteristics

USEPA Contract Laboratory Program (CLP)

- VOCs by CLP SOW
- SVOCs by CLP SOW
- Pesticide/PCBs by CLP SOW
- TAL Metals by CLP SOW

Soil Vapor and Ambient Air

- VOCs by USEPA Method TO-15
- Modified USEPA 8260 with Tedlar bags or sorbent traps

USEPA Drinking Water (Target compound lists will be determined on a project-specific basis.)

- VOCs by Method 524.2

USEPA Waste Water Methods

- VOCs by Method 624
- SVOCs by Method 625
- Pesticides/PCBs by Method 608

For non-CLP methods, the exact TCL, and the quantitation limits and method detection limits, will be identified for each project sampling task in the project-specific FAPs. The detection limits will be evaluated during the development of data quality objects to ensure that detection limits are low enough to meet project objectives.

7.2.1.1 Field Preservation of Soil VOC Samples

In accordance with ASP Exhibit 1, Part II, VOC soil samples will be collected in accordance with preservation procedures identified in USEPA Method 5035. This requires the use of sample collection and handling procedures that restrict the loss of VOCs due to volatilization or biodegradation. Sample collection procedures are described in subsection 4.5.2.1. The following options for sample collection are identified in Method 5035:

- Encore samplers with analysis or preservation within 48 hours
- closed-system low concentration vials with freezing
- closed-system low concentration vials with sodium bisulfate preservation
- high concentration vials with methanol preservation

7.2.1.2 Tentatively Identified Compounds

During the project planning process, a decision will be made regarding the reporting of Tentatively Identified Compounds (TICs). The MACTEC PM and technical staff will obtain direction on a project by project basis from the NYSDEC PM to determine if the reporting of TICs for VOC and/or SVOC methods is needed. If the reporting of TICs is needed, MACTEC will instruct the lab to report TICs. TIC data will be reviewed during the data validation or data usability evaluation process and TICs detected in samples will be tabulated and summarized in project reports.

7.2.2 Field Screening Analytical Methods

Analytical chemistry data may be collected in the field using field analytical techniques. Field screening procedures may be used to support a number of activities that require real time data for decision making in the field. Use of field screening may also be added to a project as a cost effective means of collecting a larger number of samples. Field screening data may be qualitative or quantitative depending on the project objectives. In situations where obtaining quantitative data is a DQO, a subset of samples will be collected as split samples and analyzed at an off-site laboratory. A data comparison study will be completed to evaluate the comparability of the results.

The following scenarios may incorporate the use of field screening data:

- Screening of soil, water, or air samples for presence, absence, or relative concentration of contaminants
- Screening of soil sampling intervals to provide data for selection of samples shipped to an off-site laboratory
- Screening of groundwater intervals for well screen placement decisions
- Screening of soil, water, or air samples for the selection of soil or groundwater exploration locations

Portable Gas Chromatograph. A Portable Gas Chromatograph, such as a Photovac Voyager, may be used for VOC screening of soil, water, or air samples. The instrument is calibrated with known concentration standards and provides a means of collecting real time data on VOCs. Field screening objectives, target compounds, reporting limits, and Standard Operating Procedures (SOPs) will be identified in the project-specific FAPs.

Mobile Laboratory Services. For some projects, a mobile laboratory may be set up on the facility to provide on-site laboratory services using USEPA methods. These methods may include analyses for VOCs, SVOCs, pesticides, PCBs, metals, or any other target analytes that are included in the program. Mobile laboratory objectives, target analytes, reporting limits, and SOPs will be identified in the project-specific FAPs.

Field Test Kits. A variety of field test kits are available for testing water chemistry parameters or target analytes. Methods have been approved as field screening procedures by the USEPA (USEPA; 1996). These include colorimetric tests and immunoassay methods. The following field screening methods may be considered for use in support of field investigation activities:

- Pentachlorophenol by Method 4010A
- PCBs by Method 4020

- Petroleum Hydrocarbons by Method 4030
- PAH by Method 4035
- Ferrous Iron by HACH kit
- Hexavalent Chromium by HACH kit
- Sulfide by HACH

Field screening objectives, target compounds, reporting limits, and SOPs will be identified in the project FAPs.

7.2.3 Sediment Moisture Content.

Sediment samples may have high percent moisture content. With the exception of samples for VOC and AVS:SEM analysis, the laboratory will take steps to reduce the effect of moisture content and achieve the reporting limits and project action limits. Potential steps include:

- Centrifuging the sample and decanting off the layer of water above the solid matrix;
- Sample drying;
- Increasing sample volume size;
- Performing multiple extractions and combining extracts prior to analysis; or,
- Other alternatives proposed by the laboratory.

7.3 LABORATORY CERTIFICATION

Analyses will be performed by a laboratory certified by the NYSDOH ELAP. The selected laboratory will be identified in the project-specific FAP.

7.4 LABORATORY DATA PACKAGE DELIVERABLES

Data reporting requirements for each project-specific sampling event will be defined in the project FAP. Data packages for most analytical data sets will be either Category A, Category B, or CLP as defined in the ASP (NYSDEC, 2005).

7.5 DATA MANAGEMENT & LABORATORY ELECTRONIC DATA DELIVERABLE

MACTEC uses a standardized data management process for all WAs completed under the NYSDEC program. This includes routines to capture sample information at all stages of a site investigation and storage of electronic data in a permanent database. MACTEC has developed the Technical Environmental Database (TED), a SQL Server based relational database. MACTEC requires the laboratories to submit analytical results in an EQuIS-based TED electronic data deliverable (EDD) format for uploading into TED. A description of the TED EDD format is presented in Table 7.1.

8.0 DATA REDUCTION, VALIDATION AND REPORTING

General procedure for chemistry reviews of lab data generated during SI and remedial actions are specified in this FAP/QAPP. For most projects, full data validation will not be completed. A DUSR will be completed. If directed from the NYSDEC PM due to a project-specific QA goal, a full data validation or third party validation will be completed. MACTEC will establish protocols for data reduction, validation, and reporting in the project-specific FAP.

8.1 REDUCTION

Data reduction is the process of converting measurement system outputs to an expression of the parameter which is consistent with the comparability objective. Calculations made during data reduction are described in the referenced analytical methods and in the participating laboratory QA Program.

Upon receipt, analytical data packages are turned over to the data management staff for reduction to standard data tabulations. Analytical data includes hard copy, and electronic data deliverables that are downloaded directly to the TED. During the data review process the electronic data are checked against the hardcopy data package to verify that no systematic error occurred during the production of the electronic deliverable.

Completed data tabulations are provided to the data validation staff along with the original data packages.

8.2 DUSR AND VALIDATION

For the majority of analytical data collected under this program, a data usability review will be completed in accordance with NYSDEC Division of Environmental Remediation guidance DER-10, Appendix 2B for Data Usability Summary Reports (NYSDEC, 2010a). During the DUSR review the results are reviewed using the laboratory hardcopy deliverables to verify that results were reported and qualified correctly by the laboratory, and to evaluate QC measurements to determine the usability of results. Additional data qualifiers may be added to the results using professional judgment of the project chemist and general procedures specified in USEPA Region II validation guidelines.

A DUSR is prepared for each project sampling task by the project chemist or scientist. The MACTEC QAO, or designee, completes a final review of the DUSR before data are finalized. The DUSR includes the following information:

- Site Location and Sampling Event
- Subcontract Laboratory Name and Address
- Summary of Analytical Methods
- Data Quality Observations and Data Qualification Summary
- Table of Final Results and Qualifiers

If a formal validation of data is required, the requirement will be identified in the project FAP and confirmed with the NYSDEC PM. Validation of laboratory data will be performed in accordance with *National Functional Guidelines for Organics Review*, (USEPA, 1999) and *Laboratory Data Validation, Functional Guidelines for Evaluating Inorganics Analyses* (USEPA, 2004), as well as the appropriate USEPA Region II revisions to these protocols.

An example summary of the presentation of final DUSR or validation results is included in Figure 8.1.

8.3 DATA MANAGEMENT AND NYSDEC EDD REPORTING

MACTEC's TED will be used for all analytical data generated as part of the NYSDEC program. TED contains fields to store raw laboratory results, validated laboratory results, site spatial data and geotechnical information. Federal and NYS project-specific regulatory standards have also been included in the database and are available to project for comparison to laboratory results.

Computerized routines in TED are used to produce temporary data spreadsheets for data review and data qualification during completion of DUSRs and validation reports. These spreadsheets are used to input final results and qualifiers into the TED once data review is completed. Final cross tabulation data tables including complete results for all samples and methods are produced with each DUSR directly from the TED. An example of a final data table is included in Figure 8.1.

A variety of other data outputs are routinely created from data in TED. These include risk assessment statistical tables, laboratory split sample comparison tables, detected contaminant crosstab tables (hit tables), and comparison to applicable or relevant and appropriate requirements crosstab tables (Exceedance tables). Analytical results in TED can be used in a variety of GIS data graphics and plotting programs including CADD. The following tables are often prepared to present data in site reports:

- Hits Only Cross Tabulation Tables
- Analyte Frequency and Concentration Summary Tables
- Data Comparisons to Regulatory Standards

User access to TED projects is password protected. Users are assigned roles which limit their ability to modify data. The majority of users have only read capability. TED files are fully backed up on a nightly schedule, with incremental backups scheduled throughout the day. Updates and Deletes to the database are recorded and preserved for tracking, along with a date stamp and the users initials.

TED is also used for computerized sample tracking for projects that choose to use the Tracking Module. In TED, the sample tracking programs are used to provide labels and bottle information before samples are collected through automated COC and shipping information for shipping samples to the lab to producing a tracking file to quickly verify that all analyses requested from the lab are returned.

8.3.1 NYSDEC Electronic Data Deliverable

Beginning in 2011, all laboratory data (and other required associated data) shall be submitted to the NYSDEC in an electronic format in accordance with the NYSDEC Electronic Document Standards (EDS) and EDD that complies with the Department's Electronics Data Warehouse Standards or as otherwise directed by the NYSDEC PM.

All final documents are to be submitted in an electronic format that complies with the most recent DER's EDS. Until such time as the Department establishes an EDS final documents are to be submitted as an Adobe© PDF document.

All final data sets shall be provided in a NYSDEC EQuIS EDD format that complies with the most recent guidance at the NYSDEC EDD Submission Website (http://www.dec.ny.gov/chemical/62440.html). The delivery of data in the NYSDEC EQuIS EDD format may be specified for a subset of tasks in the project-specific FAPs. For these projects, a computerized routine is used to convert the TED data directly into the NYSDEC EQuIS EDD format. It will be the responsibility of the MACTEC PM to identify the need for an NYSDEC EQuIS EDD prior to initiating field activities.

9.0 INTERNAL QUALITY CONTROL

9.1 FIELD QUALITY CONTROL

QC procedures have been established for MACTEC field activities. Field QC activities include the use of calibration standards for pH, specific conductance, temperature, and PIDs as described in Section 6.

A routine process of collecting field QC samples will be incorporated into all field programs unless otherwise directed by the NYSDEC PM. Field QC samples to be submitted to the laboratory include:

- trip blanks
- equipment blanks
- field duplicates
- matrix spikes

These samples provide a quantitative basis for evaluating the data reported. The project-specific FAP will specify the number and type of QC samples to be obtained during field activities.

Trip Blanks. Trip blanks are required for assessing the potential for contaminating aqueous VOC samples during sample shipment. The trip blank consists of a VOC sample container filled by the laboratory with reagent water and is shipped to the site with other VOC sample containers. A trip blank is included with each shipment of water samples scheduled for VOC analysis and will be analyzed with the other VOC samples.

Soil samples that are collected as unpreserved samples will utilize a water trip blank. Soil samples that are preserved in the field will utilize a trip blank that is prepared with the preservation fluid used in the actual samples (sodium bisulfate or methanol).

Field Duplicates. Field duplicates of soil and water samples will be submitted for analysis of all project-specific parameters at a rate of 5 percent of the samples collected. These duplicates are intended to assess the homogeneity of the sampled media and the precision of the sampling protocol.

Equipment Blanks. Equipment blanks (i.e., rinsate blanks) for the bailer, sampling pump, and/or tubing assembly are scheduled during monitoring well sampling at a rate of 5 percent of the samples collected. VOCs and SVOCs or inorganics present within the bailer, pump apparatus, or discharge tubing are assessed by collecting a sample of reagent water passed through the sampling apparatus after washing with the decontamination solution followed by at least one rinse with reagent water. If dedicated equipment is used at a site, the need for equipment blanks may be dropped from the sampling program.

Soil equipment blanks are collected during each field event at a rate of 5 percent of the samples collected. VOC, SVOC, or inorganics present within or on the sampling apparatus where intimate contact with the sample occurs (i.e., split-spoon, trowel), are assessed by rinsing the sampling apparatus with deionized water following decontamination. Rinsate blanks are collected directly into the appropriate water container.

Matrix Spike/Matrix Spike Duplicates (MS/MSD). The NYSDEC ASP requires the laboratory to analyze MS/MSDs for organic analyses at a frequency of 5 percent. To meet this requirement the MACTEC FOL will select samples for MS/MSD analyses and will provide additional sample volume to the laboratory.

9.2 QUALITY REVIEW OF STUDIES AND REPORT PREPARATION

Quality reviews are performed during the course of a project to ensure that all project deliverables meet currently accepted professional standards. The level of effort for each assignment will vary depending on type of assignment, project objectives and goals, duration, and size. Review of the project will entail periodic discussions between technical staff, Task Leaders, Site Managers, QAO, PM, and Program Manager.

To enhance the professional quality of the company's studies and reports, the PM and Program Manager will:

- require that reports refer to and are consistent in scope with the project proposal and contract; and
- require that the report be organized and written so that (1) NYSDEC understands the risks and uncertainties associated with the report and (2) facts are distinguished from opinion, and risks and limitations are identified.

Implementation of QC for reports involves the use of a technical review routing and sign-off forms. Figure 9.1 illustrates the Deliverable Review Tracking Form. The PM and Program Manager provide final review and release for all deliverables.

10.0 QA PERFORMANCE AND SYSTEM AUDITS

QA audits may be performed to verify that proper procedures, documentation, and QA/QC measures are being used to provide data of acceptable quality and that subsequent calculation, interpretation and other project outputs are checked and validated. Audits may be completed by MACTEC or by the NYSDEC or other agencies with interest in the project. Both scheduled and unscheduled audits are possible. Audits of laboratories, field program tasks, subcontractors, or other activities that are included in projects.

The QAO may conduct project audits of calculations, interpretations and reports which are based on the measurement system outputs, and system and performance audits. Scheduled audits will be identified in the project FAP as a project-specific task. Unscheduled audits may also be performed following a request from the NYSDEC PM, the MACTEC Program Manager, or QAO.

The scheduling of QA and system audits completed by MACTEC will be determined on a project-specific basis and identified in the WA Issuance from the NYSDEC. During the project scoping process, the MACTEC PM and technical leaders, in consultation with the NYSDEC PM, will evaluate the project scope, quality goals, and execution tasks, and determine if audits are needed. If audits are included in the scope of the project, the MACTEC QAO will complete the audits and provide a formal audit report to the MACTEC PM and the NYSDEC for review. Audits are completed using the following processes:

<u>Audit Planning</u>

- Review project FAP and QAPP
- prepare checklist based on project plans or other applicable guidance documents
- schedule audit to observe target processes
- identify project contacts

<u>Audit Execution</u>

- travel to and from project location
- pre-audit meeting with project staff
- observation and evaluations of target processes and personnel
- post-audit meeting and summary of observations and findings
- implement corrective actions if necessary

<u>Audit Reporting</u>

- complete audit report
- review observations and findings with PM
- implement additional corrective actions if necessary
- track corrective actions and document closure of actions

In general, environmental laboratory approval is based on certification of the NYSDOH ELAP and laboratory audits will not be completed by MACTEC unless specifically requested by NYSDEC. It will be the responsibility of MACTEC to determine that laboratories are certified under ELAP and that they maintain the certification for the duration of the project.

10.1 PROJECT SYSTEMS AUDIT

A project systems audit may be conducted on all components of measurement systems to determine proper selection of procedures and utilization of resources. The systems audit may include evaluation of the following aspects of field and/or laboratory procedures.

Organization and Personnel. The project organization is reviewed for compliance with the proposed organization and for clarity of assigned responsibility. Personnel assigned to the project will be reviewed to determine that assigned responsibility, skill, and training of the personnel are properly matched. The PM maintains firsthand knowledge of the project-team's capabilities and will discuss the organization's efficacy with the QAO. Assigned personnel may be interviewed by the QAO during an audit.

Facilities and Equipment. The audit will address whether field equipment and analytical instruments are selected and used to meet requirements specified by the project objectives stated in the project-specific FAP. Equipment and facilities provided for personnel health and safety may also be evaluated. Calibration and documentation procedures for instruments used in the field are also reviewed.

Analytical Methodology. A review of analytical methodology relative to data requirements for the project will be performed. An on-site observation of analyst technique, data reduction, and record keeping may be performed, if necessary. Periodic review of precision and accuracy of data will be performed.

Sampling and Sample Handling Procedure. A field audit of sampling activities may be performed by the MACTEC QAO. Field documentation may be reviewed. The site visit will be documented in an audit report.

Data Handling. During a system audit, the QAO will review data handling procedures with the Task Leaders and Site Managers. Accuracy, consistency, documentation, and appropriate selection of methodologies will be discussed.

10.2 PROJECT REVIEW

Project reviews are scheduled and conducted periodically by the Program Manager. The intent of project review is to assess scope and contractual compliance and overall technical quality of the contracted services.

10.3 QUALITY ASSURANCE AUDIT REPORT

A written report of the QA project/system audit is prepared to include:

- an assessment of project team status in each of the major project areas;
- clear statements of areas requiring improvement or problems to be corrected;

- recommendations and assistance will be provided regarding proposed corrective actions or system improvements. (If no action is required, the report will state that the QA audit was satisfactorily completed); and
- a timetable for any corrective action required.

11.0 PREVENTIVE MAINTENANCE

11.1 ANALYTICAL INSTRUMENTATION

Preventive maintenance of analytical instrumentation is addressed by the subcontract laboratories SOPs that are presented in the Laboratory QA documents.

11.2 FIELD INSTRUMENTS

Preventive maintenance of field equipment is performed by field chemists and field operations support staff, and routinely precedes each sampling event. More extensive maintenance is performed on the basis of hours in use. Field instrumentation is calibrated on a regular schedule. In the event that field equipment calibration is not met, a review of instrument maintenance options will be completed. When possible, maintenance steps will be completed to bring instruments into calibration. Sampling crews report on the performance of the equipment after each sampling event. Critical spare parts are kept in stock.

12.0 DATA ASSESSMENT

12.1 GENERAL

The purpose of data quality assessment is to document that data generated under the program are accurate and consistent with project objectives. The quality of data will be assessed based on the precision, accuracy, representativeness, comparability, and completeness of the data that are generated. Data quality assessment will be conducted in three phases:

Phase 1. Prior to data collection, sampling and analysis procedures are evaluated in regard to their ability to generate the appropriate, technically acceptable information required to achieve project objectives. This FAP/QAPP meets this requirement by establishing project objectives defined in terms of parameters, analytical methods, and required sampling protocols.

Phase 2. During data collection, results will be reviewed to assess whether procedures are efficient and effective and that the data generated provide sufficient information to achieve project objectives. The precision and accuracy of selected measurement systems will be evaluated. In general, evaluation of data will be based on performance audits, results of duplicate and spiked sample analyses, and review of completeness objectives.

Documentation may include:

- number and identity of duplicate samples collected;
- number and identity of duplicate, spike, and field blank samples analyzed;
- identification of statistical techniques, if used, to measure central tendency, dispersion, or testing for outliers;
- use of historical data and its reference;
- identification of analytical method; and
- data validation results.

Phase 3. Following completion of data collection activities, an assessment of the adequacy of the database generated in regard to completing project objectives will be undertaken by the QAO and PM. Recommendations for improved QC will be developed, if appropriate. In the event that data gaps are identified, the auditor may recommend the collection of additional raw data to fully support the project's findings and recommendations.

Each phase of the assessment will be conducted in conjunction with appropriate project staff.

13.0 CORRECTIVE ACTION

Corrective or preventive action is required when potential or existing conditions are identified that may have an adverse impact on data quantity or quality. Corrective action can be immediate or long-term. In general, any member of the program staff who identifies a condition adversely affecting quality can initiate corrective action by notifying his or her supervisor or the QAO. The communication will identify the situation requiring corrective action and explain how it may affect data quality or quantity.

13.1 IMMEDIATE CORRECTIVE ACTION

Immediate corrective action is usually applied to spontaneous, non-recurring problems, such as an instrument malfunction. The individual who detects or suspects nonconformance to previously established criteria or protocol in equipment, instruments, data, methods, etc., will immediately notify their supervisor. The supervisor and the appropriate Task Leader, Site Manager, or PM will then investigate the extent of the problem and take the necessary corrective steps. If a large quantity of data is affected, the Task Leader must prepare a memorandum to the PM and QAO. These individuals will collectively decide how to proceed. If the problem is limited in scope, the Task Leader or Site Manager will decide on the corrective action measure, document the solution and notify the PM and the QAO in memorandum form.

13.2 LONG-TERM CORRECTIVE ACTION

Long-term corrective action procedures are devised and implemented to prevent the recurrence of a potentially serious problem. The QAO will be notified of the problem and will conduct an investigation to determine the severity and extent of the problem. They will then file a corrective action request with the PM and project leaders.

In case of dispute between the QAO and the PM, the MACTEC Program Manager will make a final determination for the company.

Corrective actions may also be initiated as a result of other activities, including:

- performance audits;
- systems audits;
- laboratory/field comparison studies; and
- QA project audits conducted by the QAO.

The need for laboratory audits or field program audits will be determined on a project-specific basis as described in Section 10.

The QAO will be responsible for documenting all notifications, recommendations, and final decisions. The PM and the QAO will be jointly responsible for notifying program staff and implementing the agreed upon course of action. The QAO will be responsible for verifying the efficacy of the implemented actions. The development and implementation of preventive and corrective actions will be timed, to the extent possible, so as not to adversely impact either project schedules or subsequent data generation/processing activities. The QAO will also be responsible for developing or identifying and implementing routine program controls to minimize the need for corrective action.

14.0 REPORTS TO MANAGEMENT

Management personnel at all levels receive QA reports appropriate to their level of responsibility. The PM receives copies of all QA documentation. QC documentation is retained within the department which generated the product or service (e.g., field data documentation) except where this documentation is a deliverable for a specific contract. QC documentation is also submitted to the QAO for review and approval. Previous sections detailed the QA activities which are integral to MACTEC QA Program and the reports which they generate. A final audit report for each project may also be prepared. The reports would include:

- periodic assessment of measurement data accuracy, precision and completeness;
- results of performance audits and/or systems audits;
- significant QA problems and recommended solutions for future projects; and
- status of solutions to any problems previously identified.

Additionally, any incidents requiring corrective action will be fully documented. Procedurally, the PM will prepare the reports to management. These reports will be addressed to the Task Leader, or Site Manager and QAO. The summary of findings shall be factual, concise, and complete. Any required supporting information will be appended to the report.

15.0 SUSTAINABILTY AND GREEN REMEDIATION

Green remediation is a component of MACTEC's overall quality assurance program. Green remediation seeks to minimize ancillary environmental impacts such as greenhouse gas emissions through minimizing energy consumption, maximizing the reuse of land, and the recycling of materials.

During the drafting of project-specific FAPs, as well as within the remedial analysis in the project-specific feasibility studies and within the remedial design documents, emphasis will be placed on using green strategies and approaches. These strategies will include efforts to reduce direct and indirect emissions of carbon dioxide and other greenhouse gasses, conserve natural resources, reduce waste, and maximize habitat value.

All members of the project team will be briefed on current sustainability and green remediation strategies. This will include following guidance outlined in DER-31 (NYSDEC, 2010b).

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FIGURES

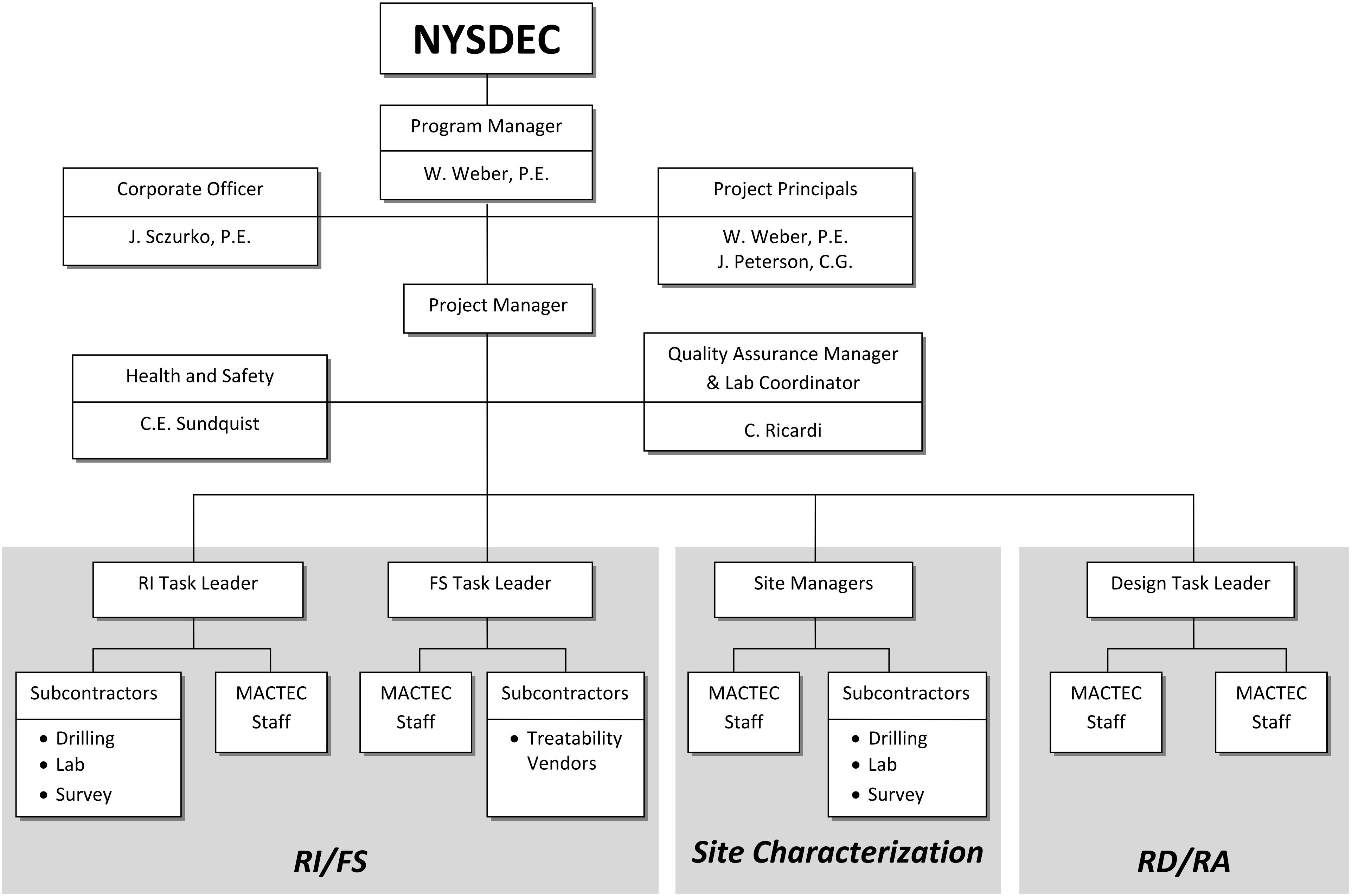

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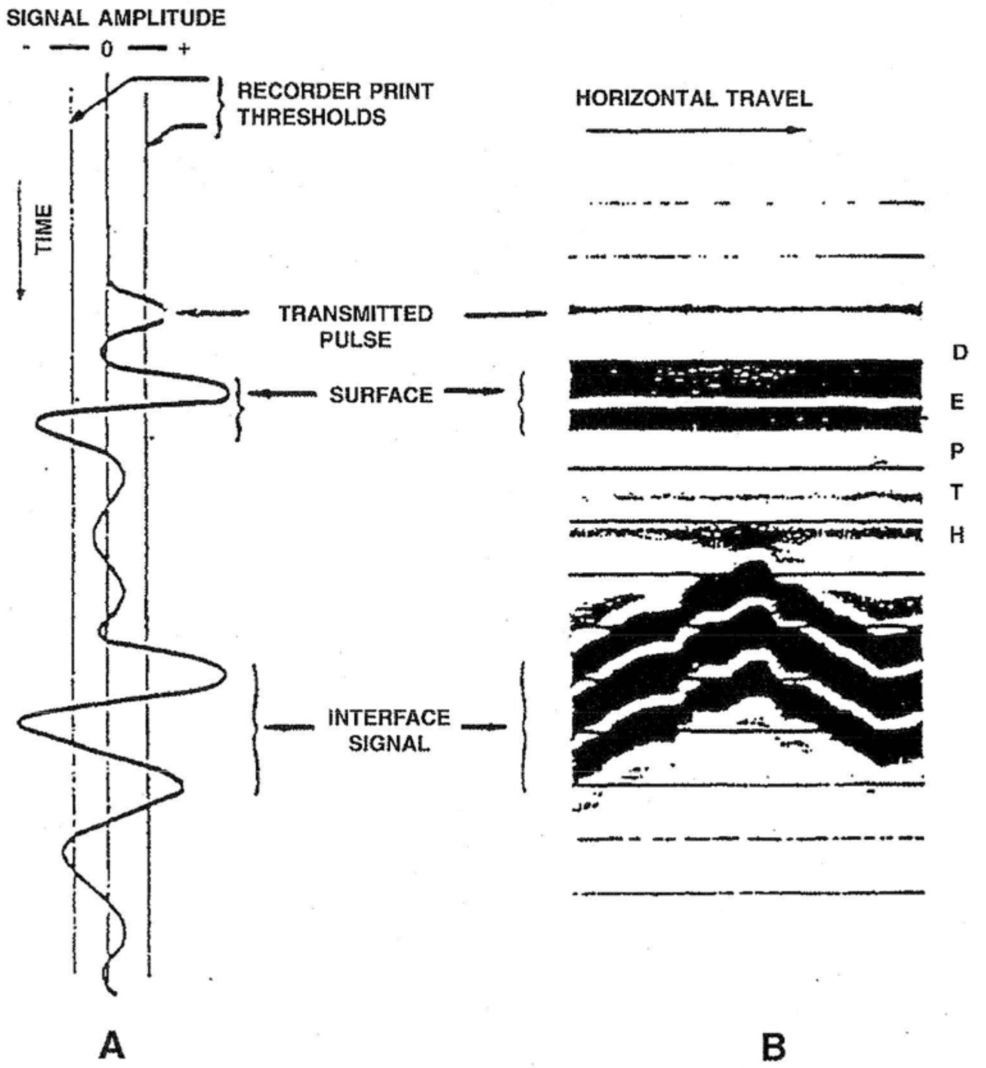
Figure 2.1
Organization Chart
NYSDEC Quality Assurance Program Plan



(A) SKETCH OF A SINGLE PULSE AND REFLECTIONS AS SEEN BY THE RECEIVER.

(B) EXAMPLE OF PROFILE INFORMATION AS DISPLAYED BY THE GRAPHIC RECORDER.

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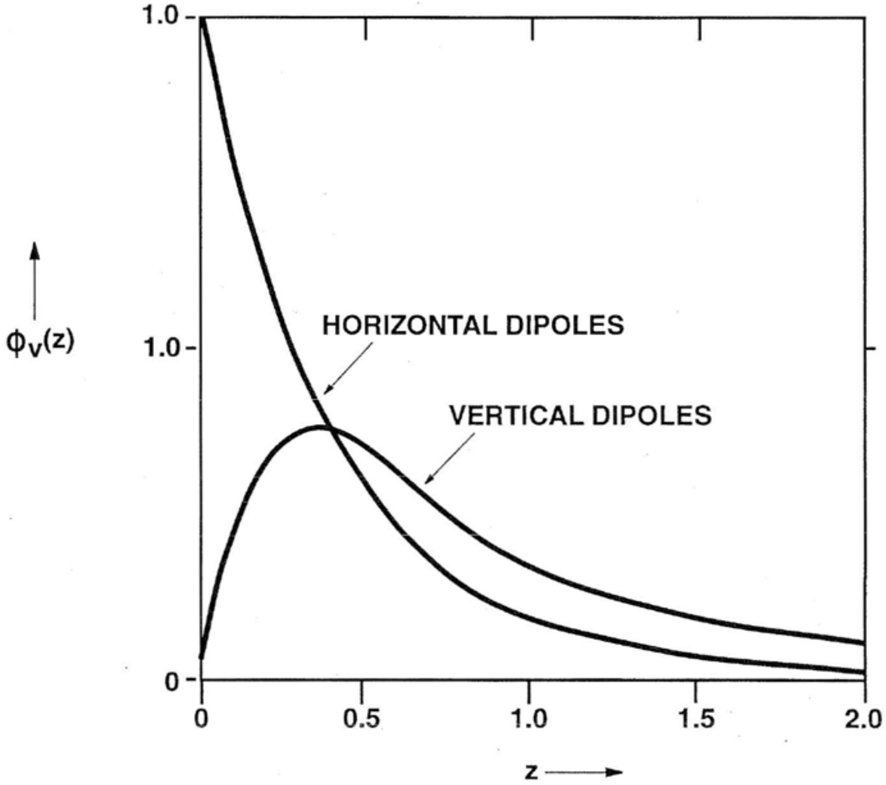
FIGURE 4.1
GPR SYSTEM DATA
NYSDEC QUALITY ASSURANCE PROJECT PLAN



Note: "$\phi_V(z)$" is the relative contribution to the secondary magnetic field intensity from material in a thin layer (dz) located at (normalized) depth "z".

"z" is the depth of the thin layer (dz) divided by the intercoil spacing between transmitter and receiver

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FIGURE 4.2
TERRAIN CONDUCTIVITY SURVEY COMPARISON OF RELATIVE RESPONSES FOR VERTICAL AND HORIZONTAL DIPOLES
NYSDEC QUALITY ASSURANCE PROGRAM PLAN

TEST PIT RECORD

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Project Name:		Test Pit ID:	
Project Location:		Page No.	
Project No.:	Client:	of:	

Test Pit Location:	Monitoring Equipment:	
Weather:	Photographs (Y/N):	Protection Level:
Surface Conditions:	Length of Exc:	Width of Exc:
Subcontractor:	Date Started:	Date Completed:
Operator:	Logged By:	Checked By:
Equipment:	Refusal Depth:	Total Depth:
Reference Elevation:	Water Level:	Time:

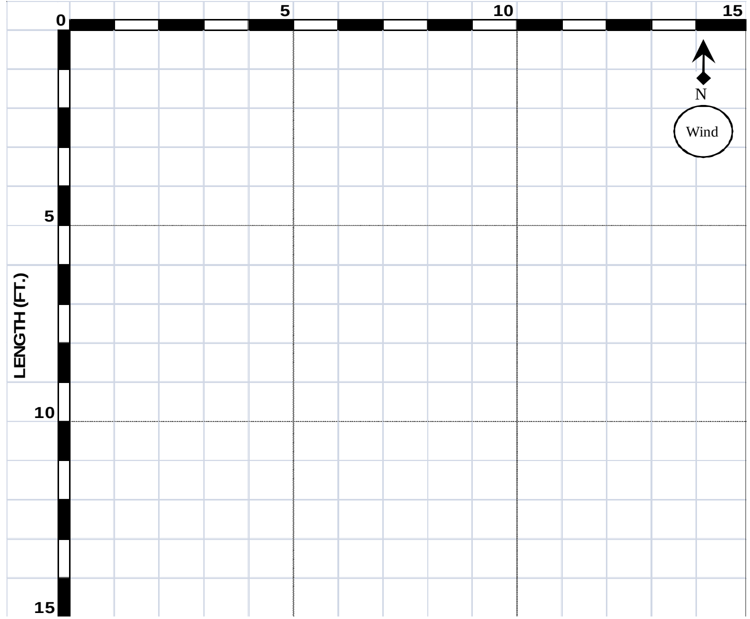
Location Sketch

N

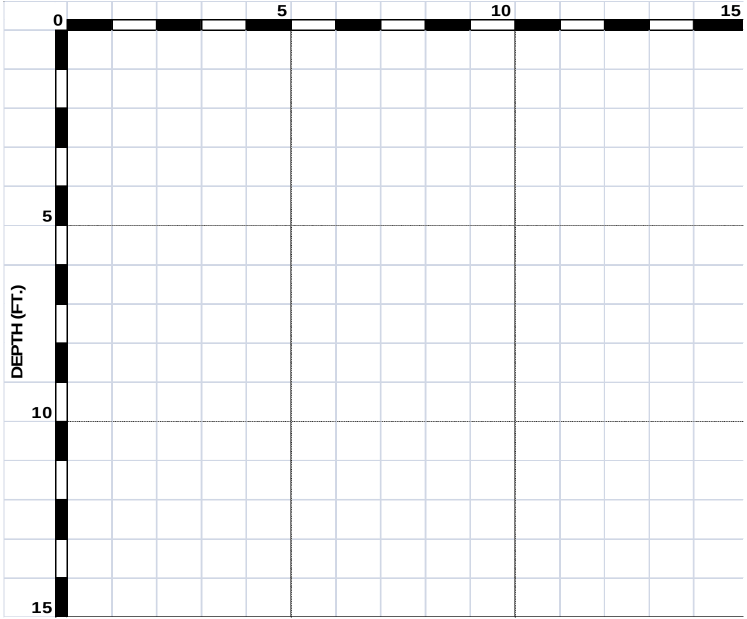
Wind

Sample Information			Monitoring				Sample Description and Classification	USCS Group Symbol	Remarks
Depth (ft. bgs)	Sample No. & Type	Pocket Pen/ Torvane (Kg/cm^2)	PID Field Scan	PID Headspace	Lab Tests Performed	Lab Sample ID			

PLAN VIEW



CROSS-SECTIONAL VIEW



NOTES:

FIGURE 4.3
TEST PIT RECORD
NYSDEC QUALITY ASSURANCE PROGRAM PLAN

SOIL BORING LOG

MACTEC 511 Congress Street, Portland Maine 04101	Project Name:		Boring ID:
	Project Location:		Page No.
	Project No.:	Client:	of:
Boring Location:	Refusal Depth:	Total Depth:	Bore Hole ID/OD:
Weather:	Soil Drilled:	Method:	Casing Size:
Subcontractor:	P.I.D (eV):	Protection Level:	Sampler:
Driller:	Date Started:	Date Completed:	Sampler ID/OD:
Rig Type/Model:	Logged By:	Checked By:	Hammer Wt/Fall:
Reference Elevation:	Water Level:	Time:	Hammer Type:

Sample Information					Monitoring						
Depth (feet bgs)	Sample Number	Penetration/ Recovery (feet)	SPT Blows/6"	N Value	PID Field Scan	PID Headspace	Lab Tests Performed	Lab Sample ID	Sample Description and Classification	USCS Group Symbol	Remarks
0.0											

NOTES:

FIGURE 4.4
SOIL BORING LOG
NYSDEC QUALITY ASSURANCE PROGRAM PLAN

ROCK CORING LOG

MACTEC 511 Congress Street, Portland Maine 04101	Project Name:		Boring ID:
	Project Location:		Page No.
	Project No.:	Client:	of:
Boring Location:	Refusal Depth:	Total Depth:	Bore Hole ID/OD:
Weather:	Soil Drilled:	Method:	Casing Size:
Subcontractor:	P.I.D (eV):	Protection Level:	Bit Type:
Driller:	Date Started:	Date Completed:	Bit Size:
Rig Type/Model:	Logged By:	Checked By:	Bit Use:
Reference Elevation:	Water Level:	Time:	Core Interval:

Depth (feet bgs)	Sample Number	Penetration/ Recovery (feet)	Natural Core Breaks		Weathered Condition	Rock Quality			Drill Rate (min/ft)	Color	Rock Description and Comments on Drilling	Graphic Log	Additional Remarks
			Type/Dip	Surface Condition		Total 4" Core	RQD (%)	Rock Quality Description					

NOTES:

FIGURE 4.5
ROCK CORING LOG
NYSDEC QUALITY ASSURANCE PROGRAM PLAN

KEY TO SOIL DESCRIPTIONS AND TERMS

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS (>50% RETAINED on the No. 200 sieve)	GRAVELS (>50% of coarse fraction RETAINED on the No. 4 sieve)	CLEAN GRAVELS (<5% fines)	GW	Well-graded gravels or gravel-sand mixtures; trace or no fines.
			GP	Poorly-graded gravels or gravel-sand mixtures; trace or no fines.
		GRAVEL WITH FINES (>12% fines)	GM	Silty gravels or gravel-sand-silt mixtures.
			GC	Clayey gravels or gravel-sand-clay mixtures.
	SANDS (50% or more of coarse fraction PASSES the No. 4 sieve size)	CLEAN SANDS (<5% fines)	SW	Well-graded sands or sand-gravel mixtures; trace or no fines.
			SP	Poorly-graded sands or sand-gravel mixtures; trace or no fines.
		SAND WITH FINES (>12% fines)	SM	Silty sands or sand-gravel-silt mixtures.
			SC	Clayey sands or sand-gravel-clay mixtures.
FINE-GRAINED SOILS (50% or more PASSES the No. 200 sieve)	SILTS AND CLAYS (liquid limit <50)		ML	Inorganic silts or rock flour, non-plastic or very slightly plastic. PI <4 or plots below "A" line.
			CL	Inorganic lean clays. Low to medium plasticity. PI >7 and plots on or above "A" line.
			OL	Organic silts, clays and silty clays. Low to medium plasticity.
	SILTS AND CLAYS (liquid limit≥50)		MH	Inorganic elastic silt. PI line plots on or above "A" line.
			CH	Inorganic fat clay. High plasticity. PI line plots on or above "A" line.
			OH	Organic silts and clays. High plasticity.
	HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils. Decomposed vegetable tissue. Fibrous to amorphous texture.

TERMS DESCRIBING SOILS (excludes particles > 3", organics, debris, etc.)	TERMS DESCRIBING MATERIALS i.e. particles > 3", organics, debris, etc.)
Trace: Particles present, but < 5%	Occasional: Particles present, but < 10%
Few: 5% - 10%	Some: 10% to 25%
Little: 10% - 25%	Frequent: >25%
Some: 25% - 45%	

TERMS DESCRIBING MOISTURE	TERMS DESCRIBING STRUCTURE
Dry: Absence of moisture; dusty	Layer: > 3" thick
Moist: Damp, but no visible water	Seam: 1/16" to 3" thick
Wet: Visible/free water	Parting: < 1/16" thick

CORRELATION OF STANDARD PENETRATION TEST (SPT) WITH RELATIVE DENSITY AND CONSISTENCY

GRAVEL, SAND & SILT (NON-PLASTIC)

Relative Density	N-Value (blows per foot)
Very loose	0 - 4
Loose	5 - 10
Compact	11 - 30
Dense	31 - 50
Very Dense	> 51

SILT (PLASTIC) & CLAY

Consistency	SPT N-Value	Su (psf)	Field Guidelines
Very Soft	0 - 2	0 - 250	Fist easily penetrates
Soft	3 - 4	250 - 500	Thumb easily penetrates
Medium Stiff	5 - 8	500 - 1000	Thumb penetrates with moderate effort.
Firm	9 - 15	1000 - 2000	Indented by thumb with great effort
Very Stiff	16 - 30	2000 - 4000	Indented by thumbnail
Hard	>31	over 4000	Indented by thumbnail with difficulty

ROCK QUALITY DESIGNATION (RQD)

$$\text{RQD} = \frac{\text{sum of the lengths of intact pieces of core* >100mm (0.3ft.)}}{\text{length of core advance}}$$

*Minimum NQ rock core (1.88 in. OD of core)

Quality Description	RQD
Very Poor	<25%
Poor	26% - 50%
Fair	51% - 75%
Good	76% - 90%
Excellent	>91%

Desired Soil Observations: (in this order)

Color
Primary Soil Component
Secondary Soil Components
Angularity and/or shape of sand/gravel particles
USCS Symbol (See ASTM D 2488 Figs 1a, 1b, & 2)
Density/Consistency
Moisture
Plasticity (as applicable)
Structure
Geologic Origin
Fill, Alluvium, Lacustrine, Glacial Till, etc.
Presence of organics (leaves, roots, rootlets, etc.) or debris (concrete, brick, wood, metal, etc.)
Presence of cobbles or boulders (based on observations of drilling)
Odor, PID data, Torvane or pocket penetrometer data, etc.

Example Descriptions:

Olive brown, fine to medium sand, little silt, trace angular gravel, SM, medium dense, moist: FILL
- occasional concrete and brick fragments; petroleum odor; PID = 1.4 ppm

Gray, CLAY, little fine sand, trace angular gravel, CL, stiff, moist, desiccated: LACUSTRINE

Yellowish brown, fine SAND, trace silt, trace rounded gravel, poorly-graded, SP, loose, wet: ALLUVIUM
- occasional partings of fine sand; 1-inch seam of olive brown silt at 8' bgs; Torvane = 0.55 tsf

Desired Rock Observations: (in this order)

Color (i.e. olive brown, gray, reddish brown)
Texture (aphanitic, fine-grained, etc.)
Lithology (igneous, sedimentary, metamorphic, etc.)
Hardness (very hard, hard, mod. hard, etc.)
Weathering (fresh, very slight, slight, moderate, mod. severe, severe,
Geologic discontinuities/jointing:
-dip (horiz - 0^{o}-5^{o}, low angle - 5^{o}-35^{o}, mod. dipping - 35^{o}-55^{o}, steep - 55^{o}-85^{o}, vertical - 85^{o}-90^{o})
-spacing (very close - <5 cm, close - 5-30 cm, mod.close 30-100 cm, wide - 1-3 m, very wide >3 m)
-tightness (tight, open or healed)
-infilling (grain size, color, etc.)
Interpreted Formation (Waterville, Ellsworth, Cape Elizabeth, etc.)
RQD and Rock Mass Description (very poor, poor, fair, etc.)
Recovery

Sample Container Labeling Requirements (if retained): Site, Boring ID, Sample Number, Sample Depth, Sample Recovery, Blow Counts, Personnel Initials.

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FIGURE 4.6
USCS KEY TO SOIL DESCRIPTIONS
NYSDEC QUALITY ASSURANCE PROGRAM PLAN

WELL/PIEZOMETER CONSTRUCTION DIAGRAM STICKUP

LOCATION ID:

Project Name:

Project Location:

Project Number: Task Number

Subcontractor: Drilling Method:

Development Method: Development Date:

Bucking Posts/Ballards:

Notes:

Date Started: Date Completed:

Logged By:

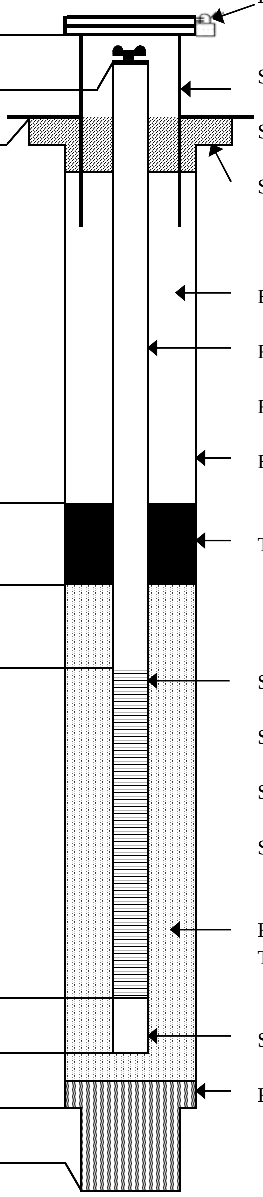
Checked By: Checked Date:

Measuring Point Information

Measuring Point (MP) Type Top Of Riser

MP Elevation (ft):

Item	**Depth BMP (ft)**	**Elevation (ft)**
Stickup		
Riser Pipe (Top)		
Ground Surface Elevation		
Top of Well Seal		
Top of Sand Pack		
Top of Screen		
Base of Screen		
End Cap		
Drilled Depth		
Bottom of Exploration		
Bedrock Surface		



Description

Lock Identification

Stickup Casing Type:

Stickup Casing Diameter:

Surface Seal Type:

Backfill/Grout Type:

Riser Pipe Type:

Riser Pipe ID:

Borehole Diameter:

Type of Seal:

Screen Type:

Screen ID:

Screen Slot Size:

Screen Length:

Filter/Sand Pack Type:

Sump:

Fallback/Backfill:

NOT TO SCALE

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FIGURE 4.7
WELL/PIEZOMETER CONSTRUCTION DIAGRAM - STICKUP
NYSDEC QUALITY ASSURANCE PROJECT PLAN

WELL/PIEZOMETER CONSTRUCTION DIAGRAM FLUSHMOUNT

LOCATION ID:

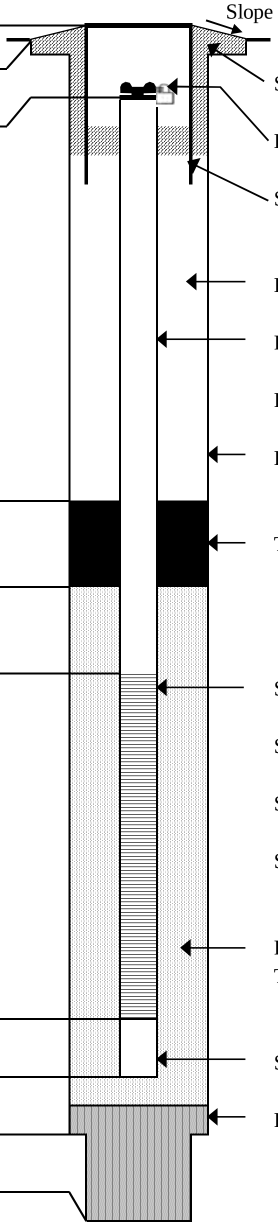
Project Name:
Project Location:
Project Number: Task Number
Subcontractor: Drilling Method:
Development Method: Development Date:
Bucking Posts/Ballards:
Notes:

Date Started: Date Completed:
Logged By:
Checked By: Checked Date:

Measuring Point Information

Measuring Point (MP) Type: Top Of Riser
MP Elevation (ft):

Item	**Depth BMP (ft)**	**Elevation (ft)**
Surface Casing Elevation		
Ground Surface Elevation		
Riser Pipe (Top)		
Top of Well Seal		
Top of Sand Pack		
Top of Screen		
Base of Screen		
End Cap		
Drilled Depth		
Bottom of Exploration		
Bedrock Surface		



Description

Surface Seal Type:
Lock Identification
Stickup Casing Diameter:
Backfill/Grout Type:
Riser Pipe Type:
Riser Pipe ID:
Borehole Diameter:
Type of Seal:
Screen Type:
Screen ID:
Screen Slot Size:
Screen Length:
Filter/Sand Pack Type:
Sump:
Fallback/Backfill:

NOT TO SCALE

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FIGURE 4.8
WELL/PIEZOMETER CONSTRUCTION DIAGRAM - FLUSHMOUNT
NYSDEC QUALITY ASSURANCE PROJECT PLAN

WELL DEVELOPMENT RECORD

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PROJECT NAME		**LOCATION ID**	**PAGE** OF
PROJECT NUMBER		**START TIME**	**START DATE**
WELL INSTALLATION DATE	**WELL DEVELOPMENT DATE**	**END TIME**	**END DATE**

WELL DIAMETER (INCHES) ☐ 1-IN. ☐ 2-IN. ☐ 4-IN. ☐ 6-IN. ☐ 8-IN. ☐ OTHER ____________

CASING DIAMETER (INCHES) ☐ 4-IN. ☐ 6-IN. ☐ 8-IN. ☐ 10-IN. ☐ 12-IN. ☐ OTHER ____________

MEASUREMENT POINT (MP) ☐ TOP OF RISER (TOR) ☐ TOP OF CASING (TOC) ☐ OTHER ____________

INITIAL WELL DEPTH (BMP)	FT	**FINAL WELL DEPTH (BMP)**	FT	**SCREEN LENGTH**	FT	**PROT. CASING STICKUP (AGS)**	FT
INITIAL DTW (BMP)	FT	**SEDIMENT REMOVED** (final well depth - initial well depth)	FT	**SCREENED INTERVAL (BMP)**	TO	**TOC/TOR DIFFERENCE**	FT
WATER COLUMN (initial well depth - initial depth to water)	FT	**DTW AFTER DEVELOP. (BMP)**	FT	**PUMPING DEPTH (BMP)**	FT	**PID AMBIENT AIR**	PPM
CALCULATED GAL/VOL (column X well diameter squared X 0.041)	GAL	**FINAL RECOVERY DEPTH (BMP)**	FT	**APPROXIMATE RECHARGE RATE**	FT/MIN	**PID WELL MOUTH**	PPM
TOTAL VOL. PURGED (mL per minute X total minutes X 0.00026 gal/mL)	GAL	**FINAL RECOVERY TIME (elapsed)**	MIN	**FLUIDS LOST DURING DRILLING**	GAL	**END OF WELL DEVELOPMENT SAMPLE TAKEN?**	Y ☐ N ☐

FIELD PARAMETERS

TIME	DTW (ft BMP)	PURGE RATE (mL/min)	TEMP. (^oC)	SP. CONDUCTANCE (mS/cm)	pH (units)	DISS. O_2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	VOLUME PURGED (gal)	TOTAL GALLONS	COMMENTS

EQUIPMENT DOCUMENTATION

☐ DEDICATED SUBMERSIBLE
☐ SURGE BLOCK
☐ BAILER
  ☐ 2" ☐ ______
☐ GRUNDFOS
  ☐ 2" ☐ 4"
☐ OTHER

☐ WATER LEVEL METER
☐ PID ____________
☐ WQ METER ____________
☐ TURB. METER ____________
☐ OTHER ____________
☐ OTHER ____________
☐ OTHER

WELL DEVELOPMENT CRITERIA

	Y	N
Well water clear to the unaided eye?	☐	☐
Sediment thickness remaining in well <1.0% of screen length?	☐	☐
Total water removed = a minimum of 5x calculated well volumes plus 5x drilling fluids lost?	☐	☐
Turbidity < 5NTUs?	☐	☐
10% change in field parameters?	☐	☐

WAS DEVELOPMENT CRITERIA MET? Y ☐ N ☐

ADDITIONAL OBSERVATIONS

PURGE WATER CONTAINERIZED Y ☐ N ☐

NUMBER OF GALLONS GENERATED ____________

SKETCH

NOTES

Well Developer Signature:
Print Name:
Checked By:
Date:

FIGURE 4.9
WELL DEVELOPMENT RECORD
NYSDEC QUALITY ASSURANCE PROGRAM PLAN

GROUNDWATER/ PORE WATER GRAB SAMPLING RECORD

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PROJECT NAME		**SAMPLE LOCATION**	**DATE**
PROJECT NUMBER		**START TIME**	**END TIME**
SAMPLE ID	**SAMPLE TIME**	**SITE NAME/NUMBER**	**PAGE** OF

SAMPLE TYPE ☐ GRAB ☐ WELL/PIEZOMETER ☐ GEOPROBE ☐ PORE WATER ☐ OUTFALL ☐ OTHER ______________

WELL DIAMETER (INCHES) ☐ 1 ☐ 2 ☐ 4 ☐ 6 ☐ 8 ☐ OTHER ______________

TUBING ID (INCHES) ☐ 1/8 ☐ 1/4 ☐ 3/8 ☐ 1/2 ☐ 5/8 ☐ OTHER ______________

MEASUREMENT POINT (MP) ☐ TOP OF RISER (TOR) ☐ TOP OF CASING (TOC) ☐ OTHER ______________

WELL INTEGRITY

	YES	NO	N/A
CAP	___	___	___
CASING	___	___	___
LOCKED	___	___	___
COLLAR	___	___	___

INITIAL DTW (BMP)	FT	**FINAL DTW (BMP)**	FT	**PROT. CASING STICKUP (AGS)**	FT	**TOC/TOR DIFFERENCE**	FT
WELL DEPTH (BMP)	FT	**SCREEN LENGTH**	FT	**PID AMBIENT AIR**	PPM	**REFILL TIMER SETTING**	SEC
WATER COLUMN	FT	**DRAWDOWN VOLUME** (initial DTW- final DTW X well diam. squared X 0.041)	GAL	**PID WELL MOUTH**	PPM	**DISCHARGE TIMER SETTING**	SEC
CALCULATED GAL/VOL (column X well diameter squared X 0.041)	GAL	**TOTAL VOL. PURGED** (mL per minute X total minutes X 0.00026 gal/mL)	GAL	**DRAWDOWN/ TOTAL PURGED**		**PRESSURE TO PUMP**	PSI

FIELD PARAMETERS

TIME	DTW (FT)	PURGE RATE (mL/min)	TEMP. (^oC)	SP. CONDUCTANCE (mS/cm)	pH (units)	DISS. O_2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	PUMP INTAKE DEPTH (ft)	COMMENTS
	BEGIN PURGING									

SAMPLE OBSERVATIONS: CLEAR ____________ COLORED ______________ CLOUDY ______________ TURBID ______________ ODOR ______________ OTHER (see notes) ______________

EQUIPMENT DOCUMENTATION

TYPE OF PUMP
- ☐ PERISTALTIC
- ☐ SUBMERSIBLE
- ☐ BLADDER
- ______________
- ☐ WATTERA
- ☐ OTHER ______________
- ☐ OTHER ______________

DECON FLUIDS USED
- ☐ LIQUINOX
- ☐ DEIONIZED WATER
- ☐ POTABLE WATER
- ☐ NITRIC ACID
- ☐ HEXANE
- ☐ METHANOL
- ☐ OTHER ______________

TUBING/PUMP/BLADDER MATERIALS
- ☐ SILICON TUBING
- ☐ TEFLON TUBING
- ☐ TEFLON LINED TUBING
- ☐ HDPE TUBING
- ☐ LDPE TUBING
- ☐ OTHER ______________
- ☐ OTHER ______________
- ☐ S. STEEL PUMP MATERIAL
- ☐ PVC PUMP MATERIAL
- ☐ GEOPROBE SCREEN
- ☐ TEFLON BLADDER
- ☐ OTHER ______________
- ☐ OTHER ______________
- ☐ OTHER ______________

EQUIPMENT USED
- ☐ WATER LEVEL METER
- ☐ PID ______________
- ☐ WQ METER ______________
- ☐ TURB. METER ______________
- ☐ PUMP ______________
- ☐ OTHER ______________
- ☐ FILTERS NO. ____ TYPE ______________

ANALYTICAL PARAMETERS

	PARAMETER	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	QC COLLECTED	SAMPLE BOTTLE ID NUMBERS
☐							
☐							
☐							
☐							
☐							
☐							
☐							

NOTES

SKETCH

PURGE OBSERVATIONS

	YES	NO	
PURGE WATER CONTAINERIZED	☐	☐	NUMBER OF GALLONS GENERATED ______________
NO-PURGE METHOD UTILIZED	☐	☐	If yes, purged approximately 1 standing volume prior to sampling or _________mL for this sample location.

Sampler Signature: Print Name:

Checked By: Date:

FIGURE 4.10
GROUNDWATER/ PORE WATER GRAB SAMPLING RECORD
NYSDEC QUALITY ASSURANCE PROJECT PLAN

SOIL VAPOR IMPLANT SAMPLING RECORD

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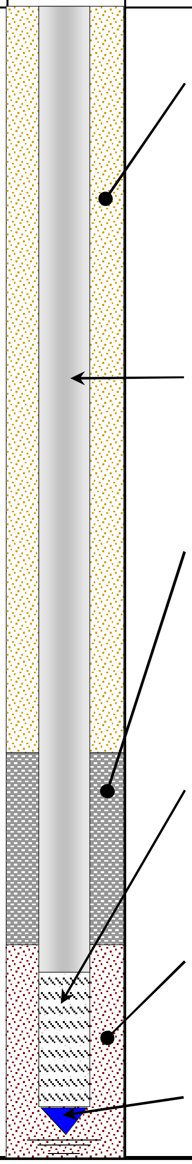
	Project Name:		Boring ID:
	Project Location:		Page No.
	Project No.:	Client:	of:
Boring Location:	Refusal Depth:	Total Depth:	Bore Hole ID/OD:
Weather:	Soil Drilled:	Method:	Casing Size:
Subcontractor:	P.I.D (eV):	Protection Level:	Sampler:
Driller:	Date Started:	Date Completed:	Sampler ID/OD:
Rig Type/Model:	Logged By:	Checked By:	Hammer Wt/Fall:
Reference Elevation:	Water Level:	Time:	Hammer Type:
He Breakthrough %:	Initial He %:	Final He %:	

Sample Information					Monitoring						
Depth (feet bgs)	Sample Number	Penetration/ Recovery (feet)	SPT Blows/6"	N Value	PID Field Scan	PID Headspace	Lab Sample Collected	Lab Sample ID	USCS Group Symbol	Soil Vapor Diagram	Overburden Drilling Notes:
											Soil Vapor Point Construction Notes:



NOTES:

FIGURE 4.11
SOIL VAPOR IMPLANT SAMPLING RECORD
NYSDEC QUALITY ASSURANCE PROGRAM PLAN

SOIL VAPOR PROBE CONSTRUCTION DIAGRAM

LOCATION ID:

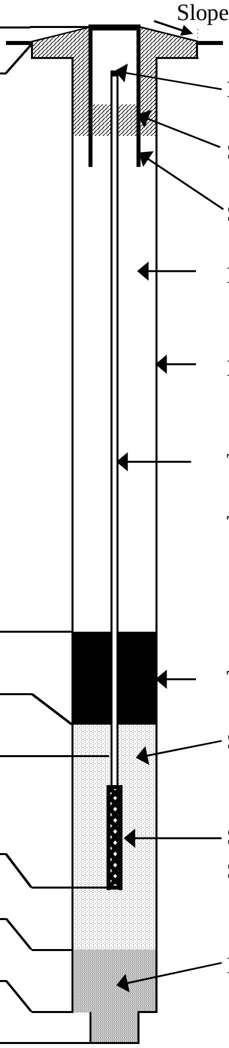
Project Name: ______
Project Location: ______
Project Number: ______ Task Number ______
Subcontractor: ______ Drilling Method ______
Rig Type ______ Sampling Depth ______
Notes: ______

Date Started: ______ Date Completed: ______
Logged By: ______
Checked By: ______ Checked Date: ______

Measuring Point Information

Measuring Point (MP) Type: Top Of Riser
MP Elevation (ft): ______

Item	**Depth BMP (ft)**	**Elevation (ft)**
Surface Casing Elevation		
Ground Surface Elevation		
Top of Bentonite Seal		
Top of Fill Material		
Top of SV Screen		
Base of SV Screen		
Drilled Depth		
Bottom of Fill Material		
Bottom of Exploration		
Bedrock Surface		



Description

Slope Away
Fitting or Wrapped Tubing ______
Surface Seal Type: ______
Stickup Casing Diameter: ______
Backfill/Grout Type: ______
Borehole Diameter: ______
Tubing Type: ______
Tubing ID: ______
Type of Seal: ______
Sampling Zone Fill Material ______
Screen Type: ______
Screen Length: ______
Fallback/Backfill: ______

NOT TO SCALE

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FIGURE 4.12
PERMANENT SOIL VAPOR PROBE CONSTRUCTION DIAGRAM - SINGLE POINT
NYSDEC QUALITY ASSURANCE PROJECT PLAN

SURFACE SOIL SAMPLING RECORD

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PROJECT NAME		**SAMPLE LOCATION**	**DATE**
PROJECT NUMBER		**START TIME**	**END TIME**
SAMPLE ID	**SAMPLE TIME**	**SITE NAME/NUMBER**	**PAGE** OF

SAMPLE INFORMATION

TYPE OF SAMPLE

- ☐ DISCRETE
- ☐ COMPOSITE

QC SAMPLES

- ☐ DUPLICATE ______________
- ☐ EQ BLK ______________

MS/MSD:

- ☐ YES
- ☐ NO

SAMPLE INTERVAL:

TOP ______________
BOTTOM ______________

TYPE OF MATERIAL:

- ☐ ORGANIC
- ☐ SAND
- ☐ GRAVEL
- ☐ CLAY
- ☐ FILL
- ☐ OTHER______________

COLLECTION EQUIPMENT

- ☐ HAND AUGER/CORER
- ☐ S.S. SPLIT BARREL
- ☐ ALUMINIUM PAN
- ☐ S.S. SHOVEL
- ☐ HAND SPOON/SPATULA
- ☐ S.S. BUCKET
- ☐ OTHER ______________

SAMPLE OBSERVATIONS

ODOR ______________
COLOR ______________
OTHER ______________
PID ______________

DECON FLUIDS USED

- ☐ ALL USED
- ☐ LIQUINOX/DI H_2O SOLUTION
- ☐ DEIONIZED WATER
- ☐ POTABLE WATER
- ☐ NITRIC ACID
- ☐ HEXANE
- ☐ 25% METHANOL/75% ASTM TYPE II H_2O
- ☐ ETHYL ALCOHOL

FIELD SKETCH SHOWN/ATTACHED

- ☐ YES
- ☐ NO

ANALYTICAL PARAMETERS

	PARAMETER	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	QC COLLECTED	SAMPLE BOTTLE ID NUMBERS
☐							
☐							
☐							
☐							
☐							
☐							
☐							
☐							
☐							
☐							

NOTES

SKETCH

Sampler Signature:
Print Name:
Checked By:
Date:

FIGURE 4.13
SURFACE SOIL SAMPLING RECORD
NYSDEC QUALITY ASSURANCE PROJECT PLAN

SURFACE WATER AND SEDIMENT SAMPLING RECORD

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PROJECT NAME		**SAMPLE LOCATION**	**DATE**
PROJECT NUMBER		**START TIME**	**END TIME**
SAMPLE ID	**SAMPLE TIME**	**SITE NAME/NUMBER**	**PAGE** OF

SURFACE WATER DATA

WATER DEPTH AT SAMPLE LOCATION ______ FT.
DEPTH OF SAMPLE BELOW WATER SURFACE ______ FT.
FLOW RATE ______ ML/MIN

WATER QUALITY PARAMETERS:

TEMPERATURE ______ °C
SPEC. COND. ______ mS/cm
PH ______ pH Units
ORP ______ mV
TURBIDITY ______ NTUs
DO ______ mg/L
☐ WINKLER METHOD
☐ DO PROBE

EQUIPMENT USED:

☐ BEAKER
☐ BOTTLE
☐ PACS BOMB
☐ PUMP ______
☐ FILTER
No. ______ Type: ______

☐ FIELD DUPLICATE COLLECTED
DUP. ID ______

TYPE OF SURFACE WATER:

☐ STREAM
☐ RIVER
☐ LAKE
☐ POND
☐ SEEP
☐ ______

FIELD SKETCH SHOWN/ATTACHED

☐ YES ☐ NO

DECON FLUIDS USED

☐ ALL USED
☐ LIQUINOX/DI H_2O SOLUTION
☐ DEIONIZED WATER
☐ POTABLE WATER
☐ NITRIC ACID
☐ HEXANE
☐ 25% METHANOL/75% ASTM TYPE II H_2O
☐ ETHYL ALCOHOL
☐ ______

SAMPLING EQUIPMENT

WATER QUALITY METER MODEL NO. ______ UNIT ID NO. ______
TURBIDITY METER MODEL NO. ______ UNIT ID NO. ______

SEDIMENT AMPLE INFORMATION

TYPE OF SAMPLE

☐ DISCRETE
☐ COMPOSITE

QC SAMPLES

☐ DUPLICATE ______
☐ EQ BLK ______

MS/MSD:
☐ YES
☐ NO

SAMPLE INTERVAL:

TOP ______
BOTTOM ______

TYPE OF MATERIAL:

☐ ORGANIC
☐ SAND
☐ GRAVEL
☐ CLAY
☐ FILL
☐ OTHER______________

COLLECTION EQUIPMENT

☐ HAND AUGER/CORER
☐ S.S. SPLIT BARREL
☐ ALUMINIUM PAN
☐ S.S. SHOVEL
☐ HAND SPOON/SPATULA
☐ S.S. BUCKET
☐ OTHER ______

SAMPLE OBSERVATIONS

ODOR ______
COLOR ______
OTHER ______
PID ______

DECON FLUIDS USED

☐ ALL USED
☐ LIQUINOX/DI H_2O SOLUTION
☐ DEIONIZED WATER
☐ POTABLE WATER
☐ NITRIC ACID
☐ HEXANE
☐ 25% METHANOL/75% ASTM TYPE II H_2O
☐ ETHYL ALCOHOL

FIELD SKETCH SHOWN/ATTACHED

☐ YES
☐ NO

ANALYTICAL PARAMETERS

	PARAMETER	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	QC COLLECTED	SAMPLE BOTTLE ID NUMBERS
☐							
☐							
☐							
☐							
☐							
☐							
☐							
☐							
☐							

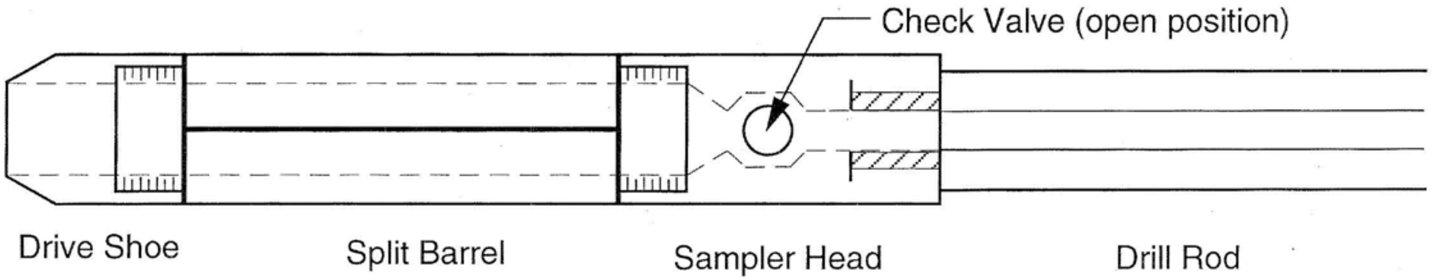
NOTES/SKETCH

Sampler Signature: Print Name:

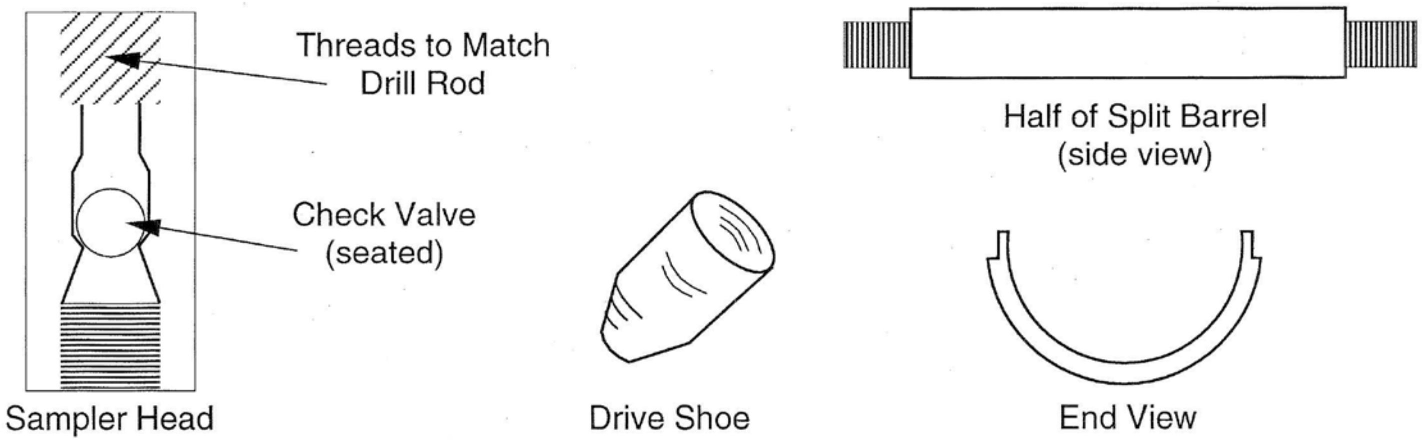
Checked By: Date:

FIGURE 4.14
SURFACE WATER AND SEDIMENT SAMPLING RECORD
NYSDEC QUALITY ASSURANCE PROJECT PLAN

SPLIT-SPOON SAMPLER



SPLIT-SPOON SAMPLER DISASSEMBLED



NOT TO SCALE

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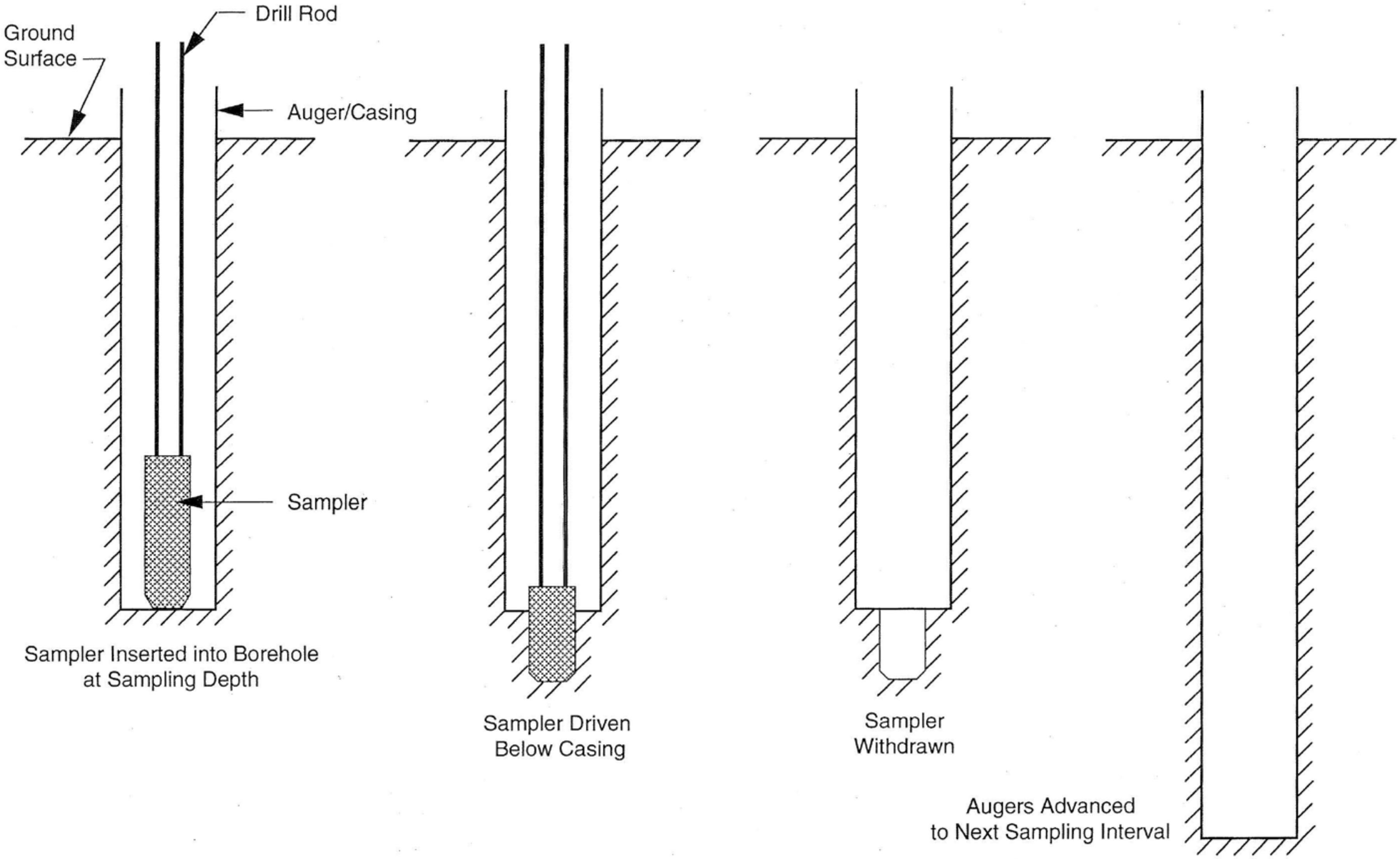
FIGURE 4.15
SPLIT-SPOON SAMPLER
NYSDEC QUALITY ASSURANCE PROGRAM PLAN



Sampler Inserted into Borehole at Sampling Depth

Sampler Driven Below Casing

Sampler Withdrawn

Augers Advanced to Next Sampling Interval

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FIGURE 4.16
STEPS IN SAMPLING A TEST BORING
NYSDEC QUALITY ASSURANCE PROGRAM PLAN

LOW FLOW GROUNDWATER SAMPLING RECORD

PROJECT NAME		**LOCATION ID**	**DATE**
PROJECT NUMBER		**START TIME**	**END TIME**
SAMPLE ID	**SAMPLE TIME**	**SITE NAME/NUMBER**	**PAGE** OF

WELL DIAMETER (INCHES) ☐ 1 ☐ 2 ☐ 4 ☐ 6 ☐ 8 ☐ OTHER ____________

TUBING ID (INCHES) ☐ 1/8 ☐ 1/4 ☐ 3/8 ☐ 1/2 ☐ 5/8 ☐ OTHER ____________

MEASUREMENT POINT (MP) ☐ TOP OF RISER (TOR) ☐ TOP OF CASING (TOC) ☐ OTHER ____________

WELL INTEGRITY

	YES	NO	N/A
CAP	___	___	___
CASING	___	___	___
LOCKED	___	___	___
COLLAR	___	___	___

INITIAL DTW (BMP)	FT	**FINAL DTW (BMP)**	FT	**PROT. CASING STICKUP (AGS)**	FT	**TOC/TOR DIFFERENCE**	FT
WELL DEPTH (BMP)	FT	**SCREEN LENGTH**	FT	**PID AMBIENT AIR**	PPM	**REFILL TIMER SETTING**	SEC
WATER COLUMN	FT	**DRAWDOWN VOLUME** (initial DTW- final DTW X well diam. squared X 0.041)	GAL	**PID WELL MOUTH**	PPM	**DISCHARGE TIMER SETTING**	SEC
CALCULATED GAL/VOL (column X well diameter squared X 0.041)	GAL	**TOTAL VOL. PURGED** (mL per minute X total minutes X 0.00026 gal/mL)	GAL	**DRAWDOWN/ TOTAL PURGED**		**PRESSURE TO PUMP**	PSI

FIELD PARAMETERS WITH PROGRAM STABILIZATION CRITERIA (AS LISTED IN THE QAPP)

TIME 3-5 Minutes	DTW (FT) 0.0-0.33 ft Drawdown	PURGE RATE (mL/min)	TEMP. (^{o}C) (+/- 3 degrees)	SP. CONDUCTANCE (mS/cm) (+/- 3%)	pH (units) (+/- 0.1 units)	DISS. O_2 (mg/L) (+/- 10%)	TURBIDITY (ntu) (+/- 10% <10 ntu)	REDOX (mv) (+/- 10 mv)	PUMP INTAKE DEPTH (ft)	COMMENTS
	BEGIN PURGING									
FINAL STABILIZED FIELD PARAMETERS (to appropriate significant figures[SF])										

TEMP.: nearest degree (ex. 10.1 = 10)
COND.: 3 SF max (ex. 3333 = 3330, 0.696 = 0.696)
pH: nearest tenth (ex. 5.53 = 5.5)
DO: nearest tenth (ex. 3.51 = 3.5)
TURB: 3 SF max, nearest tenth (6.19 = 6.2, 101 = 101)
ORP: 2 SF (44.1 = 44, 191 = 190)

EQUIPMENT DOCUMENTATION

TYPE OF PUMP
- ☐ PERISTALTIC
- ☐ SUBMERSIBLE
- ☐ BLADDER
- ____________
- ☐ WATTERA
- ☐ OTHER ____________
- ☐ OTHER ____________

DECON FLUIDS USED
- ☐ LIQUINOX
- ☐ DEIONIZED WATER
- ☐ POTABLE WATER
- ☐ NITRIC ACID
- ☐ HEXANE
- ☐ METHANOL
- ☐ OTHER ____________

TUBING/PUMP/BLADDER MATERIALS
- ☐ SILICON TUBING
- ☐ TEFLON TUBING
- ☐ TEFLON LINED TUBING
- ☐ HDPE TUBING
- ☐ LDPE TUBING
- ☐ OTHER ____________
- ☐ OTHER ____________
- ☐ S. STEEL PUMP MATERIAL
- ☐ PVC PUMP MATERIAL
- ☐ GEOPROBE SCREEN
- ☐ TEFLON BLADDER
- ☐ OTHER ____________
- ☐ OTHER ____________
- ☐ OTHER ____________

EQUIPMENT USED
- ☐ WL METER ____________
- ☐ PID ____________
- ☐ WQ METER ____________
- ☐ TURB. METER ____________
- ☐ PUMP ____________
- ☐ OTHER ____________
- ☐ FILTERS NO. ____ TYPE ____________

ANALYTICAL PARAMETERS

	PARAMETER	METHOD NUMBER	FIELD FILTERED	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	QC COLLECTED	SAMPLE BOTTLE ID NUMBERS
☐								
☐								
☐								
☐								
☐								
☐								
☐								

PURGE OBSERVATIONS

	YES	NO		
PURGE WATER CONTAINERIZED	☐	☐	NUMBER OF GALLONS GENERATED	____________
NO-PURGE METHOD UTILIZED	☐	☐	If yes, purged approximately 1 standing volume prior to sampling or __________mL for this sample location.	

SKETCH/NOTES

Sampler Signature:

Print Name:

Checked By:

Date:

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FIGURE 4.17
LOW FLOW GROUNDWATER SAMPLING RECORD
NYSDEC QUALITY ASSURANCE PROJECT PLAN

GROUNDWATER USAGE SURVEY

Name: ____________________

Address: ____________________

____

Telephone Number: (   ) ____________________

DOMESTIC WATER SOURCE: (Circle One) **Private Well** **City Water Supply**

Do you foresee any changes in this source in the future ? ____________

If so, what ? ____________________

If you have a private well:

How deep ? ________ **How old ?** ______ **Diameter ?** ______ **Drilled or Dug ?** ______

Plumbing material (Circle One) **PVC** (Plastic) **Copper**

Is the line connected to a Water Softening or other Treatment System ? ____________

____

Any problems ? (color, odor, taste, staining, inadequate supply) ____________

____

SEWAGE SYSTEM: (Circle One) **Private Septic System** **City Sewer Line**

Any problems ? ____________________

____

Please sketch Well location, and Septic system with approximate distances to each other.

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FIGURE 4.18
GROUNDWATER USAGE SURVEY
NYSDEC QUALITY ASSURANCE PROGRAM PLAN

PORT2007022p.mac

INDOOR AIR SAMPLING RECORD

PROJECT NAME: ____________ LOCATION ID: ____________ DATE: ____________

PROJECT NO./TASK NO.: ____________ CLIENT: ____________

PROJECT LOCATION: ____________ SAMPLER NAME: ____________

WEATHER CONDITIONS (AM): ____________ SAMPLER SIGNATURE: ____________

WEATHER CONDITIONS (PM): ____________ CHECKED BY: ____________ DATE: ____________

SUMMA Canister Record Information

SUB-SLAB SOIL VAPOR SAMPLE		BASEMENT INDOOR AIR SAMPLE		FIRST FLOOR AIR SAMPLE		AMBIENT AIR SAMPLE	
Flow Regulator Number:		Flow Regulator Number:		Flow Regulator Number:		Flow Regulator Number:	
Flow Rate (mL/min):		Flow Rate (mL/min):		Flow Rate (mL/min):		Flow Rate (mL/min):	
Canister Serial Number:		Canister Serial Number:		Canister Serial Number:		Canister Serial Number:	
Start Date/Time		Start Date/Time		Start Date/Time		Start Date/Time	
Start Pressure ("Hg):		Start Pressure ("Hg):		Start Pressure ("Hg):		Start Pressure ("Hg):	
Stop Date/Time		Stop Date/Time		Stop Date/Time		Stop Date/Time	
Stop Pressure ("Hg):		Stop Pressure ("Hg):		Stop Pressure ("Hg):		Stop Pressure ("Hg):	
Sample ID:		Sample ID:		Sample ID:		Sample ID:	

Other Sampling Information:

Finished Basement, Crawl Space, Unfinished		Story/Level:		Story/Level:		Direction from Building	
Floor Slab Thickness:		Room:		Room:		Distance from Building:	
Potential Vapor Entry Points:		Potential Vapor Entry Points:		Potential Vapor Entry Points:		Distance from Roadway:	
Floor Surface:		Floor Surface:		Floor Surface:		Ground Surface:	
Noticable Odor:		Noticable Odor:		Noticable Odor:		Noticable Odor:	
PID Reading (ppb):		PID Reading (ppb):		PID Reading (ppb):		PID Reading (ppb):	
Intake Depth/Height:		Intake Height:		Intake Height:		Intake Height above Ground Surface:	
Helium Test Conducted? Breakthrough %:		Indoor Air Temp		Indoor Air Temp		Intake tubing?	

Comments/Location Sketch:

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FIGURE 4.19

INDOOR AIR SAMPLING RECORD

NYSDEC QUALITY ASSURANCE PROJECT PLAN

P:\Projects\nysdec1\qapp\2011\Figures\Figure 4.19 Indoor Air Sampling form.xls

AQUIFER TEST COMPLETION CHECKLIST

SETUP	**DATE**	AQUIFER TEST NO. ____ PERFORMED BY: ____
MONITORING WELL ID		
DATE OF TEST		
TYPE OF TEST		
HERMIT TYPE/SERIAL#		
TEST #		
DATA COLLECTION RATE		
TRANSDUCER		
SERIAL #		
PSIG		
SCALE FACTOR		
OFFSET		
INPUT CHANNEL		
TEST DATA		
INPUT MODE (TOC/SUR)		
STATIC WATER LEVEL (FT./TOC)		
WELL DEPTH (FT./TOC)		
XD DEPTH (FT.TOC)		
INITIAL XD REFERENCE		
SLUG DEPTH (FT./TOC)		
TIME OF SLUG PLACEMENT		
TIME OF WL EQUILIBRATION		
NEW XD REFERENCE		
START TIME OF TEST		
END TIME OF TEST		

NOTES:

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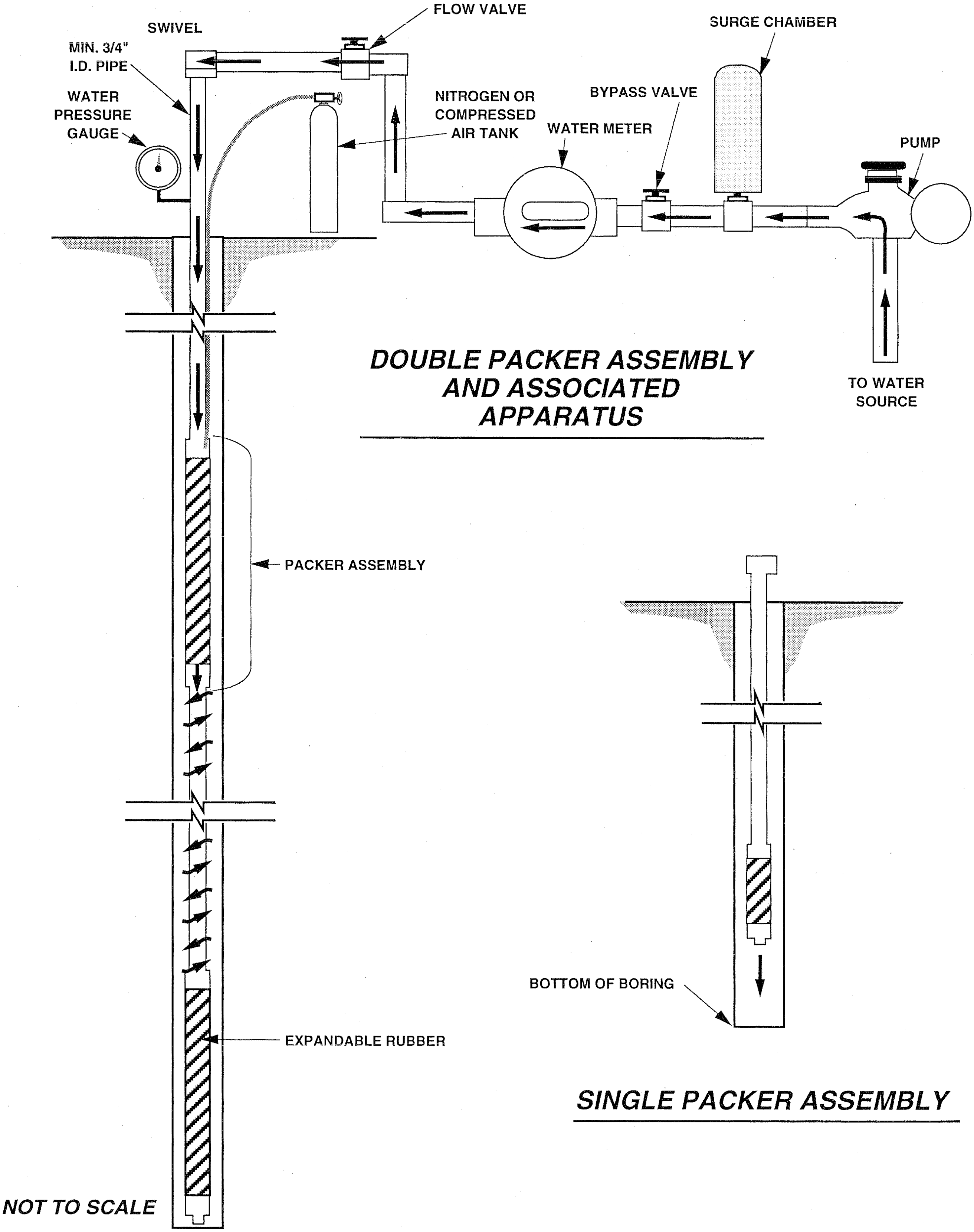
FIGURE 4.20
AQUIFER TEST COMPLETION CHECKLIST
NYSDEC QUALITY ASSURANCE PROGRAM PLAN



DOUBLE PACKER ASSEMBLY AND ASSOCIATED APPARATUS

SINGLE PACKER ASSEMBLY

NOT TO SCALE

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Portland, ME 04101

FIGURE 4.21
EXAMPLE OF PACKER TEST SET UP
NYSDEC QUALITY ASSURANCE PROGRAM PLAN

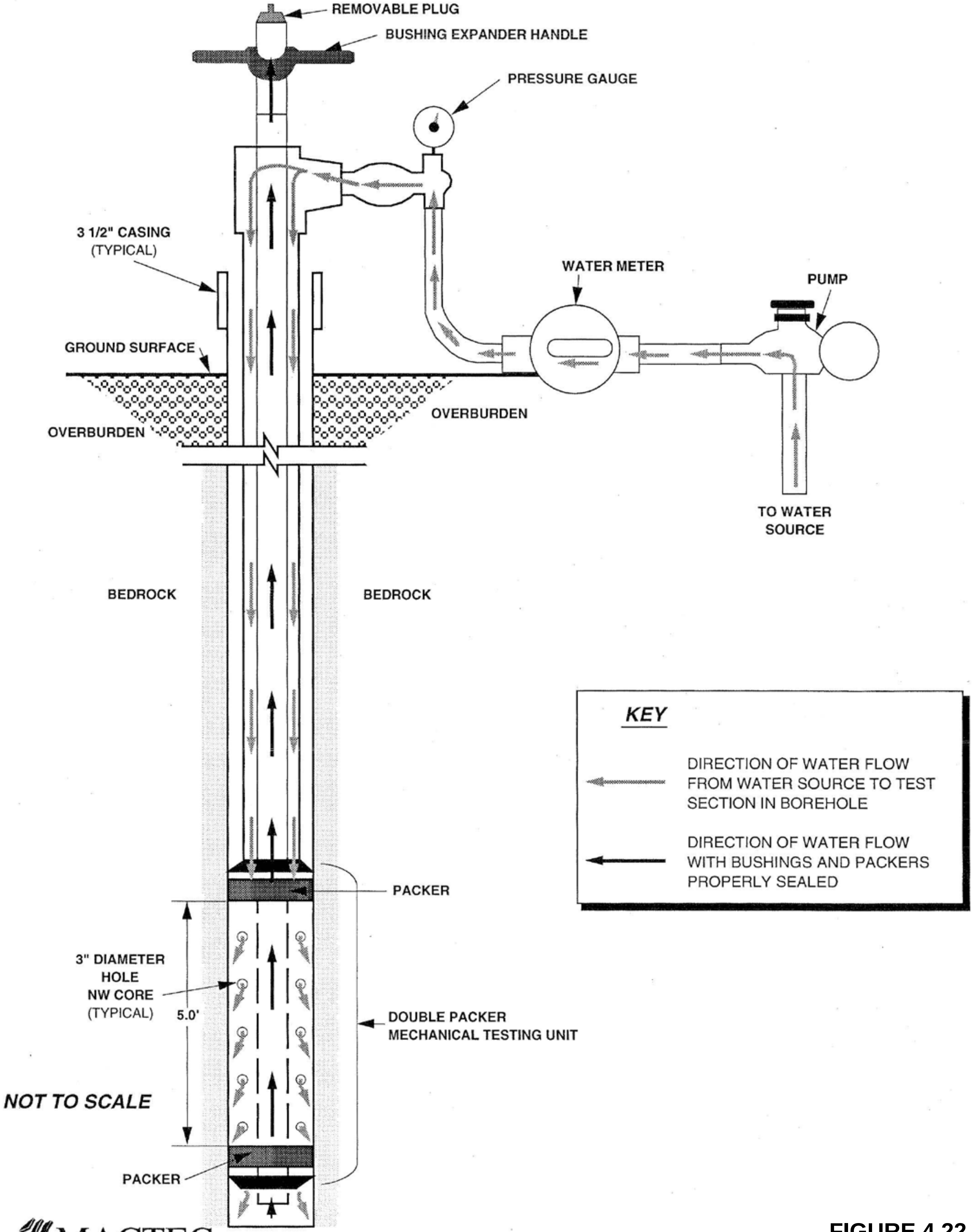

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FIGURE 4.22
SCHEMATIC OF MECHANICAL PACKER PRESSURE TEST AND RELATED EQUIPMENT
NYSDEC QUALITY ASSURANCE PROGRAM PLAN

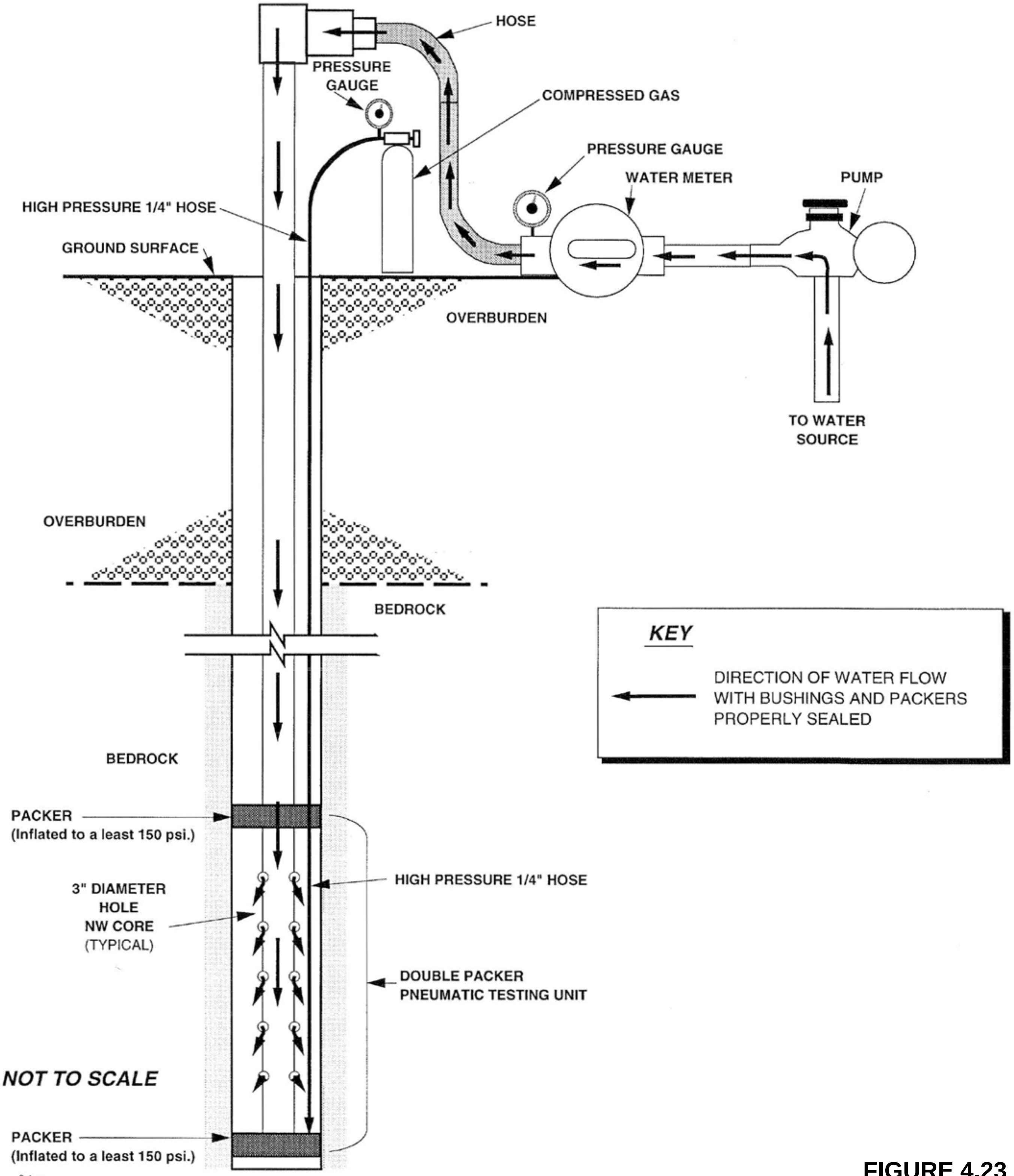

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FIGURE 4.23
SCHEMATIC OF PNEUMATIC PACKER PRESSURE TEST AND RELATED EQUIPMENT
NYSDEC QUALITY ASSURANCE PROGRAM PLAN

PACKER TEST LOG

Project: ____________________

Page 1 of ___

Client: ____________________

Contractor: ____________________

	Packer System	Water Meter	Water Gauge	Surge Chamber
Type:				
Manufacturer:				
Model Number:				

M.G.P. = (0.566 to 1.0) x Z

Computed Maximum Gauge Press (mgp): ____________________

Computed Internal Friction: ____________________

Rock Type: ____________________

Hole Radius (Feet): ____________________

Boring Number: ____________________

Test Numbers: ____________________

Job Number: ____________________

Location: ____________________

____

Elevation: ____________________

Date Start: ____________________

Date Finish: ____________________

Driller: ____________________

Geologist: ____________________

Depths (all distances measured from ground surface in feet)

To Top of Rock: ____________________

To Bottom of Boring: ____________________

To Water Table: ____________________

To Top of Lower Packer: ____________________

To Bottom of Upper Packer: ____________________

Length of Test Section: ____________________

Height of Water Pressure Gauge Above Ground Surface: ____________________

Test Interval (feet)	Test Number	Start Time	Elapsed Time (min)	Packer Pressure (psi)	Gauge Pressure (HP) (psi)	Meter Reading (gals)	Volume of Flow (Q) (gals/min)	Permeability (K) (feet/day)

Formula to Compute Permeability: $k = C \frac{Q}{2p\,L\,H_T} \text{IN} \frac{L}{r}$

Assumptions:
$L \geq 10r$
$H_T = (Hp \times 2.307) + Hg$
$C = 1.928 \times 10^2$

k = Permeability (feet/day)
Q = Constant Flow Rate (gallons per minute)
L = Length of Test Section (feet)
H_T = Differential Head on Test Section (feet)
r = Radius of Borehole (feet)
C = Conversion Factor to Obtain k in units of feet/day

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FIGURE 4.24
PACKER TEST LOG
NYSDEC QUALITY ASSURANCE PROGRAM PLAN

Shaded Areas: Lab Use Only

Form No. ____________________

MACTEC, Inc.	511 Congress Street P.O. Box 7050 Portland, ME 04112-7050	**CHAIN OF CUSTODY FORM**		Page _____ of _____
		Agreed Turnaround Time ☐ 24 hour ☐ 72 hour ☐ 5 Day ☐ 10 Day ☐ 3 Week ☐ Other	Lab Batch No. Seals Intact? ☐ Yes ☐ No ☐ NA	Lab ID: Shipping Container Damage? ☐ Yes ☐ No ☐ NA

PROJECT INFO		LABORATORY INFO		INVOICE (if other than MACTEC contact)	
MACTEC Contact	Project No.	Laboratory Name	Phone	Company Name	Phone
Project Title/No.	Purchase Order No.	Laboratory Contact	Fax	Company Contact	Fax
Address		Address		Address	
City/State/Zip		City/State/Zip		City/State/Zip	
Special Handling Instructions					

Lab Sample No.	Date/Time Collected	Sample ID.	Sample Type[1]	Sample Media[2]	[C]omposite [G]rab	Sample Volume	Sample Location/Depth/Fraction/Etc. (describe if necessary)	Requested Analysis								

[1] Type	[2] Sample Media	[3] Analysis Requested		
BIO - In-Vitro RS - Rad EN - Environ. MIX - Rad + Chem HAZ - Hazardous OTH - Other (describe)	VOL - Volumetric AF - Air Filter WIPE - Smear LIQ - Liquid OTH - Other (describe)	ALPHA - Alpha Spec. GROSS - Gross beta/gamma GAMMA - Gamma Spec. LSC - Liquid Scintillation OTH - Other (describe)	Relinquished by: Date/Time Received by: Date/Time Relinquished by: Date/Time Received by: Date/Time	Relinquished by: Date/Time Received by: Date/Time Relinquished by: Date/Time Received by: Date/Time

WHITE: Laboratory Copy YELLOW: Report Copy PINK: MACTEC Copy

FIGURE 5.1

CHAIN OF CUSTODY RECORD

FIELD INSTRUMENTATION CALIBRATION RECORD

PROJECT NAME: ____________ TASK NO: ____________ DATE: ________
PROJECT NUMBER: ____________ MACTEC CREW: ____________
PROJECT LOCATION: ____________ SAMPLER NAME: ____________
WEATHER CONDITIONS (AM): ____________ SAMPLER SIGNATURE: ____________
WEATHER CONDITIONS (PM): ____________ CHECKED BY: ____________ DATE: ________

MULTI-PARAMETER WATER QUALITY METER

METER TYPE ________
MODEL NO. ________
UNIT ID NO. ________

AM CALIBRATION Start Time __________/End Time__________

POST CALIBRATION CHECK Start Time ___________/End Time___________

	Units	**Standard Value**	**Meter Value**	***Acceptance Criteria (AM)**	**Standard Value**	**Meter Value**	***Acceptance Criteria (PM)**
pH (4)	SU	4.0		+/- 0.1 pH Units			
pH (7)	SU	7.0		+/- 0.1 pH Units	7.0		+/- 0.3 pH Units
pH (10)	SU	10.0		+/- 0.1 pH Units			
Redox	+/- mV	240		+/- 10 mV	240		+/- 10 mV
Conductivity	mS/cm	1.413		+/- 0.5 % of standard	1.413		+/- 5% of standard
DO (saturated)	%	100		+/- 2% of standard			
DO (saturated)	mg/L[1] (see Chart 1)			+/- 0.2 mg/L			+/- 0.5 mg/L of standard
DO (<0.1)	mg/L	<0.1		< 0.5 mg/L			
Temperature	°C						
Baro. Press.	mmHg						

TURBIDITY METER

METER TYPE ________
MODEL NO. ________
UNIT ID NO. ________

	Units	**Standard Value**	**Meter Value**	**Standard Value**	**Meter Value**	***Acceptance Criteria (PM)**
<0.1 Standard	NTU	<0.1		<0.1		+/- 0.3 NTU of stan.
20 Standard	NTU	20		20		+/- 5% of standard
100 Standard	NTU	100		100		+/- 5% of standard
800 Standard	NTU	800		800		+/- 5% of standard

PHOTOIONIZATION DETECTOR

METER TYPE ________
MODEL NO. ________
UNIT ID NO. ________

Background	ppmv	<0.1		<0.1		within 5 ppmv of BG
Span Gas	ppmv	100		100		+/- 10% of standard

O_2-LEL 4 GAS METER

METER TYPE ________
MODEL NO. ________
UNIT ID NO. ________

Methane	%	50		50		+/- 10% of standard
O_2	%	20.9		20.9		+/- 10% of standard
H_2S	ppmv	25		25		+/- 10% of standard
CO	ppmv	50		50		+/- 10% of standard

OTHER METER

METER TYPE ________
MODEL NO. ________
UNIT ID NO. ________

See Notes Below for Additional Information

☐ Equipment calibrated within the Acceptance Criteria specified for each of the parameters listed above.
☐ Equipment (not) calibrated within the Acceptance Criteria specified for each of the parameters listed above**.

MATERIALS RECORD

Deionized Water Source: Portland FOS
Lot#/Date Produced: ____________
Trip Blank Source: ____________
Sample Preservatives Source: ____________
Disposable Filter Type: 0.45μm cellulose
Calibration Fluids / Standard Source:
- DO Calibration Fluid (<0.1 mg/L) Portland FOS
- Other ____________
- Other ____________
- Other ____________

	Cal. Standard Lot Number	**Exp. Date**
pH (4)		
pH (7)		
pH (10)		
ORP		
Conductivity		
<0.1 Turb. Stan.		
20 Turb. Stan.		
100 Turb. Stan.		
800 Turb. Stan.		
PID Span Gas		
O_2-LEL Span Gas		
Other		

NOTES:

* = Unless otherwise noted, calibration procedures and acceptance criteria are in general accordance with USEPA Region 1 SOPs for Field Instrument Calibration (EQASOP-FieldCalibrat) and Low Stress Purging and Sampling (EQASOP-GW001), each dated 1/19/2010. Additonal acceptance criteria obtained from instrument specific manufacturer recommendations.
** = If meter reading is not within acceptance criteria, clean/replace probe and re-calibrate, or use calibrated back-up meter if available. If project requirements necessitate use of the instrument, clearly document any deviations from acceptance criteria on all data sheets and log book entries.
1 = DO Saturated standard value is calculated based on Oxygen Solubility at Indicated Pressure Chart from the USEPA Region 1 SOP for Field Instrument Calibration (EQASOP-FieldCalibrat), dated 1/19/2010.

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FIGURE 6.1
FIELD INSTRUMENT CALIBRATION RECORD
NYSDEC QUALITY ASSURANCE PROJECT PLAN

FIGURE 8.1: FINAL RESULTS CROSS TABULATION TABLE

Lab Sample Id	**X4779-20**		**X4779-21**		**X4826-01**		**X4826-02**		**X4826-06**	
SDG	**X4779**		**X4779**		**X4826**		**X4826**		**X4826**	
Location	**MW-13D**		**MW-3**		**MW-16L**		**MW-16U**		**GW-14**	
Field Sample Id	**HTMWD1302601XX**		**HTMW00301801XX**		**HTMW16L03001XX**		**HTMW16U02201XX**		**HTGW01402501XX**	
Field Sample Date	**10/3/2006**		**10/3/2006**		**10/4/2006**		**10/4/2006**		**10/9/2006**	
Qc Code	**FS**		**FS**		**FS**		**FS**		**FS**	
Parameter	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
1,1,1-Trichloroethane	10	U	10	U	10	U	10	U	10	U
1,1,2,2-Tetrachloroethane	10	U	10	U	10	U	10	U	10	U
1,1,2-Trichloro-1,2,2-Trifluoroethane	10	U	10	U	10	U	10	U	10	U
1,1,2-Trichloroethane	10	U	10	U	10	U	10	U	10	U
1,1-Dichloroethane	10	U	10	U	10	U	10	U	10	U
1,1-Dichloroethene	10	U	10	U	10	U	10	U	10	U
1,2,4-Trichlorobenzene	10	U	10	U	10	U	10	U	10	U
1,2-Dibromo-3-chloropropane	10	U	10	U	10	U	10	U	10	U
1,2-Dibromoethane	10	U	10	U	10	U	10	U	10	U
1,2-Dichlorobenzene	10	U	10	U	10	U	10	U	10	U
1,2-Dichloroethane	10	U	10	U	10	U	10	U	10	U
1,2-Dichloropropane	10	U	10	U	10	U	10	U	10	U
1,3-Dichlorobenzene	10	U	10	U	10	U	10	U	10	U
1,4-Dichlorobenzene	10	U	10	U	10	U	10	U	10	U
2-Butanone	50	U	50	U	50	U	50	U	50	U
2-Hexanone	50	U	50	U	50	U	50	U	50	U
4-Methyl-2-pentanone	50	U	50	U	50	U	50	U	50	U
Acetic acid, methyl ester	10	U	10	U	10	U	10	U	10	U
Acetone	50	U	50	U	50	U	50	U	50	U
Benzene	10	U	10	U	10	U	10	U	10	U
Bromodichloromethane	10	U	10	U	10	U	10	U	10	U
Bromoform	10	U	10	U	10	U	10	U	10	U
Bromomethane	10	U	10	U	10	U	10	U	10	U
Carbon disulfide	10	U	10	U	10	U	10	U	10	U
Carbon tetrachloride	10	U	10	U	10	U	10	U	10	U
Chlorobenzene	10	U	10	U	10	U	10	U	10	U
Chlorodibromomethane	10	U	10	U	10	U	10	U	10	U
Chloroethane	10	U	10	U	10	U	10	U	10	U
Chloroform	10	U	10	U	10	U	10	U	10	U
Chloromethane	10	U	10	U	10	U	10	U	10	U
Cis-1,2-Dichloroethene	10	U	0.88	J	9.8	J	6.4	J	23	
cis-1,3-Dichloropropene	10	U	10	U	10	U	10	U	10	U
Cyclohexane	10	U	10	U	10	U	10	U	10	U
Dichlorodifluoromethane	10	U	10	U	10	U	10	U	10	U
Ethyl benzene	10	U	10	U	10	U	10	U	10	U

FIGURE 8.1: FINAL RESULTS CROSS TABULATION TABLE

Lab Sample Id	**X4779-20**		**X4779-21**		**X4826-01**		**X4826-02**		**X4826-06**	
SDG	**X4779**		**X4779**		**X4826**		**X4826**		**X4826**	
Location	**MW-13D**		**MW-3**		**MW-16L**		**MW-16U**		**GW-14**	
Field Sample Id	**HTMWD1302601XX**		**HTMW00301801XX**		**HTMW16L03001XX**		**HTMW16U02201XX**		**HTGW01402501XX**	
Field Sample Date	**10/3/2006**		**10/3/2006**		**10/4/2006**		**10/4/2006**		**10/9/2006**	
Qc Code	**FS**		**FS**		**FS**		**FS**		**FS**	
Parameter	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
Isopropylbenzene	10	U	10	U	10	U	10	U	10	U
Methyl cyclohexane	10	U	10	U	10	U	10	U	10	U
Methyl Tertbutyl Ether	10	U	10	U	10	U	10	U	10	U
Methylene chloride	10	U	10	U	10	U	10	U	10	U
o-Xylene	10	U	10	U	10	U	10	U	10	U
Styrene	10	U	10	U	10	U	10	U	10	U
Tetrachloroethene	10	U	10	U	10	UJ	10	UJ	10	U
Toluene	10	U	10	U	10	U	10	U	10	U
trans-1,2-Dichloroethene	10	U	10	U	10	U	10	U	10	U
trans-1,3-Dichloropropene	10	U	10	U	10	U	10	U	10	U
Trichloroethene	15		25		10		11		9.1	J
Trichlorofluoromethane	10	UJ	10	UJ	10	U	10	U	10	U
Vinyl chloride	10	U	10	U	5.5	J	0.97	J	10	U
Xylene, m/p	10	U	10	U	10	U	10	U	10	U

Notes:
Results in micrograms per liter (µg/L)
Samples analyzed for VOCs by EPA Method OLM04.2
QC Code:
- FS = Field Sample
- FD = Field Duplicate
- TB = Trip Blank

Qualifiers:
- U = Not detected at a concentration greater than the RL
- J = Estimated Value
- D = Analyte was reported from a dilited analytical run.
- B = Analyte was detected in the method blank

DELIVERABLE REVIEW TRACKING FORM

Project Title: **Project No.:**

Client: **New York State Department of Environmental Conservation (NYSDEC)**

Deliverable Title:

Author(s):

Date to be Shipped: **Due Date to Client:**

	DRAFT REPORT	
ASPECTS REVIEWED	**REVIEWED BY**	**DATE**
Format/Organization (PM)		
Conforms to Scope (PM)		
Technical Approach (TR)		
Computations Checked (TR)		
Figures Checked (TR)		
Tables Checked (TR)		
Conclusions/Recommendations (TR)		
Two Signatures/Sealed (PM)		
Budget (if applicable) (PM)		
All Comments Addressed (PM/TL)		

FINAL REVIEW RELEASE SIGNATURES:

Project Manager: Date:

Principal Reviewer: Date:

NOTES:

1. Retain this form in Project File
2. All blocks are not applicable to all deliverables
3. TL = Technical Lead
   TR = Technical Reviewer
   PM = Project Manager

Figure 9.1

TABLES

TABLE 2.1
SUBCONTRACTOR CORRECTIVE ACTION STEPS

NYSDEC QUALITY ASSURANCE PROGRAM PLAN

1.	MACTEC visits subcontractors' facilities prior to initiating subcontract relationship
2.	CS and procurement staff develop, negotiate, and issue clear and concise subcontract agreement protecting the NYSDEC's and MACTEC's interests
3.	CS and procurement staff communicate to the subcontractor assigned roles and responsibilities of the MACTEC project team
4.	CS and PM maintain regular contact regarding subcontractor's technical performance and any deviations from scope and schedule
5.	CS and PM review subcontractor invoices for conformance to contract terms and conditions
6.	CS and PM attempt to resolve any issues with subcontractor's authorized representative
7.	CS and PM require subcontractor progress reports describing scope, schedule, and budget conformance
8.	CS and PM solicit Program Manager and other senior MACTEC staff advice on non-routine issues
9.	CS and Program Manager involve subcontractors' senior management in unresolved issues
10.	CS and PM invoke applicable financial penalties
11.	CS and Program Manager consider subcontract termination if subcontract allows and performance problems are well-documented and unresolvable
12.	Refuse further subcontract associations

Notes:

CS = Contract Specialist
MACTEC = MACTEC Engineering and Consulting
NYSDEC = New York State Department of Environmental Conservation
PM = Project Manager

TABLE 4.1
SAMPLE CONTAINER, PRESERVATION AND HOLD TIME REQUIREMENTS

NYSDEC QUALITY ASSURANCE PROGRAM PLAN

PARAMETER	MEDIUM	CONTAINER	VOLUME REQUIREMENTS	PRESERVATION	HOLDING TIMES[1]
Volatile Organics					
TCL VOCs	Low Soil/Sediment	VOA Vial*	Fill - no headspace*	Cool, 4°C*	7 days
	Low Soil/Sediment	VOA Vial - field preserved	5 g	Freeze within 48 hours	14 days
	Low Soil/Sediment	VOA Vial - field preserved	5 g	Cool, 4°C with sodium bisulfate	14 days
	High Soil/Sediment	VOA Vial - field preserved	10 g	Cool, 4°C with methanol	14 days
	Groundwater/Liquid	glass, Teflon® lined septa	(2) 40 mL	Cool, 4°C HCL to pH <2	14 days
Extractable Organics					
TCL SVOCs, TCL Pesticides/PCBs	Soil/Sediment	Glass, Teflon® lined lid	100 g	Cool, 4°C	14 days extract/40 days analyze
	Groundwater/Liquid	Glass, Teflon® lined cap	(2) l-L	Cool, 4°C	7 days extract/40 days analyze
Inorganics					
TAL Inorganics	Soil/Sediment	Glass	2g	Cool, 4°C	6 months
Mercury		Glass	1g	Cool, 4°C	28 days
Cyanide		Glass	10g	Cool, 4°C	14 days
Hexavalent Chromium		Glass	2g	Cool, 4°C	24 hrs.
TAL Inorganics	Groundwater/Liquid	Glass or Polyethylene	450 mL	HNO_3 to pH<2, 4°C	6 months
Mercury		Glass or Polyethylene	200 mL	HNO_3 to pH<2, 4°C	28 days
Cyanide		Glass or Polyethylene	1 L	NaOH to pH>12, 4°C	14 days
Hexavalent Chromium		Glass or Polyethylene	500 mL	Cool, 4°C	24 hrs.
TCLP					
VOCs	Soil/Sediment	Glass, Teflon® lined lid	3x100g	Cool, 4°C	7 days extraction/7 days analyze
SVOCs	Soil/Sediment	Glass, Teflon® lined lid	200g	Cool, 4°C	7 days extraction/7 days extraction/40 days analyze
Mercury	Soil/Sediment	Glass, Teflon® lined lid	200g	Cool, 4°C	7 days extraction/28 days analyze
Inorganics	Soil/Sediment	Glass, Teflon® lined lid	200g	Cool, 4°C	180 days extraction/180 days analyze
Pesticides	Soil/Sediment	Glass, Teflon® lined lid	200g	Cool, 4°C	7 days extraction/40 days analyze
Herbicides	Soil/Sediment	Glass, Teflon® lined lid	200g	Cool, 4°C	7 days extraction/40 days analyze
Ignitability	Soil/Sediment	Glass, Teflon® lined lid	25g	Cool, 4°C	28 days
Reactivity	Soil/Sediment	Glass, Teflon® lined lid	40g	Cool, 4°C	28 days

TABLE 4.1
SAMPLE CONTAINER, PRESERVATION AND HOLD TIME REQUIREMENTS

NYSDEC QUALITY ASSURANCE PROGRAM PLAN

PARAMETER	MEDIUM	CONTAINER	VOLUME REQUIREMENTS	PRESERVATION	HOLDING TIMES[1]
Corrosivity	Soil/Sediment	Glass, Teflon® lined lid	30g	Cool, 4°C	28 days

Notes:* Only if directed by NYSDEC PM

[1] All holding times are from date of sample collection.

°C = Celsius
g = gram
Hg = mercury
HNO_3 = nitric acid
L = liter

mL = milliliter
NaOH = sodium hydroxide
PCB = polychlorinated biphenyls
SVOC = semivolatile organic compound
TAL = Target Analyte List
TCL = Target Compound List
VOC = volatile organic compound

TABLE 4.2
APPROXIMATE ELECTROMAGNETIC PROPERTIES OF VARIOUS MATERIALS

MATERIAL	RELATIVE DIELECTRIC PERMITIVITY	PULSE VELOCITY (ns/ft)
Air	1	1
Freshwater	81	9
Seawater	81	9
Sand (dry)	4 - 6	2.1 - 2.4
Sand (saturated)	30	5.5
Silt (saturated)	10	3.1
Clay (saturated)	8 - 12	2.8 - 3.3
Average "dirt"	16	4
Dry sandy coastal land	10	3.1
Marshy forested flat land	12	3.5
Rich agricultural land	15	3.9
Pastoral land, hilly, forested	13	3.6
Freshwater ice	4	2.0
Permafrost	4 - 8	2.0 - 2.9
Granite (dry)	5	2.2
Limestone	7 - 9	2.6
Concrete	6.4	2.5
Asphalt	3 - 5	1.7 - 2.5

Notes:

ns/ft = nanoseconds per foot

Table 6.1: Field Instrument Calibration

Instrument	Activity	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA
pH Probe	Calibrate probe with up to three temperature-equilibrated standards to bracket expected pH values on site.	Daily-before use Calibration check - at end of day, or if instrument gives erratic results	Stable readings ± 0.1 pH units within 3 minutes	If probe reading fails to stabilize, do not use. Check/replace membrane and recalibrate or service as necessary. Repeat analysis of affected samples or qualify data if analysis cannot be repeated.	Task Leader and Field Samplers
DO Probe	Calibrate with 2 standards – saturated DO standard and 0.0 mg/L DO standard	Daily-before use Calibration check - at end of day, or if instrument gives erratic results	± 0.2 mg/L before use. ± 0.5 mg/L for end of day calibration check.	If DO reading exceeds criterion, recalibrate or service as necessary. Repeat analysis of affected samples or qualify data if analysis cannot be repeated.	Task Leader and Field Samplers
Specific Conductance Electrode	Calibrate electrode with a standard solution close to expected sample values.	Daily-before use Calibration check - at end of day, or if instrument gives erratic results	± 5% of standard or ± 10 mS/cm of standard (whichever is greater)	If sp. conductance electrode reading exceeds criterion, then clean probe or service as necessary and recalibrate. Repeat analysis of affected samples or qualify data if analysis cannot be repeated.	Task Leader and Field Samplers
Thermistor-Temperature Sensor	Calibrate against NIST-certified thermometer annually.	Calibration check –prior to onset of program	± 0.2 ^{o}C of NIST certified thermometer.	If temperature sensor reading exceeds criterion, then clean probe, or service as necessary and recalibrate. Repeat analysis of affected samples or qualify data if analysis cannot be repeated.	Task Leader and Field Samplers

Table 6.1: Field Instrument Calibration

Instrument	Activity	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA
Turbidimeter	Hach-calibrate with <0.1, 20, 100, and 800 NTU standards.	Daily-before use Calibration check-at end of day, or if instrument gives erratic results	± 5% per scale.	If turbidity reading exceeds criterion, then calibrate or service as necessary. Repeat analysis of affected samples or qualify data if analysis cannot be repeated.	Task Leader and Field Samplers
ORP/ Eh Probe	Calibrate against a Hanna solution.	Daily-before use Calibration check -at end of day, or if instrument gives erratic results	± 10 mV of standard	If ORP/Eh reading exceeds criterion, then have manufacture recalibrate. Repeat analysis of affected samples or qualify data if analysis cannot be repeated.	Task Leader and Field Samplers
FID	Calibrate with 100 ppmV methane standard. Blank: zero air check	Daily-before use Calibration check – at end of day, or if instrument gives erratic results	± 10% of true value	Recalibrate or service; rerun affected sample.	Task Leader and Field Samplers
PID	Calibrate with 100 ppmV isobutylene standard. Blank: zero air check	Daily-before use Calibration check – at end of day, or if instrument gives erratic results	± 10% of true value	Recalibrate or service; rerun affected sample.	Task Leader and Field Samplers

TABLE 7.1
ELECTRONIC DATA DELIVERABLE REQUIREMENTS
NYSDEC QUALITY ASSURANCE PROJECT PLAN

Equis "EZEDD01" Field Name	data type	Required For "EDD"	Description	"TED" Table	"TED" Column
project_code	1 Text20	X	This field contains the internal project_code used by TED to identify a unique site. This will be provided to the lab on a per project basis.	Location	Site_id
sample_name	2 Text30	X	This field contains the sample number as written in the Analysis Request and Chain of Custody (AR/COC) form sent to the laboratory with the field samples for analysis. This is a unique number assigned to each sample by sampling personnel. For laboratory samples enter "LAB QC".	sample_collection	field_sample_id
sys_sample_code	3 Text20				
sample_date	4 Date	X	mm/dd/yyyy. Date sample was collected in the field. Date information must be identical with the date from the AR/COC form. Leave blank for lab samples. Year may be entered as yyyy.	sample_collection	field_sample_date
sample_time	5 Time				
analysis_location	6 Text2				
lab_name_code	7 Text10	X	Laboratory that performed the analysis.	sample_analysis	lab_id
lab_sample_id	8 Text20	X	Unique sample ID internally assigned by the laboratory.	sample_analysis	lab_sample_id
sample_type_code	9 Text10	X	Specifies sample type. For field samples, enter FS (regular environmental sample), otherwise, use values listed in the LOV. For example, normal field samples must be distinguished from laboratory method blank samples, etc.	sample_collection	qc_code
Lab_Del_Group	10 Text20	X	Tracking code used by the laboratory. Commonly called Sample Delivery Group (SDG).	sample_analysis	lab_sample_delivery_group
Lab_Batch_Number	11 Text20		Tracking number used by the laboratory to identify a group of samples analyzed in the same batch. This field, in conjunction with laboratory blank ID, is used to link the relationship between field samples and laboratory blank and other QC samples.		
lab_anl_method_name	12 Text35	X	Test method used in the analysis of the analyte.	sample_analysis	analysis_method

TABLE 7.1
ELECTRONIC DATA DELIVERABLE REQUIREMENTS
NYSDEC QUALITY ASSURANCE PROJECT PLAN

Equis "EZEDD01" Field Name	data type	Required For "EDD"	Description	"TED" Table	"TED" Column
cas_rn	13 Text15	X	Unique analyte identifier. Use assigned CAS number when one is identified for an analyte. Tentatively Identified Compounds (TICs) and a number of other analytes are not assigned a standard CAS number. The laboratory is required to assign a UNIQUE identifier for all chemical_names.	sample_analysis_results	casno
chemical_name	14 Text60	X	Name of analyte or parameter analyzed.		
result_value	15 Text20	X	Must only be a numeric value. It is stored as a string of characters so that significant digits can be retained. Must be identical with values presented in the hard copy. Analytical result is reported left justified. Reported as the reporting_detection_limit for non-detects.	sample_analysis_results	lab_result
lab_qualifiers	16 Text7	X	Qualifier flags assigned by the laboratory.	sample_analysis_results	lab_qualifier
result_unit	17 Text15	X	This format assumes that the result value and detect limit have the same units.	sample_analysis_results	result_uom
result_type_code	18 Text10	X	Type of result (TIC, target analyte, etc.)	sample_analysis_results	result_type
detect_flag	19 Text2	X	Enter “Y” for detected analytes or “N” for non-detected analytes.	sample_analysis_results	report_hit_flag
reporting_detection_limit	20 Text20	X	Must only be a numeric value. Use the value of the Reported Detection Limit (RDL), Practical Quantitation Limit (PQL), or Contract Required Quantitation Limit. Value is stored as a string to retain significant figures. Unit of measure must be identical with result_unit value.	sample_analysis_results	detection_limit
dilution_factor	21 Text6	X	Must be a numeric entry. The factor by which the sample was diluted as part of the preparation process. If no dilution was done, enter the value 1. Value is stored as a string to retain significant figures.	sample_analysis	dilution_factor
sample_matrix_code	22 Text10	X	Code which distinguishes between different type of sample matrix. For example, soil samples must be distinguished from ground water samples, etc. Valid codes for HESE are "G" (gas), "L" (liquid), "S" (solid), and "P" (free or raw liquid product).	sample_collection	matrix

TABLE 7.1
ELECTRONIC DATA DELIVERABLE REQUIREMENTS
NYSDEC QUALITY ASSURANCE PROJECT PLAN

Equis "EZEDD01" Field Name	data type	Required For "EDD"	Description	"TED" Table	"TED" Column
total_or_dissolved (or fraction)	23 Text1	X	Must be "T" for total metal concentration, "D" for dissolved or filtered metal concentration, or "N" for organic (or other) parameters for which neither "total" nor "dissolved" is applicable. Also, HESE requires "C" for TCLP and "S" for SPLP fractions.	sample_analysis	fraction
basis	24 Text10				
analysis_date	25 Date	X	mm/dd/yyyy. Date sample was analyzed.	sample_analysis	analysis_date
analysis_time	26 Time				
method_detection_limit	27 Text20				
lab_prep_method_name	28 Text35		Description of sample preparation or extraction method.	sample_analysis	prep_method_name
prep_date	29 Date	X	mm/dd/yyyy. This field is used to determine whether holding times for field samples have been exceeded.	sample_analysis	extraction_date
prep_time	30 Time				
test_batch_id	31 Text20				
result_error_delta	32 Text20				
TIC_retention_time	33 Text8				
qc_level	34 Text10		Laboratory QC level associated with the analysis	sample_analysis	qc_level
result_comment	35 Text255		Any comments related to the analysis.	sample_analysis_results	comments
sample_quantitation_limit (may be REQUIRED FIELD for certain projects)	36 Text20		Must only be a numeric value. Use the value of the Sample Quantitation Limit (SQL). Value is stored as a string to retain significant figures. Unit of measure must be identical with result_unit value.	sample_analysis_results	TBD

Note: All "X" marked fields are minimum data required to load data to "TED".

APPENDIX A

INDOOR AIR QUALITY QUESTIONNAIRE AND BUILDING INVENTORY FORM (FROM NYSDOH FINAL VAPOR INTRUSION GUIDANCE – OCTOBER 2006)

OSR – 3

NEW YORK STATE DEPARTMENT OF HEALTH
INDOOR AIR QUALITY QUESTIONNAIRE AND BUILDING INVENTORY
CENTER FOR ENVIRONMENTAL HEALTH

This form must be completed for each residence involved in indoor air testing.

Preparer's Name ______________________________ Date/Time Prepared ____________

Preparer's Affiliation ___________________________ Phone No.__________________

Purpose of Investigation____

1. OCCUPANT:

Interviewed: Y / N

Last Name: _____________________ First Name: _____________________

Address: ____

County: ______________

Home Phone: _________________ Office Phone: _________________

Number of Occupants/persons at this location ______ Age of Occupants ___________________

2. OWNER OR LANDLORD: (Check if same as occupant ___)

Interviewed: Y / N

Last Name: _____________________First Name: _______________________

Address: ____

County: ______________

Home Phone: _________________ Office Phone: _________________

3. BUILDING CHARACTERISTICS

Type of Building: (Circle appropriate response)

Residential
Industrial

School
Church

Commercial/Multi-use
Other: _______________

If the property is residential, type? (Circle appropriate response)

Ranch
Raised Ranch
Cape Cod
Duplex
Modular

2-Family
Split Level
Contemporary
Apartment House
Log Home

3-Family
Colonial
Mobile Home
Townhouses/Condos
Other:_______________

If multiple units, how many? ________

If the property is commercial, type?

Business Type(s) ______________________________________

Does it include residences (i.e., multi-use)? Y / N If yes, how many? ______

Other characteristics:

Number of floors______ Building age______

Is the building insulated? Y / N How air tight? Tight / Average / Not Tight

4. AIRFLOW

Use air current tubes or tracer smoke to evaluate airflow patterns and qualitatively describe:

Airflow between floors

Airflow near source

Outdoor air infiltration

Infiltration into air ducts

5. BASEMENT AND CONSTRUCTION CHARACTERISTICS (Circle all that apply)

a. Above grade construction:	wood frame	concrete	stone	brick
b. Basement type:	full	crawlspace	slab	other ________
c. Basement floor:	concrete	dirt	stone	other ________
d. Basement floor:	uncovered	covered	covered with ________________	
e. Concrete floor:	unsealed	sealed	sealed with ________________	
f. Foundation walls:	poured	block	stone	other ________
g. Foundation walls:	unsealed	sealed	sealed with ________________	
h. The basement is:	wet	damp	dry	moldy
i. The basement is:	finished	unfinished	partially finished	

j. Sump present? Y / N

k. Water in sump? Y / N / not applicable

Basement/Lowest level depth below grade: ________(feet)

Identify potential soil vapor entry points and approximate size (e.g., cracks, utility ports, drains)

____

____

6. HEATING, VENTING and AIR CONDITIONING (Circle all that apply)

Type of heating system(s) used in this building: (circle all that apply – note primary)

Hot air circulation
Space Heaters
Electric baseboard

Heat pump
Stream radiation
Wood stove

Hot water baseboard
Radiant floor
Outdoor wood boiler

Other __________

The primary type of fuel used is:

Natural Gas
Electric
Wood

Fuel Oil
Propane
Coal

Kerosene
Solar

Domestic hot water tank fueled by: ________________________

Boiler/furnace located in: Basement Outdoors Main Floor Other__________

Air conditioning: Central Air Window units Open Windows None

Are there air distribution ducts present? Y / N

Describe the supply and cold air return ductwork, and its condition where visible, including whether there is a cold air return and the tightness of duct joints. Indicate the locations on the floor plan diagram.

____

____

____

____

7. OCCUPANCY

Is basement/lowest level occupied? Full-time Occasionally Seldom Almost Never

Level	**General Use of Each Floor (e.g., familyroom, bedroom, laundry, workshop, storage)**
Basement	
1st Floor	
2nd Floor	
3rd Floor	
4th Floor	

8. FACTORS THAT MAY INFLUENCE INDOOR AIR QUALITY

a. Is there an attached garage? Y / N

b. Does the garage have a separate heating unit? Y / N / NA

c. Are petroleum-powered machines or vehicles stored in the garage (e.g., lawnmower, atv, car) Y / N / NA Please specify____________

d. Has the building ever had a fire? Y / N When?____________

e. Is a kerosene or unvented gas space heater present? Y / N Where? ____________

f. Is there a workshop or hobby/craft area? Y / N Where & Type? ____________

g. Is there smoking in the building? Y / N How frequently? ____________

h. Have cleaning products been used recently? Y / N When & Type? ____________

i. Have cosmetic products been used recently? Y / N When & Type? ____________

j. Has painting/staining been done in the last 6 months? Y / N Where & When? ______________

k. Is there new carpet, drapes or other textiles? Y / N Where & When? ______________

l. Have air fresheners been used recently? Y / N When & Type? ______________

m. Is there a kitchen exhaust fan? Y / N If yes, where vented?____________

n. Is there a bathroom exhaust fan? Y / N If yes, where vented?____________

o. Is there a clothes dryer? Y / N If yes, is it vented outside? Y / N

p. Has there been a pesticide application? Y / N When & Type?________________

Are there odors in the building? Y / N
If yes, please describe: ____

Do any of the building occupants use solvents at work? Y / N
(e.g., chemical manufacturing or laboratory, auto mechanic or auto body shop, painting, fuel oil delivery, boiler mechanic, pesticide application, cosmetologist

If yes, what types of solvents are used? ____

If yes, are their clothes washed at work? Y / N

Do any of the building occupants regularly use or work at a dry-cleaning service? (Circle appropriate response)

Yes, use dry-cleaning regularly (weekly)
Yes, use dry-cleaning infrequently (monthly or less)
Yes, work at a dry-cleaning service
No
Unknown

Is there a radon mitigation system for the building/structure? Y / N Date of Installation: ___________
Is the system active or passive? Active/Passive

9. WATER AND SEWAGE

Water Supply:	Public Water	Drilled Well	Driven Well	Dug Well	Other: _______
Sewage Disposal:	Public Sewer	Septic Tank	Leach Field	Dry Well	Other: _______

10. RELOCATION INFORMATION (for oil spill residential emergency)

a. Provide reasons why relocation is recommended: ________________________________

b. Residents choose to: remain in home relocate to friends/family relocate to hotel/motel

c. Responsibility for costs associated with reimbursement explained? Y / N

d. Relocation package provided and explained to residents? Y / N

11. FLOOR PLANS

Draw a plan view sketch of the basement and first floor of the building. Indicate air sampling locations, possible indoor air pollution sources and PID meter readings. If the building does not have a basement, please note.

Basement:

First Floor:

12. OUTDOOR PLOT

Draw a sketch of the area surrounding the building being sampled. If applicable, provide information on spill locations, potential air contamination sources (industries, gas stations, repair shops, landfills, etc.), outdoor air sampling location(s) and PID meter readings.

Also indicate compass direction, wind direction and speed during sampling, the locations of the well and septic system, if applicable, and a qualifying statement to help locate the site on a topographic map.

13. PRODUCT INVENTORY FORM

Make & Model of field instrument used: ______________________________

List specific products found in the residence that have the potential to affect indoor air quality.

Location	Product Description	Size (units)	Condition*	Chemical Ingredients	Field Instrument Reading (units)	Photo** Y / N

* Describe the condition of the product containers as **Unopened (UO), Used (U),** or **Deteriorated (D)**
** Photographs of the **front and back** of product containers can replace the handwritten list of chemical ingredients. However, the photographs must be of good quality and ingredient labels must be legible.

ATTACHMENT C

FIELD DATA RECORDS

Project: Mohonk Road Industrial Plant
Client: NYSDEC
Location: Hamlet of High Falls, Marbletown, New York
Contractor: MACTEC Engineering & Consulting
Date: ____________ **Technician:** ______________________________

FDR 1: Mohonk Road Industrial Plant Site, Monitoring Well Static Groundwater Levels

Monitoring Well	X Coordinate	Y Coordinate	Construction Information			Water Level Information				Comments
			Total Depth (ft BGS)	Bottom Elevation (ft AMSL)	Top of Casing (ft AMSL)	Time	Depth to Water (ft bTOC)	Depth to Bottom (ft bTOC)	Casing Stickup (ft AGS)	
SVE-19	UNK	UNK	55	UNK	~2 ft AGS					
SVE-20	UNK	UNK	55	UNK	~2 ft AGS					
SVE-21	UNK	UNK	55	UNK	~2 ft AGS					
SVE-22	UNK	UNK	55	UNK	~2 ft AGS					
SVE-23	UNK	UNK	55	UNK	~2 ft AGS					
ERT-12	571897.25	4629866	195	108.94	303.94					
ERT-2	571843.56	4629843	200	109.81	309.81					
ERT-3	571850.19	4629819	220	95.89	315.89					
ERT-4	571979.5	4629806.5	50	276.67	326.67					
MW-1B	571967.38	4629665	100	233.53	333.53					
MW-4	571971.06	4629799	21.5	307.71	329.21					
MW-5B	571981.81	4629825.5	36.2	289.1	325.3					
MW-5R2	572003.06	4629852	125	188.63	313.63					
MW-6B	572042.38	4629780.5	100	223.95	323.95					
MW-7B	571794.25	4629797	100	213.93	313.93					
MW-7R2	571790.75	4629797	180	134.3	314.3					
MW-8B	572249.41	4630989.19	100	59.68	159.68					
MW-9B	572016.88	4630545	145	103.21	248.21					
MW-10B	572734.6	4630604	100	125.64	225.64					
MW-11B	572126.19	4630011	181	100.72	281.72					
MW-11C	572125	4630007	220	64.58	284.58					
MW-12B	572234.19	4630222.41	200	58.2	258.2					
MW-13B3	571312.94	4630103	200	21.93	221.93					
MW-14B	572600.32	4630930.34	155	1.67	156.67					
MW-15B	571701.56	4630172.5	150	94.89	244.89					
MW-16	572083.65	4630265.75	93	181.11	274.11					
MW-17-1	572545.72	4630421.63	57	184.92	241.92					
MW-17-2			110	131.92	241.92					
MW-17-3			129	112.92	241.92					
MW-18-13	571579.98	4630508.22	101	103.45	204.45					
MW-18-23			128	76.45	204.45					
MW-18-33			145	59.45	204.45					
MW-19-13	572596.93	4631100.5	49	80.88	129.88					
MW-19-23			95	34.88	129.88					
MW-19-33			195	-65.12	129.88					
MW-20-1	571966.96	4631057.64	77	125.84	202.84					
MW-20-2			111.5	91.34	202.84					
MW-20-3			149	53.84	202.84					
MW-21-13	572596	4630042	48	185.59	233.59					
MW-21-23			69.5	164.09	233.59					
MW-21-33			78	155.59	233.59					
MW-21-43			124	109.59	233.59					
MW-21-53			145	88.59	233.59					
MW-21-63			163	70.59	233.59					

Notes:
BGS: below ground surface
AGS: above ground surface
AMSL: Above mean sea level
bTOC: Below top of casing

Project: Mohonk Road Industrial Plant
Client: NYSDEC
Location: Hamlet of High Falls, Marbletown, New York
Consultant: MACTEC Engineering & Consulting
Date: **Techinician(s):**

MACTEC

Phase 2a: Soil Vapor Extraction Test Under Non-pumping Conditions

Time Elapsed (min)	**System Parameters**				**SVE-19**		**SVE-20**		**SVE-21**		**SVE-22**		**SVE-23**		**Comments (ex: Note when sample collected for lab analysis)**
	Temperature (°F)	**Suction Pressure ("H_2O)**	**Suction PID (ppm)**	**Air Flow (scfm)**	**Air Flow (scfm)**	**PID**	**Air Flow (scfm)**	**PID**	**Air Flow (scfm)**	**PID**	**Air Flow (scfm)**	**PID**	**Air Flow (scfm)**	**PID**	
0	Started SVE system at lowest blower setting														
5															
15															
30															
45															
60															
	Throttle Back Dilution Valve														
65															
75															
90															
105															
120															
	Throttle Back Dilution Valve (if possible)														
125															
135															
150															
165															
180															
	Throttle Back Dilution Valve (if possible)														
185															
195															
210															
225															
240															
	Throttle Back Dilution Valve (if possible)														
245															
255															
270															
285															
300															

Project: Mohonk Road Industrial Plant
Client: NYSDEC
Location: Hamlet of High Falls, Marbletown, New York
Consultant: MACTEC Engineering & Consulting
Date: **Technician:**

MACTEC

Phase 2b: Radius of Influence Testing

Temp:		Elapsed Time (min)	Active Well					Comments
			SVE 19	SVE 20	SVE 21	SVE 22	SVE 23	
SVE System Measurments	Temperature (°F)	20						
		40						
		60						
	Suction Pressure ("H_2O)	20						
		40						
		60						
	System Airflow (SCFM)	20						
		40						
		60						
SVE Radius of Influence Measurments (wci) from Wellhead Vacuum Indicators	SVE-19	20						
		40						
		60						
	SVE-20	20						
		40						
		60						
	SVE-21	20						
		40						
		60						
	SVE-22	20						
		40						
		60						
	SVE-23	20						
		40						
		60						

Project: Mohonk Road Industrial Plant
Client: NYSDEC
Location: Hamlet of High Falls, Marbletown, New York
Consultant: MACTEC Engineering & Consulting
Date: **Technician:**

Phase 2b: Radius of Influence Testing

Temp:		Elapsed Time (min)	Active Well					Comments
			SVE 19	SVE 20	SVE 21	SVE 22	SVE 23	
SVE System Measurments	Temperature (°F)	20						
		40						
		60						
	Suction Pressure ("H_2O)	20						
		40						
		60						
	System Airflow (SCFM)	20						
		40						
		60						
SVE Radius of Influence Measurments (wci) from Wellhead Vacuum Indicators	SVE-19	20						
		40						
		60						
	SVE-20	20						
		40						
		60						
	SVE-21	20						
		40						
		60						
	SVE-22	20						
		40						
		60						
	SVE-23	20						
		40						
		60						

Project: Mohonk Road Industrial Plant
Client: NYSDEC
Location: Hamlet of High Falls, Marbletown, New York
Consultant: MACTEC Engineering & Consulting
Date: **Technician:**

MACTEC

Phase 2b: Radius of Influence Testing

Temp:		Elapsed Time (min)	Active Well					Comments
			SVE 19	SVE 20	SVE 21	SVE 22	SVE 23	
SVE System Measurments	Temperature (°F)	20						
		40						
		60						
	Suction Pressure ("H_2O)	20						
		40						
		60						
	System Airflow (SCFM)	20						
		40						
		60						
SVE Radius of Influence Measurments (wci) from Wellhead Vacuum Indicators	SVE-19	20						
		40						
		60						
	SVE-20	20						
		40						
		60						
	SVE-21	20						
		40						
		60						
	SVE-22	20						
		40						
		60						
	SVE-23	20						
		40						
		60						

Project: Mohonk Road Industrial Plant
Client: NYSDEC
Location: Hamlet of High Falls, Marbletown, New York
Consultant: MACTEC Engineering & Consulting
Date: **Technician:**

Phase 2b: Radius of Influence Testing

Temp:		**Elapsed Time (min)**	**Active Well**					**Comments**
			SVE 19	**SVE 20**	**SVE 21**	**SVE 22**	**SVE 23**	
SVE System Measurments	**Temperature (°F)**	**20**						
		40						
		60						
	Suction Pressure ("H_2O)	**20**						
		40						
		60						
	System Airflow (SCFM)	**20**						
		40						
		60						
SVE Radius of Influence Measurments (wci) from Wellhead Vacuum Indicators	**SVE-19**	**20**						
		40						
		60						
	SVE-20	**20**						
		40						
		60						
	SVE-21	**20**						
		40						
		60						
	SVE-22	**20**						
		40						
		60						
	SVE-23	**20**						
		40						
		60						

Project: Mohonk Road Industrial Plant
Client: NYSDEC
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MACTEC

Phase 2b: Radius of Influence Testing

Temp:		Elapsed Time (min)	Active Well					Comments
			SVE 19	SVE 20	SVE 21	SVE 22	SVE 23	
SVE System Measurments	Temperature (°F)	20						
		40						
		60						
	Suction Pressure ("H_2O)	20						
		40						
		60						
	System Airflow (SCFM)	20						
		40						
		60						
SVE Radius of Influence Measurments (wci) from Wellhead Vacuum Indicators	SVE-19	20						
		40						
		60						
	SVE-20	20						
		40						
		60						
	SVE-21	20						
		40						
		60						
	SVE-22	20						
		40						
		60						
	SVE-23	20						
		40						
		60						

Project: Mohonk Road Industrial Plant
Client: NYSDEC
Location: Hamlet of High Falls, Marbletown, New York
Consultant: MACTEC Engineering & Consulting
Date: **Technician:**

Phase 3: SVE Well Groundwater Pumping Test

New form needed for each additional well pump added

Time Elapsed (min)	Well Pumping Rates (gpm)						Groundwater Levels					Comments
	SVE-19	SVE-20	SVE-21	SVE-22	SVE-23	Combined	SVE-19	SVE-20	SVE-21	SVE-22	SVE-23	
0	Take baseline GW readings, begin Pumping											
1												
5												
10												
15												
20												
25												
30												
35												
40												
45												
50												
55												
60												
65												
70												
75												
80												
85												
90												
95												
100												
105												
110												
115												
120												
125												
130												
135												
140												
145												
150												
155												
160												
165												
170												
175												
180												

Project: Mohonk Road Industrial Plant
Client: NYSDEC
Location: Hamlet of High Falls, Marbletown, New York
Contractor: MACTEC Engineering & Consulting
Date: **Technician:**

Phase 4: Dual Phase Extraction Test (Soil Vapor and Groundwater)

Time Elapsed (min)	SVE System Parameters				SVE-19		SVE-20		SVE-21		SVE-22		SVE-23		Comments
	Temperature (°F)	Suction Pressure ("H2O)	Suction PID (ppm)	Air Flow (scfm)	Airflow (scfm)	GW Ext. Rate (gpm)	Airflow (scfm)	GW Ext. Rate (gpm)	Airflow (scfm)	GW Ext. Rate (gpm)	Airflow (scfm)	GW Ext. Rate (gpm)	Airflow (scfm)	GW Ext. Rate (gpm)	
0	Started SVE system at final Phase 2 blower setting														
5															
15															
30															
45															
60															
	Ramp up blower speed														
65															
75															
90															
105															
120															
	Ramp up blower speed (if possible)														
125															
135															
150															
165															
180															
	Ramp up blower speed (if possible)														
185															
195															
210															
225															
240															
	Ramp up blower speed (if possible)														
245															
255															
270															
285															
300															

Project: Mohonk Road Industrial Plant
Client: NYSDEC
Location: Hamlet of High Falls, Marbletown, New York
Contractor: MACTEC Engineering & Consulting
Date: ____________ **Technician:** ________________________

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Mohonk Road Industrial Plant Site, Monitoring Well Static Groundwater Levels

Monitoring Well	X Coordinate	Y Coordinate	Construction Information			Water Level Information				Comments
			Total Depth (ft BGS)	Bottom Elevation (ft AMSL)	Top of Casing (ft AMSL)	Pre-Test		Post-Test		
						Time	Depth to Water	Time	Depth to Water	
SVE-19	UNK	UNK	55	UNK	~2 ft AGS					
SVE-20	UNK	UNK	55	UNK	~2 ft AGS					
SVE-21	UNK	UNK	55	UNK	~2 ft AGS					
SVE-22	UNK	UNK	55	UNK	~2 ft AGS					
SVE-23	UNK	UNK	55	UNK	~2 ft AGS					
ERT-1	571897.25	4629866	195	108.94	303.94					
ERT-2	571843.56	4629843	200	109.81	309.81					
ERT-3	571850.19	4629819	220	95.89	315.89					
ERT-4	571979.5	4629806.5	50	276.67	326.67					
MW-4	571971.06	4629799	21.5	307.71	329.21					
MW-5B	571981.81	4629825.5	36.2	289.1	325.3					
MW-5R	572003.06	4629852	125	188.63	313.63					
MW-6B	572042.38	4629780.5	100	223.95	323.95					
MW-7B	571794.25	4629797	100	213.93	313.93					
MW-7R	571790.75	4629797	180	134.3	314.3					
MW-11B	572126.19	4630011	181	100.72	281.72					
MW-11C	572125	4630007	220	64.58	284.58					

Project: Mohonk Road Industrial Plant
Client: NYSDEC
Location: Hamlet of High Falls, Marbletown, New York
Contractor: MACTEC Engineering & Consulting
Date: **Technician:** **Technician:**
QC'd by/Date:

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Monitoring Well	X Coordinate	Y Coordinate	Total Depth (ft BGS)	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Comments
				DTW	DTW	DTW	DTW	DTW	DTW	DTW	DTW	DTW	DTW	
ERT-1	571897.25	4629866	195											
ERT-2	571843.56	4629843	200											
ERT-3	571850.19	4629819	220											
ERT-4	571979.5	4629806.5	50											
MW-4	571971.06	4629799	21.5											
MW-5B	571981.81	4629825.5	36.2											
MW-5R	572003.06	4629852	125											
MW-6B	572042.38	4629780.5	100											
MW-7B	571794.25	4629797	100											
MW-7R	571790.75	4629797	180											
MW-11B	572126.19	4630011	181											
MW-11C	572125	4630007	220											

Notes:
BGS: below ground surface
AGS: above ground surface
AMSL: Above mean sea level
bTOC: Below top of casing
DTW: Depth to water
Depth to water measured bTOC

FIELD INSTRUMENTATION CALIBRATION RECORD

PROJECT NAME: Mohonk Road Industrial Plant (MRIP)
PROJECT NUMBER: 3611191234
PROJECT LOCATION: Hamlet of High Falls, Marbletown, New York
WEATHER CONDITIONS (AM): ____________
WEATHER CONDITIONS (PM): ____________

TASK NO: ____________ DATE: ________
MACTEC CREW: ____________
SAMPLER NAME: ____________
SAMPLER SIGNATURE: ____________
CHECKED BY: ____________ DATE: ________

MULTI-PARAMETER WATER QUALITY METER

METER TYPE ____________
MODEL NO. ____________
UNIT ID NO. ____________

AM CALIBRATION
Start Time __________ **/End Time** __________

POST CALIBRATION CHECK
Start Time __________ **/End Time** __________

	Units	**Standard Value**	**Meter Value**	***Acceptance Criteria (AM)**	**Standard Value**	**Meter Value**	***Acceptance Criteria (PM)**
pH (4)	SU	4.0		+/- 0.1 pH Units			
pH (7)	SU	7.0		+/- 0.1 pH Units	7.0		+/- 0.3 pH Units
pH (10)	SU	10.0		+/- 0.1 pH Units			
Redox	+/- mV	240		+/- 10 mV	240		+/- 10 mV
Conductivity	mS/cm	1.413		+/- 0.5 % of standard	1.413		+/- 5% of standard
DO (saturated)	%	100		+/- 2% of standard			
DO (saturated)	mg/L[1] (see Chart 1)			+/- 0.2 mg/L			+/- 0.5 mg/L of standard
DO (<0.1)	mg/L	<0.1		< 0.5 mg/L			
Temperature	°C						
Baro. Press.	mmHg						

TURBIDITY METER

METER TYPE ____________
MODEL NO. ____________
UNIT ID NO. ____________

	Units	**Standard Value**	**Meter Value**	**Standard Value**	**Meter Value**	***Acceptance Criteria (PM)**
<0.1 Standard	NTU	<0.1		<0.1		+/- 0.3 NTU of stan.
20 Standard	NTU	20		20		+/- 5% of standard
100 Standard	NTU	100		100		+/- 5% of standard
800 Standard	NTU	800		800		+/- 5% of standard

PHOTOIONIZATION DETECTOR

METER TYPE ____________
MODEL NO. ____________
UNIT ID NO. ____________

Background	ppmv	<0.1		<0.1		within 5 ppmv of BG
Span Gas	ppmv	100		100		+/- 10% of standard

O_2-LEL 4 GAS METER

METER TYPE ____________
MODEL NO. ____________
UNIT ID NO. ____________

Methane	%	50		50		+/- 10% of standard
O_2	%	20.9		20.9		+/- 10% of standard
H_2S	ppmv	25		25		+/- 10% of standard
CO	ppmv	50		50		+/- 10% of standard

OTHER METER

METER TYPE ____________
MODEL NO. ____________
UNIT ID NO. ____________

See Notes Below for Additional Information

☐ Equipment calibrated within the Acceptance Criteria specified for each of the parameters listed above.
☐ Equipment (not) calibrated within the Acceptance Criteria specified for each of the parameters listed above**.

MATERIALS RECORD

Deionized Water Source: Portland FOS
Lot#/Date Produced: ____________
Trip Blank Source: ____________
Sample Preservatives Source: ____________
Disposable Filter Type: 0.45µm cellulose
Calibration Fluids / Standard Source:
- DO Calibration Fluid (<0.1 mg/L) Portland FOS
- Other ____________
- Other ____________
- Other ____________

	Cal. Standard Lot Number	**Exp. Date**
pH (4)		
pH (7)		
pH (10)		
ORP		
Conductivity		
<0.1 Turb. Stan.		
20 Turb. Stan.		
100 Turb. Stan.		
800 Turb. Stan.		
PID Span Gas		
O_2-LEL Span Gas		
Other		

NOTES:

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* = Unless otherwise noted, calibration procedures and acceptance criteria are in general accordance with USEPA Region 1 SOPs for Field Instrument Calibration (EQASOP-FieldCalibrat) and Low Stress Purging and Sampling (EQASOP-GW001), each dated 1/19/2010. Additonal acceptance criteria obtained from instrument specific manufacturer recommendations.

** = If meter reading is not within acceptance criteria, clean/replace probe and re-calibrate, or use calibrated back-up meter if available. If project requirements necessitate use of the instrument, clearly document any deviations from acceptance criteria on all data sheets and log book entries.

1 = DO Saturated standard value is calculated based on Oxygen Solubility at Indicated Pressure Chart from the USEPA Region 1 SOP for Field Instrument Calibration (EQASOP-FieldCalibrat), dated 1/19/2010.

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FIGURE 6.1
FIELD INSTRUMENT CALIBRATION RECORD
NYSDEC QUALITY ASSURANCE PROJECT PLAN

LOW FLOW GROUNDWATER SAMPLING RECORD

PROJECT NAME Mohonk Road Industrial Plant (MRIP)			**LOCATION ID**	**DATE**
PROJECT NUMBER 3611191234			**START TIME**	**END TIME**
SAMPLE ID	**SAMPLE TIME**		**SITE NAME/NUMBER**	**PAGE** OF

WELL DIAMETER (INCHES) ☐ 1 ☐ 2 ☐ 4 ☐ 6 ☐ 8 ☐ OTHER ____________

TUBING ID (INCHES) ☐ 1/8 ☐ 1/4 ☐ 3/8 ☐ 1/2 ☐ 5/8 ☐ OTHER ____________

MEASUREMENT POINT (MP) ☐ TOP OF RISER (TOR) ☐ TOP OF CASING (TOC) ☐ OTHER ____________

WELL INTEGRITY

	YES	NO	N/A
CAP	___	___	___
CASING	___	___	___
LOCKED	___	___	___
COLLAR	___	___	___

INITIAL DTW (BMP)	FT	**FINAL DTW (BMP)**	FT	**PROT. CASING STICKUP (AGS)**	FT	**TOC/TOR DIFFERENCE**	FT
WELL DEPTH (BMP)	FT	**SCREEN LENGTH**	FT	**PID AMBIENT AIR**	PPM	**REFILL TIMER SETTING**	SEC
WATER COLUMN	FT	**DRAWDOWN VOLUME** (initial DTW- final DTW X well diam. squared X 0.041)	GAL	**PID WELL MOUTH**	PPM	**DISCHARGE TIMER SETTING**	SEC
CALCULATED GAL/VOL (column X well diameter squared X 0.041)	GAL	**TOTAL VOL. PURGED** (mL per minute X total minutes X 0.00026 gal/mL)	GAL	**DRAWDOWN/ TOTAL PURGED**		**PRESSURE TO PUMP**	PSI

FIELD PARAMETERS WITH PROGRAM STABILIZATION CRITERIA (AS LISTED IN THE QAPP)

TIME 3-5 Minutes	DTW (FT) 0.0-0.33 ft Drawdown	PURGE RATE (mL/min)	TEMP. (^{o}C) (+/- 3 degrees)	SP. CONDUCTANCE (mS/cm) (+/- 3%)	pH (units) (+/- 0.1 units)	DISS. O_2 (mg/L) (+/- 10%)	TURBIDITY (ntu) (+/- 10% <10 ntu)	REDOX (mv) (+/- 10 mv)	PUMP INTAKE DEPTH (ft)	COMMENTS
	BEGIN PURGING									

FINAL STABILIZED FIELD PARAMETERS (to appropriate significant figures[SF])

TEMP.: nearest degree (ex. 10.1 = 10)
COND.: 3 SF max (ex. 3333 = 3330, 0.696 = 0.696)
pH: nearest tenth (ex. 5.53 = 5.5)
DO: nearest tenth (ex. 3.51 = 3.5)
TURB: 3 SF max, nearest tenth (6.19 = 6.2, 101 = 101)
ORP: 2 SF (44.1 = 44, 191 = 190)

EQUIPMENT DOCUMENTATION

TYPE OF PUMP
- ☐ PERISTALTIC
- ☐ SUBMERSIBLE
- ☐ BLADDER
- ____________
- ☐ WATTERA
- ☐ OTHER ____________
- ☐ OTHER ____________

DECON FLUIDS USED
- ☐ LIQUINOX
- ☐ DEIONIZED WATER
- ☐ POTABLE WATER
- ☐ NITRIC ACID
- ☐ HEXANE
- ☐ METHANOL
- ☐ OTHER ____________

TUBING/PUMP/BLADDER MATERIALS
- ☐ SILICON TUBING
- ☐ TEFLON TUBING
- ☐ TEFLON LINED TUBING
- ☐ HDPE TUBING
- ☐ LDPE TUBING
- ☐ OTHER ____________
- ☐ OTHER ____________
- ☐ S. STEEL PUMP MATERIAL
- ☐ PVC PUMP MATERIAL
- ☐ GEOPROBE SCREEN
- ☐ TEFLON BLADDER
- ☐ OTHER ____________
- ☐ OTHER ____________
- ☐ OTHER ____________

EQUIPMENT USED
- ☐ WL METER ____________
- ☐ PID ____________
- ☐ WQ METER ____________
- ☐ TURB. METER ____________
- ☐ PUMP ____________
- ☐ OTHER ____________
- ☐ FILTERS NO. ____ TYPE ____________

ANALYTICAL PARAMETERS

	PARAMETER	METHOD NUMBER	FIELD FILTERED	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	QC COLLECTED	SAMPLE BOTTLE ID NUMBERS
☐								
☐								
☐								
☐								
☐								
☐								
☐								

PURGE OBSERVATIONS

PURGE WATER CONTAINERIZED YES ☐ NO ☐

NUMBER OF GALLONS GENERATED ____________

NO-PURGE METHOD UTILIZED YES ☐ NO ☐

If yes, purged approximately 1 standing volume prior to sampling or __________mL for this sample location.

SKETCH/NOTES

Sampler Signature:

Print Name:

Checked By:

Date:

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FIGURE 4.17
LOW FLOW GROUNDWATER SAMPLING RECORD
NYSDEC QUALITY ASSURANCE PROJECT PLAN

PACKER TEST LOG

Project: Mohonk Road Industrial Plant (MRIP) Site

Page 1 **of** ___

Client: NYSDEC

Contractor: Wood E&I Solutions (Formerly MACTEC)

	Packer System	Water Meter	Water Gauge	Surge Chamber
Type:				
Manufacturer:				
Model Number:				

M.G.P. = (0.566 to 1.0) x Z

Computed Maximum Gauge Press (mgp): ___

Computed Internal Friction: ___

Rock Type: ___

Hole Radius (Feet): ___

Boring Number: ___

Test Numbers: ___

Job Number: ___

Location: ___

Elevation: ___

Date Start: ___

Date Finish: ___

Driller: ___

Geologist: ___

Depths (all distances measured from ground surface in feet)

To Top of Rock: ___

To Top of Lower Packer: ___

To Bottom of Boring: ___

To Bottom of Upper Packer: ___

To Water Table: ___

Length of Test Section: ___

Height of Water Pressure Gauge Above Ground Surface: ___

Test Interval (feet)	Test Number	Start Time	Elapsed Time (min)	Packer Pressure (psi)	Gauge Pressure (HP) (psi)	Meter Reading (gals)	Volume of Flow (Q) (gals/min)	Permeability (K) (feet/day)

Formula to Compute Permeability: $k = C \frac{Q}{2p\ L\ H_T} \mathrm{IN} \frac{L}{r}$

Assumptions:
$L \geq 10r$
$H_T = (Hp \times 2.307) + Hg$
$C = 1.928 \times 10^2$

k = Permeability (feet/day)
Q = Constant Flow Rate (gallons per minute)
L = Length of Test Section (feet)
H_T = Differential Head on Test Section (feet)
r = Radius of Borehole (feet)
C = Conversion Factor to Obtain k in units of feet/day

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FIGURE 4.24
PACKER TEST LOG
NYSDEC QUALITY ASSURANCE PROGRAM PLAN

ATTACHMENT D

LABORATORY REPORTING AND METHOD DETECTION LIMITS

Attachment E - Laboratory Reporting Limits and Method Detection Limits for Groundwater

Analyte Description	CAS Number	RL	MDL	Units
Volatile Organic Compounds by GC/MS				
1,1,1-Trichloroethane	71-55-6	1.00	0.820	ug/L
1,1,2,2-Tetrachloroethane	79-34-5	1.00	0.210	ug/L
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	1.00	0.310	ug/L
1,1,2-Trichloroethane	79-00-5	1.00	0.230	ug/L
1,1-Dichloroethane	75-34-3	1.00	0.380	ug/L
1,1-Dichloroethene	75-35-4	1.00	0.290	ug/L
1,2,4-Trichlorobenzene	120-82-1	1.00	0.410	ug/L
1,2-Dibromo-3-Chloropropane	96-12-8	1.00	0.390	ug/L
1,2-Dibromoethane	106-93-4	1.00	0.730	ug/L
1,2-Dichlorobenzene	95-50-1	1.00	0.790	ug/L
1,2-Dichloroethane	107-06-2	1.00	0.210	ug/L
1,2-Dichloropropane	78-87-5	1.00	0.720	ug/L
1,3-Dichlorobenzene	541-73-1	1.00	0.780	ug/L
1,4-Dichlorobenzene	106-46-7	1.00	0.840	ug/L
2-Butanone (MEK)	78-93-3	10.0	1.32	ug/L
2-Hexanone	591-78-6	5.00	1.24	ug/L
4-Methyl-2-pentanone (MIBK)	108-10-1	5.00	2.10	ug/L
Acetone	67-64-1	10.0	3.00	ug/L
Benzene	71-43-2	1.00	0.410	ug/L
Bromodichloromethane	75-27-4	1.00	0.390	ug/L
Bromoform	75-25-2	1.00	0.260	ug/L
Bromomethane	74-83-9	1.00	0.690	ug/L
Carbon disulfide	75-15-0	1.00	0.190	ug/L
Carbon tetrachloride	56-23-5	1.00	0.270	ug/L
Chlorobenzene	108-90-7	1.00	0.750	ug/L
Chloroethane	75-00-3	1.00	0.320	ug/L
Chloroform	67-66-3	1.00	0.340	ug/L
Chloromethane	74-87-3	1.00	0.350	ug/L
cis-1,2-Dichloroethene	156-59-2	1.00	0.810	ug/L
cis-1,3-Dichloropropene	10061-01-5	1.00	0.360	ug/L
Cyclohexane	110-82-7	1.00	0.180	ug/L
Dibromochloromethane	124-48-1	1.00	0.320	ug/L
Dichlorodifluoromethane	75-71-8	1.00	0.680	ug/L
Ethylbenzene	100-41-4	1.00	0.740	ug/L
Isopropylbenzene	98-82-8	1.00	0.790	ug/L
Methyl acetate	79-20-9	2.50	1.30	ug/L
Methyl tert-butyl ether	1634-04-4	1.00	0.160	ug/L
Methylcyclohexane	108-87-2	1.00	0.160	ug/L
Methylene Chloride	75-09-2	1.00	0.440	ug/L
Styrene	100-42-5	1.00	0.730	ug/L
Tetrachloroethene	127-18-4	1.00	0.360	ug/L
Toluene	108-88-3	1.00	0.510	ug/L
trans-1,2-Dichloroethene	156-60-5	1.00	0.900	ug/L
trans-1,3-Dichloropropene	10061-02-6	1.00	0.370	ug/L
Trichloroethene	79-01-6	1.00	0.460	ug/L
Trichlorofluoromethane	75-69-4	1.00	0.880	ug/L
Vinyl chloride	75-01-4	1.00	0.900	ug/L
Xylenes, Total	1330-20-7	2.00	0.660	ug/L
1,2-Dichloroethane-d4 (Surr)	17060-07-0			ug/L
4-Bromofluorobenzene (Surr)	460-00-4			ug/L
Dibromofluoromethane (Surr)	1868-53-7	5.00	0.100	ug/L
Toluene-d8 (Surr)	2037-26-5			ug/L
Semivolatile Organic Compounds (GC/MS SIM / Isotope Dilution)				
1,4-Dioxane	123-91-1	0.200	0.100	ug/L
1,4-Dioxane-d8	17647-74-4			ug/L
Fluorinated Alkyl Substances				
13C2 PFDA	STL00996			ng/L
13C2 PFDoA	STL00998			ng/L
13C2 PFHxA	STL00993			ng/L
13C2 PFTeDA	STL02116			ng/L
13C2 PFUnA	STL00997			ng/L
13C3 PFBS	STL02337			ng/L
13C4 PFBA	STL00992			ng/L
13C4 PFHpA	STL01892			ng/L
13C4 PFOA	STL00990			ng/L
13C4 PFOS	STL00991			ng/L
13C5 PFNA	STL00995			ng/L
13C5 PFPeA	STL01893			ng/L
13C8 FOSA	STL01056			ng/L
18O2 PFHxS	STL00994			ng/L
6:2 FTS	27619-97-2	20.0	4.60	ng/L
8:2 FTS	39108-34-4	20.0	2.90	ng/L
d3-NMeFOSAA	STL02118			ng/L
d5-NEtFOSAA	STL02117			ng/L
M2-6:2 FTS	STL02279			ng/L
M2-8:2 FTS	STL02280			ng/L
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	2991-50-6	20.0	1.50	ng/L
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	2355-31-9	20.0	1.70	ng/L
Perfluorobutanesulfonic acid (PFBS)	375-73-5	2.00	0.490	ng/L
Perfluorobutanoic acid (PFBA)	375-22-4	2.00	1.00	ng/L
Perfluorodecanesulfonic acid (PFDS)	335-77-3	2.00	0.900	ng/L
Perfluorodecanoic acid (PFDA)	335-76-2	2.00	0.770	ng/L
Perfluorododecanoic acid (PFDoA)	307-55-1	2.00	0.590	ng/L
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	2.00	0.950	ng/L
Perfluoroheptanoic acid (PFHpA)	375-85-9	2.00	0.910	ng/L
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	2.00	0.800	ng/L
Perfluorohexanoic acid (PFHxA)	307-24-4	2.00	0.760	ng/L
Perfluorononanoic acid (PFNA)	375-95-1	2.00	0.270	ng/L
Perfluorooctanesulfonamide (FOSA)	754-91-6	2.00	0.640	ng/L
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	2.00	0.610	ng/L
Perfluorooctanoic acid (PFOA)	335-67-1	2.00	0.630	ng/L
Perfluoropentanoic acid (PFPeA)	2706-90-3	2.00	0.630	ng/L
Perfluorotetradecanoic acid (PFTeA)	376-06-7	2.00	0.920	ng/L
Perfluorotridecanoic acid (PFTriA)	72629-94-8	2.00	0.600	ng/L
Perfluoroundecanoic acid (PFUnA)	2058-94-8	2.00	0.530	ng/L

Attachment E - Laboratory Reporting Limits and Method Detection Limits for Air via Test Method TO-1

Analyte Description	CAS Number	RL	Units
1,1,1-Trichloroethane	71-55-6	0.08	ppb v/v
1,1,2,2-Tetrachloroethane	79-34-5	0.08	ppb v/v
1,1,2-Trichloroethane	79-00-5	0.08	ppb v/v
1,1,2-Trichlorotrifluoroethane	76-13-1	0.08	ppb v/v
1,1-Dichloroethane	75-34-3	0.08	ppb v/v
1,1-Dichloroethene	75-35-4	0.04	ppb v/v
1,2,4-Trichlorobenzene	120-82-1	0.08	ppb v/v
1,2,4-Trimethylbenzene	95-63-6	0.08	ppb v/v
1,2-Dibromoethane	106-93-4	0.08	ppb v/v
1,2-Dichlorobenzene	95-50-1	0.08	ppb v/v
1,2-Dichloroethane	107-06-2	0.08	ppb v/v
1,2-Dichloropropane	78-87-5	0.08	ppb v/v
1,2-Dichlorotetrafluoroethane	76-14-2	0.08	ppb v/v
1,3,5-Trimethylbenzene	108-67-8	0.08	ppb v/v
1,3-Dichlorobenzene	541-73-1	0.08	ppb v/v
1,4-Dichlorobenzene	106-46-7	0.08	ppb v/v
1,4-Dioxane	123-91-1	0.2	ppb v/v
2,2,4-Trimethylpentane	540-84-1	0.2	ppb v/v
2-Butanone	78-93-3	0.32	ppb v/v
4-Methyl-2-pentanone (MIBK)	108-10-1	0.2	ppb v/v
Benzene	71-43-2	0.08	ppb v/v
Benzyl chloride	100-44-7	0.16	ppb v/v
Bromodichloromethane	75-27-4	0.08	ppb v/v
Bromoform	75-25-2	0.08	ppb v/v
Bromomethane	74-83-9	0.08	ppb v/v
Carbon tetrachloride	56-23-5	0.032	ppb v/v
Chlorobenzene	108-90-7	0.08	ppb v/v
Chloroethane	75-00-3	0.08	ppb v/v
Chloroform	67-66-3	0.08	ppb v/v
Chloromethane	74-87-3	0.2	ppb v/v
cis-1,2-Dichloroethene	156-59-2	0.04	ppb v/v
cis-1,3-Dichloropropene	10061-01-5	0.08	ppb v/v
Cyclohexane	110-82-7	0.2	ppb v/v
Dibromochloromethane	124-48-1	0.08	ppb v/v
Dichlorodifluoromethane	75-71-8	0.08	ppb v/v
Ethanol	64-17-5	2	ppb v/v
Ethylbenzene	100-41-4	0.08	ppb v/v
Hexachlorobutadiene	87-68-3	0.08	ppb v/v
Hexane	110-54-3	0.2	ppb v/v
Methyl tert-butyl ether	1634-04-4	0.16	ppb v/v
Methylene Chloride	75-09-2	0.2	ppb v/v
m-Xylene & p-Xylene	179601-23-1	0.08	ppb v/v
o-Xylene	95-47-6	0.08	ppb v/v
Styrene	100-42-5	0.08	ppb v/v
t-Butyl alcohol	75-65-0	0.32	ppb v/v
Tetrachloroethene	127-18-4	0.08	ppb v/v
Toluene	108-88-3	0.12	ppb v/v
trans-1,2-Dichloroethene	156-60-5	0.08	ppb v/v
trans-1,3-Dichloropropene	10061-02-6	0.08	ppb v/v
Trichloroethene	79-01-6	0.036	ppb v/v
Trichlorofluoromethane	75-69-4	0.08	ppb v/v
Vinyl chloride	75-01-4	0.04	ppb v/v
4-Bromofluorobenzene (Surr)	460-00-4		ppb v/v

ATTACHMENT E

STANDARD OPERATING PROCEDURES

FLUTe™ Flexible Liner Underground Technologies, Ltd. L.C.
For a medley of innovative designs
6 Easy St., Santa Fe, NM 87504
505-455-1300, www.flut.com

Sampling guidelines for *Water FLUTe* systems installed prior to May, 2009

Rev. April, 2010

Water level in the liner.

The liner water level should be 10 ft above the highest formation water level to provide a good seal of the liner in the hole (5 ft minimum excess head). The formation water level can be measured via the "pump tube" for each port. The water level inside the liner should be tagged in the ½" id tube labeled "TAG" adjacent to the sampling tubes. If the water level inside the liner is measured in the liner, outside the Tag Tube, lower the weighted tag line very slowly to avoid damage to the liner. Water can be added to the liner by simply pouring water into the liner or through the TAG tube, whichever is easier. Do not fill the liner more than 10 ft above the highest formation water level. The water level in the liner should be checked prior to each sampling episode. (Beware that filling the liner with de-ionized water can give a false water level reading.)

Water flow

The water flow into the pumping system is shown in Fig. 1. Water flows from the formation through the spacer pore space, through the port tube, through the first check valve, and fills the "pump tube". The "sample tube" is also filled at the same time. The water level rises in the pump tube to the water table for that port.

Setting up the gas pressure source

The water is pumped with gas pressure. The FLUTe pump design is such that there is very low risk of aeration of the sample. The gas source is usually a nitrogen bottle with a regulator for setting the prescribed driving pressure. The arrangement of the FLUTe gas drive system is shown in Fig. 2. The regulator is set to the proper gas pressure defined later by closing the three way valve to prevent gas flow out of the quick connect fitting. The pressure gauge on the FLUTe pump driver is much more sensitive than the regulator for setting the regulator pressure. The FLUTe pump driver must be securely connected to the regulator at the normal ¼" NPT connection on the regulator outlet.

The regulator is attached to the top fitting on the gas bottle (a special nitrogen regulator fitting connects to a nitrogen bottle). Turn the pressure regulator handle counter-clockwise until is moves freely (the no pressure position). Rotate the main valve on the regulator (nearer the bottle) clockwise to fully closed. Open the valve on the bottle (counter clockwise). The main bottle pressure gauge on the regulator will rise to the bottle pressure. Close the regulator valve (clockwise) until the pressure starts to rise on the pressure gauge on the FLUTe pump driver (three way valve closed with no flow out of the quick connect). Adjust the regulator to the desired pressure for purging, provided by FLUTe. Remove the plug of each pump tube and connect the quick connect to the top fitting of the pump tube (see Fig. 2). Open the three way valve to drive the water out of the pump.

Purging

Water is pumped from the tubing by applying the gas pressure to the interface at the static water level in the pump tube (Fig. 1 and 2). The water is driven down in the pump tube and up through the second check valve to the surface via the sample tube. Drive the water with a sufficient gas pressure (the "recommended purge pressure") to drive all of the water in the pump tube and the sample tube to the surface, the water in the pump tubing is nearly all expelled. The purge stroke is complete when gas is expelled from the sample tube following the water flow. The pressure in the system must then be vented (i.e., dropped to atmospheric by turning the three way valve to the vent position), to allow the pump tube to refill with flow via the port tube. The recharge flow from the port tube consists of the port tube water, the water in the pore space of the spacer, and water from the medium. Because of the relatively large volume in the pump tube, most of the recharge is from the medium. The recharge will take about as long as the first purge stroke. However, a low conductivity medium will require more time.

Purging the pump tube a second time will remove any of the water that has resided in the spacer and port tube volume. That is highly recommended, since the water resident in the tubing and spacer is probably not typical of the formation water. If the refill has been prompt, the second purge water volume will be similar to the first stroke. If in doubt, or if in a sedimentary formation or screened well, a third purge stroke is recommended to remove water that may have been in long contact with the liner or spacer.

Sampling
The sampling flow is best driven on the third (or fourth) cycle by a "recommended sampling pressure" which is less than that needed to drive gas through the bottom of the pump tube. The pressure recommended is that which will drive the water to near, but not out of, the bottom of the large tube. That recommended pressure, "the sampling pressure," is calculated in the spreadsheet provided with each system. The pressure regulator is set to the sample pressure, which is lower than the purge pressure. Opening the three way valve will now apply the sample pressure to the system causing flow from the sample tube.

The first flow of the sampling cycle sweeps along droplets of water left in the tubing from the purge cycle. That residual water is depleted of volatile components. Tests have shown that the first tube volume of the sample flow should be discarded as depleted in volatiles (the "discard volume" is also calculated in the spreadsheet). Thereafter, the samples can be collected from the sample tube outflow. The volume to be discarded is shown in the spreadsheet as "discard volume". The sample tube water flow rate will start fast, then slow, and finally stop. That occurs as the water column being driven approaches the applied pressure/head. The typical sampling pressure drives to within 25 ft. of the bottom of the pump tube (the U). The large buffer zone remaining in the pump tube assures against aeration of the sample.

This procedure should provide an ample sample of good quality drawn directly from the formation.

Caution: If the pumping system refills very slowly, there may not be sufficient water in the pump to fill the "sample tube" to the surface when the stroke is performed. In that case, there will be spitting of gas from the sample water and it will be followed by a flow of gas only. The sample water should never show "spitting" and the sample stroke should never end with gas flow from the sample tube. The proper sample flow will slow until it stops flowing. Should this evidence of insufficient recharge be observed, allow the pump to refill for a longer time and repeat the sample stroke. One can tag the water level in the large tube, as described in the head measurement procedure, to assure that the pumping system has been sufficient refilled.

Measuring the head in the system

The water level at each port can be manually measured by removing the plug from the top of the pump tube and lowering a slender (~1/4") electric water level meter until it contacts the water level in the pump tube. It is not recommended to manually tag water levels more than 200 ft below the surface. The wet film adhesion may prevent the removal of the tag line. A special Teflon coated tag line can be used to extend that limit.

The water level in the large tubes may not be the current water level. After sampling, if there is any leakage of the second check valve (sand in the tube, etc…) the water in the sample tube can backflow into the larger tube, adding to the water that fills the large tube during the recharge. Also, if the water level in the formation is dropping between head measurements, the water level in the pump tube will not follow the descent if the first check valve is a good seal. For these two reasons, and for the freezing concern below, it is best to finish the sampling stroke by raising the pressure to the "purge pressure" value to purge the pumping system of all water. Then upon refilling, the level is the current head for each port. If head measurements are made between sampling events, each port's pumping system should be first be purged to allow the tubing to refill to the current head value. Always replace the plugs in the top of the pump tubes when finished sampling.

If the water might freeze in the sampling tubing near the surface, purge the entire volume of water from each sampling line, after sampling, before leaving it. Use the recommended purge pressure to remove all water, not the sampling pressure. **Each line should be blowing gas when the purge is complete.** If the lines were purged after sampling for head measurements, that is sufficient.

If the Water FLUTe uses PVDF tubing, the purge of the entire system after sampling should not be neglected, even if head measurements are not to be made. This removes the water column in the sampling tube. For deep water tables, the long term pressure of the standing water in the sampling tube might lead to excessive creep of the tubing which is susceptible to "cold flow", a characteristic of Teflon like materials. (This is not a concern except for very deep water tables (>300 ft).

In most cases, the performance of a final purge of the system after sampling is useful, even if not essential.

Simultaneous purge and sampling of all tubes

The FLUTe pumping system for each port is essentially identical in length, pump volume and elevation in the hole. This allows all ports to be purged and sampled simultaneously for a great saving in sampling time. The only difference for simultaneous sampling is that the pressure source must include a tube to each port fitting at the wellhead. FLUTe offers a manifold pump driver system at extra cost (the single port driver is provided with the Water FLUTe). The recommended purge and sample pressures are the same as used for single port sampling.

In some cases, the buoyancy of the sampling system is so great when emptied of water during the simultaneous purge that the tubing bundle can cause the liner to invert. The sampling volume spreadsheet provided with the liner notes whether the system can be purged simultaneously. This is only a problem for smaller hole diameters, many ports, and a small excess head in the liner. However, increasing the excess head in the liner to overcome the buoyancy of the tubing can be a hazard to the liner.

A short summary is provided as the following checklist:

<u>Check List</u>

1. Check/restore the water level in the liner.
2. Connect the gas driver source to the gas drive tube for the port.
3. Set the regulator to the recommended purge pressure.
4. Expel the tube water at the suggested purge pressure. Collect the purged water volume for verification of a good purge. Note the water flow time of the purge stroke.
5. Allow the tubing to refill. Repeat the purge. Collect the purge volume to assure the amount removed is at least the “port tube volume”. Was the refill long enough?
6. Purge a third time, if desired.
7. Allow the tubing to refill for the sample stroke.

8. Reduce the driving pressure to the "sampling pressure". Apply the pressure and collect the first flow to measure the discard volume. Discard that water.
9. Reduce the pressure, if needed, to slow the flow and collect the samples.
10. Perform a final purge of the water out of the sampling lines by raising the driving pressure to the purge pressure value.
11. When the sampling system has refilled, tag the water level, if desired, for the current water table. If a port system is refilling very slowly, tag it at a later time.

See the spreadsheet provided with each *Water FLUTe* for the recommended purge and sampling pressures. Those are the pressures that can be used for a simultaneous purge of the several ports, but be sure that the buoyancy of the tubing will not lift the tubing, and the wellhead. The spreadsheet flags the condition where all ports should not be purged simultaneously. In most cases, several, to all, of the ports can be purged simultaneously.

Optimum sampling procedure:

Since it is often desirable to minimize the amount of time that the sample water resides in the pumping tubing, it is useful to note the actual time that is required for the recharge of the system. Since the fill rate slows dramatically for the last portion of the recharge, it is not necessary to wait for a complete refill. For most formations, the recharge is dominated by the tubing pressure drop. In that case, the time required for the purge stroke to be completed is about the same time required for the refill. (The exception is for a tight formation that recharges the tubing very slowly.) Hence the second purge can be started after waiting the same length of time as the first purge endured. If the second purge is of a similar volume (usually somewhat less) than the first purge volume, the refill time was long enough. After the same delay, the sampling stroke can be initiated. This timing of the strokes allows one to reduce the retention time in the pumping system. For very large sample volumes produced, the refill time can be shortened even more, as long as the sample volume is adequate after the discard of the first flow.

In some situations, the retention time is still too long. FLUTe can often increase the sample tube and port tube diameters for greater flow rates. However, the standard design is well matched for to a wide range of hole diameters, depths, and water table elevations. For very deep wells, the tubing may need to be of higher pressure capacity for the required driving pressures. For water table depths below 700 ft., this may be a concern. FLUTe initiated a design change from Nylon 11 to PVDF tubing in the Water FLUTe systems in 2002 to avoid any concern about tubing interaction with the sample water. However, the prescribed purge is sufficient for the use of Nylon tubing systems.

Questions: Call 888-333-2433 and ask for Carl Keller, or a field engineer.

Figure 1. Water FLUTe pump system

(Single port system shown for clarity)

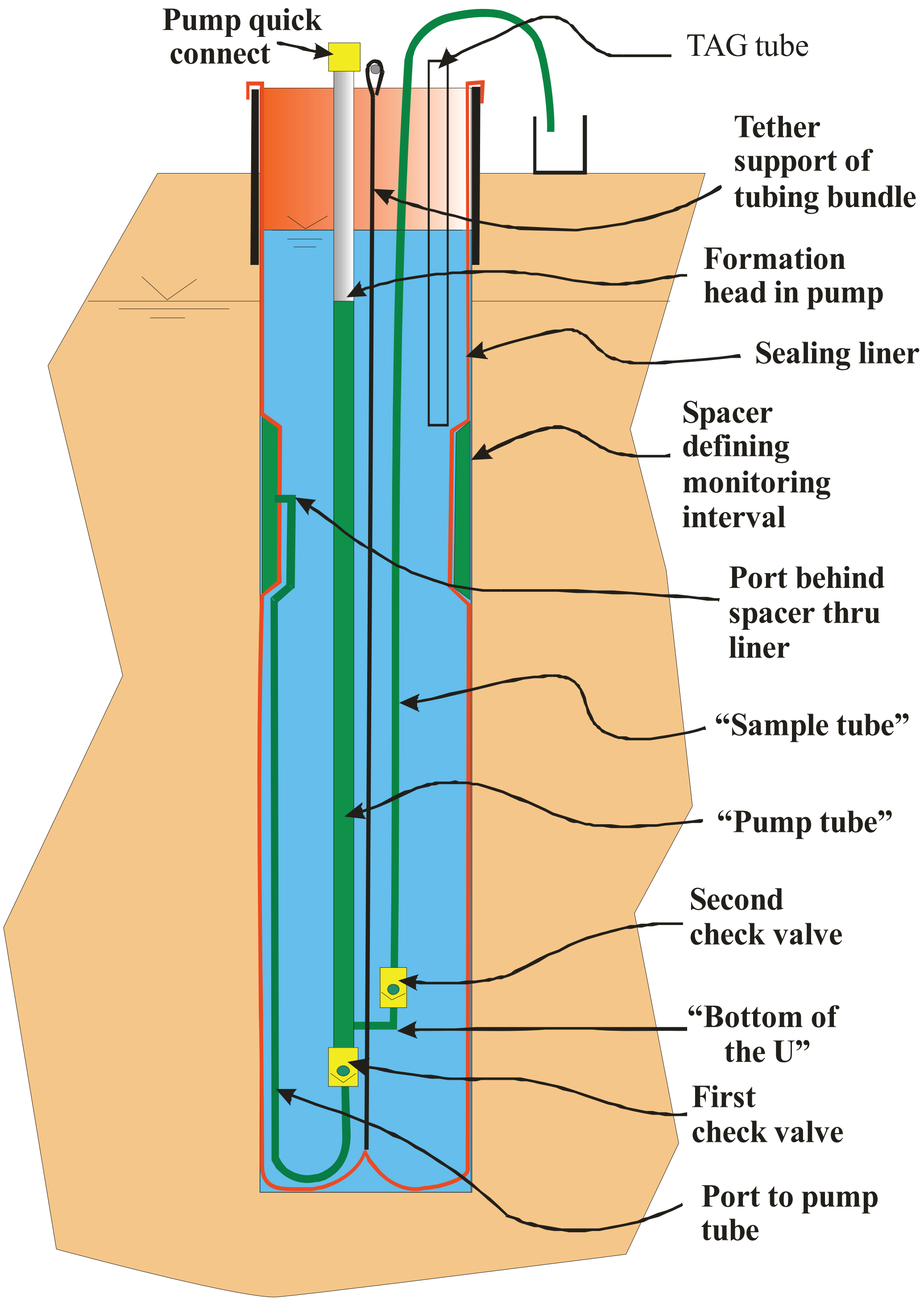
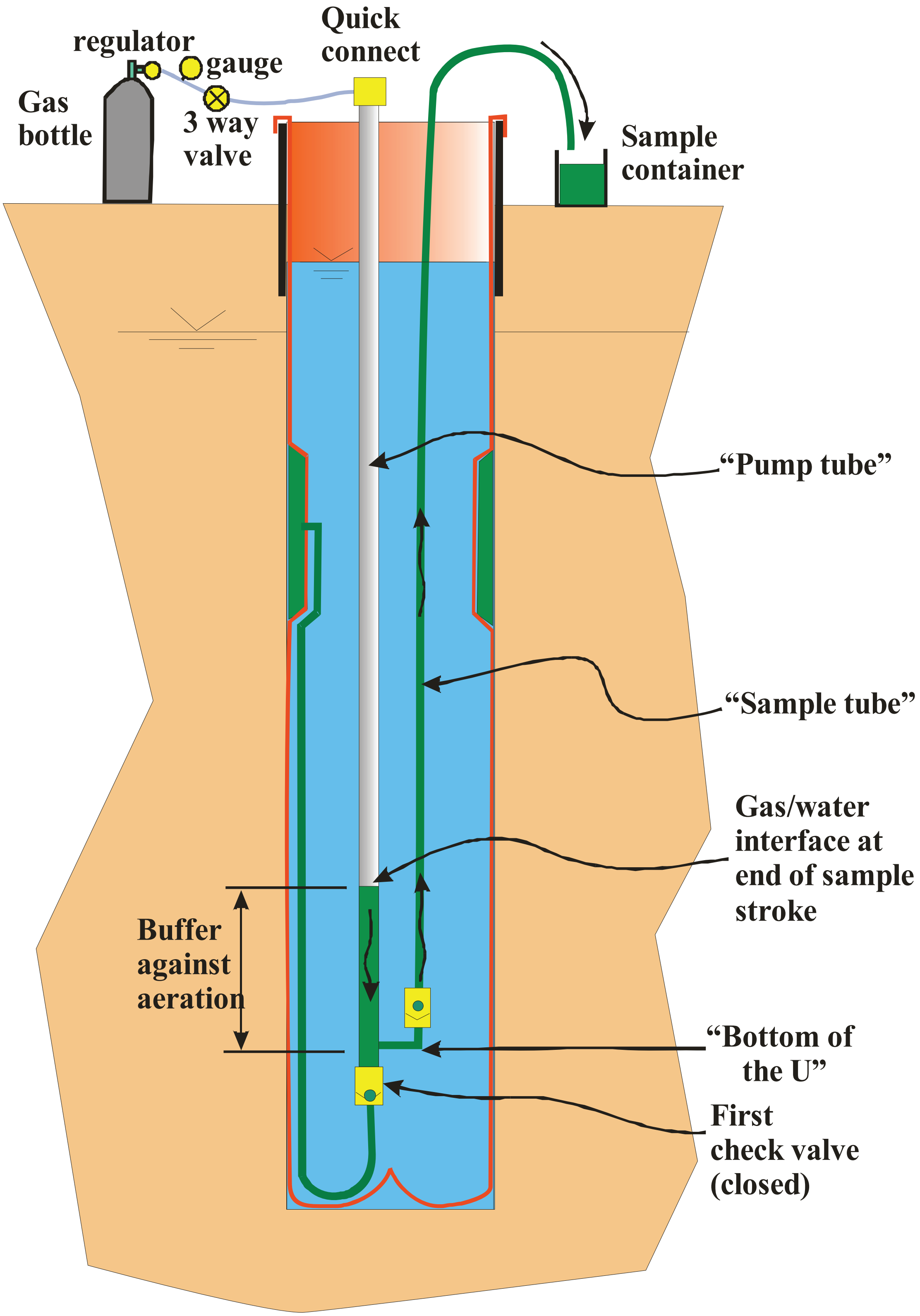


Fig. 2. Pumping Procedure



FIELD SAMPLING PROTOCOLS TO AVOID CROSS-CONTAMINATION OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)

1.0 PURPOSE

This Standard Operating Procedure (SOP) is to be used on New York State Department of Environmental Conservation (NYSDEC) project sites, in conjunction with the NYSDEC Engineering Services Contract Number D007619 Field Activities & Quality Assurance Program Plan (QAPP) prepared by MACTEC Engineering and Consulting, P.C. (MACTEC, 2011). The purpose of this SOP is to describe the procedures/considerations when collecting soil, sediment, surface water, and groundwater samples at potential per- and polyfluoroalkyl substances (PFAS) release areas. This SOP also describes a tiered approach that should be used to assist with field decisions. Sampling specific SOPs should also be reviewed prior to conducting field sampling activities at PFAS areas.

2.0 SCOPE

This procedure applies to all Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) personnel and subcontractors who collect or otherwise handle samples of soil, sediment, surface water, and groundwater for analysis of PFAS. This SOP should be reviewed by all on-site personnel prior to implementation of field activities.

3.0 REFERENCES

MACTEC, 2011. Field Activities & Quality Assurance Program Plan; Submitted to New York State Department of Environmental Protection; Submitted by MACTEC Engineering and Consulting, P.C. June.

NYSDEC, 2016. Collection of Groundwater Samples for Perfluorooctanoic Acid (PFOA) and Perfluorinated Compounds (PFCs) from Monitoring Wells- Sample Protocol. Revision 1.2 June 29, 2016

4.0 GENERAL

Given the low detection limits associated with laboratory PFAS analysis, and the many potential sources of trace levels of PFAS, field personnel are advised to act on the side of caution by strictly following the subject protocols, frequently replacing nitrile gloves, and rinsing field equipment to help mitigate the potential for false detections of PFAS. Specific items related to field sampling are discussed below.

5.0 PROCEDURES

This section contains both the responsibilities and procedures involved with field sampling for analysis of PFAS. Proper procedures are necessary to insure the quality and integrity of the samples. The details within this SOP should be used in conjunction with site-specific work plans. The site-specific work plans will generally provide the following information:

- Sample collection objectives;
- Locations to be sampled;
- Number and volume of samples to be collected at each location;
- Types of chemical analyses to be conducted for the samples;
- Specific quality control (QC) procedures, including type (MS/MSD, field duplicates, and blanks) and sampling required;
- Any additional sampling requirements or procedures beyond those covered in this SOP, as necessary; and,
- At a minimum, the procedures outlined in this SOP for field sampling will be followed.

5.1 RESPONSIBILITIES

Project Manager

The Project Manager shall provide the Quality Assurance Program Plan (QAPP)(MACTEC, 2011), and site-specific work plan to the Field Lead and Field Personnel, which shall include the sampling requirements for each investigation area. The Project Manager will detail deviations to the procedure provided in this SOP in the site-specific report.

Field Lead

The Field Lead shall ensure that samples are collected using procedures that are in accordance with the QAPP (MACTEC, 2011), site-specific work plans, and applicable SOPs. The Field Lead shall also be required to make rational and justifiable decisions when deviations from these procedures are necessary because of field conditions or unforeseen issues and report the deviations to the Project Manager.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing their tasks according to specifications outlined in the QAPP (MACTEC, 2011), site-specific work plans, applicable SOPs, and other appropriate procedures. Field personnel are responsible for reporting deviations from procedures to the Project Manager.

5.2 FIELD PROCEDURES/CONSIDERATIONS

The following are procedures/considerations to be made during field activities at potential PFAS release or sampling areas. A summary of the prohibited and acceptable items for PFAS investigation areas is included in Table 1. A checklist, provided as Attachment 1, shall be used by the Field Personnel daily prior to the commencement of fieldwork to ensure the field team is in compliance with this protocol.

Field Equipment

- **Do not use Teflon®-containing materials** (e.g., Teflon® tubing, bailers, tape, plumbing paste, or other Teflon® materials) since Teflon® contains fluorinated compounds.
- Sample containers and collected samples will be stored and shipped using dedicated coolers provided by the laboratory.
- Stainless steel, high-density polyethylene (HDPE), polypropylene, and silicon materials are acceptable for sampling. Samples should not be collected with tubing or stored in containers made of low-density polyethylene (LDPE) materials (fluorinated compounds are known to adsorb to LDPE). All sampling equipment components and sample containers should not come in contact with aluminum foil, LDPE, glass or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.
- Amec Foster Wheeler will use peristaltic pumps for groundwater sample collection at depths shallower than 25 feet. Amec Foster Wheeler will use ProActive SS Pumps with polyvinyl chloride (PVC) leads or Geotech SS Geosub pumps for groundwater sample collection at depths greater than 25 feet. These pumps are constructed with stainless steel and will minimize introductions of PFAS. However, for groundwater sample depths greater than 150 feet, a Grundfos RediFlo pump (or similar) may be used due to the pumping limitations of stainless steel pumps. PFAS-free bladder pumps may also be used for sampling. Whale® pumps can be used for well development, if needed, but should not be used for sampling, or left in the wells.
- When using liners to collect soil samples during direct-push technology or during conventional drilling and sampling methodologies, acetate liners are to be used.
- **Rite in the Rain products are the only waterproof field books that may be used**. To avoid plastic coating or glue materials, do not use other brands of waterproof field books. If Rite

in the Rain products are not available, field reports will be documented on loose paper secured on masonite or aluminum clipboards (i.e. plastic clipboards, binders, or spiral hard cover notebooks are not acceptable) using a pen or pencil.

- **Post-It Notes are not allowed** on project sites.
- Use ballpoint pens. Pens will be used when documenting field activities in the field log and on field forms as well as labeling sample containers and preparing the Chain of Custody.
- **Do not use chemical (blue) ice packs** during the sampling program. This includes the use of ice packs for the storage of food and/or samples.

Field Clothing and Personal Protective Equipment

- **Do not wear water resistant, waterproof, or stain-treated clothing** during the field program. Field clothing made of synthetic and natural fibers (preferably cotton) are acceptable. Field clothing should be laundered without the use of fabric softener. Preferably, field gear should be cotton construction and well laundered (i.e., washed a minimum of three times prior to use after purchase). New clothing may contain PFAS related treatments. **Do not use new clothing** while sampling or sample handling.
- **Do not wear clothing or boots containing Gore-Tex™** during the sampling program as it contains a PFAS membrane.
- Safety footwear will consist of steel-toed boots made with polyurethane and PVC, untreated leather boots, or well-worn leather boots. Newer leather boots may be worn if they are covered with polypropylene, polyethane, or PVC boot covers.
- Disposable nitrile gloves must be worn at all times. Further, a new pair of nitrile gloves shall be donned prior to the following activities at each sample location:
  - Decontamination of re-usable sampling equipment;
  - Prior to contact with sample bottles or water containers;
  - Insertion of anything into the well (e.g., HDPE tubing, HydraSleeve bailer, etc.);
  - Insertion of silicon tubing into the peristaltic pump;
  - Completion of monitor well purging, prior to sample collection;
  - Handling of any quality assurance/quality control samples including field blanks and equipment blanks; and,
  - After the handling of any non-dedicated sampling equipment, contact with non-decontaminated surfaces, or when judged necessary by field personnel.

Sample Containers

- Different laboratories may supply sample collection containers of varying sizes dependent on the type of media to be sampled (e.g., soil, groundwater, etc.). All samples should be collected in polypropylene or HDPE bottles. The screw cap will be made of polypropylene or HDPE and may be lined or unlined. However, if lined, the liner may not be made of Teflon® or contain PFAS.
- Container labels will be completed using pen after the caps have been placed back on each bottle.
- Glass sample containers are not to be used due to potential loss of analyte through adsorption.

Wet Weather

- Field sampling occurring during wet weather (e.g., rainfall and snowfall) should be conducted while wearing appropriate clothing that will not pose a risk for cross-contamination. Teams will avoid synthetic gear that has been treated with water-repellant finishes containing PFAS. Use rain gear made from polyurethane, vinyl, and wax or rubber-coated materials.
- Teams should consider the use of a gazebo tent, which can be erected overtop of the sample location and provide shelter from the rain. It should be noted that the canopy material is likely a treated surface and should be handled as such; therefore, gloves should be worn when setting up and moving the tent, changed immediately afterwards and further contact with the tent should be avoided until all sampling activities have been finished and the team is ready to move on to the next sample location.

Equipment Decontamination

- Field sampling equipment, including oil/water interface meters and water level indicators, and other downhole equipment used at each sample location, will require cleaning between uses. Alconox® and Liquinox® soap is acceptable for use since the Safety Data Sheets do not list fluoro-surfactants as an ingredient (do not use Liquinox® soap if also sampling for 1,4-dioxane). However, Decon 90 will not be used during decontamination activities. Water used for the final rinse during decontamination of sampling equipment will be laboratory certified “PFAS-free” water.
- For larger equipment (e.g., drill rig and large downhole drilling and sampling equipment), decontamination will be conducted with potable water using a high-pressure washer and then rinsed using potable water.

Groundwater Sampling

- At sites with dedicated sampling equipment installed in the wells that contains Teflon (e.g., tubing, pumps), this equipment should be removed from the wells and replaced with HDPE tubing and non-Teflon containing equipment, if possible. These wells will be re-developed by removing three well volumes of water, if possible, and letting the wells recover for at least 48 hours prior to sampling.
- At sites with dedicated sampling equipment installed in the wells that contain LDPE tubing, this tubing should be removed from the wells and replaced with HDPE tubing. These wells can be sampled immediately following replacement of tubing; however, attempts should be made to remove one well volume prior to sampling. For larger wells, with higher volumes of water, it may be preferable to redevelop the wells and remove one well volume with a higher volume pump. In such cases the wells should be allowed to recover for at least 48 hours prior to sampling.

Personnel Hygiene

- Field personnel will not use cosmetics, moisturizers, hand cream, or other related products as part of their personal cleaning/showering routine on the morning of a sampling event, unless the products are applied to a part of the body that will be coved by clothing. These products may contain surfactants and represent a potential source of PFAS.
- All clothing worn by sampling personnel must have been laundered multiple times.
- Many manufactured sunblock and insect repellants contain PFAS and should not be brought or used on-site. Sunblock and insect repellants that are used on-site should consist of 100% natural ingredients, unless previously vetted by the project chemist. A list of acceptable sunscreens and insect repellents is provided in Table 1.
- For washroom breaks, field personnel will leave the exclusion zone and then remove gloves and overalls. Field personnel should wash as normal with extra time for rinsing with water after soap use. When finished washing, the use of a mechanical dryer is preferred and the use of paper towel for drying is to be avoided (if possible).

Food Considerations

- No food or drink shall be brought on-site, with the exception of bottled water and hydration drinks (e.g., Gatorade® and Powerade®), which will only be allowed to be brought and consumed within the staging area.

Visitors

- Visitors to the investigation area are asked to remain outside of the exclusion zone during sampling activities.

6.0 TIERED APPROACH TO ASSIST WITH FIELD DECISIONS

In evaluating whether products contain PFAS and are suitable for use in the field, the tiered approach presented in Table 2 will be used to assist with field decisions. Any member of the field team should contact the Project Manager with questions.

Table 1. Summary of Prohibited and Acceptable Items for PFAS Sampling

Prohibited Items	Acceptable Items
Field Equipment	
Teflon® containing materials	High-density polyethylene (HDPE) materials
Storage of samples in containers made of LDPE materials	Acetate liners, HDPE bottles
Teflon® tubing	HDPE or silicon tubing
Waterproof field books not manufactured by Rite in the Rain	Rite in the Rain products or Loose paper (non-waterproof)
Plastic clipboards, binders, or spiral hard cover notebooks	Aluminum field clipboards or with Masonite
Sharpies®, if possible	Ballpoint pens
Post-It Notes	
Chemical (blue) ice packs	Regular ice
Excel Purity Paste TFW Multipurpose Thread Sealant Vibra-Tite Thread Sealant	Gasoils NT Non-PTFE Thread Sealant Bentonite
Equipment with Viton Components (need to be evaluated on a case by case basis, Viton contains PTFE, but may be acceptable if used in gaskets or O-rings that are sealed away and will not come into contact with sample or sampling equipment.)	
Field Clothing and PPE	
New clothing or water resistant, waterproof, or stain-treated clothing, clothing containing Gore-Tex™	Well-laundered clothing, defined as clothing that has been washed 6 or more times after purchase, made of synthetic or natural fibers (preferable cotton)
Clothing laundered using fabric softener	No fabric softener
Boots containing Gore-Tex™	Boots made with polyurethane and PVC, well-worn or untreated leather boots, leather boots with boot covers
	Reflective safety vests, Tyvek®, Cotton Clothing, synthetic under clothing, body braces
No cosmetics, moisturizers, hand cream, or other	**Sunscreens** - Alba Organics Natural Sunscreen, Yes To

related products as part of personal cleaning/showering routine on the morning of sampling, unless the products are applied to body parts that will be covered by clothing.	Cucumbers, Aubrey Organics, Jason Natural Sun Block, Kiss my face, Baby sunscreens that are “free” or “natural” **Insect Repellents** - Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus Insect repellant, Herbal Armor, California Baby Natural Bug Spray, BabyGanics, Deep Woods Off **Sunscreen and insect repellant -** Avon Skin So Soft Bug Guard Plus – SPF 30 Lotion
Sample Containers	
LDPE or glass containers	HDPE or polypropylene
Teflon®-lined caps	Lined or unlined HDPE or polypropylene caps
Rain Events	
Waterproof or resistant rain gear	Polyurethane, vinyl, wax or rubber-coated rain gear. Gazebo tent that is only touched or moved prior to and following sampling activities
Equipment Decontamination	
Decon 90	Alconox® and/or Liquinox® (Do not use Liquinox® if also sampling for 1,4-dioxane).
Water from an on-site well	Potable water from municipal drinking water supply
Food Considerations	
All food and drink, with exceptions noted on the right	Bottled water and hydration drinks (i.e. Gatorade® and Powerade®) to be brought and consumed only in the staging area

Table 2. Tiered Approach

Tier and Description	Action
Tier 1: Products that *will come into direct contact* with field samples include, but are not limited to, drilling grease, sampling equipment, sample containers, and well construction materials	These products will undergo the greatest scrutiny and requires chemist’s input to help evaluate the materials as a possible source of contamination[A] and as possible sampling or storage materials or both
Tier 2: Products that *will not come into direct contact* with samples, but could be *reasonably expected to contain PFAS*, such as waterproof or nonstick products	Project team/affected person can review the Safety Data Sheet (SDS)[B] and if it shows PFAS, product should not be used. If product SDS does not indicate PFAS, confirm with chemist before use
Tier 3: Products that *will not come into direct contact* with samples and are *not expected to contain PFAS*, such as ballpoint pens, zipper bags, and body braces	Project team/affected person can review SDS and if no PFAS, then appropriate to use

[A] Tier 1 products will undergo the closest scrutiny. It may be necessary to have Tier 1 products analyzed for PFAS to confirm that a specific batch or lot number does not contain PFAS. Alternate products will need to be evaluated/used if PFAS are identified in the product.

[B] SDS Check: To evaluate product SDS and/or manufacturing specs, check if the product contains anything with “fluoro” in the name or the acronyms TPE, FEP, ETFE, and/or PFA. If fluorinated compounds are not listed in the manufacturing specs and/or on the SDSs, product can be used.

Attachment 1
Daily PFAS Protocol Checklist

Date: ______________________ Installation Name: ______________________________________

Weather (*temp./precipitation*): ________________ Investigation Area:______________________________

Field Clothing and PPE:

☐ Field crew in compliance with Tables 1 and 2 in SOP

☐ Field crew has not used fabric softener on clothing

☐ Field crew has not used cosmetics, moisturizers, hand cream, or other related products on exposed body parts this morning

☐ Field crew has not applied unacceptable sunscreen or insect repellant

Field Equipment:

☐ No Teflon® containing materials on-site

☐ All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene

☐ No waterproof field books on-site other than Rite in the Rain products

☐ No plastic clipboards, binders, or spiral hard cover notebooks on-site

☐ No adhesives (Post-It Notes) on-site

☐ Coolers filled with regular ice only. No chemical (blue) ice packs in possession

Sample Containers:

☐ All sample containers made of HDPE or polypropylene. Samples are not stored in containers made of LDPE

☐ Caps are lined or unlined and made of HDPE or polypropylene

Wet Weather (as applicable):

☐ For personnel in direct contact with samples and/or sampling equipment, wet weather gear made of vinyl, polyurethane, PVC, wax or rubber- coated materials only

Equipment Decontamination:

☐ “PFAS-free” water on-site for decontamination of sample equipment

☐ Alconox and Liquinox to be used as decontamination materials (Do not use Liquinox if also sampling for 1,4-dioxane).

Food Considerations:

☐ No food or drink on-site with exception of bottled water and/or hydration drinks (e.g., Gatorade and Powerade) that is available for consumption only in the staging area

If any applicable boxes cannot be checked, the Field Manager shall describe the noncompliance issues below and work with field personnel to address noncompliance issues prior to commencement of that day’s work. Corrective action shall include removal of noncompliance items from the investigation area or removal of worker offsite until in compliance. Repeated failure to comply with PFAS sample protocols will result in the permanent removal of worker(s) from the investigation area.

Describe the noncompliance issues (include personnel not in compliance) and action/outcome of noncompliance:

____

____

____

Field Lead Name: ________________________________

Field Lead Signature: ________________________________ Time: _____________________