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August 28, 2023

Division of Environmental Remediation, Remedial Bureau E
New York State Department of Environmental Conservation
625 Broadway
Albany, New York 12233-7011

Attention: Ms. Samantha Salotto, Project Manager

Subject: **Revised Final Data Gap Investigation Field Activities Plan**
Robeson Industries, Inc.; NYSDEC Site No. 961008
MACTEC Engineering & Geology, P.C. Project No. 3616206112

Dear Ms. Salotto:

This field activities plan (FAP) has been prepared by MACTEC Engineering & Geology, P.C. (MACTEC) in response to Work Assignment No. D009809-14 from the New York State Department of Environmental Conservation (NYSDEC) for remedial system optimization (RSO) at the Robeson Industries, Inc. site in Castile, Wyoming County, New York (Site). The Site was assigned NYSDEC Site No. 961008 under the state superfund program. Field activities will be executed as described in this FAP to provide data needed to evaluate the current extent of contamination in soil, groundwater, surface water, and soil vapor/indoor air as well as to evaluate remedial alternatives for the Site.

This FAP is governed by MACTEC's *Quality Assurance Program Plan and Program Field Activities Plan* (MACTEC, 2020) and applicable standard operating procedures (SOPs) for field activities.

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BACKGROUND

Site History

The Site is approximately 21 acres, located in the town of Castile, Wyoming County, New York (Figure 1). From 1953 to 1989, cutlery products and small electrical household appliances were manufactured at the Site. Operations included caustic etching, nitric acid brightening, solvent degreasing, and solvent-based spray painting of metal and plastic components for small appliances and cutlery. A Remedial Investigation (RI) (Dames & Moore, 1993) and Supplemental Remedial Investigation (NYSDEC, 1994) were conducted to characterize and evaluate environmental media and the extent of contamination at the Site. The investigations identified volatile organic compound (VOC) contamination in vadose zone soils and groundwater with migration off-site in groundwater to the west-southwest. Contaminated groundwater, in part, daylights on the steep slopes to the west as seeps and was attributed as the source of contamination in surface water and sediments observed in these areas.

The source of contamination was interpreted to be degreasing solvents used in the manufacturing processes that were released into the environment through improper disposal, spills, leaks, and other discharges. The contaminants of concern (COCs) for the Site are chlorinated volatile organic compounds including tetrachloroethene (PCE), trichloroethene (TCE), and 1,1,1-trichloroethane and their associated daughter products 1,1-dichloroethane, 1,2-dichloroethene, 1,1,2-trichloroethane, and vinyl chloride.

Soil sampling and soil gas surveys completed during the RI indicated that soil contamination was present in the vadose zone underneath and alongside the north-northwest area of the building near a former barrel storage area. This soil contamination was interpreted to be a residual source area contributing to groundwater contamination in the shallow aquifer at the Site.

Remedial goals for the Site outlined in the Record of Decision (ROD) dated March 30, 1995 (NYSDEC, 1995), include:

- Eliminate threat to surface waters by eliminating future discharges of contaminated groundwater (e.g., seeps) from the Site.

- Mitigate impacts of contaminated groundwater to the environment.
- Eliminate potential for direct human or animal contact with impacted soils and groundwater.
- Provide, to the extent practicable, attainment of standards, criteria, and guidance (SCGs) for groundwater quality.

The remedies selected for the Site included the installation and operation of a soil vapor extraction and treatment (SVET) system to treat soil contamination identified in the vadose zone beneath the site building and a groundwater extraction and treatment (GWET) system to mitigate off-site migration of the dissolved phase groundwater plume in the shallow aquifer from approximately 25 to 50 ft bgs. Installation of the systems was completed, and operations started in 1998. A figure depicting GWET and SVET systems well locations is provided in Attachment 1.

A Site Management Plan (SMP) was prepared in 2009 (revised June 2010) to provide controls for implementing and maintaining institutional controls/engineering controls (ICs/ECs) to protect human health and the environment from contamination present at the Site following the remedial actions completed to date (NYSDEC, 2009a). ICs for the Site include land and groundwater use restrictions and adherence to the SMP until remedial goals for the property are attained or deemed complete. ECs for the Site include the SVET and GWET systems.

SVET system operation was discontinued in 2007 at which time the contaminant vapor concentrations had declined in nine of the 11 vapor extraction wells and overall VOC removal rates had declined to less than five pounds per month (NYSDEC, 2009a). These vapor concentrations were below the common effective removal rate of 10 pounds per month designated by the NYSDEC, and it was recommended for operation of the SVET system to cease. Because contaminant vapors were not eliminated by the SVET system operation, there is likely a potential for vapor intrusion of the contaminants to the indoor air. Per the SMP, the property owner is required to install a sub-slab depressurization system (SSDS) in any areas of the Site building regularly occupied. Although the SVET system may have previously acted to mitigate vapor intrusion, a SSDS is not currently in place at the Site.

The GWET system lost power in 2018 and operation was not restored. Remedial goals for groundwater were not met prior to the shutdown of the GWET system.

The source area in vadose zone soil has generally been remediated by the SVET system. However, due to soil heterogeneities within the glacial till, residual contamination likely remains in unsaturated soil beneath the site building and is contributing to groundwater and soil vapor contamination. Deep soil borings completed in 2004 (URS, 2005) identified significant TCE contamination and potential residual dense non-aqueous phase liquid (DNAPL) in the saturated zone beneath the Site. TCE was detected in groundwater beneath the building at concentrations near 1% of its solubility. If chlorinated compounds are detected at concentrations of 1% of their solubility or greater, it is commonly considered that the compounds are likely present as a DNAPL or were historically present as a DNAPL in the near vicinity. This residual contamination is likely contributing to contamination above SCGs at the groundwater seep and in groundwater migrating off-site. The GWET system as designed and implemented was not intended to address the residual contamination beneath the site building and instead wholly functioned as a hydraulic control measure to mitigate off-site migration of the contaminated groundwater plume.

Conceptual Site Model

Three distinct geologic units have been identified for the overburden at the Site. The topmost unit is a brown glacial till of variable thickness to a depth between 25 to 45 ft bgs. The brown till is underlain by a gray, loose sandy silt up to 20 ft thick. The loose sandy silt was frequently identified as flowing sands in boring logs and is typically thickest beneath the site building and thins to the west. The gray sandy silt unit is underlain by a gray, dense till encountered to a depth of 117 ft bgs. The deeper gray till unit was interpreted in the RI as a confining layer limiting downward vertical migration of contaminants at the Site. Bedrock has not been identified in past site investigations. Cross sections depicting the geologic units for the Site are provided in Attachment 1.

Groundwater flow at the Site is generally to the west-southwest from the on-site buildings towards Bennion Road (Figure 3). A significant vertical hydraulic gradient is present (0.023 to 0.1 feet per feet [ft/ft]) and is comparable to the horizontal hydraulic gradient which ranges from 0.0113 to 0.266 ft/ft on-site to 0.126 to 0.141 ft/ft at the western slope.

Natural seep areas resulting from groundwater discharging to the surface are present to the west of the site building. The local topography and geology indicate that Wolf Creek, a Class C stream west of the Site, is likely the local discharge point for groundwater to surface water from the Site and represents the nearest surface water receptor other than seeps/swamps immediately west of Site (Figure 2).

The GWET system extraction wells generally extend to the top of the gray till unit and screen all three units from 25 to 50 ft bgs. Groundwater results from 2010 to 2022 indicate that the TCE groundwater plume has remained generally stable through the 20 years of operation of the GWET system and in the subsequent four years following the system shutdown. However, rebound of TCE was observed in a sample collected from the seep area (SEEP-1) in 2021 and in off-site monitoring well MWOF-4 following the ceased operation of the GWET system in 2018. Interpreted TCE concentration plume maps for 2012, 2018, 2021, and 2022 are provided in Attachment 1.

2009 Remedial System Optimization Evaluation and Data Gaps

An RSO and Focused Feasibility Study (FFS) was prepared in 2009 to evaluate remedial alternatives for TCE source areas and off-site migration of dissolved contamination (MACTEC, 2009). The RSO evaluation concluded that vadose zone contamination contributing to groundwater contamination at the Site had generally been addressed by the SVET system. However, significant source area concentrations exist within the saturated zone beneath the building and contribute to contamination above SCGs at the groundwater seep and in groundwater migrating off-site. The source area may be as large as 43,320 square ft (URS, 2005 [Appendix F]). GWET system modifications and additional remedial alternatives were evaluated under the RSO and FFS to enhance contaminant removal and to address TCE source areas and contaminated groundwater seeps.

In 2021, MACTEC identified several data gaps during a records review and recommended further characterization of site conditions to evaluate remedial alternatives and technologies to the NYSDEC (MACTEC, 2021a).

The data gaps identified are as follows:

- Limited data to evaluate the current conditions of the residual source area beneath the building.
- Limited contaminant concentration data for individual extraction wells.

- Groundwater quality parameters, which provide data needed to evaluate remedial alternatives, have not been routinely collected historically.
- The off-site TCE groundwater plume to the west has not been fully delineated horizontally or vertically, and the plume extent cannot be evaluated by the current monitoring well network configuration (i.e., well locations and depth).
- Groundwater discharge to Wolf Creek, which is the nearest potential surface water receptor, has not been evaluated.
- Infiltration of precipitation through the site building slab due to poor building structure conditions may be flushing residual vadose zone contamination into the saturated zone and has not been evaluated.
- Limited data on residual vadose zone contamination following discontinuation of the SVET system.
- Soil vapor intrusion (SVI) and building use should be evaluated to determine if a SSDS, which was included as part of the remedy in the ROD but has not been installed, is needed.

DATA GAP INVESTIGATION SCOPE OF WORK

To address the data gaps outlined above, the following tasks are proposed:

- Install two monitoring wells in the residual source area beneath the building.
- Install additional off-site monitoring wells to refine the horizontal and vertical extent of the off-site dissolved phase TCE groundwater plume.
- Conduct vertical profile sampling in four extraction wells that span the central axis of the groundwater plume to:
  - evaluate contamination across the different geologic units, and
  - identify preferential flow paths, if present, for optimizing extraction or zones for retro-fracturing.
- Conduct quarterly groundwater sampling of wells to evaluate seasonal trends of site COC concentrations, plume stability, water table fluctuations, and groundwater quality parameters.
- Collect porewater samples at groundwater discharge locations (e.g., seeps, swamps, the on-site stream, and Wolf Creek) to evaluate potential migration and impacts of contaminated groundwater from the Site.

- Collect sediment samples in the seep and wetland areas west of the Site to assess impacts of contaminated groundwater discharge from the Site.
- Conduct an SVI evaluation of the site building to determine if a SSDS should be installed.
- Conduct a structural evaluation of the site building to determine if improvements to roof, slab, and stormwater controls will reduce direct infiltration of precipitation that may be flushing residual contamination in the vadose zone deeper into the saturated zone.

The investigation field activities, objectives, rationale, and associated data gaps to be addressed are summarized in Table 1. Well construction details for existing wells are provided in Table 2. Proposed sample identification, media, and analyses are summarized in Table 3. The tasks to complete the data gap investigation are described individually in the following paragraphs.

Direct Push and Monitoring Well Installation and Development

Two monitoring wells will be installed in the residual source area beneath the building. One well will be located hydraulically upgradient (northeast) of the most grossly contaminated wells, GWEW-09, MW-5, and DW-5, near deep soil boring DB-2 (Attachment 1). A second well will be located at the northern end of the original plant building near the former drum storage area and deep boring DB-6 (Attachment 1). Ten additional monitoring wells will be installed off-site, west of the property, to further delineate the TCE dissolved phase groundwater plume. The additional well locations are presented on Figure 4. All new wells will be screened in the gray sandy silt unit (approximately 30 to 40 ft bgs) between the denser upper brown and lower gray till units. Two wells will be installed at Bennion Road to assess if the TCE groundwater plume extends further west than the plume edge as inferred in the shallow wells (between MWOF-2 and MWOF-4).

The wells will be continuously sampled using a direct push drill rig with the ability to spin augers or drive casing due to the heaving sands identified in previous drilling programs. Soils will be field classified and screened for total VOCs using a PID in accordance with applicable SOPs in Attachment 2. Boreholes will be advanced to the top of the lower dense gray till unit. Off-site wells will be installed with 5-ft long pre-packed screens with the screen centered within the loose gray sandy silt unit. Ten-foot well screens with conventional sand pack may be considered in addition to pre-packed screens for the wells in the residual source area as field conditions allow. The construction of the residual source area wells will be determined in the field based on the observed material after consulting with the MACTEC technical lead. Boreholes will be completed with two feet of filter sand pack and three feet of bentonite chips above the well screen and bentonite-grout to grade. Bentonite chips may be substituted for bentonite grout in shallow borings. Wells will be completed with protective above-grade permanent casings.

The newly installed monitoring wells will be developed in accordance with MACTEC SOP #S23 (Attachment 2) at a minimum of 24 hours after placement of grout in the annular space. Depth to water, pumping rates, and turbidity measurements will be recorded on a Well Development Record provided in Attachment 3.

Soil Sampling

Soil samples will be collected in the vadose zone from the two monitoring wells installed in the residual source area. Up to two samples will be collected per boring above the water table (estimated between 15 and 20 ft bgs). Sampling intervals will be determined in the field based on visual (staining, sheen, etc.), olfactory (odors), or PID screening evidence of contamination. Samples will be collected in accordance with MACTEC SOPs #S13 and #S14 (Attachment 2). Samples will be submitted for laboratory analysis of VOCs using United States Environmental Protection Agency (USEPA) Method 5035 (Table 3).

Well Assessment, Repair, and Decommissioning

During long-term monitoring (LTM) sampling activities in May 2021, an obstruction or possible damage was identified in monitoring well MWOF-4 at approximately seven ft bgs. This well will be abandoned in accordance with NYSDEC CP-43: Groundwater Monitoring Well Decommissioning Policy (NYSDEC, 2009b; Attachment 4) and replaced with identical well construction as identified in Table 2.

Monitoring well MWOF-7 was also observed to be damaged with an obstruction at approximately 10 ft bgs (MACTEC, 2021b). This well will be abandoned in accordance with CP-43 and is not scoped for replacement. Well abandonment activities will be scheduled with the drilling subcontractor to occur in the same mobilization as new monitoring well installation activities near MWOF-2.

Additional necessary well repairs will be assessed in the field and recommendations will be provided in the final report. Additional well repairs or decommissioning are anticipated following the completion of this scope of work and the selection of the final remedy.

Extraction Well Network Vertical Profile Sampling

Vertical profile samples will be collected in a single event from four groundwater extraction wells: GWEW-01, GWEW-04, GWEW-05, and GWEW-09. Extraction wells GWEW-05 and GWEW-09 have been sampled historically on a combined header. Extraction well GWEW-04 has been sampled historically on a combined header with GWEW-08. These three extraction wells transect the TCE groundwater plume and have typically exhibited the highest TCE concentrations (combined header samples) of the GWET system during operation. The four extraction wells have fully saturated screen lengths between 25 and 30 ft in length (Table 2). Vertical delineation is required for the long well screens to identify preferential pathways for contaminant transport and to identify the appropriate sampling intervals to monitor the groundwater plume.

To prepare the wells for sampling, the well pumps and associated infrastructure (e.g., piping, electric wiring) will be removed from the well by the drilling subcontractor following proper safety procedures to deenergize the system. The pumps and wiring will be decontaminated, labeled, and stored in the building on-site. Well piping will be staged along the western wall of the site structure for re-use/deployment in the well, if necessary.

Following removal of the extraction pumps and supporting infrastructure, the three extraction wells will be redeveloped via pump actuated surge block agitation in 4-ft increments until the bottom of the well screen is reached, and a minimum of one well volume will be removed. Groundwater quality parameters will be collected at the start and finish of each interval. Groundwater quality parameters and volumes purged from each interval will be recorded on a Well Development Record (Attachment 3).

Following well development, each extraction well will be vertically profiled with passive diffusion bag (PDB) samplers secured on a tether the length of the open well screen. The PDBs (18 inches in length) will be secured on the tether such that a 2-ft length of separation is present between each sampler.

The well screen depth, top PDB depth, and number of PDBs per well are as follows:

- GWEW-01
  - Well screen 16-46 ft bgs
  - 8 PDBs total – set every 3.5 ft starting at 17 ft bgs (2 ft between samplers)
- GWEW-04
  - Well screen 25-50 ft bgs
  - 7 PDBs total - set every 3.5 ft starting at 26 ft bgs (2 ft between samplers)
- GWEW-05
  - Well screen 27-52 ft bgs
  - 7 PDBs total - set every 3.5 ft starting at 28 ft bgs (2 ft between samplers)
- GWEW-09
  - Well screen 26-46 ft bgs
  - 6 PDBs total - set every 3.5 ft starting at 27 ft bgs (2 ft between samplers)

PDBs will be allowed to equilibrate in the wells for a minimum of two weeks prior to retrieval for sampling.

Quarterly Groundwater Sampling

Quarterly groundwater sampling will be conducted to establish a seasonal baseline of groundwater conditions for the Site to evaluate remedial alternatives. Samples will be collected quarterly for one year from the existing LTM locations and the newly installed monitoring wells.

A synoptic round of water levels will be collected from existing LTM, select existing non-LTM wells, and newly installed groundwater monitoring wells prior to sampling (Table 2). Samples will be collected from these wells using low flow sampling procedures. Water quality parameters of temperature, pH, specific conductivity, dissolved oxygen, and oxidation-reduction potential will be collected for each sampling event. Field measurements and monitoring well sampling activities will be documented using a Low Flow Groundwater Sampling Record provided in Attachment 3.

Groundwater samples collected from each well will be analyzed for VOCs via USEPA Method 8260 by an analytical laboratory with New York State Department of Health (NYSDOH) Environmental

Laboratory Approval Program certification. Samples will be collected quarterly from select wells (DW-5, GWEW-01, MW-5, MW-104, MW-112, and MWOF-4) for the evaluation of monitored natural attenuation (MNA) screening parameters to evaluate potential seasonality in water quality for evaluating potential remedial alternatives. In conjunction with the MNA screening, microbial testing (e.g., Bio-Trap® samplers) will be completed in four wells (DW-5, MW-5, MW-111, and MW-112) for one quarter. The samplers will be deployed and retrieved in accordance with the selected vendor's SOP. One set of samples for MNA parameters will be collected from existing monitoring well MW-1 to evaluate background conditions at the Site. This single sample will be collected in the first quarterly sampling event. Monitoring well MW-1 will be developed until the well development criteria is met followed by implementation of low flow procedures for sampling.

Proposed sample identifications, analyses, and laboratory analytical methods are provided in Table 3. The analytical laboratory will be contracted directly by the NYSDEC.

Porewater and Sediment Sampling

Porewater and sediment sampling will be conducted at groundwater discharge locations (e.g., seeps, swamps, and Wolf Creek) west of the Site to evaluate potential for contaminated groundwater to impact these features. Porewater samples will be collected in accordance with MACTEC SOP #S9 to a depth that ensures sampling of groundwater and not surface water. Sediment samples will be collected in accordance with MACTEC SOP #S10. The samples will be analyzed for VOCs via USEPA Method 8260 (Table 3). Proposed porewater and sediment sample locations are depicted on Figure 5. Porewater and sediment sampling will occur during one of the quarterly groundwater sampling events.

Building Inspection and SVI Evaluation

<u>Building Inspection</u>

An evaluation of the integrity of the site building roof and slab and stormwater controls will be conducted to assess potential for direct precipitation/runoff water to drain through the building slab thus flushing residual vadose zone contamination beneath the Site building into the groundwater saturated zone. This will be accomplished through a visual inspection on-site, including photographs and field sketches, with findings, conclusions, and recommendations presented in a technical memo.

The inspection will not include destructive testing, material testing, or examination of storm/sewer infrastructure beneath the building or where inaccessible. Visual observations of floor drains and storm and sanitary piping will be made and recorded if present and accessible.

<u>SVI Evaluation</u>

The SMP requires installation and maintenance of a SSDS by the property owner in areas of regular human occupancy (NYSDEC, 2009a). Human occupancy (specific locations and duration) and SVI potential in the site building will be evaluated to determine if a SSDS should be installed. The evaluation will include the following:

1) Interview with the occupant/owner to identify locations and duration of human occupancy in the building and completion of a Structure Sampling Questionnaire and Building Inventory (MACTEC SOP #25, Attachment 2).
2) Installation of three permanent sub-slab vapor sample points in areas of occupied spaces and known remaining contamination in accordance with MACTEC SOP #25. Proposed locations are depicted on Figure 6. A utility clearance of proposed locations will be performed by a qualified contractor prior to installation. Exact locations will be chosen based on accessibility, floor conditions, and utility clearance findings.
3) Collection of paired sub-slab vapor and indoor air samples at three locations and one outdoor ambient air sample over an 8-hour period using SUMMA®-type canisters. Samples will be analyzed for VOCs by USEPA Method TO-15 with a minimum reporting limit for TCE of 0.25 micrograms per cubic meter (mcg/m^3). Each pair will include one sub-slab vapor sample and one indoor air sample collected concurrently. A duplicate indoor air sample will be collected at one of the three locations. Proposed sample locations are depicted on Figure 6. An ambient air sample will be collected upwind of the building, if possible, and the sample location determined in the field; therefore, the proposed sample location is not depicted on Figure 6. Sampling and analysis will be in accordance with MACTEC SOP #25 (Attachment 2).

Building inspection and SVI evaluation activities will be documented in a field logbook and on applicable field forms. Further investigation and/or recommended improvements will be addressed in a field activities report.

INVESTIGATION DERIVED WASTE

Soil cuttings generated during direct push and well installation activities will be containerized in 55-gallon drums and labeled accordingly. At the completion of field activities, the soil will be sampled for waste characterization and disposal parameters and disposed of by a licensed waste transportation and disposal subcontractor (Table 3). MACTEC will provide oversight of the subcontractor during investigation derived waste (IDW) removal activities.

Aqueous IDW generated from well installation, development, and sampling will be containerized and treated on-site using a granular activated carbon (GAC) unit and discharged to the ground surface. Nondedicated sampling equipment (e.g., nitrile gloves, PDB samplers) will be disposed of as municipal waste.

TREATMENT SYSTEM DECOMMISSIONING

Based on email correspondence from the NYSDEC, the GWET and SVET systems are planned for decommissioning (Salotto et al., 2022; Attachment 5). Decommissioning of the systems' equipment will be completed by a NYSDEC callout contractor and is not part of the data gap investigation. MACTEC will provide decommissioning oversight and prepare and submit daily field reports to the NYSDEC summarizing decommissioning activities.

SUSTAINABILITY AND RESILIENCY

During investigation activities, MACTEC will consider the implementation objectives of the NYSDEC Program Policy Division of Environmental Remediation (DER)-31 / Green Remediation (NYSDEC, 2011), which identifies the NYSDEC DER's approach to remediating sites in the context of the larger environment, a concept known as green remediation. The "Green Remediation" approach is intended to improve the overall sustainability of the investigation by promoting the use of more sustainable practices and technologies. Green Remediation practices and technologies are less disruptive to the environment, generate less IDW, increase reuse and recycling, and emit fewer pollutants, including greenhouse gases, to the atmosphere.

The following bullet points describe Green Remediation concepts and techniques that will be considered for the investigation.

- Waste generated is anticipated to consist of soil and water. MACTEC will evaluate ways to appropriately discard soil cuttings on-site to eliminate possible off-site transportation and disposal of waste, and by that reduce management costs and emissions associated with transportation. As mentioned above, aqueous IDW will be treated on-site using a GAC unit and discharged to the ground surface. Where applicable, PDB samplers will be used for groundwater sample collection, which generate minimal purge water waste.
- Energy efficiency will be considered in the selection of any equipment, and MACTEC will adopt usage practices to minimize unnecessary electrical usage.
- Emissions of air pollutants and carbon dioxide/greenhouse gases will be minimized wherever practical. Consolidation of site visits to reduce total trips, reduction of any trucking to and from the Site, and alternatives to gas-powered generators will be considered.
- Information on energy usage, solid waste generation, transportation and shipping, and water usage will be recorded to facilitate and document consistent implementation of green remediation during site activities and to identify corresponding benefits.

HEALTH AND SAFETY

Field activities will be conducted in modified Level D personal protection. The project-specific health and safety plan is included as Attachment 6. A community air monitoring plan (CAMP) consistent with NYSDOH guidance will be implemented during intrusive activities at the Site. VOC and particulate readings will be provided to the NYSDEC and NYSDOH on a weekly basis. Any exceedances will be reported the same day of occurrence or the next business day, if after hours, including effectiveness of corrective measures implemented. Details of the CAMP program are included in Attachment 7.

ACCESS AND CLEARANCE

Locations of proposed investigation activities are on and off the Site property. MACTEC will coordinate access with the NYSDEC and the property owners prior to mobilization. For clearances of exploration locations, MACTEC will be responsible for marking locations in the field and the subcontractors for coordinating utility clearance with Dig Safely New York to identify locations of utilities and to conduct a private utility mark-out prior to ground disturbance activities. It is anticipated that brush/overgrowth clearing will be required by the drilling subcontractor to access the proposed monitoring well locations.

REPORTING

MACTEC will submit a field activities report that will include a narrative of the field investigation activities, discussion of the analytical results with comparison to applicable screening criteria, an updated conceptual site model, and recommendations for additional investigation or no further action. Findings from the first year of quarterly groundwater sampling will be discussed with the NYSDEC project manager to initiate an assessment of remedial alternatives.

If you have questions on the material provided herein, please contact Nate Vogan at 518-344-9211 or Nathan.vogan@wsp.com if you have questions or concerns regarding this FAP.

Sincerely,
MACTEC Engineering & Geology, P.C.

Sara Wright
Project Manager

Nate Vogan, P.G.
Site Hydrogeologist

Enclosures (16)

- Figure 1 Site Location
- Figure 2 Site Features
- Figure 3 Interpreted Overburden Potentiometric Surface August 2022
- Figure 4 Proposed Monitoring Well Locations
- Figure 5 Proposed Porewater and Sediment Sample Locations
- Figure 6 Proposed Soil Vapor Intrusion Sampling Locations

REFERENCES

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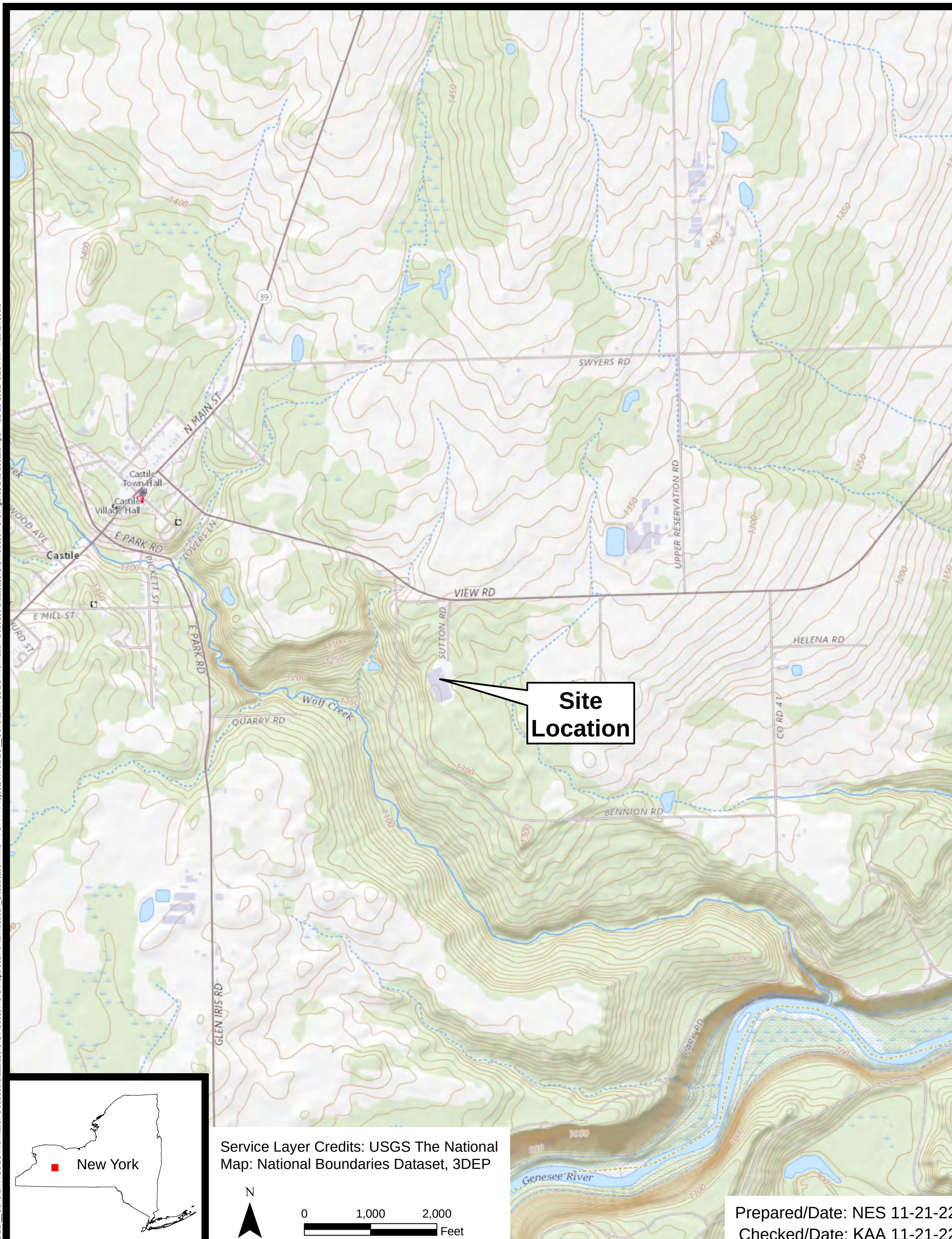
LIST OF ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
CAMP	Community Air Monitoring Plan
COC	Contaminant of Concern
DER	Division of Environmental Remediation
DNAPL	Dense Non-Aqueous Phase Liquid
ECs	Engineering Controls
FAP	Field Activities Plan
FFS	Focused Feasibility Study
ft	foot/feet
ft/ft	feet per feet
GAC	Granular Activated Carbon
GWET	Groundwater Extraction and Treatment
ICs	Institutional Controls
IDW	Investigation Derived Waste
LTM	Long-Term Monitoring
MACTEC	MACTEC Engineering & Geology, P.C.
mcg/m^3	Micrograms per Cubic Meter
MNA	Monitored Natural Attenuation
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PCE	Tetrachloroethene

LIST OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

PDB	Passive Diffusion Bag
PID	Photoionization Detector
RI	Remedial Investigation
ROD	Record of Decision
RSO	Remedial System Optimization
SCGs	Standards, Criteria, and Guidance
SMP	Site Management Plan
SOP	Standard Operating Procedure
SSDS	Sub-Slab Depressurization System
SVET	Soil Vapor Extraction and Treatment
SVI	Soil Vapor Intrusion
TCE	Trichloroethene
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

FIGURES



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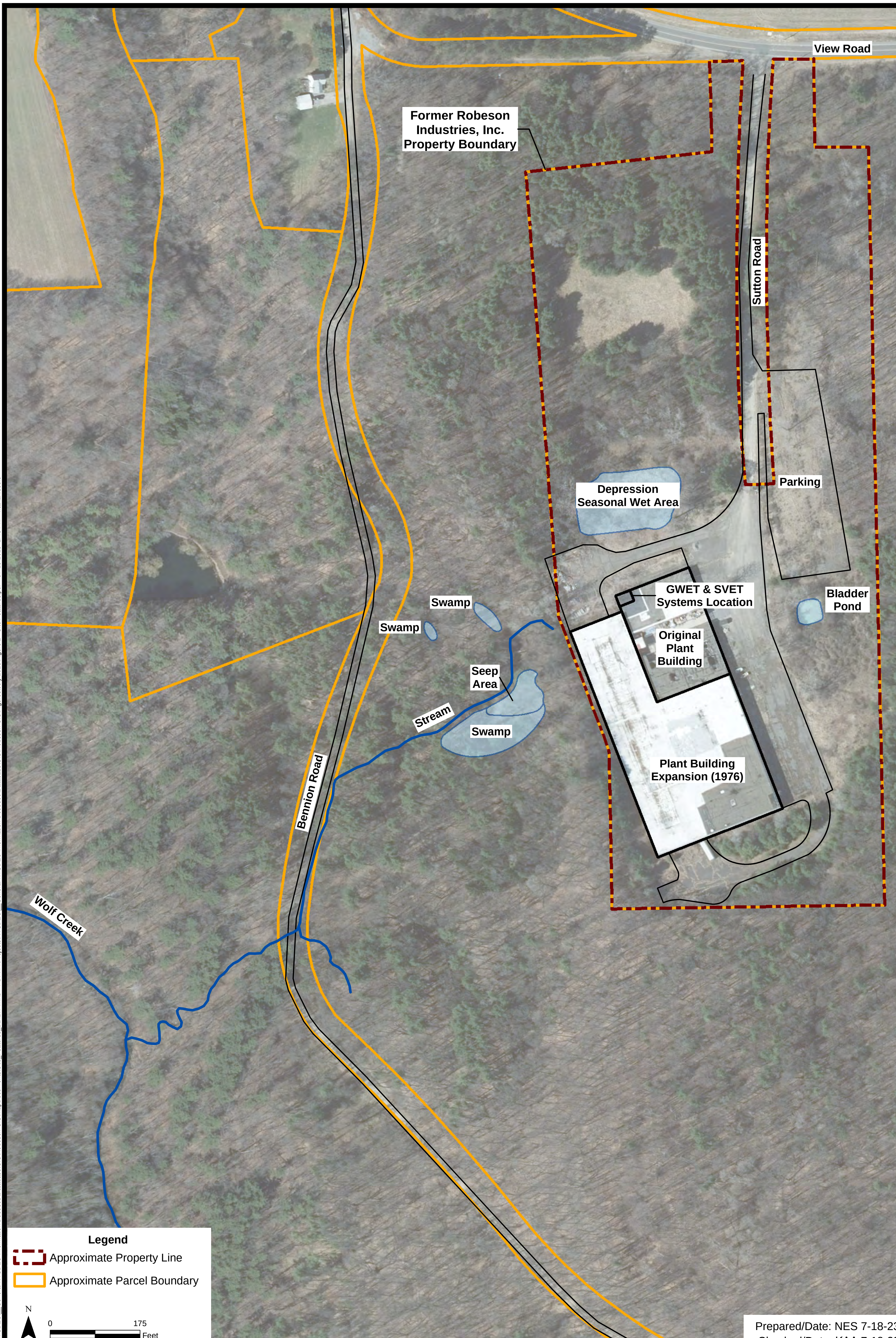
NYSDEC Site No. 961008
Robeson Industries, Inc.
Castile, New York

MACTEC

Site Location

Project 3616206112 Figure 1



NYSDEC Site No. 961008
Robeson Industries, Inc.
Castile, New York

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Site Features

Project 3616206112

Figure 2

NYSDEC Site No. 961008
Robeson Industries, Inc.
Castile, New York

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Interpreted Overburden Potentiometric Surface
August 2022
Project 3616206112 Figure 3

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Prepared/Date: NES 8-9-23
Checked/Date: KAA 8-9-23

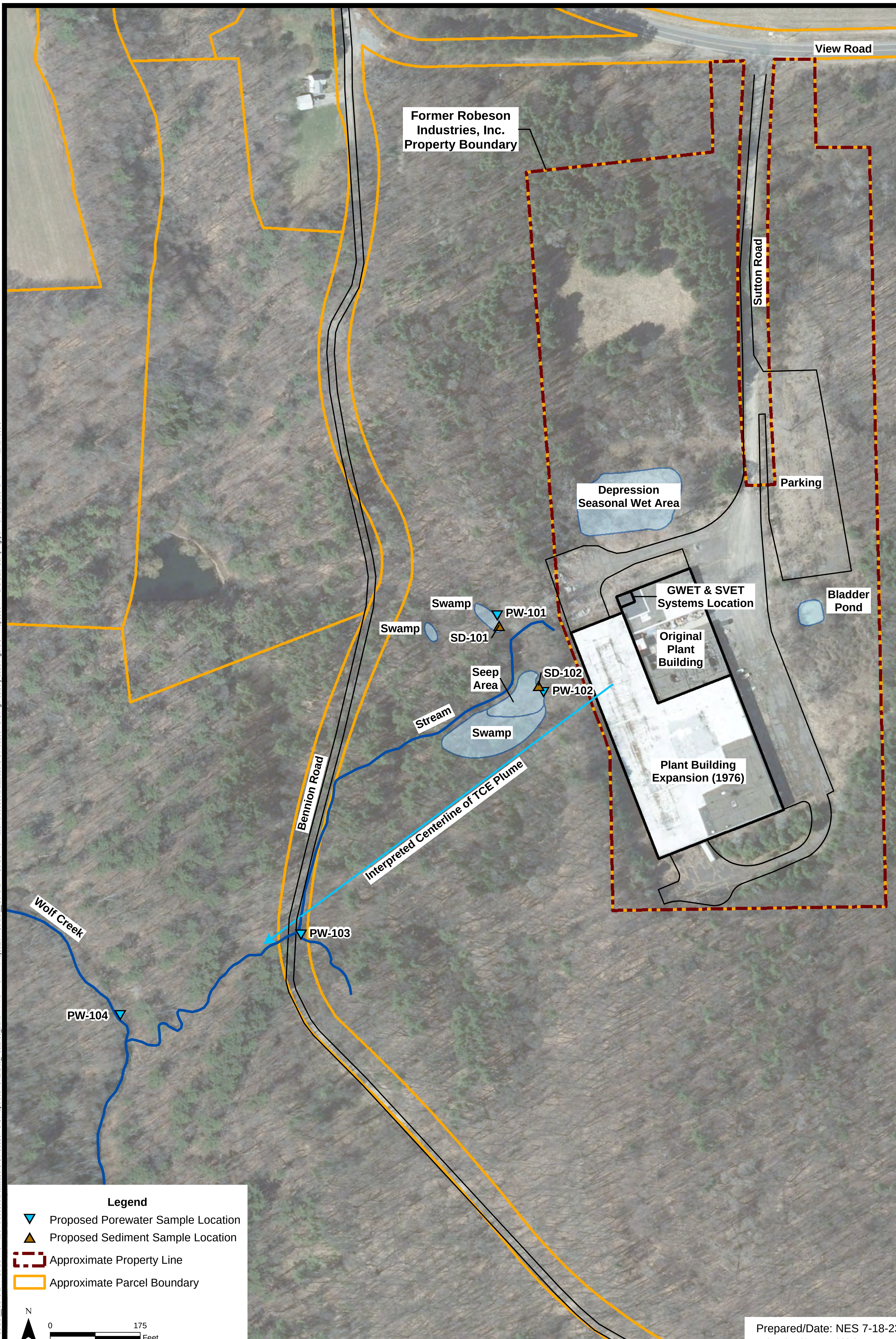
NYSDEC Site No. 961008
Robeson Industries, Inc.
Castile, New York

MACTEC

Proposed Monitoring Well Locations

Project 3616206112

Figure 4



Prepared/Date: NES 7-18-23
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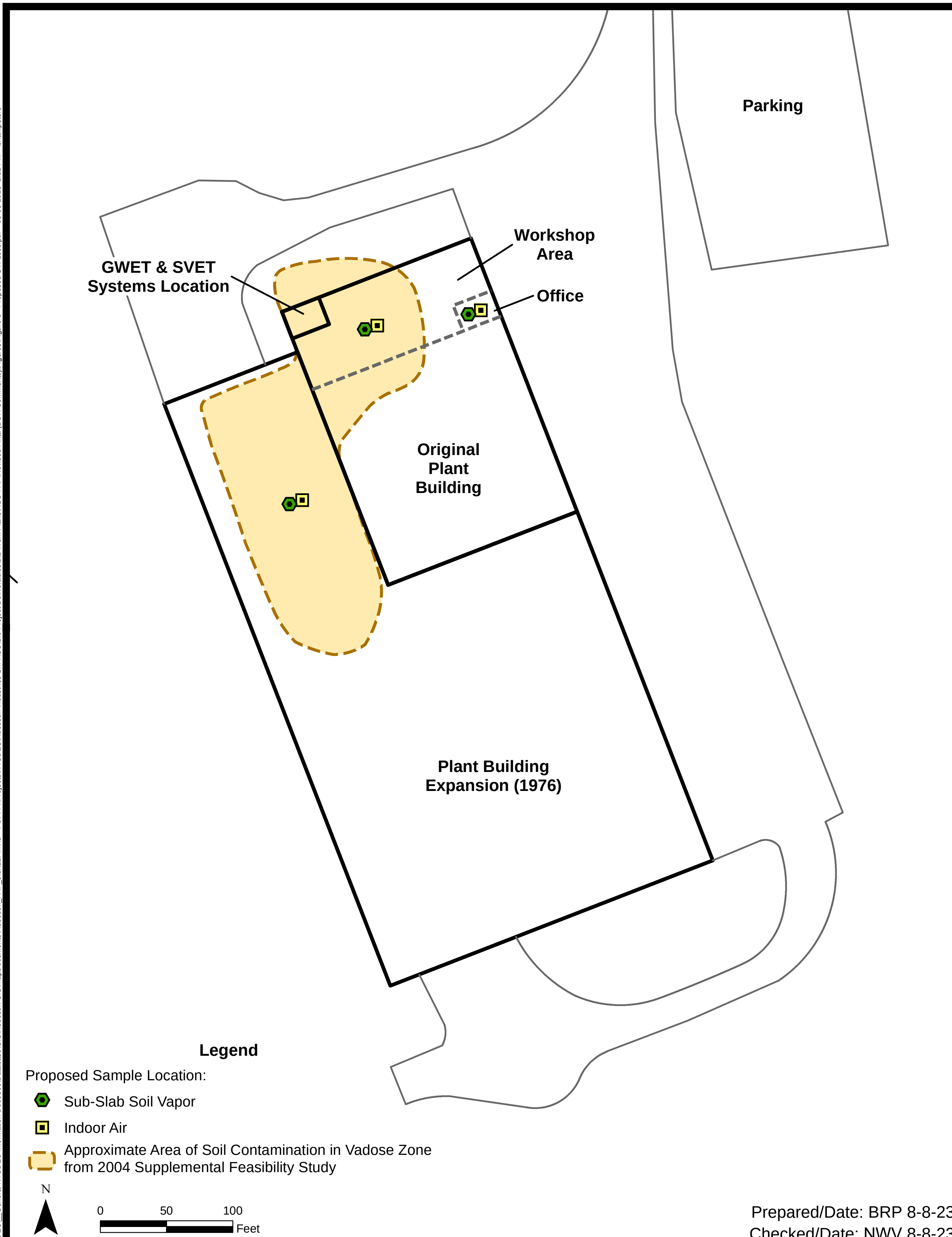
NYSDEC Site No. 961008
Robeson Industries, Inc.
Castile, New York

MACTEC

Proposed Porewater and Sediment Sample Locations
Project 3616206112
Figure 5



Prepared/Date: BRP 8-8-23
Checked/Date: NWV 8-8-23

NYSDEC Site No. 961008
Robeson Industries, Inc.
Castile, New York

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Proposed Soil Vapor Intrusion Sampling Locations

Project 3616206112 Figure 6

Document: P:\Projects\NYSDEC_General NYSDEC Information D009809\Database\GIS\Robeson GIS\MapDocuments\Robeson_FAP_8.5x11P.mxd PDF: P:\Projects\NYSDEC\Robeson Industries SM-RSO\8.0 Project Deliverables\8.2 Work Plans\RSO FAP\Revised Final (DOH Comments)\Figures\Figure 6 - Proposed SVI Locs.pdf 08-08-2023 1:32 PM brian.peters

TABLES

Table 1: Remedial System Optimization Data Gaps, Objectives, and Investigation Activities Rationale

Unit/Media	Data Gap Identified	Data Gap Investigation Objective	Scoped Field Activity	Rationale/Potential Receptors
Groundwater	The groundwater extraction well network (10 wells) was historically sampled via six combined headers; therefore, limited concentration data for individual pumping wells is available for a pumping optimization evaluation. Preferential pathways for contaminant transport of stratification within the long screen wells have not been evaluated.	Nature & Extent: Evaluate and vertically delineate groundwater concentrations in individual extraction wells (GWEW-01, -04, -05, -09) to provide detail on preferential flow paths.	Remove extraction pumps/pump infrastructure, develop wells, and collect groundwater samples via passive diffusion bags for VOCs analysis from four extraction wells (GWEW-01, -04, -05, -09). Sample each well at 3.5-foot vertical intervals along screened interval.	Provides discrete data for individual extraction wells that transect the plume for potential pump optimization, retrofracturing, and monitoring interval selection.
Groundwater	Residual contamination was observed in deep borings under the site building in the gray sandy silt unit. Current groundwater conditions in the potential source area have not been evaluated.	Nature & Extent and Remedy Evaluation: Evaluate current concentrations of Site contaminants of conern and groundwater quality parameters in residual source area.	Install two monitoring wells in previously identified source area. Wells will be installed in the gray sandy silt unit (approximately 30-40 feet below ground surface) in the vicinity of previous deep borings DB-2 and DB-6.	Provides necessary supporting data for evaluating applicability and potential effectiveness of remedial alternatives for the residual source area.
Groundwater	The western extent of the trichloroethene groundwater plume in the loose gray sandy silt unit is undefined.	Nature & Extent: Horizontally and vertically delineate the groundwater plume west of the Site.	Install 10 additional groundwater monitoring wells in the loose sandy silt unit between the site building and Bennion Road.	Delineates extent of contamination west of the Site and evaluates if off-site receptors require additional consideration for remedy selection.
Groundwater	Groundwater sampling data (concentrations and water quality parameters) collected since 2009 are insufficient to evaluate seasonal trends of CVOCs and groundwater conditions for remedy evaluation and selection.	Fate & Transport and Remedy Evaluation: Evaluate potential seasonal variations of chlorinated VOC concentrations and groundwater chemistry.	Collect quarterly groundwater samples for chlorinated VOCs and water quality parameters using low-flow sampling techniques from existing long-term monitoring wells and newly installed wells. Collect quarterly MNA parameters at select wells.	Refines the conceptual site model and provides necessary supporting data for evaluating applicability and potential effectiveness of remedial alternatives.

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Table 1: Remedial System Optimization Data Gaps, Objectives, and Investigation Activities Rationale

Unit/Media	Data Gap Identified	Data Gap Investigation Objective	Scoped Field Activity	Rationale/Potential Receptors
Groundwater	The presence of microbes in groundwater for biodegradation of chlorinated VOCs has not been evaluated at the Site.	Fate & Transport and Remedy Evaluation: Evaluate presence/absence of MNA microbe genera at the Site.	Conduct microbial testing (e.g., Bio-Trap® samplers) in four monitoring wells (DW-5, MW-5, MW-111, MW-112).	Provides data to evaluate biodegradation pathways (e.g., reductive dechlorination) and bioaugmentation applicability as a remedy for the Site.
Porewater and Sediment	Groundwater discharge to seeps and surface water bodies has not been evaluated directly other than surface water collection. Sediment contamination from groundwater discharge has not been evaluated.	Fate & Transport: Evaluate potential groundwater discharge points as a potential exposure pathway in surface water and sediment west of the Site.	Conduct porewater sampling from previously sampled seep, swamp, and stream at Bennion Road west of the site building. Collect a sample at Wolf Creek just north of the Bennion Road stream confluence.	Evaluates the potential for contaminated groundwater discharge to contribute to surface water or sediment contamination that may impact receptors.
Soil	Verification of the Soil Vapor Extraction & Treatment remedy has not been completed following its discontinuation. Residual contamination in the vadose zone is undefined.	Nature & Extent: Evaluate vadose zone soils for residual contamination in previously identified source areas under and immediately adjacent to the site building.	Collect up to two soil samples above the water table from the two monitoring wells to be installed in the building source areas.	Provides data to evaluate the potential for residual vadose zone contamiantion to contribute to soil vapor intrusion at the Site.
Soil Vapor	Soil vapor intrusion was identified as a complete exposure pathway for site occupants. A sub-slab depressurization system that was recommended in the 2009 Site Management Plan has not been installed. Specific rooms and duration of human occupany of the site building is unknown.	Fate & Transport: Evaluate soil vapor intrusion and human occupancy within the site building to determine if a sub-slab depressurization should be installed.	Evaluate current human occupancy (specific locations and duration) within the site building. Collect concurrent sub-slab vapor and indoor air samples in areas where residual vadose zone contamination and elevated groundwater concentractions may be present and in occupied spaces.	Determines if the Site is in compliance with engineering controls in the Site Management Plan and evaluates if protective measures for on-site exposure to soil vapor is required as part of remedy selection.

Notes:
MNA = monitored natural attenuation
VOC(s) = volatile organic compound(s)

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Table 2: Well Construction Details

Well ID	Year Installed[1]	Material	Well Diameter (inches)	Screen Length (ft)	Screened Interval (ft bgs)	Ground Elevation[1] (ft amsl)	TOR Elevation[1] (ft amsl)	Depth to Water[2] (ft below TOR)	Depth to Bottom[2] (ft below TOR)	Groundwater Elevation[2] (ft amsl)	Notes
Groundwater Extraction Wells											
GWEW-01	1997	PVC	NA	30	16-46	NA	NA	16.66	pump in well	NA	
GWEW-02	1997	PVC	NA	30	16-46	NA	NA	NM	NM	NA	
GWEW-04	1997	PVC	NA	25	25-50	NA	NA	NM	NM	NA	
GWEW-05	1997	PVC	NA	25	27-52	NA	NA	NM	NM	NA	
GWEW-06	1997	PVC	NA	10	25-35	NA	NA	NM	NM	NA	
GWEW-08	1997	PVC	NA	30	20-50	NA	NA	16.10	pump in well	NA	
GWEW-09	1997	PVC	NA	20	26-46	NA	NA	21.78	pump in well	NA	
GWEW-10	1997	PVC	NA	10	25-35	NA	NA	NM	NM	NA	
On-Site Groundwater Monitoring Wells											
DW-5	1992	PVC	4	10	40-50	1304.65	1306.33	26.12	48.92	1280.21	
MW-1	1990	PVC	2	10	21.7-31.7	NA	1316.24	18.56	33.56	1297.68	
MW-2	1990	PVC	2	10	30-40	NA	1305.3	15.90	34.10	1289.40	Damaged well lid
MW-3	1990	PVC	2	10	23.8-33.8	NA	1305.93	25.97	28.68	1279.96	
MW-4	1991	PVC	2	10	20-30	NA	1305.68	22.99	30.10	1282.69	
MW-5	1992	PVC	4	10	20-30	1304.33	1306.02	25.46	31.46	1280.56	
MW-7	1992	PVC	4	10	16-26	1304.95	1306.84	16.32	23.25	1290.52	
MW-8	1992	PVC	4	10	10-20	1299.78	1301.7	19.95	22.70	1281.75	
MW-B	1990	PVC	2	10	10-20	NA	1301.65	13.82	17.01	1287.83	
MW-C	1990	PVC	2	10	10-20	NA	1304.95	17.46	21.85	1287.49	
MW-D	1990	PVC	2	10	9-19	NA	1304.52	dry	20.80	dry	
MW-X	NA	PVC	2	10	9.6-19.6	NA	1300.54	14.77	20.15	1285.77	
Off-Site Groundwater Monitoring Wells											
MWOF-1	1992	PVC	2	10	5-15	1234.50	1236.9	6.90	17.65	1230.00	
MWOF-2	1992	PVC	2	10	10-20	1199.20	1201.85	12.91	22.24	1188.94	
MWOF-3	1993	PVC	1.5	5	9-14	1255.13	1257.5	15.53	16.54	1241.97	

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Table 2: Well Construction Details

Well ID	Year Installed[1]	Material	Well Diameter (inches)	Screen Length (ft)	Screened Interval (ft bgs)	Ground Elevation[1] (ft amsl)	TOR Elevation[1] (ft amsl)	Depth to Water[2] (ft below TOR)	Depth to Bottom[2] (ft below TOR)	Groundwater Elevation[2] (ft amsl)	Notes
Off-Site Groundwater Monitoring Wells (continued)											
MWOF-4	1993	PVC	1.5	5	6-11	1249.44	1251.66	9.51	13.47	1242.15	
MWOF-5	1993	PVC	1.5	5	6-11	1247.53	1249.73	8.59	13.48	1241.14	
MWOF-6	1993	PVC	1.5	5	6-11	1278.81	1280.9	11.91	13.98	1268.99	
MWOF-7	2004	PVC	2	10	9-19	1199.40	NA	7.67	NM	NA	Obstruction 10.3 ft bgs
MWOF-8	2004	PVC	2	5	2.7-7.7	1251.30	NA	2.08	9.71	NA	
MWOF-9	2004	PVC	2	10	15-25	1259.00	NA	22.82	27.96	NA	
Piezometers											
PZ-3	NA	PVC	2	NA	NA	NA	NA	25.86	38.50	NA	No protective casing
PZ-4	NA	PVC	2	NA	NA	NA	NA	NM	NM	NA	No protective casing

Notes:
[1] From 2009 Site Management Plan
[2] Measured 11/12/2020
amsl = above mean sea level
bgs = below ground surface
ft = feet
NA = not available
NM = not measured
PVC = polyvinyl chloride
TOR = top of riser
Highlight indicates current long-term monitoring well
Highlight indicates monitoring well selected for hydraulic monitoring

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Table 3: Proposed Sample Identification, Analyses, and Analytical Methods

Media^	Location ID	Sample Depth (ft bgs)	Sample ID	Sample Method	Analytical Parameters and Methods					
					VOCs Method 8260	MNA[1]	Microbial Testing qPCR[2]	VOCs Method 5035	VOCs Method TO-15	IDW[3]
Soil Boring Sampling										
Soil	SB-111	TBD	961008-SB111___	Grab				1		
Soil	SB-111	TBD	961008-SB111___	Grab				1		
Soil	SB-112	TBD	961008-SB112___	Grab				1		
Soil	SB-112	TBD	961008-SB112___	Grab				1		
Soil	TBD	TBD	961008-SBxxx___D	Grab				1		
Soil	TBD	TBD	961008-SBxxx___MS	Grab				1		
Soil	TBD	TBD	961008-SBxxx___MSD	Grab				1		
Water	Trip Blank	NA	961008-TB-_-mmddyy	NA				1		
Water	Rinsate Blank	NA	961008-RB-_-mmddyy	NA				1		
SVI Evaluation Sampling (Ambient Air, Indoor Air, Sub-Slab Soil Vapor)										
Ambient Air	AA-001	NA	961008-AA001	8-hr time-averaged					1	
Indoor Air	IA-001	NA	961008-IA001	8-hr time-averaged					1	
Indoor Air	IA-002	NA	961008-IA002	8-hr time-averaged					1	
Indoor Air	IA-003	NA	961008-IA003	8-hr time-averaged					1	
Indoor Air	TBD	NA	961008-IA00_D	8-hr time-averaged					1	
Sub-slab Soil Vapor	SU-001	TBD	961008-SU001___	8-hr time-averaged					1	
Sub-slab Soil Vapor	SU-002	TBD	961008-SU002___	8-hr time-averaged					1	
Sub-slab Soil Vapor	SU-003	TBD	961008-SU003___	8-hr time-averaged					1	
Investigation Derived Waste Characterization Sampling										
Soil	NA	NA	961008-WC-mmddyy	Composite						1
Extraction Well Network Vertical Profile Sampling										
Groundwater	GWEW-01	17.0	961008-GWEW0117	PDB	1a					
Groundwater	GWEW-01	20.5	961008-GWEW0120.5	PDB	1a					
Groundwater	GWEW-01	24.0	961008-GWEW0124	PDB	1a					
Groundwater	GWEW-01	27.5	961008-GWEW0127.5	PDB	1a					
Groundwater	GWEW-01	31.0	961008-GWEW0131	PDB	1a					
Groundwater	GWEW-01	34.5	961008-GWEW0134.5	PDB	1a					
Groundwater	GWEW-01	38.0	961008-GWEW0138	PDB	1a					
Groundwater	GWEW-01	41.5	961008-GWEW0141.5	PDB	1a					
Groundwater	GWEW-04	26.0	961008-GWEW04026	PDB	1a					
Groundwater	GWEW-04	29.5	961008-GWEW04029.5	PDB	1a					
Groundwater	GWEW-04	33.0	961008-GWEW04033	PDB	1a					
Groundwater	GWEW-04	36.5	961008-GWEW04036.5	PDB	1a					
Groundwater	GWEW-04	40.0	961008-GWEW04040	PDB	1a					
Groundwater	GWEW-04	43.5	961008-GWEW04043.5	PDB	1a					
Groundwater	GWEW-04	47.0	961008-GWEW04047	PDB	1a					

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Table 3: Proposed Sample Identification, Analyses, and Analytical Methods

					Analytical Parameters and Methods					
Media^	**Location ID**	**Sample Depth (ft bgs)**	**Sample ID**	**Sample Method**	**VOCs Method 8260**	**MNA[1]**	**Microbial Testing qPCR[2]**	**VOCs Method 5035**	**VOCs Method TO-15**	**IDW[3]**
Extraction Well Network Vertical Profile Sampling (continued)										
Groundwater	GWEW-05	28.0	961008-GWEW05028	PDB	1a					
Groundwater	GWEW-05	31.5	961008-GWEW05031.5	PDB	1a					
Groundwater	GWEW-05	35.0	961008-GWEW05035	PDB	1a					
Groundwater	GWEW-05	38.5	961008-GWEW05038.5	PDB	1a					
Groundwater	GWEW-05	42.0	961008-GWEW05042	PDB	1a					
Groundwater	GWEW-05	45.5	961008-GWEW05045.5	PDB	1a					
Groundwater	GWEW-05	49.0	961008-GWEW05049	PDB	1a					
Groundwater	GWEW-09	27.0	961008-GWEW09027	PDB	1a					
Groundwater	GWEW-09	30.5	961008-GWEW09030.5	PDB	1a					
Groundwater	GWEW-09	34.0	961008-GWEW09034	PDB	1a					
Groundwater	GWEW-09	37.5	961008-GWEW09037.5	PDB	1a					
Groundwater	GWEW-09	41.0	961008-GWEW09041	PDB	1a					
Groundwater	GWEW-09	44.5	961008-GWEW09044.5	PDB	1a					
Groundwater	GWEW-xx	TBD	961008-GWEWxx___D	PDB	1a					
Groundwater	GWEW-xx	TBD	961008-GWEWxx___MS	PDB	1a					
Groundwater	GWEW-xx	TBD	961008-GWEWxx___MSD	PDB	1a					
Field Blank	NA	NA	961008-FB-_-mmddyy	NA	1a					
Trip Blank	NA	NA	961008-TB-_-mmddyy	NA	1a					
Existing Monitoring Well Sampling										
Groundwater	GWEW-01	TBD	961008-GWEW01___	Low-flow	Q	Q				
Groundwater	GWEW-03	TBD	961008-GWEW03___	Low-flow	Q					
Groundwater	GWEW-09	TBD	961008-GWEW09___	Low-flow	Q					
Groundwater	MW-C	TBD	961008-MWC___	Low-flow	Q					
Groundwater	MW-X	TBD	961008-MWX___	Low-flow	Q					
Groundwater	MW-1	TBD	961008-MW1___	Low-flow		1				
Groundwater	MW-3	TBD	961008-MW3___	Low-flow	Q					
Groundwater	MW-5	TBD	961008-MW5___	Low-flow	Q	Q	1b			
Groundwater	DW-5	TBD	961008-DW5___	Low-flow	Q	Q	1b			
Groundwater	MWOF-3	TBD	961008-MWOF3___	Low-flow	Q					
Groundwater	MWOF-4	TBD	961008-MWOF4___	Low-flow	Q	Q				
Groundwater	MWOF-5	TBD	961008-MWOF5___	Low-flow	Q					
Groundwater	MW-xxx	TBD	961008-MWxxx___D	Low-flow	Q					
Groundwater	MW-xxx	TBD	961008-MWxxx___MS	Low-flow	Q					
Groundwater	MW-xxx	TBD	961008-MWxxx___MSD	Low-flow	Q					
Trip Blank	NA	NA	961008-TB-_-mmddyy	NA	Q					
New Monitoring Well Sampling										
Groundwater	MW-101	TBD	961008-MW101___	Low-flow	Q					
Groundwater	MW-102	TBD	961008-MW102___	Low-flow	Q					
Groundwater	MW-103	TBD	961008-MW103___	Low-flow	Q					
Groundwater	MW-104	TBD	961008-MW104___	Low-flow	Q	Q				
Groundwater	MW-105	TBD	961008-MW105___	Low-flow	Q					
Groundwater	MW-106	TBD	961008-MW106___	Low-flow	Q					
Groundwater	MW-107	TBD	961008-MW107___	Low-flow	Q					

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Table 3: Proposed Sample Identification, Analyses, and Analytical Methods

Media^	Location ID	Sample Depth (ft bgs)	Sample ID	Sample Method	Analytical Parameters and Methods: VOCs Method 8260	MNA[1]	Microbial Testing qPCR[2]	VOCs Method 5035	VOCs Method TO-15	IDW[3]
New Monitoring Well Sampling (continued)										
Groundwater	MW-108	TBD	961008-MW108___	Low-flow	Q					
Groundwater	MW-109	TBD	961008-MW109___	Low-flow	Q					
Groundwater	MW-110	TBD	961008-MW110___	Low-flow	Q					
Groundwater	MW-111	TBD	961008-MW111___	Low-flow	Q		1b			
Groundwater	MW-112	TBD	961008-MW112___	Low-flow	Q	Q	1b			
Groundwater	MW-xxx	TBD	961008-MWxxx___D	Low-flow	Q					
Groundwater	MW-xxx	TBD	961008-MWxxx___MS	Low-flow	Q					
Groundwater	MW-xxx	TBD	961008-MWxxx___MSD	Low-flow	Q					
Field Blank	NA	NA	961008-FB-_-mmddyy	NA	Q					
Trip Blank	NA	NA	961008-TB-_-mmddyy	NA	Q					
Sediment Sampling										
Sediment	SD-101	TBD	961008-SD101___	Grab	1b					
Sediment	SD-102	TBD	961008-SD102___	Grab	1b					
Sediment	TBD	TBD	961008-SDxxx___D	Grab	1b					
Sediment	TBD	TBD	961008-SDxxx___MS	Grab	1b					
Sediment	TBD	TBD	961008-SDxxx___MSD	Grab	1b					
Water	Trip Blank	NA	961008-TB-_-mmddyy	NA	1b					
Water	Rinsate Blank	NA	961008-RB-_-mmddyy	NA	1b					
Water	Field Blank	NA	961008-FB-_-mmddyy	NA	1b					
Porewater Sampling										
Porewater	PW-101	TBD	961008-PW101___	Grab	1b					
Porewater	PW-102	TBD	961008-PW102___	Grab	1b					
Porewater	PW-103	TBD	961008-PW103___	Grab	1b					
Porewater	PW-104	TBD	961008-PW104___	Grab	1b					
Porewater	PW-xxx	TBD	961008-PWxxx___D	Grab	1b					
Porewater	PW-xxx	TBD	961008-PWxxx___MS	Grab	1b					
Porewater	PW-xxx	TBD	961008-PWxxx___MSD	Grab	1b					
Trip Blank	NA	NA	961008-TB-_-mmddyy	NA	1b					

Notes:

Sample ID: < NYSDEC Site No.> (961008) | <Location ID> (e.g., MW101) | <sample depth> (ft bgs);___ to be determined in field

^ Field Quality Control samples (duplicates [D], matrix spike [MS], matrix spike duplicate [MSD]) will be collected at a frequency of 1 per 20 samples.

1 MNA parameters include: Total Organic Carbon by Method SM 5310B; Chloride, Sulfate, Nitrate, Nitrite by USEPA Method 300.0; Sulfide by Method SM 4500-S^{2-} D; Methane/Ethane/Ethene/CO_2 by Method RSK-175; Alkalinity by Method SM 2320B; Total Iron and Manganese by USEPA Method 6010C; Ferric and Ferrous Iron by Method SM 3500-Fe B.

2 qPCR DNA testing for Dehalococcoides (DHC), Dehalobacter spp (DHB), Dehalogenimonas spp (DHG) microbial populations, functional genes analysis for Vinyl Chloride Reductase (bvcA and vcrA) and TCE Reductase (tceA).

3 Investigation derived waste (IDW) analyses include: VOCs by USEPA Method 8260D; SVOCs by USEPA Method 8270E; Toxicity Characteristic Leaching Potential (TCLP) Metals by Method 1311; Mercury by USEPA Method 7471B; Polychlorinated Biphenyls by USEPA Method 8082A; Pesticides by USEPA Method 8081B; Total Cyanide by USEPA Method 9010C; Total Sulfide by Method SM 4500-S^2; pH by Method 9040C; Ignitability/Flashpoint; Per- and Polyfluoroalkyl Substances by Method 537; Herbicides by USEPA Method 8151A.

1 = one sampling event
1a = one sampling event (sampling of PDBs deployed after well development); to coincide with first quarterly sampling event.
1b = one sampling event (third quarter of first year)
Q = one year of quarterly sampling
NA = not applicable
TBD = to be determined

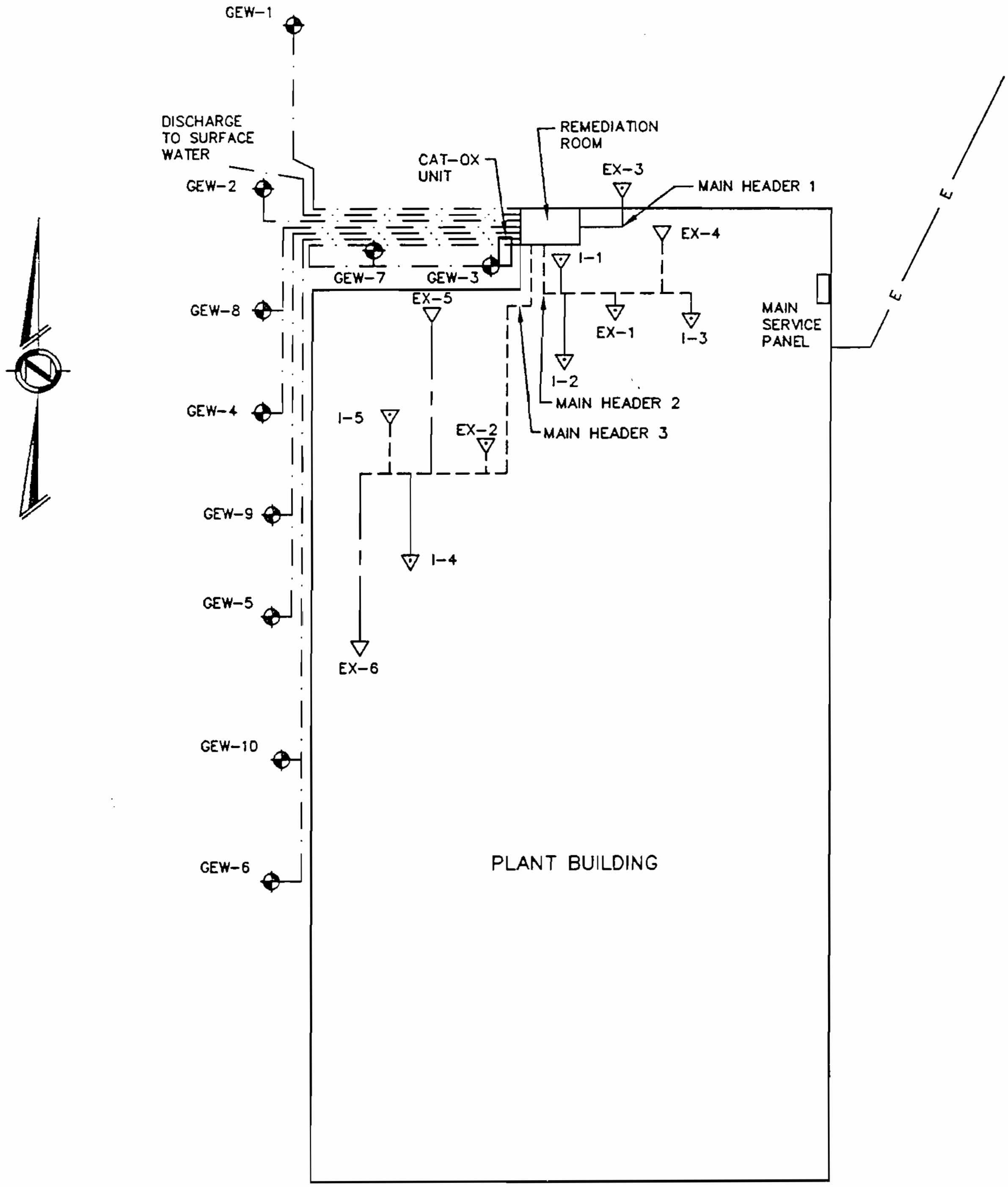
ft bgs = feet below ground surface
MNA = monitored natural attenuation
PDB = passive diffusion bag
qPCR = quantitative polymerase chain reaction
SVOCs = semi-volatile organic compounds
USEPA = United States Environmental Protection Agency
VOCs = volatile organic compounds

Created by: KT 11/01/22
Checked by: KA 08/03/23

ATTACHMENT 1

Historical GWET & SVET Systems Well Locations Figure, Conceptual Site Model – Geologic Cross Sections, Source Area Deep Boring Details, and Trichloroethene Concentrations in Groundwater Plume Maps 2018-2022

Historical GWET & SVET Systems Well Locations Figure



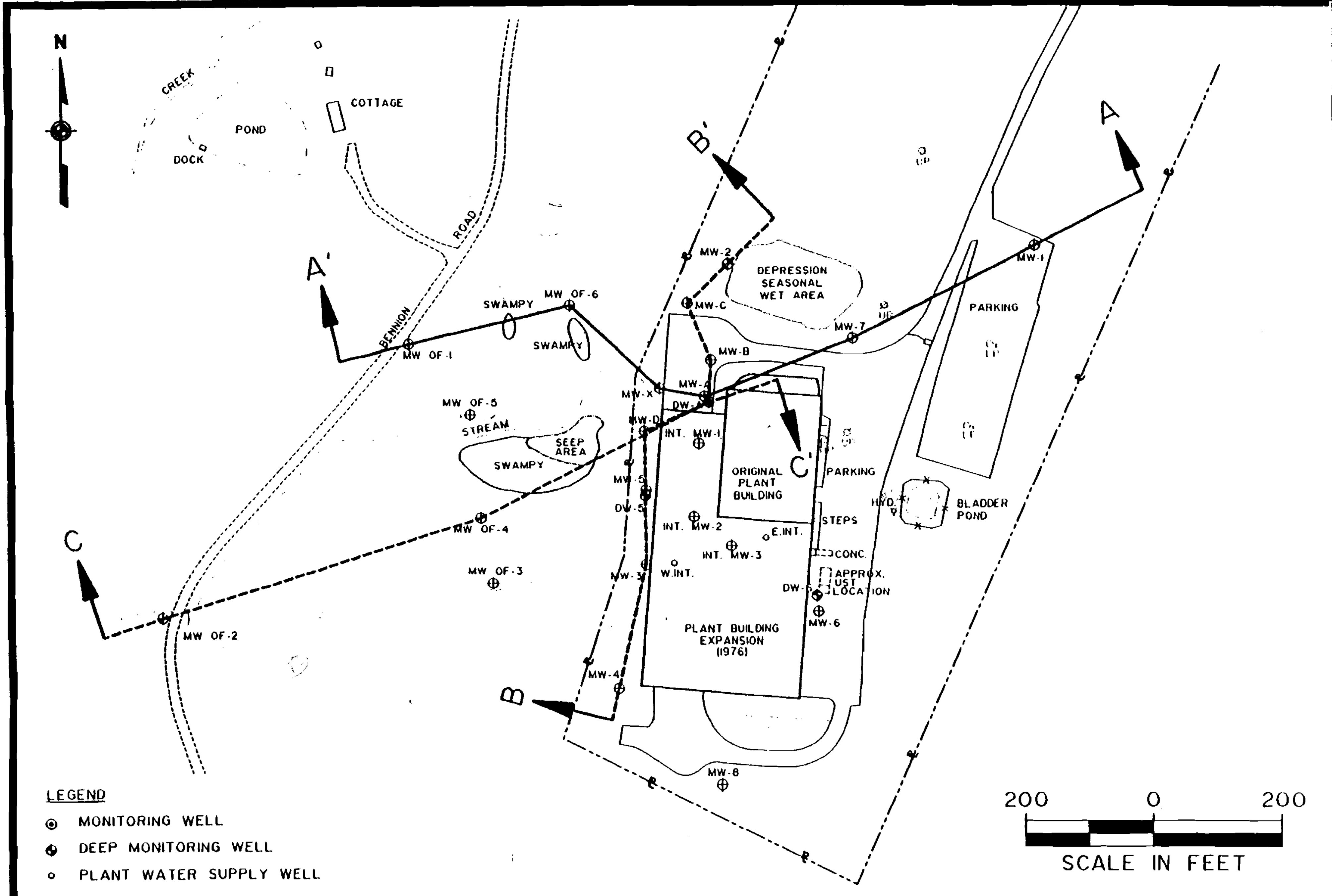
TYREE ORGANIZATION, Ltd.

ROBESON INDUSTRIES
GWET & SVET WELL LOCATIONS

SITE: ROBESON INDUSTRIES		SCALE: 1"=80'±
LOCATION: CASTILE, NEW YORK		PLATE:
CLIENT: N.Y.S.D.E.C.		FIGURE 1
DRW BY: RJS	DATE: 03/23/99	

Conceptual Site Model – Geologic Cross Sections

AC-5509 \35243.06\ 1=20 2/7/94-3-RAL

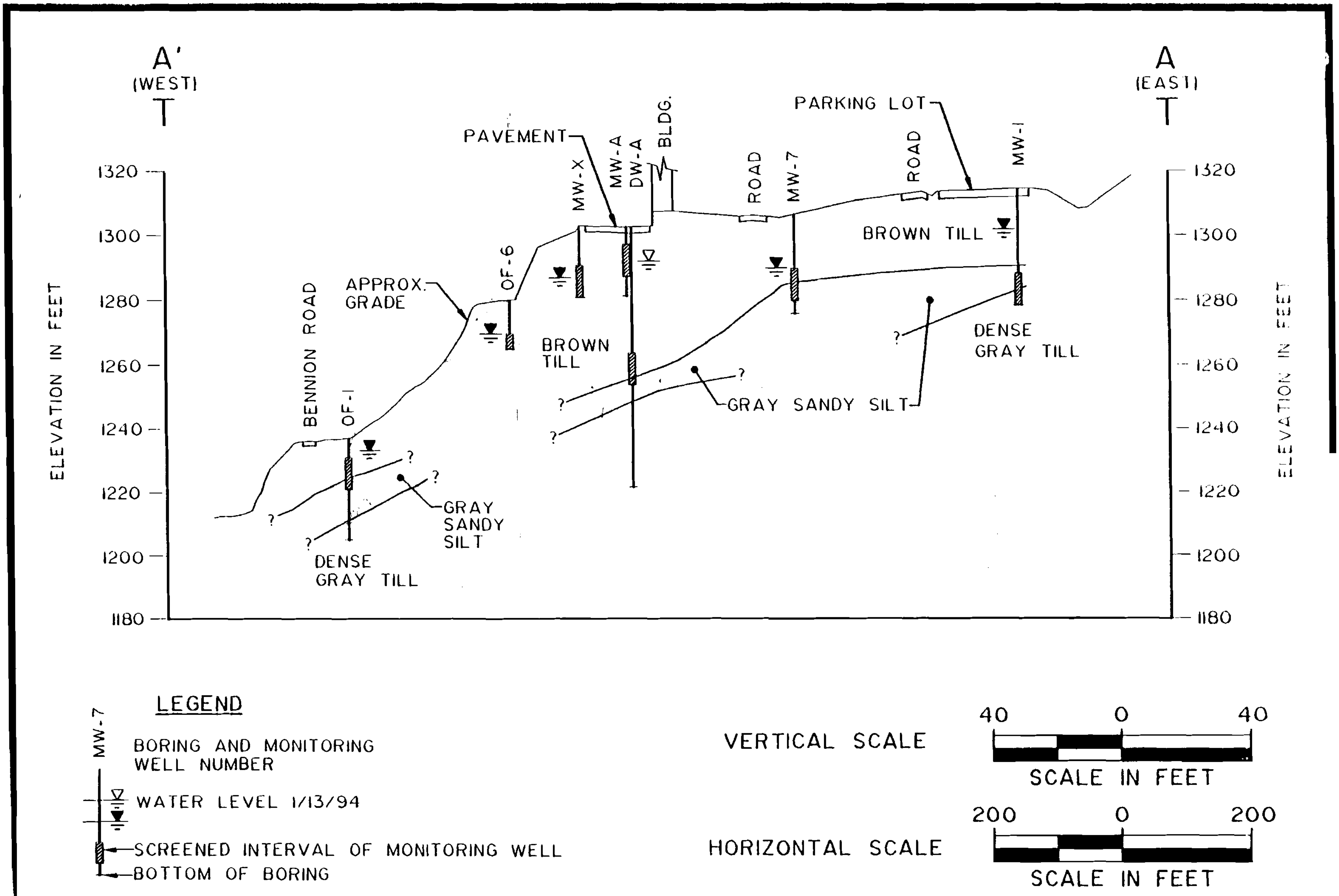


URS CONSULTANTS, INC.

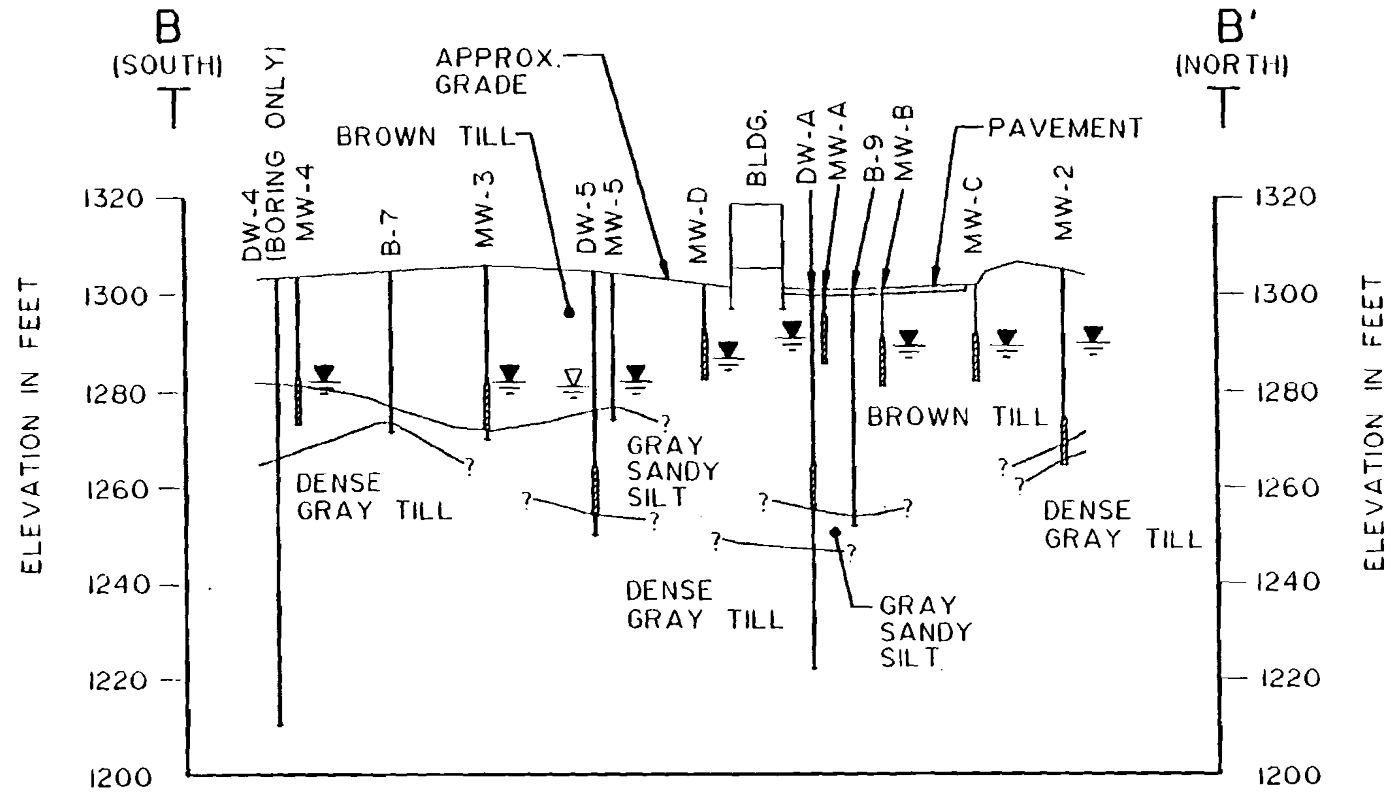
ROBESON INDUSTRIAL CORPORATION
CASTILE, NEW YORK
NYSDEC SITE No. 961008

SITE PLAN SHOWING CROSS SECTIONS

FIGURE 3-1



URS CONSULTANTS, INC.	ROBESON INDUSTRIAL CORPORATION CASTILE, NEW YORK NYSDEC SITE No. 961008	**CROSS SECTION A-A' (EAST-WEST)**	**FIGURE 3-2**



LEGEND

MW-5 BORING AND MONITORING WELL NUMBER

WATER LEVEL 1/13/94

SCREENED INTERVAL OF MONITORING WELL

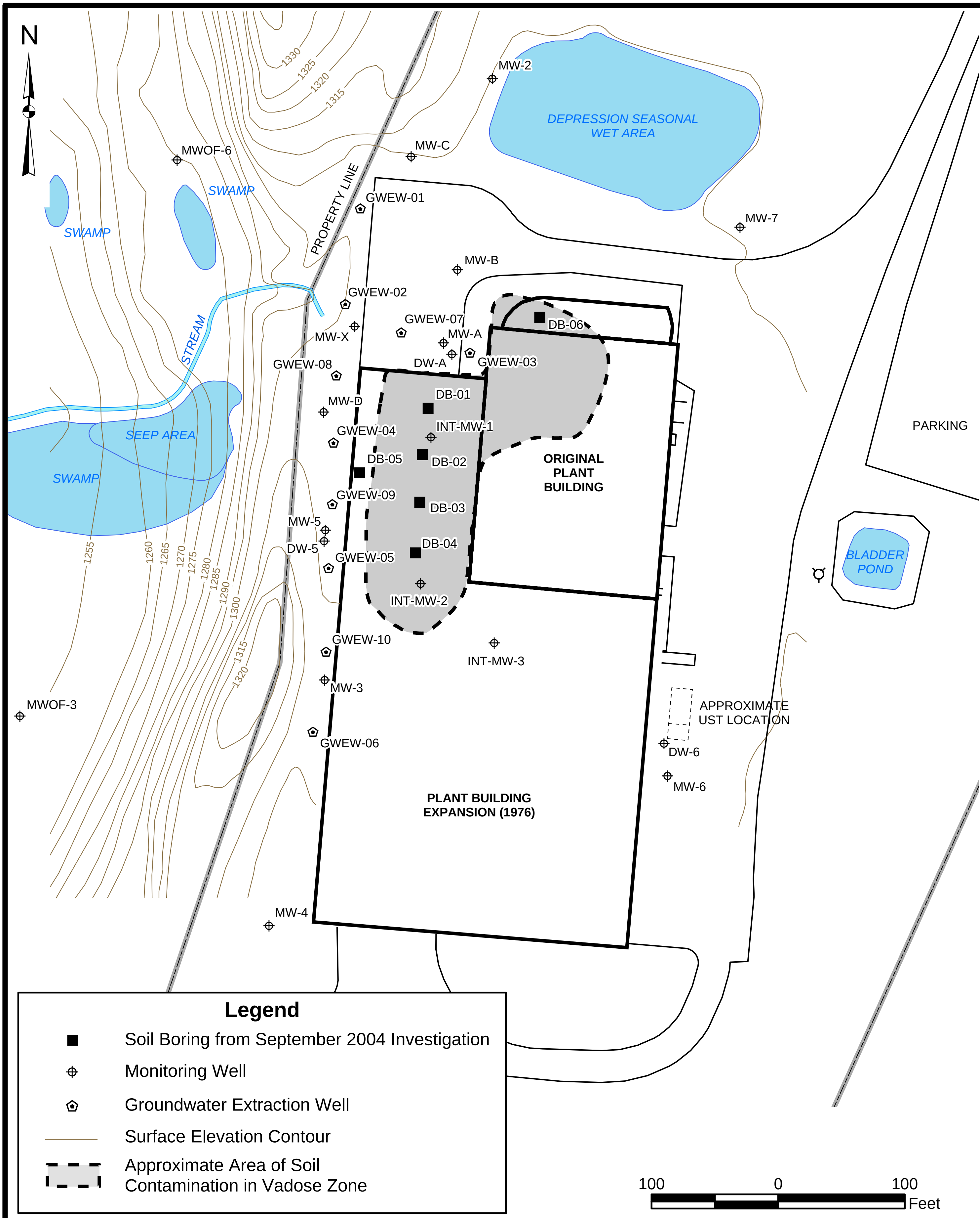
BOTTOM OF BORING

VERTICAL SCALE: 40 0 40 SCALE IN FEET

HORIZONTAL SCALE: 200 0 200 SCALE IN FEET

URS CONSULTANTS, INC.	ROBESON INDUSTRIAL CORPORATION CASTILE, NEW YORK NYSDEC SITE No. 961008	CROSS SECTION B-B' SOUTH-NORTH)	FIGURE 3-3

Source Area Deep Boring Details



Legend

- Soil Boring from September 2004 Investigation
- Monitoring Well
- Groundwater Extraction Well
- Surface Elevation Contour
- Approximate Area of Soil Contamination in Vadose Zone

URS

ROBESON INDUSTRIES - TOWN OF CASTILE
BORING LOCATIONS FOR SEPTEMBER
2004 INVESTIGATION

FIGURE 2-3

N:\11173790.00000\DB\GIS\BORING LOCATIONS FOR SEPTEMEBER 2004 INVESTIGATION.mxd
04/28/05

TABLE 2
VALIDATED SAMPLE RESULTS
SUPPLEMENTAL SOIL INVESTIGATION
ROBESON INDUSTRIES

Location ID		DB-01	DB-02	DB-02	DB-02	DB-03
Sample ID		DB-1(25-27)	DB-2(25-27)	DB-2(30-32)	DB-2(35-37)	DB-3(15-17)
Matrix		Soil	Soil	Soil	Soil	Soil
Depth Interval (ft)		25.0-27.0	25.0-27.0	30.0-32.0	35.0-37.0	15.0-17.0
Date Sampled		09/10/04	09/13/04	09/13/04	09/13/04	09/14/04
Parameter	**Units**					
Volatile Organic Compounds						
Chloromethane	UG/KG	12 U	12 UJ	12 U	12 UJ	11 U
Vinyl chloride	UG/KG	12 U	12 UJ	12 U	12 UJ	11 U
Chloroethane	UG/KG	12 U	12 U	12 U	12 UJ	11 U
Bromomethane	UG/KG	12 U	12 U	12 U	12 UJ	11 U
Trichlorofluoromethane	UG/KG	12 U	12 U	12 U	12 UJ	11 U
1,1,2-Trichloro-1,2,2-trifluoroethane	UG/KG	12 U	12 U	12 U	12 UJ	11 U
Dichlorodifluoromethane	UG/KG	12 U	12 U	12 U	12 UJ	11 U
1,1-Dichloroethene	UG/KG	12 U	12 U	12 U	8 J	11 U
Acetone	UG/KG	8 J	18 J	9 J	14 J	6 J
Carbon disulfide	UG/KG	12 U	12 U	12 U	12 UJ	11 U
Methylene chloride	UG/KG	12 U	12 U	12 U	12 UJ	11 U
1,1-Dichloroethane	UG/KG	12 U	12 U	12 U	7 J	11 U
1,2-Dichloroethene (cis)	UG/KG	3 J	12 U	3 J	7 J	14
1,2-Dichloroethene (trans)	UG/KG	12 U	12 U	12 U	12 UJ	11 U
2-Butanone	UG/KG	12 U	12 U	12 U	12 UJ	11 U
Chloroform	UG/KG	12 U	12 U	12 U	12 UJ	11 U
1,1,1-Trichloroethane	UG/KG	83	12 U	45	2,700 DJ	11 U
Carbon tetrachloride	UG/KG	12 U	12 U	12 U	12 UJ	11 U
Benzene	UG/KG	12 U	12 U	12 U	12 UJ	11 U
1,2-Dichloroethane	UG/KG	12 U	12 U	12 U	12 UJ	11 U
1,2-Dibromoethane	UG/KG	12 U	12 U	12 U	12 UJ	11 U
Trichloroethene	UG/KG	11,000 DJ	170	6,100 D	43,000 D	1,500 D
1,2-Dichloropropane	UG/KG	12 U	12 U	12 U	12 UJ	11 U

Flags assigned during chemistry validation are shown.

MADE BY _AMK_11/22/04_______
CHKD BY _JJL_11/29/04________

Detection Limits shown are MDL

TABLE 2
VALIDATED SAMPLE RESULTS
SUPPLEMENTAL SOIL INVESTIGATION
ROBESON INDUSTRIES

Location ID		DB-01	DB-02	DB-02	DB-02	DB-03
Sample ID		DB-1(25-27)	DB-2(25-27)	DB-2(30-32)	DB-2(35-37)	DB-3(15-17)
Matrix		Soil	Soil	Soil	Soil	Soil
Depth Interval (ft)		25.0-27.0	25.0-27.0	30.0-32.0	35.0-37.0	15.0-17.0
Date Sampled		09/10/04	09/13/04	09/13/04	09/13/04	09/14/04
Parameter	**Units**					
Volatile Organic Compounds						
Bromodichloromethane	UG/KG	12 U	12 U	12 U	12 UJ	11 U
cis-1,3-Dichloropropene	UG/KG	12 U	12 U	12 U	12 UJ	11 U
Cyclohexane	UG/KG	12 U	12 U	12 U	12 UJ	11 U
4-Methyl-2-pentanone	UG/KG	12 U	12 U	12 U	12 UJ	11 U
Toluene	UG/KG	2 J	7 J	12 U	2 J	1 J
trans-1,3-Dichloropropene	UG/KG	12 U	12 U	12 U	12 UJ	11 U
1,1,2-Trichloroethane	UG/KG	12 U	12 U	12 U	12 UJ	11 U
Tetrachloroethene	UG/KG	12 U	12 U	12 U	12 UJ	11 U
2-Hexanone	UG/KG	12 U	12 U	12 U	12 UJ	11 U
Dibromochloromethane	UG/KG	12 U	12 U	12 U	12 UJ	11 U
Chlorobenzene	UG/KG	12 U	12 U	12 U	12 UJ	11 U
Ethylbenzene	UG/KG	12 U	12 U	12 U	12 UJ	11 U
Styrene	UG/KG	12 U	12 U	12 U	12 UJ	11 U
Bromoform	UG/KG	12 U	12 U	12 U	12 UJ	11 U
1,1,2,2-Tetrachloroethane	UG/KG	12 U	12 U	12 U	12 UJ	11 U
Xylene (total)	UG/KG	12 U	12 U	12 U	12 UJ	11 U
1,2-Dichlorobenzene	UG/KG	12 U	12 U	12 U	12 UJ	11 U
1,3-Dichlorobenzene	UG/KG	12 U	12 U	12 U	12 UJ	11 U
1,4-Dichlorobenzene	UG/KG	12 U	12 U	12 U	12 UJ	11 U
1,2,4-Trichlorobenzene	UG/KG	12 U	12 U	12 U	12 UJ	11 U
Isopropylbenzene	UG/KG	12 U	12 U	12 U	12 UJ	11 U
Methyl acetate	UG/KG	12 U	12 U	12 U	12 UJ	11 U
Methyl t-butyl ether	UG/KG	12 U	12 U	12 U	12 UJ	11 U

Flags assigned during chemistry validation are shown.

MADE BY _AMK_11/22/04_______
CHKD BY _JJL_11/29/04________

Detection Limits shown are MDL

TABLE 2
VALIDATED SAMPLE RESULTS
SUPPLEMENTAL SOIL INVESTIGATION
ROBESON INDUSTRIES

Location ID		DB-01	DB-02	DB-02	DB-02	DB-03
Sample ID		DB-1(25-27)	DB-2(25-27)	DB-2(30-32)	DB-2(35-37)	DB-3(15-17)
Matrix		Soil	Soil	Soil	Soil	Soil
Depth Interval (ft)		25.0-27.0	25.0-27.0	30.0-32.0	35.0-37.0	15.0-17.0
Date Sampled		09/10/04	09/13/04	09/13/04	09/13/04	09/14/04
Parameter	Units					
Volatile Organic Compounds						
Methylcyclohexane	UG/KG	12 U	12 U	12 U	12 UJ	11 U
1,2-Dibromo-3-chloropropane	UG/KG	12 U	12 UJ	12 U	12 UJ	11 U

Flags assigned during chemistry validation are shown.

MADE BY _AMK_11/22/04_______
CHKD BY _JJL_11/29/04________

Detection Limits shown are MDL

TABLE 2
VALIDATED SAMPLE RESULTS
SUPPLEMENTAL SOIL INVESTIGATION
ROBESON INDUSTRIES

Location ID		DB-03	DB-04	DB-04	DB-05	DB-05
Sample ID		DB-3(25-27)	DB-4(10-12)	DB-4(25-27)	DB-5(25-27)	DB-5(30-32)
Matrix		Soil	Soil	Soil	Soil	Soil
Depth Interval (ft)		25.0-27.0	10.0-12.0	25.0-27.0	25.0-27.0	30.0-32.0
Date Sampled		09/14/04	09/15/04	09/15/04	09/15/04	09/15/04
Parameter	**Units**					
Volatile Organic Compounds						
Chloromethane	UG/KG	12 U	11 UJ	12 U	12 U	12 U
Vinyl chloride	UG/KG	12 U	11 UJ	12 U	12 U	12 U
Chloroethane	UG/KG	12 U	11 U	12 U	12 U	12 U
Bromomethane	UG/KG	12 U	11 U	12 U	12 U	12 U
Trichlorofluoromethane	UG/KG	12 U	11 U	12 U	12 U	12 U
1,1,2-Trichloro-1,2,2-trifluoroethane	UG/KG	12 U	11 U	12 U	12 U	12 U
Dichlorodifluoromethane	UG/KG	12 U	11 U	12 U	12 U	12 U
1,1-Dichloroethene	UG/KG	12 U	11 U	12 U	12 U	12 U
Acetone	UG/KG	8 J	11 UJ	12 U	12 U	12 U
Carbon disulfide	UG/KG	12 U	11 U	12 U	12 U	12 U
Methylene chloride	UG/KG	12 U	11 U	12 U	12 U	12 U
1,1-Dichloroethane	UG/KG	12 U	11 U	12 U	12 U	12 U
1,2-Dichloroethene (cis)	UG/KG	11 J	11 U	36	17	22
1,2-Dichloroethene (trans)	UG/KG	12 U	11 U	12 U	12 U	12 U
2-Butanone	UG/KG	12 U	11 U	12 U	12 U	12 U
Chloroform	UG/KG	12 U	11 U	12 U	12 U	12 U
1,1,1-Trichloroethane	UG/KG	6 J	11 U	12 U	12 U	25
Carbon tetrachloride	UG/KG	12 U	11 U	12 U	12 U	12 U
Benzene	UG/KG	12 U	11 U	12 U	12 U	12 U
1,2-Dichloroethane	UG/KG	12 U	11 U	12 U	12 U	12 U
1,2-Dibromoethane	UG/KG	12 U	11 U	12 U	12 U	12 U
Trichloroethene	UG/KG	8,100 D	41	3,400 D	6,300 D	6,100 D
1,2-Dichloropropane	UG/KG	12 U	11 U	12 U	12 U	12 U

Flags assigned during chemistry validation are shown.

MADE BY _AMK_11/22/04_______
CHKD BY _JJL_11/29/04________

Detection Limits shown are MDL

TABLE 2
VALIDATED SAMPLE RESULTS
SUPPLEMENTAL SOIL INVESTIGATION
ROBESON INDUSTRIES

Location ID		DB-03	DB-04	DB-04	DB-05	DB-05
Sample ID		DB-3(25-27)	DB-4(10-12)	DB-4(25-27)	DB-5(25-27)	DB-5(30-32)
Matrix		Soil	Soil	Soil	Soil	Soil
Depth Interval (ft)		25.0-27.0	10.0-12.0	25.0-27.0	25.0-27.0	30.0-32.0
Date Sampled		09/14/04	09/15/04	09/15/04	09/15/04	09/15/04
Parameter	Units					
Volatile Organic Compounds						
Bromodichloromethane	UG/KG	12 U	11 U	12 U	12 U	12 U
cis-1,3-Dichloropropene	UG/KG	12 U	11 U	12 U	12 U	12 U
Cyclohexane	UG/KG	12 U	11 U	12 U	12 U	12 U
4-Methyl-2-pentanone	UG/KG	12 U	11 U	12 U	12 U	12 U
Toluene	UG/KG	12 U	5 J	12 U	12 U	1 J
trans-1,3-Dichloropropene	UG/KG	12 U	11 U	12 U	12 U	12 U
1,1,2-Trichloroethane	UG/KG	12 U	11 U	12 U	12 U	12 U
Tetrachloroethene	UG/KG	4 J	11 U	12 U	1 J	12 U
2-Hexanone	UG/KG	12 U	11 U	12 U	12 U	12 U
Dibromochloromethane	UG/KG	12 U	11 U	12 U	12 U	12 U
Chlorobenzene	UG/KG	12 U	11 U	12 U	12 U	12 U
Ethylbenzene	UG/KG	12 U	11 U	12 U	12 U	12 U
Styrene	UG/KG	12 U	11 U	12 U	12 U	12 U
Bromoform	UG/KG	12 U	11 U	12 U	12 U	12 U
1,1,2,2-Tetrachloroethane	UG/KG	12 U	11 UJ	12 U	12 U	12 U
Xylene (total)	UG/KG	12 U	11 U	12 U	12 U	12 U
1,2-Dichlorobenzene	UG/KG	12 U	11 U	12 U	12 U	12 U
1,3-Dichlorobenzene	UG/KG	12 U	11 U	12 U	12 U	12 U
1,4-Dichlorobenzene	UG/KG	12 U	11 U	12 U	12 U	12 U
1,2,4-Trichlorobenzene	UG/KG	12 U	11 U	12 U	12 U	12 U
Isopropylbenzene	UG/KG	12 U	11 U	12 U	12 U	12 U
Methyl acetate	UG/KG	12 U	11 U	12 U	12 U	12 U
Methyl t-butyl ether	UG/KG	12 U	11 U	12 U	12 U	12 U

Flags assigned during chemistry validation are shown.

MADE BY _AMK_11/22/04_______
CHKD BY _JJL_11/29/04________

Detection Limits shown are MDL

TABLE 2
VALIDATED SAMPLE RESULTS
SUPPLEMENTAL SOIL INVESTIGATION
ROBESON INDUSTRIES

Location ID		DB-03	DB-04	DB-04	DB-05	DB-05
Sample ID		DB-3(25-27)	DB-4(10-12)	DB-4(25-27)	DB-5(25-27)	DB-5(30-32)
Matrix		Soil	Soil	Soil	Soil	Soil
Depth Interval (ft)		25.0-27.0	10.0-12.0	25.0-27.0	25.0-27.0	30.0-32.0
Date Sampled		09/14/04	09/15/04	09/15/04	09/15/04	09/15/04
Parameter	Units					
Volatile Organic Compounds						
Methylcyclohexane	UG/KG	12 U	11 U	12 U	12 U	12 U
1,2-Dibromo-3-chloropropane	UG/KG	12 U	11 U	12 U	12 U	12 U

Flags assigned during chemistry validation are shown.

MADE BY _AMK_11/22/04_______
CHKD BY _JJL_11/29/04________

Detection Limits shown are MDL

TABLE 2
VALIDATED SAMPLE RESULTS
SUPPLEMENTAL SOIL INVESTIGATION
ROBESON INDUSTRIES

Location ID		DB-05	DB-06	DB-06	SG-03	SG-08
Sample ID		DB-5(40-42)	DB-6(20-22)	DB-6(30-32)	SG-3(3-4)	SG-8(12-14)
Matrix		Soil	Soil	Soil	Soil	Soil
Depth Interval (ft)		40.0-42.0	20.0-22.0	30.0-32.0	3.0-4.0	12.0-14.0
Date Sampled		09/15/04	09/16/04	09/16/04	09/22/04	09/22/04
Parameter	Units					
Volatile Organic Compounds						
Chloromethane	UG/KG	12 U	12 U	12 U	12 UJ	11 U
Vinyl chloride	UG/KG	12 U	12 U	12 U	12 UJ	11 U
Chloroethane	UG/KG	12 U	12 U	12 U	12 UJ	11 U
Bromomethane	UG/KG	12 U	12 U	12 U	12 U	11 U
Trichlorofluoromethane	UG/KG	12 U	12 U	12 U	12 U	11 U
1,1,2-Trichloro-1,2,2-trifluoroethane	UG/KG	12 U	12 U	12 U	12 U	11 U
Dichlorodifluoromethane	UG/KG	12 U	12 U	12 U	12 U	11 U
1,1-Dichloroethene	UG/KG	82	12 U	150	12 U	11 U
Acetone	UG/KG	12 U	6 J	14	12 U	11 U
Carbon disulfide	UG/KG	4 J	12 U	9 J	12 U	11 U
Methylene chloride	UG/KG	16 U	12 U	12 U	12 U	11 U
1,1-Dichloroethane	UG/KG	170	12 U	710 DJ	12 U	11 U
1,2-Dichloroethene (cis)	UG/KG	5 J	12 U	6 J	12 U	11 U
1,2-Dichloroethene (trans)	UG/KG	12 U	12 U	12 U	12 U	11 U
2-Butanone	UG/KG	12 U	12 U	12 U	12 U	11 U
Chloroform	UG/KG	12 U	12 U	12 U	12 U	11 U
1,1,1-Trichloroethane	UG/KG	1,200 DJ	860 DJ	210	12 U	11 U
Carbon tetrachloride	UG/KG	12 U	12 U	12 U	12 U	11 U
Benzene	UG/KG	12 U	12 U	12 U	12 U	11 U
1,2-Dichloroethane	UG/KG	12 U	12 U	12 U	12 U	11 U
1,2-Dibromoethane	UG/KG	12 U	12 U	12 U	12 U	11 U
Trichloroethene	UG/KG	19,000 D	3,500 D	18,000 D	12 U	11 U
1,2-Dichloropropane	UG/KG	12 U	12 U	12 U	12 U	11 U

Flags assigned during chemistry validation are shown.

MADE BY _AMK_11/22/04_______
CHKD BY _JJL_11/29/04________

Detection Limits shown are MDL

TABLE 2
VALIDATED SAMPLE RESULTS
SUPPLEMENTAL SOIL INVESTIGATION
ROBESON INDUSTRIES

Location ID		DB-05	DB-06	DB-06	SG-03	SG-08
Sample ID		DB-5(40-42)	DB-6(20-22)	DB-6(30-32)	SG-3(3-4)	SG-8(12-14)
Matrix		Soil	Soil	Soil	Soil	Soil
Depth Interval (ft)		40.0-42.0	20.0-22.0	30.0-32.0	3.0-4.0	12.0-14.0
Date Sampled		09/15/04	09/16/04	09/16/04	09/22/04	09/22/04
Parameter	**Units**					
Volatile Organic Compounds						
Bromodichloromethane	UG/KG	12 U	12 U	12 U	12 U	11 U
cis-1,3-Dichloropropene	UG/KG	12 U	12 U	12 U	12 U	11 U
Cyclohexane	UG/KG	12 U	12 U	12 U	12 U	11 U
4-Methyl-2-pentanone	UG/KG	12 U	12 U	12 U	12 U	11 U
Toluene	UG/KG	1 J	2 J	1 J	12 U	11 U
trans-1,3-Dichloropropene	UG/KG	12 U	12 U	12 U	12 U	11 U
1,1,2-Trichloroethane	UG/KG	12 U	12 U	12 U	12 U	11 U
Tetrachloroethene	UG/KG	12 U	12 U	12 U	12 U	11 U
2-Hexanone	UG/KG	12 U	12 U	12 U	12 U	11 U
Dibromochloromethane	UG/KG	12 U	12 U	12 U	12 U	11 U
Chlorobenzene	UG/KG	12 U	12 U	12 U	12 U	11 U
Ethylbenzene	UG/KG	12 U	12 U	12 U	12 U	11 U
Styrene	UG/KG	12 U	12 U	12 U	12 U	11 U
Bromoform	UG/KG	12 U	12 U	12 U	12 U	11 U
1,1,2,2-Tetrachloroethane	UG/KG	12 U	12 U	12 U	12 U	11 U
Xylene (total)	UG/KG	12 U	12 U	12 U	12 U	11 U
1,2-Dichlorobenzene	UG/KG	12 U	12 U	12 U	12 U	11 U
1,3-Dichlorobenzene	UG/KG	12 U	12 U	12 U	12 U	11 U
1,4-Dichlorobenzene	UG/KG	12 U	12 U	12 U	12 U	11 U
1,2,4-Trichlorobenzene	UG/KG	12 U	12 U	12 U	12 U	11 U
Isopropylbenzene	UG/KG	12 U	12 U	12 U	12 U	11 U
Methyl acetate	UG/KG	12 U	12 U	12 U	12 U	11 U
Methyl t-butyl ether	UG/KG	12 U	12 U	12 U	12 U	11 U

Flags assigned during chemistry validation are shown.

MADE BY _AMK_11/22/04_______
CHKD BY _JJL_11/29/04________

Detection Limits shown are MDL

TABLE 2
VALIDATED SAMPLE RESULTS
SUPPLEMENTAL SOIL INVESTIGATION
ROBESON INDUSTRIES

Location ID		DB-05	DB-06	DB-06	SG-03	SG-08
Sample ID		DB-5(40-42)	DB-6(20-22)	DB-6(30-32)	SG-3(3-4)	SG-8(12-14)
Matrix		Soil	Soil	Soil	Soil	Soil
Depth Interval (ft)		40.0-42.0	20.0-22.0	30.0-32.0	3.0-4.0	12.0-14.0
Date Sampled		09/15/04	09/16/04	09/16/04	09/22/04	09/22/04
Parameter	**Units**					
Volatile Organic Compounds						
Methylcyclohexane	UG/KG	12 U	12 U	12 U	12 U	11 U
1,2-Dibromo-3-chloropropane	UG/KG	12 U	12 U	12 U	12 U	11 U

Flags assigned during chemistry validation are shown.

MADE BY _AMK_11/22/04_______
CHKD BY _JJL_11/29/04________

Detection Limits shown are MDL

TABLE 2
VALIDATED SAMPLE RESULTS
SUPPLEMENTAL SOIL INVESTIGATION
ROBESON INDUSTRIES

Location ID		SG-11	SG-11	SG-17	SG-17	SG-22
Sample ID		SG-11(7-8)	SG-11(11-12)	SG-17(7-8)	SG-17(11-12)	SG-22(0-4)
Matrix		Soil	Soil	Soil	Soil	Soil
Depth Interval (ft)		7.0-8.0	11.0-12.0	7.0-8.0	11.0-12.0	0.0-4.0
Date Sampled		09/22/04	09/22/04	09/22/04	09/22/04	09/22/04
Parameter	**Units**					
Volatile Organic Compounds						
Chloromethane	UG/KG	12 UJ	11 UJ	12 UJ	12 UJ	11 UJ
Vinyl chloride	UG/KG	12 UJ	11 UJ	12 UJ	12 UJ	11 UJ
Chloroethane	UG/KG	12 UJ	11 UJ	12 UJ	12 UJ	11 UJ
Bromomethane	UG/KG	12 U	11 U	12 U	12 U	11 U
Trichlorofluoromethane	UG/KG	12 U	11 U	12 U	12 U	11 U
1,1,2-Trichloro-1,2,2-trifluoroethane	UG/KG	12 U	11 U	12 U	12 U	11 U
Dichlorodifluoromethane	UG/KG	12 U	11 U	12 U	12 U	11 U
1,1-Dichloroethene	UG/KG	12 U	11 U	12 U	12 U	11 U
Acetone	UG/KG	17 U	11 U	12 U	16 U	11 U
Carbon disulfide	UG/KG	12 U	11 U	12 U	12 U	11 U
Methylene chloride	UG/KG	12 U	11 U	12 U	15 U	15 U
1,1-Dichloroethane	UG/KG	12 U	11 U	12 U	12 U	11 U
1,2-Dichloroethene (cis)	UG/KG	12 U	11 U	12 U	12 U	11 U
1,2-Dichloroethene (trans)	UG/KG	12 U	11 U	12 U	12 U	11 U
2-Butanone	UG/KG	12 U	11 U	12 U	12 U	11 U
Chloroform	UG/KG	12 U	11 U	12 U	12 U	11 U
1,1,1-Trichloroethane	UG/KG	12 U	11 U	12 U	12 U	11 U
Carbon tetrachloride	UG/KG	12 U	11 U	12 U	12 U	11 U
Benzene	UG/KG	12 U	11 U	12 U	12 U	11 U
1,2-Dichloroethane	UG/KG	12 U	11 U	12 U	12 U	11 U
1,2-Dibromoethane	UG/KG	12 U	11 U	12 U	12 U	11 U
Trichloroethene	UG/KG	12 U	11 U	12 U	12 U	11 U
1,2-Dichloropropane	UG/KG	12 U	11 U	12 U	12 U	11 U

Flags assigned during chemistry validation are shown.

MADE BY _AMK_11/22/04_______
CHKD BY _JJL_11/29/04________

Detection Limits shown are MDL

TABLE 2
VALIDATED SAMPLE RESULTS
SUPPLEMENTAL SOIL INVESTIGATION
ROBESON INDUSTRIES

Location ID		SG-11	SG-11	SG-17	SG-17	SG-22
Sample ID		SG-11(7-8)	SG-11(11-12)	SG-17(7-8)	SG-17(11-12)	SG-22(0-4)
Matrix		Soil	Soil	Soil	Soil	Soil
Depth Interval (ft)		7.0-8.0	11.0-12.0	7.0-8.0	11.0-12.0	0.0-4.0
Date Sampled		09/22/04	09/22/04	09/22/04	09/22/04	09/22/04
Parameter	Units					
Volatile Organic Compounds						
Bromodichloromethane	UG/KG	12 U	11 U	12 U	12 U	11 U
cis-1,3-Dichloropropene	UG/KG	12 U	11 U	12 U	12 U	11 U
Cyclohexane	UG/KG	12 U	11 U	12 U	12 U	11 U
4-Methyl-2-pentanone	UG/KG	12 U	11 U	12 U	12 U	11 U
Toluene	UG/KG	12 U	11 U	12 U	12 U	11 U
trans-1,3-Dichloropropene	UG/KG	12 U	11 U	12 U	12 U	11 U
1,1,2-Trichloroethane	UG/KG	12 U	11 U	12 U	12 U	11 U
Tetrachloroethene	UG/KG	12 U	11 U	12 U	12 U	11 U
2-Hexanone	UG/KG	12 U	11 U	12 U	12 U	11 U
Dibromochloromethane	UG/KG	12 U	11 U	12 U	12 U	11 U
Chlorobenzene	UG/KG	12 U	11 U	12 U	12 U	11 U
Ethylbenzene	UG/KG	12 U	11 U	12 U	12 U	11 U
Styrene	UG/KG	12 U	11 U	12 U	12 U	11 U
Bromoform	UG/KG	12 U	11 U	12 U	12 U	11 U
1,1,2,2-Tetrachloroethane	UG/KG	12 U	11 U	12 U	12 U	11 U
Xylene (total)	UG/KG	12 U	11 U	12 U	12 U	11 U
1,2-Dichlorobenzene	UG/KG	12 U	11 U	12 U	12 U	11 U
1,3-Dichlorobenzene	UG/KG	12 U	11 U	12 U	12 U	11 U
1,4-Dichlorobenzene	UG/KG	12 U	11 U	12 U	12 U	11 U
1,2,4-Trichlorobenzene	UG/KG	12 U	11 U	12 U	12 U	11 U
Isopropylbenzene	UG/KG	12 U	11 U	12 U	12 U	11 U
Methyl acetate	UG/KG	12 U	11 U	12 U	12 U	11 U
Methyl t-butyl ether	UG/KG	12 U	11 U	12 U	12 U	11 U

Flags assigned during chemistry validation are shown.

MADE BY _AMK_11/22/04_______
CHKD BY _JJL_11/29/04________

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Detection Limits shown are MDL

TABLE 2
VALIDATED SAMPLE RESULTS
SUPPLEMENTAL SOIL INVESTIGATION
ROBESON INDUSTRIES

Location ID		SG-11	SG-11	SG-17	SG-17	SG-22
Sample ID		SG-11(7-8)	SG-11(11-12)	SG-17(7-8)	SG-17(11-12)	SG-22(0-4)
Matrix		Soil	Soil	Soil	Soil	Soil
Depth Interval (ft)		7.0-8.0	11.0-12.0	7.0-8.0	11.0-12.0	0.0-4.0
Date Sampled		09/22/04	09/22/04	09/22/04	09/22/04	09/22/04
Parameter	Units					
Volatile Organic Compounds						
Methylcyclohexane	UG/KG	12 U	11 U	12 U	12 U	11 U
1,2-Dibromo-3-chloropropane	UG/KG	12 U	11 U	12 U	12 U	11 U

Flags assigned during chemistry validation are shown.

MADE BY _AMK_11/22/04_______
CHKD BY _JJL_11/29/04________

Detection Limits shown are MDL

TABLE 2
VALIDATED SAMPLE RESULTS
SUPPLEMENTAL SOIL INVESTIGATION
ROBESON INDUSTRIES

Location ID		SG-22
Sample ID		SG-22(7-8)
Matrix		Soil
Depth Interval (ft)		7.0-8.0
Date Sampled		09/22/04
Parameter	Units	
Volatile Organic Compounds		
Chloromethane	UG/KG	12 UJ
Vinyl chloride	UG/KG	12 UJ
Chloroethane	UG/KG	12 UJ
Bromomethane	UG/KG	12 U
Trichlorofluoromethane	UG/KG	12 U
1,1,2-Trichloro-1,2,2-trifluoroethane	UG/KG	12 U
Dichlorodifluoromethane	UG/KG	12 U
1,1-Dichloroethene	UG/KG	12 U
Acetone	UG/KG	13 U
Carbon disulfide	UG/KG	12 U
Methylene chloride	UG/KG	14 U
1,1-Dichloroethane	UG/KG	12 U
1,2-Dichloroethene (cis)	UG/KG	12 U
1,2-Dichloroethene (trans)	UG/KG	12 U
2-Butanone	UG/KG	12 U
Chloroform	UG/KG	12 U
1,1,1-Trichloroethane	UG/KG	12 U
Carbon tetrachloride	UG/KG	12 U
Benzene	UG/KG	12 U
1,2-Dichloroethane	UG/KG	12 U
1,2-Dibromoethane	UG/KG	12 U
Trichloroethene	UG/KG	12 U
1,2-Dichloropropane	UG/KG	12 U

Flags assigned during chemistry validation are shown.

MADE BY _AMK_11/22/04_______
CHKD BY _JJL_11/29/04________

Detection Limits shown are MDL

TABLE 2
VALIDATED SAMPLE RESULTS
SUPPLEMENTAL SOIL INVESTIGATION
ROBESON INDUSTRIES

Location ID		SG-22
Sample ID		SG-22(7-8)
Matrix		Soil
Depth Interval (ft)		7.0-8.0
Date Sampled		09/22/04
Parameter	**Units**	
Volatile Organic Compounds		
Bromodichloromethane	UG/KG	12 U
cis-1,3-Dichloropropene	UG/KG	12 U
Cyclohexane	UG/KG	12 U
4-Methyl-2-pentanone	UG/KG	12 U
Toluene	UG/KG	12 U
trans-1,3-Dichloropropene	UG/KG	12 U
1,1,2-Trichloroethane	UG/KG	12 U
Tetrachloroethene	UG/KG	12 U
2-Hexanone	UG/KG	12 U
Dibromochloromethane	UG/KG	12 U
Chlorobenzene	UG/KG	12 U
Ethylbenzene	UG/KG	12 U
Styrene	UG/KG	12 U
Bromoform	UG/KG	12 U
1,1,2,2-Tetrachloroethane	UG/KG	12 U
Xylene (total)	UG/KG	12 U
1,2-Dichlorobenzene	UG/KG	12 U
1,3-Dichlorobenzene	UG/KG	12 U
1,4-Dichlorobenzene	UG/KG	12 U
1,2,4-Trichlorobenzene	UG/KG	12 U
Isopropylbenzene	UG/KG	12 U
Methyl acetate	UG/KG	12 U
Methyl t-butyl ether	UG/KG	12 U

Flags assigned during chemistry validation are shown.

MADE BY _AMK_11/22/04_______
CHKD BY _JJL_11/29/04________

Detection Limits shown are MDL

TABLE 2
VALIDATED SAMPLE RESULTS
SUPPLEMENTAL SOIL INVESTIGATION
ROBESON INDUSTRIES

Location ID		SG-22
Sample ID		SG-22(7-8)
Matrix		Soil
Depth Interval (ft)		7.0-8.0
Date Sampled		09/22/04
Parameter	**Units**	
Volatile Organic Compounds		
Methylcyclohexane	UG/KG	12 U
1,2-Dibromo-3-chloropropane	UG/KG	12 U

Flags assigned during chemistry validation are shown.

MADE BY _AMK_11/22/04_______
CHKD BY _JJL_11/29/04________

Detection Limits shown are MDL

TABLE 3
VALIDATED FIELDQC SAMPLE RESULTS
SUPPLEMENTAL SOIL INVESTIGATION
ROBESON INDUSTRIES

Location ID		FIELDQC
Sample ID		DB-6-RB
Matrix		Quality Control
Depth Interval (ft)		-
Date Sampled		09/16/04
Parameter	Units	Rinse Blank (1-1)
Volatile Organic Compounds		
Chloromethane	UG/L	10 U
Vinyl chloride	UG/L	10 U
Chloroethane	UG/L	10 U
Bromomethane	UG/L	10 U
Trichlorofluoromethane	UG/L	10 U
1,1,2-Trichloro-1,2,2-trifluoroethane	UG/L	10 U
Dichlorodifluoromethane	UG/L	10 U
1,1-Dichloroethene	UG/L	10 U
Acetone	UG/L	10 U
Carbon disulfide	UG/L	10 U
Methylene chloride	UG/L	2 J
1,1-Dichloroethane	UG/L	10 U
1,2-Dichloroethene (cis)	UG/L	10 U
1,2-Dichloroethene (trans)	UG/L	10 U
2-Butanone	UG/L	10 U
Chloroform	UG/L	10 U
1,1,1-Trichloroethane	UG/L	10 U
Carbon tetrachloride	UG/L	10 U
Benzene	UG/L	10 U
1,2-Dichloroethane	UG/L	10 U
1,2-Dibromoethane	UG/L	10 U
Trichloroethene	UG/L	10 U
1,2-Dichloropropane	UG/L	10 U

Flags assigned during chemistry validation are shown.

MADE BY _AMK_11/22/04_______
CHKD BY _JJL_11/29/04________

Detection Limits shown are MDL

TABLE 3
VALIDATED FIELDQC SAMPLE RESULTS
SUPPLEMENTAL SOIL INVESTIGATION
ROBESON INDUSTRIES

Location ID		FIELDQC
Sample ID		DB-6-RB
Matrix		Quality Control
Depth Interval (ft)		-
Date Sampled		09/16/04
Parameter	**Units**	Rinse Blank (1-1)
Volatile Organic Compounds		
Bromodichloromethane	UG/L	10 U
cis-1,3-Dichloropropene	UG/L	10 U
Cyclohexane	UG/L	10 U
4-Methyl-2-pentanone	UG/L	10 U
Toluene	UG/L	10 U
trans-1,3-Dichloropropene	UG/L	10 U
1,1,2-Trichloroethane	UG/L	10 U
Tetrachloroethene	UG/L	10 U
2-Hexanone	UG/L	10 U
Dibromochloromethane	UG/L	10 U
Chlorobenzene	UG/L	10 U
Ethylbenzene	UG/L	10 U
Styrene	UG/L	10 U
Bromoform	UG/L	10 U
1,1,2,2-Tetrachloroethane	UG/L	10 U
Xylene (total)	UG/L	10 U
1,2-Dichlorobenzene	UG/L	10 U
1,3-Dichlorobenzene	UG/L	10 U
1,4-Dichlorobenzene	UG/L	10 U
1,2,4-Trichlorobenzene	UG/L	5 J
Isopropylbenzene	UG/L	10 U
Methyl acetate	UG/L	10 U
Methyl t-butyl ether	UG/L	10 U

Flags assigned during chemistry validation are shown.

MADE BY _AMK_11/22/04_______
CHKD BY _JJL_11/29/04________

Detection Limits shown are MDL

TABLE 3
VALIDATED FIELDQC SAMPLE RESULTS
SUPPLEMENTAL SOIL INVESTIGATION
ROBESON INDUSTRIES

Location ID		FIELDQC
Sample ID		DB-6-RB
Matrix		Quality Control
Depth Interval (ft)		-
Date Sampled		09/16/04
Parameter	Units	Rinse Blank (1-1)
Volatile Organic Compounds		
Methylcyclohexane	UG/L	10 U
1,2-Dibromo-3-chloropropane	UG/L	10 U

Flags assigned during chemistry validation are shown.

MADE BY _AMK_11/22/04_______
CHKD BY _JJL_11/29/04________

Detection Limits shown are MDL

URS Corporation	**TEST BORING LOG**
	BORING NO: DB-1
PROJECT: Robeson Site	**SHEET: 1 of 2**
CLIENT: New York State Department of Environmental Conservation	**JOB NO.:** 11173791
BORING CONTRACTOR: Nothnagle Drilling	**LOCATION: 24' so.of north wall, 49' east of w. wall**

GROUNDWATER:					**CAS.**	**SAMPLER**	**TUBE**	**GROUND ELEVATION:**
DATE	**TIME**	**LEVEL**	**TYPE**	**TYPE**		Split-spoon		**DATE STARTED:9/10/04**
				DIA.		2"		**DATE FINISHED: 9/10/04**
				WT.		140#		**DRILLER: Neil Short**
				FALL		30"		**GEOLOGIST: Tim Burmeier**
								REVIEWED BY: Duane Lenhardt

DEPTH FEET	**STRATA**	**"S" NO.**	**"N" NO.**	**BLOWS PER 6"**		**REC%**	**COLOR**	**CONSISTENCY HARDNESS**	**MATERIAL DESCRIPTION**	**PID**	**REMARKS**
1		1	22	x	11	60%	Medium Brown	Medium Dense	Concrete floor (0-0.5') Fill: Regraded local material-silty fine to coarse sand and gravel	0	Slightly Moist
				11	12						
		2	32	12	15	70%		Dense		0	Moist
				17	12						
5		3	33	13	17	45%				0	
				16	14						
		4	17	10	9	70%		Medium Dense	Silty fine sand with faint layering and fine round gravel	0	
				8	8						
		5	15	5	7	75%				0	
10				8	10						
15											
		6	18	14	10	55%	Light Gray Brown		-predominantly fine gravel (15-16')	0	
				8	4						Wet at 16'
20											
		7	26	6	12	95%	Medium Brown		Silty fine sand with trace fine gravel	10	
				14	15						
25											
		8	28	6	13	80%			Sandy silt-very fine sand	20-30	
				15	16						
30											
		9	24	6	10	100%			Fine sand, well graded salt and pepper appearance	0	
				14	14						
									Silty very fine-fine sand		
35		10	23	WOR	WOH	100%		Very Loose	(continues on page 2)	2-6	

COMMENTS: Boring advanced with Gus Pech 750 rig using 2 1/4" ID hollow-stem augers.
Sampling with 2-inch diameter split spoon samplers. All samples were screened inside plastic baggies with a Mini-Rae 2000 PID. WOR=weight of rods, WOH = weight of hammer
Sampled 25-27' for VOCs analysis

Boring No.
DB-1

URS Corporation	**TEST BORING LOG**
	BORING NO: DB-1
PROJECT: Robeson Site	**SHEET: 2 of 2**
CLIENT: New York State Department of Environmental Conservation	**JOB NO.:** 11173791
BORING CONTRACTOR: Nothnagle Drilling	**LOCATION: 24' so.of north wall, 49' east of w. wall**

GROUNDWATER:					**CAS.**	**SAMPLER**	**TUBE**	**GROUND ELEVATION:**
DATE	**TIME**	**LEVEL**	**TYPE**	**TYPE**		Split-spoon		**DATE STARTED:9/10/04**
				DIA.		2"		**DATE FINISHED: 9/10/04**
				WT.		140#		**DRILLER: Neil Short**
				FALL		30"		**GEOLOGIST: Tim Burmeier**
								REVIEWED BY: Duane Lenhardt

DEPTH FEET	**STRATA**	**"S" NO.**	**"N" NO.**	**BLOWS PER 6"**		**REC%**	**COLOR**	**CONSISTENCY HARDNESS**	**MATERIAL DESCRIPTION**	**PID**	**REMARKS**
36		10	23	5	10	100%	Light Brown	Medium Dense	Silty very fine-fine quartz sand	2-6	Wet
40											
		11	43	6	18	100%		Dense	Very fine sandy silt	0	
				25	22						
45											
		12	19	WOR	5	100%		Medium Dense		0	
				14	15						
50											
		13	12	4	5	90%				0	
				7	5						
									End of boring at 52 feet		
55											
60											
65											
70											

COMMENTS: Boring advanced with Gus Pech 750 rig using 2 1/4" ID hollow-stem augers.
Sampling with 2-inch diameter split spoon samplers. All samples were screened inside plastic baggies
with a Mini-Rae 2000 PID. WOR=weight of rods, WOH = weight of hammer
Sampled 25-27' for VOCs analysis

Boring No.
DB-1

URS Corporation	**TEST BORING LOG**
	BORING NO: DB-2
PROJECT: Robeson Site	**SHEET: 1 of 2**
CLIENT: New York State Department of Environmental Conservation	**JOB NO.:** 11173791
BORING CONTRACTOR: Nothnagle Drilling	**LOCATION: 60' so.of north wall, 49' east of w. wall**

GROUNDWATER:					**CAS.**	**SAMPLER**	**TUBE**	**GROUND ELEVATION:**
DATE	**TIME**	**LEVEL**	**TYPE**	**TYPE**		Split-spoon		**DATE STARTED:9/13/04**
				DIA.		2"		**DATE FINISHED: 9/13/04**
				WT.		140#		**DRILLER: Neil Short**
				FALL		30"		**GEOLOGIST: Tim Burmeier**
								REVIEWED BY: Duane Lenhardt

DEPTH FEET	**STRATA**	**SAMPLE "S" NO.**	**"N" NO.**	**BLOWS PER 6"**		**REC%**	**COLOR**	**CONSISTENCY HARDNESS**	**MATERIAL DESCRIPTION**	**PID**	**REMARKS**
1		1	28	x	15	40%	Medium Brown	Medium Dense	Concrete floor (0-0.5') Fill: Regraded local material-silty sandy gravel	0	Slightly Moist
				13	15						
		2	37	14	16	40%		Dense		0	Moist
				21	22						
5		3	24	13	13	45%		Medium Dense		0	
				11	11						
		4	27	11	11	50%				0	
				16	15				Silty sand fine to medium with fine gravel		
		5	36	10	20	60%		Dense	-gravel becomes fine to coarse	0	
10				16	20						
15									Fine to coarse sandy gravel		
		6	29	19	18	50%	Light Gray Brown	Medium Dense	-predominantly fine gravel (15-16')	0.7	Wet at 16'
				11	10						
20											
		7	5	2	2	20%	Medium Brown	Loose	Silty coarse gravel	2-3	
				3	4						
25											
		8	24	9	11	85%		Medium Dense	Silt	2-3	
				13	15						
30											
		9	29	9	13	70%	Gray			4-16	
				16	19						
									- trace gravel		
35		10	20	3	8	100%			(continues on page 2)	210	

COMMENTS: Boring advanced with Gus Pech 750 rig using 2 1/4" ID hollow-stem augers.
Sampling with 2-inch diameter split spoon samplers. All samples were screened inside plastic baggies
with a Mini-Rae 2000 PID. WOR=weight of rods, WOH = weight of hammer
Sampled 25-27' , 30-32' and 35-37'for VOCs analysis

Boring No.
DB-2

URS Corporation	**TEST BORING LOG**
	BORING NO: DB-2
PROJECT: Robeson Site	**SHEET: 2 of 2**
CLIENT: New York State Department of Environmental Conservation	**JOB NO.:** 11173791
BORING CONTRACTOR: Nothnagle Drilling	**LOCATION: 24' so.of north wall, 49' east of w. wall**

GROUNDWATER:					**CAS.**	**SAMPLER**	**TUBE**	**GROUND ELEVATION:**
DATE	**TIME**	**LEVEL**	**TYPE**	**TYPE**		Split-spoon		**DATE STARTED:9/13/04**
				DIA.		2"		**DATE FINISHED: 9/13/04**
				WT.		140#		**DRILLER: Neil Short**
				FALL		30"		**GEOLOGIST: Tim Burmeier**
								REVIEWED BY: Duane Lenhardt

DEPTH FEET	**STRATA**	**"S" NO.**	**"N" NO.**	**BLOWS PER 6"**		**REC%**	**COLOR**	**CONSISTENCY HARDNESS**	**MATERIAL DESCRIPTION**	**PID**	**REMARKS**
36		10	23	12	12	100%	Gray	Medium Dense	Silty fine sand	210	Wet
40											
		11	20	5	9	100%	Gray Brown		Silty very fine-fine sand	0.5	
				11	19						
45											
		12	24	6	13	75%	Gray		Silty fine to coarse angular gravel	5.4	
				11	11						
50											
		13	21	7	11	35%			Silty fine sand	0	
				10	10						
									End of boring at 52 feet		
55											
60											
65											
70											

COMMENTS: Boring advanced with Gus Pech 750 rig using 2 1/4" ID hollow-stem augers.
Sampling with 2-inch diameter split spoon samplers. All samples were screened inside plastic baggies
with a Mini-Rae 2000 PID. WOR=weight of rods, WOH = weight of hammer
Sampled 25-27' , 30-32' and 35-37'for VOCs analysis

Boring No.
DB-2

URS Corporation	**TEST BORING LOG**
	BORING NO: DB-3
PROJECT: Robeson Site	**SHEET: 1 of 2**
CLIENT: New York State Department of Environmental Conservation	**JOB NO.:** 11173791
BORING CONTRACTOR: Nothnagle Drilling	**LOCATION: 98' so.of north wall, 49' east of w. wall**

GROUNDWATER:					**CAS.**	**SAMPLER**	**TUBE**	**GROUND ELEVATION:**
DATE	**TIME**	**LEVEL**	**TYPE**	**TYPE**		Split-spoon		**DATE STARTED :9/14/04**
				DIA.		2"		**DATE FINISHED: 9/14/04**
				WT.		140#		**DRILLER: Neil Short**
				FALL		30"		**GEOLOGIST: Tim Burmeier**
								REVIEWED BY: Duane Lenhardt

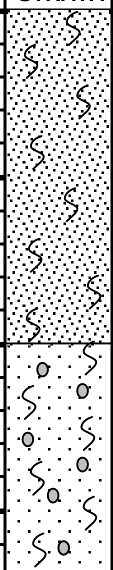
DEPTH FEET	**STRATA**	**"S" NO.**	**"N" NO.**	**BLOWS PER 6"**		**REC%**	**COLOR**	**CONSISTENCY HARDNESS**	**MATERIAL DESCRIPTION**	**PID**	**REMARKS**
1		1	21	x	9	70%	Medium Brown	Medium Dense	Concrete floor (0-0.5') Fill: Regraded local material-silty sandy gravel	0	Slightly Moist
				12	13						
		2	43	15	19	65%		Dense		0	Moist
				24	29						
5		3	22	11	11	35%		Medium Dense		0	
				11	9						
		4	30	12	15	50%				0	
				15	15						
		5	20	15	11	75%			Silty fine sand, trace fine-coarse gravel	5.2 (peak)	
10				9	9						
15											
		6	53	9	23	85%		Very Dense	Fine to coarse gravel with silty sand	210 (peak)	
				30	32						
20											
		7	23	3	10	55%		Medium Dense		30-50	Wet at 20'
				13	13						
25											
		8	28	9	14	85%			Silt with very fine sand	30 (peak)	
				14	16						
30											
		9	19	5	9	75%	Gray		Silty fine sand	1-10	
				10	11						
35		10	6	2	2	100%		Loose	(continues on page 2)	4-29	

COMMENTS: Boring advanced with Gus Pech 750 rig using 2 1/4" ID hollow-stem augers.
Sampling with 2-inch diameter split spoon samplers. All samples were screened inside plastic baggies
with a Mini-Rae 2000 PID. WOR=weight of rods, WOH = weight of hammer
Sampled 15-17' and 25-27' for VOCs analysis

Boring No.
DB-3

URS Corporation	**TEST BORING LOG**
	BORING NO: DB-3
PROJECT: Robeson Site	**SHEET: 2 of 2**
CLIENT: New York State Department of Environmental Conservation	**JOB NO.:** 11173791
BORING CONTRACTOR: Nothnagle Drilling	**LOCATION: 24' so.of north wall, 49' east of w. wall**

GROUNDWATER:					**CAS.**	**SAMPLER**	**TUBE**	**GROUND ELEVATION:**
DATE	**TIME**	**LEVEL**	**TYPE**	**TYPE**		Split-spoon		**DATE STARTED:9/13/04**
				DIA.		2"		**DATE FINISHED: 9/13/04**
				WT.		140#		**DRILLER: Neil Short**
				FALL		30"		**GEOLOGIST: Tim Burmeier**
								REVIEWED BY: Duane Lenhardt

DEPTH FEET	**STRATA**	**"S" NO.**	**"N" NO.**	**BLOWS PER 6"**		**REC%**	**COLOR**	**CONSISTENCY HARDNESS**	**MATERIAL DESCRIPTION**	**PID**	**REMARKS**
36		10	6	4	7	100%	Gray	Loose	Silty very fine - fine sand	4-29	Wet
40											
		11	9	wh	3	100%				0.5	
				6	7						
45											
		12	25	9	12	60%		Medium Dense	Fine sandy silt with fine gravel	5.4	
				13	13						
50											
		13	50	33	39	85%		Dense		0	
				11	100/2						
									End of boring at 52 feet		
55											
60											
65											
70											

COMMENTS: Boring advanced with Gus Pech 750 rig using 2 1/4" ID hollow-stem augers.
Sampling with 2-inch diameter split spoon samplers. All samples were screened inside plastic baggies
with a Mini-Rae 2000 PID. WOR=weight of rods, WOH = weight of hammer
Sampled 15-17' and 25-27' for VOCs analysis

Boring No.
DB-3

URS Corporation	**TEST BORING LOG**
	BORING NO: DB-4
PROJECT: Robeson Site	**SHEET: 1 of 2**
CLIENT: New York State Department of Environmental Conservation	**JOB NO.:** 11173791
BORING CONTRACTOR: Nothnagle Drilling	**LOCATION: 137' s.of n. wall, 49' east of w. wall**

GROUNDWATER:					**CAS.**	**SAMPLER**	**TUBE**	**GROUND ELEVATION:**
DATE	**TIME**	**LEVEL**	**TYPE**	**TYPE**		Split-spoon		**DATE STARTED : 9/14/04**
				DIA.		2"		**DATE FINISHED: 9/15/04**
				WT.		140#		**DRILLER: Neil Short**
				FALL		30"		**GEOLOGIST: Tim Burmeier**
								REVIEWED BY: Duane Lenhardt

DEPTH FEET	**STRATA**	**"S" NO.**	**"N" NO.**	**BLOWS PER 6"**		**REC%**	**COLOR**	**CONSISTENCY HARDNESS**	**MATERIAL DESCRIPTION**	**PID**	**REMARKS**
1		1	20	x	5	55%	Medium Brown	Medium Dense	Concrete floor (0-0.5') Fill: Regraded local material- sandy silt with gravel	0	Slightly Moist
				15	9						
		2	29	13	13	50%				0	
				16	16						
5		3	32	13	15	80%		Dense		0.6 (peak)	
				17	19						
		4	56	23	27	80%		Very Dense	Silt with fine sand and fine gravel	2-6	
				29	30						
		5	38	12	17	80%		Dense		1-3	Moist
10				21	22						
		6	44	11	18	75%				1-5	
				26	30						
15											
		7	42	12	20	55%			Silty fine to coarse sand and fine to coarse gravel	2-11	
				22	15						
20											
		8	36	13	16	85%			Silt, trace gravel	5-20	
				20	10						
25											
		9	24	6	12	75%	Gray	Medium Dense	Silt with very fine sand	6-12	
				12	10						
30											
		10	10	3	4	60%			Silty fine sand	5-12	
				6	8						
35		11	4	1	1	90%		Loose	(continues on page 2)	2	

COMMENTS: Boring advanced with Gus Pech 750 rig using 2 1/4" ID hollow-stem augers.
Sampling with 2-inch diameter split spoon samplers. All samples were screened inside plastic baggies
with a Mini-Rae 2000 PID. WOR=weight of rods, WOH = weight of hammer
Sampled 10-12' and 25-27' for VOCs analysis

Boring No.
DB-4

URS Corporation									**TEST BORING LOG**
									BORING NO: DB-4
PROJECT: Robeson Site									**SHEET: 2 of 2**
CLIENT: New York State Department of Environmental Conservation									**JOB NO.:** 11173791
BORING CONTRACTOR: Nothnagle Drilling									**LOCATION: 137' s.of n. wall, 49' east of w. wall**
GROUNDWATER:					**CAS.**	**SAMPLER**	**TUBE**		**GROUND ELEVATION:**
DATE	**TIME**	**LEVEL**	**TYPE**	**TYPE**		Split-spoon			**DATE STARTED: 9/14/04**
				DIA.		2"			**DATE FINISHED: 9/15/04**
				WT.		140#			**DRILLER: Neil Short**
				FALL		30"			**GEOLOGIST: Tim Burmeier**
									REVIEWED BY: Duane Lenhardt

DEPTH FEET	**STRATA**	**"S" NO.**	**"N" NO.**	**BLOWS PER 6"**		**REC%**	**COLOR**	**CONSISTENCY HARDNESS**	**MATERIAL DESCRIPTION**	**PID**	**REMARKS**
36		11	4	3	5	90%	Gray	Loose	Sand- very fine - fine with 'salt and pepper appearance	4-29	Wet
40											
									Ended boring at 40 feet due to heaving sand problem		
45											
50											
55											
60											
65											
70											

COMMENTS: Boring advanced with Gus Pech 750 rig using 2 1/4" ID hollow-stem augers.
Sampling with 2-inch diameter split spoon samplers. All samples were screened inside plastic baggies
with a Mini-Rae 2000 PID. WOR=weight of rods, WOH = weight of hammer
Sampled 10-12' and 25-27' for VOCs analysis

Boring No.
DB-4

URS Corporation

TEST BORING LOG

BORING NO: DB-5
SHEET: 1 of 2
JOB NO.: 11173791
LOCATION: 137' s.of n. wall, 49' east of w. wall
GROUND ELEVATION:
DATE STARTED : 9/15/04
DATE FINISHED: 9/15/04
DRILLER: Neil Short
GEOLOGIST: Tim Burmeier
REVIEWED BY: Duane Lenhardt

PROJECT: Robeson Site
CLIENT: New York State Department of Environmental Conservation
BORING CONTRACTOR: Nothnagle Drilling

GROUNDWATER:					CAS.	SAMPLER	TUBE
DATE	TIME	LEVEL	TYPE	TYPE		Split-spoon	
				DIA.		2"	
				WT.		140#	
				FALL		30"	

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	PID	REMARKS
1		1	19	x 3 / 16 60	65%	Medium Brown	Medium Dense	Concrete floor (0-0.5') Fill: Regraded local material- sandy silt with gravel	0*	Moist
		2	22	10 11 / 11 11	55%				0*	
5		3	11	7 6 / 5 6	90%				0*	
		4	19	3 7 / 12 17	50%			Fine sand	0*	
10		5	34	16 16 / 18 25	55%		Dense	- becomes silty - with fine to coarse gravel at 8.5'	0*	
									0*	
15										
		6	19	11 10 / 9 9	5%		Medium Dense	Silty fine to coarse sand and fine to coarse gravel	1	
20										
		7	22	6 13 / 9 9	35%			Silty gravel	1-3	Wet at 20'
25										
		8	33	14 15 / 18 18	85%		Dense	Silt	20-50	
30										
		9	26	9 14 / 12 11	75%	Gray	Medium Dense	Silty fine sand	30	
35		10	31	7 14	75%		Dense	(continues on page 2)	20-45	

COMMENTS: Boring advanced with Gus Pech 750 rig using 2 1/4" ID hollow-stem augers.
Sampling with 2-inch diameter split spoon samplers. All samples were screened inside plastic baggies
with a Mini-Rae 2000 PID. WOR=weight of rods, WOH = weight of hammer
Sampled 25-27', 30-32' and 40-42' for VOCs analysis

Boring No.
DB-5

URS Corporation

TEST BORING LOG

BORING NO: DB-5

PROJECT: Robeson Site | **SHEET: 2 of 2**

CLIENT: New York State Department of Environmental Conservation | **JOB NO.:** 11173791

BORING CONTRACTOR: Nothnagle Drilling | **LOCATION: 81' s.of n. wall, 15' east of w. wall**

GROUNDWATER:					CAS.	SAMPLER	TUBE	GROUND ELEVATION:
DATE	TIME	LEVEL	TYPE	TYPE		Split-spoon		DATE STARTED: 9/15/04
				DIA.		2"		DATE FINISHED: 9/15/04
				WT.		140#		DRILLER: Neil Short
				FALL		30"		GEOLOGIST: Tim Burmeier
								REVIEWED BY: Duane Lenhardt

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"		REC%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	PID	REMARKS
36		10	31	17	19	75%	Gray	Dense	Very fine - fine sand, fluid, heaving consistency	20-45	Wet
40											
		11	2	WOR / 2	WOR / 2	100%		Loose		30-50	
									Ended boring at 42 feet due to heaving sand problem		
45											
50											
55											
60											
65											
70											

COMMENTS: Boring advanced with Gus Pech 750 rig using 2 1/4" ID hollow-stem augers.
Sampling with 2-inch diameter split spoon samplers. All samples were screened inside plastic baggies
with a Mini-Rae 2000 PID. WOR=weight of rods, WOH = weight of hammer
Sampled 25-27', 30-32' and 40-42' for VOCs analysis

Boring No.
DB-5

URS Corporation

TEST BORING LOG

BORING NO: DB-6

PROJECT: Robeson Site

SHEET: 1 of 2

CLIENT: New York State Department of Environmental Conservation

JOB NO.: 11173791

BORING CONTRACTOR: Nothnagle Drilling

LOCATION: 11' n.of n. wall, 42' east of w.cor.

GROUND ELEVATION:

DATE STARTED : 9/16/04

DATE FINISHED: 9/16/04

DRILLER: Neil Short

GEOLOGIST: Tim Burmeier

REVIEWED BY: Duane Lenhardt

GROUNDWATER:

DATE	TIME	LEVEL	TYPE		CAS.	SAMPLER	TUBE
				TYPE		Split-spoon	
				DIA.		2"	
				WT.		140#	
				FALL		30"	

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"		REC%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	PID	REMARKS
1		1	11	8	7	70%	Medium Brown	Medium Dense	Asphalt paving (0-0.2') Fill: Regraded local material- sandy silt with gravel	0.5 (peak)	Moist
				4	3						
		2	5	3	2	80%		Loose		0	
				3	5						
5		3	19	14	10	70%		Medium Dense		0	
				9	5						
		4	30	8	14	70%				0	
				16	17						
		5	28	9	16	65%			Silty fine sand with fine-coarse gravel	0	
10				12	8						
15											
		6	15	3	5	10%				40-115	Wet
				10	10						
20											
		7	14	3	4	80%			Silt	20-50	
				10	6						
25											
		8	10	3	4	85%				20-54	
				6	7						
30											
		9	18	4	9	85%	Gray			50-177	
				9	9						
35		10	11	1	4	80%			(continues on page 2)	0	

COMMENTS: Boring advanced with Gus Pech 750 rig using 2 1/4" ID hollow-stem augers.
Sampling with 2-inch diameter split spoon samplers. All samples were screened inside plastic baggies
with a Mini-Rae 2000 PID. WOR=weight of rods, WOH = weight of hammer
Sampled 25-27' for VOCs analysis

Boring No.
DB-6

URS Corporation	TEST BORING LOG
	BORING NO: DB-6
PROJECT: Robeson Site	SHEET: 2 of 2
CLIENT: New York State Department of Environmental Conservation	JOB NO.: 11173791
BORING CONTRACTOR: Nothnagle Drilling	LOCATION: 11' n.of n. wall, 42' east of w.cor.

GROUNDWATER:					CAS.	SAMPLER	TUBE	GROUND ELEVATION:
DATE	TIME	LEVEL	TYPE	TYPE		Split-spoon		DATE STARTED: 9/16/04
				DIA.		2"		DATE FINISHED: 9/16/04
				WT.		140#		DRILLER: Neil Short
				FALL		30"		GEOLOGIST: Tim Burmeier
								REVIEWED BY: Duane Lenhardt

DEPTH FEET	SAMPLE STRATA	"S" NO.	"N" NO.	BLOWS PER 6"		REC%	DESCRIPTION COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	PID	REMARKS
36		10	6	7	7	80%	Gray	Loose	Silt	0	Wet
40											
		11	12	WOR	5	100%	Brown	Medium Dense	Silty very fine sand with fluid heaving consistency	0	
				7	8						
45											
		12	1	WOR	WOR	100%		Loose	Fine sandy silt with fine gravel	0	
				1	1						
50											
		13	13	5	6	100%		Medium Dense	Fine sandy silt with fine to coarse gravel	0	
				7	4						
									End of boring at 52 feet		
55											
60											
65											
70											

COMMENTS: Boring advanced with Gus Pech 750 rig using 2 1/4" ID hollow-stem augers.
Sampling with 2-inch diameter split spoon samplers. All samples were screened inside plastic baggies
with a Mini-Rae 2000 PID. WOR=weight of rods, WOH = weight of hammer
Sampled 20-22' and 30-32' for VOCs analysis

Boring No.
DB-6

Trichloroethene Concentrations in Groundwater Plume Maps 2018-2022

NYSDEC Site No. 961008
Robeson Industries, Inc.
Castile, New York

MACTEC

TCE in Groundwater - 2018

Project 3616206112

Figure 3

NYSDEC Site No. 961008 Robeson Industries, Inc. Castile, New York	MACTEC	Overburden Groundwater TCE Plume May 2021 Project 3616206112 Figure 5

NYSDEC Site No. 961008 Robeson Industries, Inc. Castile, New York	MACTEC	Overburden Groundwater TCE Plume Figure August 2022 Project 3616206112

Document: P:\Projects\NYSDEC__General NYSDEC Information D009809\Database\GIS\Robeson GIS\MapDocuments\GW_Nov2020_May2021_Aug2022_11x17P.mxd PDF: P:\Projects\NYSDEC\Robeson Industries SM-RSO\4.0 Invest_Remed\4.6 Site_Data\G. Figures\Figure X - OB GW TCE Plume August 2022.pdf 11-29-2022 11:15 AM nathan.soule

ATTACHMENT 2

Standard Operating Procedures

TABLE A-1 FIELD SAMPLING STANDARD OPERATING PROCEDURES (SOPS)

SOP #	SOP Title	Revision No.	Revision Date	Attachments	Related SOPs
S1	Drinking Water Sampling From Private and Public Supply Wells	0	4/20/2020	Water Grab Sampling Record Field Calibration Record	S3 S29
S2	Water Level Measurement and Monitoring Well Condition Evaluation Procedures	0	4/20/2020	Water Level Measurement FDR	S21
S3	Low Flow Groundwater Sampling	0	4/20/2020	Low Flow Groundwater Sampling Record Field Instrument Calibration Record Information Handout: Low Flow Groundwater Field Parameter Data	S2 S21 S29
S4	Hydrasleeve™ Groundwater Sample Collection	0	4/20/2020	Water Grab Sampling Record Field Instrument Calibration Record	S2 S21 S29
S5	Passive Diffusion Bag Groundwater Sample Collection	0	4/20/2020	Water Grab Sampling Record	S2 S21 S29
S6	Per- and Polyfluoroalkyl Substances (PFAS) Field Sampling Protocols	0	4/20/2020	Daily PFAS Protocol Checklist Record	
S7	Surface Water Sampling	0	4/20/2020	Surface Water and Sediment Sampling Record Field Instrument Calibration Record	S10 S21 S29
S8	Chain of Custody Procedures	0	4/20/2020		
S9	Pore Water Sampling	0	4/20/2020	Water Grab Sampling Record Field Instrument Calibration Record	S21 S29
S10	Sediment Sampling	0	4/20/2020	Surface Water and Sediment Sampling Record	S7 S21 S29
S11	Description and Identification of Soil Samples	0	4/20/2020	Key to Soil Descriptions and Terms	S16 S17 S18 S19
S12	Description and Identification of Rock Samples	0	4/20/2020	Field Guide for Rock Core Logging	S16 S17 S18 S19
S13	Soil Sample Collection	0	4/20/2020		S11 S14 S16 S17 S18 S19 S21 S29
S14	Field Preservation of VOC and GRO Soil Samples	0	4/20/2020	En Core® Sampling Procedures Terra Core™ Sampling Kit Fact Sheet	S11 S13 S16 S17 S18 S19 S29
S15	Methanol Extraction of Fractured Rock Sample Collection	0	4/20/2020		S12 S16 S29

Prepared by: NWV 04/14/2020
Checked by: JMF 04/24/2020

SOP #	SOP Title	Revision No.	Revision Date	Attachments	Related SOPs
S16	Drilling - Soil Boring and Rock Coring Oversight	0	4/20/2020	Utility Clearance Form Soil Boring Log Rock Coring Log Field Instrument Calibration Record	S11 S12 S20 S21 S22
S17	Direct Push Sampling	0	4/20/2020	Utility Clearance Form Soil Boring Log Field Instrument Calibration Record	S11 S20 S21 S22
S18	Sonic Drilling Oversight	0	4/20/2020	Utility Clearance Form Soil Boring Log Field Instrument Calibration Record	S11 S20 S21 S22
S19	Test Pit Excavation and Sampling Oversight	0	4/20/2020	Utility Clearance Form Test Pit Excavation Log Field Instrument Calibration Record	S11 S20 S21
S20	Heavy Equipment Decontamination Oversight	0	4/20/2020		
S21	Field Equipment Decontamination	0	4/20/2020		
S22	Monitoring Well and Microwell Installation	0	4/20/2020	Well/Piezometer Construction Record - Stickup Well/Piezometer Construction Record - Flushmount	S16 S17 S18
S23	Monitoring Well Development	0	4/20/2020	Well Development Record Field Instrument Calibration Record	S2 S3 S21
S24	Monitoring Well Decommissioning	0	4/20/2020	Well Decommissioning Record Field Instrument Calibration Record NYSDEC CP-43: Groundwater Monitoring Well Decommissioning Policy	S16 S20
S25	Soil Vapor Intrusion Sampling	0	4/20/2020	Soil Vapor Intrusion Sampling Record NYSDEC Structure Sampling Questionnaire SSDS Inspection Record S25D - Field Instrument Calibration Record	S29
S26	Quality Assurance and System Audit Procedures	0	4/20/2020		

SOP # S2

STANDARD OPERATIONG PROCEDURE #S2

WATER LEVEL MEASUREMENT AND MONITORING WELL CONDITION EVALUATION PROCEDURES

April 20, 2020

NYSDEC Program QAPP – D009809

Revision 0

APPROVED:

Charles R Staples

April 27, 2020

Charles Staples, PG, Program Technical Lead   Date

Review   Date

WATER LEVEL MEASUREMENT AND MONITORING WELL CONDITION EVALUATION PROCEDURES

1.0 PURPOSE

This Standard Operating Procedure (SOP) was prepared to direct field personnel in the methods for measuring water levels in and evaluating the condition of monitoring wells during field investigations at hazardous and non-hazardous waste sites. The objective of water level measurements is to gain accurate measurements (to within 0.01 feet [ft]) of the depth of ground water for use during well installation, use in preparation of groundwater elevation contour maps, slug tests, packer tests, and pumping tests.

Deviation from this procedure in planning or in the execution of planned activities must be approved by the project manager and documented in the field logbook and/or field data record.

2.0 PROCEDURE

2.1 Responsibilities

Project Manager

The project manager (PM) is responsible for determining the appropriate water level measurement procedures based on the sampling program objectives

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to water level measurement activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL and documenting the deviation in the field logbook and/or field data record.

2.2 Preparation

Office preparation

1. Review pertinent information with regards to well construction, development, and sampling information on the wells to be measured, if available.

2. Assemble appropriate logbooks and field data records to complete the field assignment.
3. Make copies of field data records with water level measurements and the description of monitoring well conditions from the previous sampling event, if available.

Equipment Selection and Sampling Considerations

The following list of equipment may be utilized during water level measurements. Site-specific conditions may warrant the use of additional or deletion of items from this list.

- Electronic water level indicators – graduated with an engineer's scale at 0.01 ft intervals
- Tap water or Deionized water
- Alconox®, Liquinox® or other non-phosphate concentrated laboratory grade soap
- Pump sprayer
- Pint sized squeeze bottles
- Any necessary personal protective equipment (gloves, eyewear, Tyvek® suits)
- Air monitoring instruments as required (PID or FID as specified in HASP)
- Field logbook
- Monitoring well inventory and/or water level field data records (FDRs) (site specific as needed)
- Well keys
- Previous measurement data (if available)
- Oil/water interface probe (if necessary)
- Engineer's rule
- Additional weight on tape if required

2.3 Field Procedures

Site-specific conditions may warrant the use of stringent air monitoring and potentially more significant decontamination scenarios.

- Record the condition of the well (protective casing, concrete collar, lock in place, etc.) on the FDR.
- Check that the water level tape has no obvious kinks or damage. If multiple water level meters are to be used, they should be checked for consistency by comparing readings from all meters used at one easily accessible monitoring well.
- Don appropriate PPE for the task and site conditions. Stand upwind of the well; unlock and open the well. If a vented cap is present, conduct well mouth air screening from the vent. If a non-vented well cap is present, remove the cap and screen the well mouth immediately. Record all

pertinent air monitoring results (sustained, dissipating, background, odor) on the FDR and in the field logbook.

- Identify the previous measuring point marking or notch on the riser or casing (if present). Record this location in the field logbook and on the FDR. It is important to always include the measuring point reference with the water level measurement (*e.g.* 7.15 feet below top of PVC riser [TOR]).
- Using a previously decontaminated water level indicator, turn on the meter, check the audible indicator, reel the electronic probe into the well riser (with the increments visible) slowly until the meter sounds, grasp the tape with hand, withdraw the tape and lower it again slowly until the sound is again audible. Check the depth to water on the tape and make a mental note of the depth to within 0.01 feet. Lower the probe again slowly and repeat the measurement for accuracy. If the measurement varies, repeat until a consistent measurement has been determined. It is not uncommon for a well to be under vacuum/pressure and for water in the well to rise or drop after the cap has been opened until the water reaches equilibrium with atmospheric pressure. A one-foot error is the most common measurement type during water level measurements. Be sure to read the depth correctly on the tape.
- Record the depth to water from the measuring point on the FDR. Make sure to include the measuring point reference with the water level measurement.
- Procedures utilized during water level measurements where free phase petroleum products are floating on the water table should be modified to include the use of the oil/water interface probe. The procedures during the use of this probe should be implemented similarly and by manufacturers' specifications. Using this type of probe, the thickness of the product can be determined.
- When measuring the depth to the bottom of the well, care must be taken to accurately determine the true depth to bottom as the graduated tape on a water level indicator will vary with manufacturer. At the start of the field program, using an engineer’s rule, measure from the 1-ft graduated mark on the tape to the 0-ft setpoint on the probe. For some manufactures (e.g. Heron Instruments) the 0-ft setpoint is the bottom of the probe and depth to bottom measurements can be directly recorded from the graduated tape. Pin style water level indicators (e.g. Solinst) typically have a 0-ft setpoint that is halfway up the metallic probe. For these style probes the offset from the bottom of the probe to the point of the pin must be measured and then added to depth to bottom measurements from the graduated tape.

Decontaminate the probe and tape. Refer to the **Field Equipment Decontamintion** for guidance.

3.0 ATTACHMENTS

Water Level Measurement and Monitoring Well Condition Field Data Record

SOP # S3

MACTEC STANDARD OPERATING PROCEDURE #S3

LOW FLOW GROUNDWATER SAMPLING PROCEDURES

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

Charles R Staples

April 27, 2020

Charles Staples, PG, Program Technical Lead | Date

Reviewed | Date

LOW FLOW GROUNDWATER SAMPLING

1.0 PURPOSE

The following steps outline the purging and sample collection activities for low-flow sampling. Data will be recorded on the Low Flow Groundwater Field Data Record (FDR). Construction of monitoring wells may vary; therefore, this SOP may not be applicable to all situations.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure should be documented in the field logbook and/or field data record.

2.0 REFERENCES

U.S. Environmental Protection Agency (EPA), 2017. Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from monitoring Wells (Revision 4). EQASOP-GW4. Effective date July 30, 1996, Revised September 19, 2017.

3.0 PROCEDURE

This section contains both the responsibilities and procedures involved with sampling environmental monitoring wells. Proper procedures are necessary to ensure the quality and integrity of the samples.

3.1 Responsibilities

Project Manager

The project manager (PM) is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and any other appropriate procedures based on the sampling objectives.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL and documenting the deviation in the field logbook.

3.2 Preparation

Office Preparation

- Review pertinent information with regards to well construction, development, and sampling information on the wells to be tested, if available.
- 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.
- Assemble appropriate logbooks and field data records to complete the field assignment.
- Make copies of field data records from the last sampling event.

Equipment Selection

Sampling pumps and water quality probes may vary depending on the well diameter, groundwater constituents and depth to groundwater, but generally, sampling will consist of the following equipment:

- Pump (e.g., peristaltic, bladder, submersible, or inertial) 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. Peristaltic pumps are effective only for wells where the depth to water is less than about 25 ft. Bladder pumps and submersible pumps are most commonly used for wells with depths to water greater than 25 ft. Inertial pumps are only recommended for narrow diameter wells that cannot be sampled using a bladder or peristaltic pump.
- Water quality parameter probes and flow-through cell (e.g., YSI) for measuring pH, temperature, conductivity (and/or specific conductance), dissolved oxygen (DO) and oxidation/reduction potential (ORP) of groundwater
- Turbidity meter (e.g. Hach)
- Calibration solutions for the water quality parameter probes
- Graduated water level indicator (accurate to 0.01 ft)
- Tubing, connections and tools as appropriate
- Graduated cylinder
- Watch or stopwatch
- Purge water container (e.g. 5-gallon bucket or carboy)
- Low flow groundwater sampling record (**example Attached**)
- Personal protection equipment (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.

3.3 Field Procedures

Water quality parameter measurements shall be made using instrumentation and a flow through cell. Water quality parameter instruments will be calibrated daily as per the manufacturer's instructions. Equipment information (make, model, and serial number) and calibration readings shall be recorded on the field instrument calibration record (**example attached**).

Sampling will be conducted using the following procedure:

1. Don appropriate PPE.
2. Measure and record the depth to water and depth to the bottom of the well. Care should be taken to minimize disturbance of the water column within the well during pre-sample measurements.
3. If a submersible pump is used, decontaminate pump prior to use (if pumps are dedicated then this applies to the initial effort only) (**Equipment Decontamination SOP Table A-1**). Attach appropriate length of dedicated 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 will 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 (i.e., less than 0.3 ft) or no drawdown, 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. Appropriate measurement frequency may be calculated using the flow rate and the time required to purge a volume equivalent to that in the sample tubing and flow through cell. Record any adjustments to pumping rates on the FDR.
6. During purging and sampling the tubing should remain filled with water.
7. If there is visible turbidity in the discharge water, continue purging until the turbidity clears up, if possible, before connecting to the flow through cell. Connect the discharge tubing to the flow through cell. The flow through cell cannot be used for turbidity measurements. Turbidity should be measured prior to entering the flow through cell through the use of an inline tee fitting. Purging is considered complete and sampling may begin when the field parameters have stabilized, or the purge time has

exceeded 2 hours. 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 does not stabilize, continue purging well for up to two hours, collect sample and document on the FDR and in field logbook. 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, then DO is considered stabilized)
- Specific conductivity (+/- 3%)
- Temperature (+/- 3°)
- pH (± 0.1 unit)
- ORP (± 10 millivolts)

8. To ensure the sample is representative of formation water, the final purge volume must be greater than the volume of the well drawdown (calculated by multiplying the height of the drop in water level by the radius of the well casing squared times pie) plus the volume of the sample tubing.
9. If there is excessive drawdown in the well such that water levels do not stabilize while pumping, the well can be sampled using the no-purge method. For this method, the well is purged until dry and the well allowed to recharge as much as possible. The sample is then collected from the recharged water.
10. To collect the analytical sample, disconnect the tubing from the flow through cell. 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 (pumping rate may be lowered for the collection of VOC samples to avoid splashing or overfilling).
11. The volatile organic compound (VOC) fraction shall be collected first. The VOC sample container shall be filled without air space within the container. The VOC container should not be overfilled to avoid diluting the sample preservative. The vial should be 90% filled, and then topped off using water added incrementally from the container cap.
    - Samples will be labelled and handled consistent with the procedures in the QAPP and **Chain of Custody SOP (Table A-1)**.
12. Subsequent sampling efforts should duplicate the pump intake depth and final purge rate from the initial sampling event (use final pump dial setting information).
13. If using non-dedicated equipment, remove the pump from the well and decontaminate by flushing with the decontamination fluid specified in the **Equipment Decontamination SOP (Table A-1)**, or the site-specific FAP. Typically, decontamination will consist of flushing the pump with potable water and Alconox® followed by flushing with deionized water.

14. Complete remaining calculation and entries on the Low flow Groundwater FDR after sampling is completed at each well. Include any observations made during sampling such as color, odor, etc., in the field logbook and FDR.
15. Secure the well cap, compression plug, and lock.

4.0 ATTACHMENTS

Low Flow Groundwater Sampling Record

Field Instrument Calibration Record

Information Handout: Low Flow Groundwater Field Parameter Data

LOW FLOW GROUNDWATER SAMPLING RECORD

MACTEC

511 Congress Street
Suite 200
Portland, Maine 04101

PROJECT NAME		LOCATION ID	DATE
PROJECT NUMBER		START TIME	END TIME
SAMPLE ID	SAMPLE TIME	SITE NAME/INSTALLATION	PAGE OF

WELL DIAMETER (IN.) ☐ 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 INTERVAL**	FT	**PID AMBIENT AIR**	NA PPM	**REFILL TIMER SETTING**	NA SEC
WATER COLUMN	FT	**DRAWDOWN VOLUME** (final DTW- initial DTW X well diam. squared X 0.041)	GAL	**PID WELL MOUTH**	NA PPM	**DISCHARGE TIMER SETTING**	NA SEC
CALCULATED GAL/VOL (water column X well diameter^2 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**	NA PSI

FIELD PARAMETERS WITH PROGRAM STABILIZATION CRITERIA (AS LISTED IN THE QAPP)

TIME	DTW (FT)	PURGE RATE (mL/min)	TEMP. (°C) ±3%	SP. CONDUCTANCE (mS/cm) ±3%	DISS. O_2 (mg/L) ±10% or 3 values <0.5 mg/L	pH (units) ±0.1	REDOX (mv) ±10 mv	TURBIDITY (ntu) ±10% and <10 ntu or 3 values <5 ntu	PUMP INTAKE DEPTH (ft)	COMMENTS
	BEGIN PURGING									

FINAL STABILIZED FIELD PARAMETERS (rounded to appropriate significant figures)

TEMP.: nearest degree (ex. 10.1 = 10)
COND.: 3 significant figure max (ex. 1.686 = 1.69)
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	DECON FLUIDS USED	TUBING/PUMP/BLADDER MATERIALS		EQUIPMENT USED
☐ PERISTALTIC	☐ ALCONOX	☐ SILICON TUBING	☐ S. STEEL PUMP MATERIAL	☐ WL METER ____
☐ SUBMERSIBLE	☐ DEIONIZED WATER	☐ HDPE TUBING	☐ PVC PUMP MATERIAL	☐ PID ____
☐ BLADDER ____	☐ POTABLE WATER	☐ LDPE TUBING	☐ GEOPROBE SCREEN	☐ WQ METER ____
☐ WATTERA	☐ NITRIC ACID	☐ OTHER ____	☐ OTHER ____	☐ TURB. METER ____
☐ OTHER ____	☐ HEXANE	☐ OTHER ____	☐ OTHER ____	☐ PUMP ____
☐ OTHER ____	☐ METHANOL		☐ OTHER ____	☐ OTHER ____
	☐ OTHER ____			☐ FILTERS NO. ____ TYPE ____

ANALYTICAL PARAMETERS

	PARAMETER	METHOD NUMBER	ANALYTE LIST	FIELD FILTERED	PRESERVATION METHOD	VOLUME REQUIRED	QC COLLECTED
☐							
☐							
☐							
☐							
☐							
☐							
☐							

PURGE OBSERVATIONS

PURGE WATER CONTAINERIZED YES ☐ NO ☐

NUMBER OF GALLONS GENERATED ____

NO-PURGE METHOD UTILIZED YES ☐ NO ☐

NOTES

DEVIATIONS FROM THE WORK PLAN

Sampler Signature: Print Name:

Checked By: Date:

FIELD INSTRUMENT 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: Laboratory provided
Sample Preservatives Source: Laboratory provided
Disposable Filter Type: in-line 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.

MACTEC
511 Congress Street, Portland Maine 04101

FIELD INSTRUMENT CALIBRATION RECORD

MACTEC

NYSDEC Field Programs

Information Handout: Low Flow Groundwater Field Parameter Data

March 2017, Revised April 2020

INTRODUCTION

This sheet provides information related to field data collection during low flow groundwater sampling including: temperature, pH, turbidity, conductivity, dissolved oxygen (DO), and oxidation/reduction potential (ORP). The goal of this handout is to provide a general understanding of the data being collected to assist staff with identify situations where data may not be accurate due to improper instrument calibration or instrument error.

Documents containing additional information are provided as attachments including:

- USEPA Region 1 Standard Operating Procedure Calibration of Field Instruments (Attachment 1)
- USEPA Region 1 Low Stress (Low Flow) Purging And Sampling Procedure For The Collection Of Groundwater Samples From Monitoring Wells (Attachment 2)
- instrument information pamphlets provided by Pine Environmental (Attachment 3), and
- a link to the USGS National Field Manual website.

GENERAL CONSIDERATIONS FOR FIELD EVENTS

- Review NYSDEC Program QAPP SOPs and Project Field Activities Plan (FAP)
- Record field data on appropriate Field Data Record (FDR)
- Avoid storing equipment/instruments for long periods in extreme cold or hot conditions that might occurred in parked car in the field
- Calibrate instruments in controlled environment (room temp if possible).
- Do not get turbidity meters wet. All other equipment is typically more water resistant but is not waterproof. Care should be taken to protect all equipment during rain events.
- Record field parameter results as displayed on the instrument. Significant figures and rounding will be applied later during data summary process.
- For questions regarding equipment contact the Field Operations Lead or Bruce Cunningham 207 828-3657 if equipment is obtained from Field Operations Support group in Portland (FOS).

LOW FLOW GROUNDWATER FIELD DATA

Instruments used for low flow groundwater sampling that are currently provided by the FOS group in Portland, Maine include:

- YSI 556 Multiparameter System
- HACH 2100P Turbidimeter or HACH 2100Q
- Water level indicator

Instructions on instrument calibration, maintenance and operation which are provided by Pine Environmental Services are included in Attachment 3.

Temperature

Units: Temperature should be measured in degrees Celsius (°C).

Calibration – Thermometers are not calibrated by field staff, they are checked against a NIST Thermometer annually. Record of annual calibration filed in Portland FOS with Bruce Cunningham. If the instrument readings are questionable it can be checked with ice water which should be register approximately 0 °C

Other considerations: Some field parameters are corrected based on temperature (pH, dissolved oxygen, and specific conductance). So it is important that the temperature is correct.

Typical measurements: Average groundwater temperatures in the Northeast range from approximately 5.5 °C in Maine to 11 °C in southern New York. Seasonal temperatures vary by as much as ± 10 °C in shallow wells and less in deeper wells.

pH

Units: pH is measured in pH standard units (SU) on a scale of 0-14. The pH (power of hydrogen) scale measures the concentration of hydrogen ions in solution.

Calibration – pH will be calibrated prior to mobilization to the field and daily once prior to conducting field activities and once after sampling is complete. pH will be calibrated with 2 or 3 solutions (based on project requirements) covering the expected range. Typically pH 4 and pH 7 (and pH 10 if a third solution is required) will be used. Acceptance criteria is ± 0.1 for the AM check and ± 0.3 at pH 7 for the PM check. Rinse and dry the probe between solution checks.

Maintenance and Corrective Actions: pH is measured through the glass bulb located on the end of the probe. Do not touch the glass bulb with fingers. Oily film or scratches on the bulb will interfere with the design characteristics of the glass membrane and affect pH measurements. Do not use the instrument if the bulb is broken or scratched or if the electrode body is cracked, broken or the internal electrode has been damaged. If necessary, the probe can be replaced either through FOS or the rental company.

Typical measurements: Most groundwater in the US has pH ranging from 6 to 8.5 SU and surface water ranges from 6.5 to 8.5 SU. The pH of distilled water is usually around 5.6 SU due to dissolved CO2 and the formation of carbonic acid.

Oxidation/Reduction Potential (ORP)

Units: ORP (also referred to as redox potential [Eh]) is a measure of the intensity of electron activity between two electrodes. ORP is measured in millivolts (mV).

Calibration: ORP will be calibrated prior to mobilization to the field and daily prior to conducting field activities. The instrument should be allowed to stabilize before running daily calibrations and should be adjusted for temperature according to the manufactures specifications. Our typical calibration solution has a value of 240 mV with an acceptance criteria of ±10 mV.

Maintenance and Corrective Actions: If calibration readings are not within acceptance criteria the electrodes may need to be cleaned. Cleaning instructions are provided in the YSI technical notes or contact Bruce Cunningham for assistance. Alternatively new calibration solutions may be needed.

Typical measurements: ORP will vary from site to site and within sites depending on a variety of factors including dissolved chemicals (metals and other compounds), and pH. In general, positive values indicate an oxidizing environment and negative values indicate a reducing environment.

Redox conditions can affect the presence of dissolved chemicals in water. Iron (ferrous iron) and dissolved manganese are often present in reducing conditions and hexavalent chromium (Cr6) might be found in oxidizing conditions.

Specific Conductance (conductivity)

Units: Conductivity is measured in Siemens (S) and distance. Field data records typically use millisiemens per centimeter (mS/cm), but instruments may provide data in other converted forms (10^6 μS/cm = 10^3 mS/cm = 1 S/cm). mho may also be used as a unit of measure for conductivity; this is numerically the same S.

Calibration: Conductivity will be calibrated prior to mobilization to the field and daily once prior to conducting field activities and once after sampling is completed. Daily calibration is a check against a standard of known concentration. Acceptance criteria for conductivity is ± 0.5% for the AM check and ± 5% for the post sampling check.

Maintenance and Corrective Actions: If calibration readings are not within the acceptance criteria, the electrodes may need to be cleaned. Contact Bruce Cunningham if equipment was obtained from FOS and he will provide instructions as appropriate.

Because the actual conductivity of a solution changes with temperature, conductivity measurements are automatically normalized to 25°C by the field instrument.

Typical measurements:

Distilled Water: 0.0005 mS/cm

Deionized water: 0.00001 – 0.001 mS/cm

Tap Water: 0.5 – 0.8 mS/cm

Drinking water: 0.05 – 0.5 mS/cm

Groundwater: 0.05 – 50 mS/cm

Surface Water: 0.01 – 4 mS/cm

Sea water: 50 mS/cm

Dissolved Oxygen

Units: Instrumentation will report DO values as either percent saturation or ppm (mg/L) units. Field data should be reported in mg/L.

Calibration: DO instrument calibration check will be conducted prior to mobilization to the field and daily once prior to conducting field activities and once after sampling is complete. Calibration checks are conducted using an oxygen saturated solution and DO free solution (if require for the field program).

Calibration for DO must be adjusted based on air pressure (mmHg) and temp (°C). Use Pressure and Temperature Chart to determine saturated solution concentration (Attachment 4). Air pressure readings can be obtained from **http://weather.noaa.gov/.** Barometric pressure is often in inches Hg which can be converted to mm by multiplying inches by 25.4.

Acceptance criteria:
DO saturation solution ± 2% (0.2 mg/L) AM calibration and ± 5% (0.5 mg/L) PM calibration.
Zero solution: < 5% (0.5 mg/L) both AM and PM.

Maintenance and Corrective Actions: The DO sensor should not be allowed to dry out and should be kept moist during storage. Method performance can be negatively affected by the following:

- calibration drift
- a loose, wrinkled, or damaged membrane
- air bubbles in the electrolyte solution
- loose-fitting O-rings and membranes
- damaged, dirty, or otherwise contaminated electrodes under the membrane.

If there is a problem with the membrane, follow instructions that are included with the instrument on how to repair or replace the membrane or contact Bruce Cunningham at FOS with questions.

Typical measurements: Groundwater DO can range from near saturation (approximately 14 mg/L) in locations where the water table is near the ground surface to <2 mg/L. Although low DO could be the result of many factors, it may indicate reducing groundwater conditions due to:

- proximity to wetlands
- landfills
- VOC plumes

Turbidity

Units: Turbidity is a measure of how light is scattered or absorbed and is measured in NTU (Nephelometric Turbidity Units).

Calibration: Initial instrument calibration is completed by the manufacturer or FOS. Check standards should be run daily prior to use in the field with commercial reference standards. Acceptance criteria is ± 5%. Check standard vials should be cleaned prior to use.

Maintenance and Corrective Actions: Dirty or scratched vials/cell or air bubbles can give false results. It is important to make sure the sample vial is clean. If there are visible scratches replace the sample vial.

Typical measurements: Clean drinking water has turbidity <5 NTU. Turbidity <50 NTU may not be visually noticeable.

Additional Information:

Additional documents that provide useful include:

- USEPA Region 1 Standard Operating Procedure Calibration of Field Instruments; Quality Assurance Unit, USEPA Region I, 11 Technology Drive, North Chelmsford, MA 01863. Jan 2010.
- USEPA Region 1 Low Stress (Low Flow) Purging And Sampling Procedure For The Collection Of Groundwater Samples From Monitoring Wells (Revision 4). EQASOP-GW4. Effective date July 30, 1996, Revised September 19, 2017.
- Various information provided by instrument manufacturers **http://www.fieldenvironmental.com/assets/files/Manuals/YSI%20556%20MPS%20Manual.pdf; https://www.ysi.com/parameters/dissolved-oxygen?Dissolved-Oxygen-1**
- USGS National Field Manual for the Collection of Water-Quality Data, **http://water.usgs.gov/owq/FieldManual/**

SOP # S5

MACTEC STANDARD OPERATING PROCEDURE #S5

PASSIVE DIFFUSION BAG GROUNDWATER SAMPLE COLLECTION

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

Charles R Staples

______________________________________ April 27, 2020

Charles Staples, PG, Program Technical Lead Date

Reviewed Date

_____________________ _____________________

_____________________ _____________________

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PASSIVE DIFFUSION BAG GROUNDWATER SAMPLE COLLECTION

1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes methodologies for deployment, recovery and quality assurance (QA) associated with the use of water-filled passive diffusion bag (PDB) samplers for obtaining volatile organic compound (VOC) data in environmental monitoring wells. This method of groundwater sample collection involves minimal disturbance of the groundwater aquifer to obtain a "representative" sample of groundwater.

This SOP addresses technical requirements and required documentation to be completed during PDB groundwater sampling and equipment calibration.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure must be approved by the project manager and documented in the field logbook and/or field data records.

2.0 REFERENCES

"User's Guide for Polyethylene-based Passive Diffusion Bag Samplers to Obtain Volatile Organic Compound Concentrations in Wells, Part 1: Deployment, Recovery, Data Interpretation, and Quality Control and Assurance," Water-Resources Investigations Report 01-4060, USGS, dated 2001.

"Technical and Regulatory Guidance for Using Polyethylene Diffusion Bag Samplers to Monitor Volatile Organic Compounds in Groundwater," Interstate Technology and Regulatory Council (ITRC), dated 2004 (issued by the ITRC Diffusion Sampler Team).

EON Products, Inc., Equilbrator™ Diffusion Sampler Instructions (http://www.eonpro.com) with PDB Equipment Setup Diagram

3.0 METHOD CONSIDERATIONS

A PDB sampler works on the principle of diffusion; chemical compounds dissolved in water move from areas of high concentration outside the sampler to low concentration inside the sampler until equilibrium is reached.

The effectiveness of the use of a single PDB sampler in a well is dependent on the assumption that there is horizontal flow through the well screen and that the quality of the water is representative of the ground water in the aquifer directly adjacent to the screen. If there are vertical components of intra-borehole flow, multiple intervals of the formation contributing to flow, or varying concentrations of VOCs vertically within the screened or open interval, then deployment of multiple PDB samplers within a well may be more appropriate for sampling the well.

A typical PDB sampler consists of low-density polyethylene (LDPE) lay-flat tubing that is filled with laboratory-grade deionized (DI) water and closed at both ends. They are typically 18 to 24 inches long, with a 1.25 to 1.75 inch outside diameter (OD), and hold between 200 and 350 milliliters (ml) of water; however, they can be custom sized to fit site specific needs. Placing the samplers in a low-density polyethylene-mesh mesh will protect against abrasion in open boreholes and as a means of attachment at the prescribed depth. The bags are suspended (possibly from a locking J-plug/ well cap) in the monitoring well at the target horizon by a weighted line and allowed to equilibrate with the surrounding water. A minimum equilibration time of two weeks is recommended. The PDB samplers are retrieved from the well after the equilibration period and the enclosed water is immediately transferred to appropriate sample containers for analysis (40 ml VOC vials).

The PDB can be attached to the weighted line by a variety of methods, such as wire/cable ties through a knot or ring in non-buoyant non-stretch rope, stainless steel clamp, or direct attachment to the weight. Sufficient weight should be added to counterbalance the buoyancy of the PDB samplers. Non-buoyant non-stretch rope should be dedicated to the well to prevent carryover of contaminants. Stainless steel line could be reused if thoroughly decontaminated. All weights should be made of stainless steel and thoroughly decontaminated after each use.

The PDB method has both advantages and limitations when compared to other sampling methods.

Advantages include the following: The potential for PDB samplers to eliminate or substantially reduce the amount of purge water associated with sampling. The samplers are relatively inexpensive and easy to deploy and recover. There is no downhole equipment to be decontaminated between wells, and there is a minimum amount of field equipment required. Multiple PDB samplers, distributed vertically along the screened or open interval, may be used in conjunction with borehole flow meter testing to gain insight on the movement of contaminants into and out of the well screen or open interval or to locate the zone of highest concentration in the well. In addition, the samplers are not subject to turbidity interferences because sediment can’t pass through the small pore size membrane.

Water-filled polyethylene PDB samplers are not appropriate for all compounds (e.g. MtBE, Acetone, Styrene, most semi-volatiles, most ions). The use of PDB samplers would not be appropriate if you need to collect a sample at a given point in time. There may be a problem using PDB samplers where there is low permeability, or if the well is not properly developed. If there is a vertical hydraulic gradient in the well, then the concentrations in the sampler may represent the concentrations in the water flowing vertically past the sampler rather than in the formation directly adjacent to the sampler.

One of the primary applications of PDB samplers is for long-term monitoring of VOCs in ground-water wells at well characterized sites. In addition, PDB samplers can be used to determine whether contaminant stratification is present and to locate the zone of highest concentration within a well.

4.0 PROCEDURE

This section contains both the responsibilities and procedures involved with sampling environmental monitoring wells using the PDB sampler. Proper procedures are necessary to ensure the quality and integrity of the samples.

4.1 Responsibilities

Project Manager

The project manager (PM) is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and any other appropriate procedures based on the objectives of the sampling.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL and documenting the deviation in the field logbook and/or field data record.

4.2 Preparation

- Evaluate the well construction data to determine the placement of the sampler.
- Make copies of field data record from the previous sampling event, if applicable.
- Have the vendor pre-fill the PDBs with DI water (preferably).
- The stainless-steel rings used to position the sampler at the desired depth on the tether may be attached by the vendor at the time of purchase or attached by field staff prior to deployment.

Pre-Deployment PDB Assembly Procedure

1. Sampler assemblies can either be constructed by the vendor, in the office or in the field. See Section 4.3.
2. The filled PDB samplers should be transported with a minimum of one PDB sampler designated as the pre-deployment equipment blank.

Equipment Selection and Sampling Considerations

The sampling generally uses the following equipment/items:

- Graduated water level indicator (0.01-ft accuracy),
- PDB samplers,
- Suspension line/tether, plus zip ties/rings for attaching PDBs,
- Stainless Steel weights to weight the PDB,
- Straw/tube for puncturing PDB to collect sample,
- Water grab sample field data record (FDR; example attached)
- Personal protection equipment (PPE),
- Sample containers and cooler (provided by the laboratory),
- Ice for sample preservation, and
- Clean plastic sheeting.

4.3 Field Procedures

PDB Deployment Procedure

The following deployment procedures are to be used:

1. Check well for security damage or evidence of tampering, record observations. Wells should be locked at all times when not being sampled.
2. Collect a water level measurement at the well following the **Water Level Measurement SOP** (Table A-1)
3. Before sampler deployment, measure the total well depth and compare it with the reported depth to the bottom of the well from well construction diagrams to evaluate whether sediment has accumulated in the bottom of the well.
4. Check for any obstruction in the well that would prevent PDB deployment.
5. Construct the PDB tether line. The tether line can either be constructed in the field, the office, or by the PDB vendor, with the desired PDB placement depth based on well construction details and water elevations. The tether line should be constructed such that the weight attached to the end of the tether rests on the bottom of the well with the line taut above it suspended from a locked J-plug (although the weight can be suspended if care is taken). Sufficient weight is required to be added to counterbalance the buoyancy of the PDB samplers. Calculate the distance from the bottom of the well up to the desired interval in the well where the sampler will be suspended. The

first PDB sampler should be at least two feet from the bottom of the weighted tether. For wells that are screened across the water table, PDBs should be placed at least two feet below the top of the water column to ensure that no part of the sampler will be exposed above the water table during the equilibration period. Attach rings to the tether at the desired PDB depth. Each bag requires two stainless steel rings, one at either end to properly secure the bag to the tether. If tethers are constructed by the vendor, they should be carefully checked to ensure the rings are properly placed as it is critical that the PDBs are deployed at the designated depths. If multiple PDBs are used, attach a tag to the top ring (top of the PDB sampler) identifying the sampling depth. Be sure the tags are made of the appropriate material and do not have any sharp edges that could puncture the PDB samplers or get caught up in the well.

6. Once the tether line is constructed, attach the weight to the bottom of the tether.
7. Attach the mesh or handle/ring at the top of the PDB sampler and the mesh or handle/ring at the bottom of the PDB samplers to the appropriate rings on the tether using cable ties in a way that prevents slipping of the sampler bag along the tether. Clip off excess cable tie. Care should be taken to eliminate sharp points or ends of clamps, tags, or cable ties to decrease the potential for PDB punctures or tears. Repeat as necessary for multiple samplers attached to a single tether for multiple sampling intervals and attach tether to the new j-plug/well cap.
8. Once all samplers are attached, lower the weight and weighted line down with the attached samplers into the well until the desired depth is reached. The line above the weight should be taut. The PDB samplers should now be positioned at the expected depths. A check on the depth can be done by placing a knot or mark on the line at the correct distance from the top of the upper PDB sampler to the top of the well casing and checking to make sure that the mark aligns with the lip of the casing after deployment.
9. Secure the assembly in this position with the new j-plug/well cap and secure the well.
10. Allow the system to remain undisturbed as the PDB samplers equilibrate for a minimum of two weeks.

PDB Recovery Procedure

Recovery of the PDB consists of removing the samplers from the well and immediately transferring the enclosed water to 40-milliliter sampling VOC vials for laboratory analysis.

The following PDB recovery procedures are to be used:

1. Collect a water level measurement at the well following the **Water Level Measurement SOP (Table A-1)**. Compare the current water level to the water level recorded during

deployment, and the depth of the highest PDB sampler. No part of the sampler bag should be exposed above the water table during the equilibration period.

2. When retrieving the samplers, only one sampler should be removed and processed at a time. The remaining samplers, if present, should be suspended in the well until they can be processed to isolate them from agitation, exposure to ambient weather conditions, and direct sunlight. Check the depth written on the tag attached to the top ring of the PDB sampler to ensure the correct depth is recorded on the chain of custody. If there is a lack of enough open well above the water table to hang the PDBs, samplers may be placed on and covered by clean plastic prior to processing. Gloves should be changed prior to handling each sampler.
3. Detach and remove the PDB sampler from the tether. Once retrieved, examine the surface of the PDB sampler for evidence of algae, iron or other coatings, and for tears in the membrane. Note the observations in a field logbook. If there are tears in the membrane, the sample should be rejected. If there is evidence that the PDB sampler exhibits a coating, then this should be noted, and the data results should be qualified.
4. Remove the excess liquid from the exterior of the bag to minimize the potential for cross contamination or dilution of the sample.
5. The water should be transferred from the water-filled samplers to the sample bottles immediately upon recovery. The proper collection of a sample for volatile-organic compounds requires minimal disturbance of the sample to limit volatilization and therefore a minimal loss of volatiles from the sample. The following VOC procedures should be followed:
    a. Open the vial, set cap in a protected place, and collect the sample. Using the disposable discharge "straw" or tube (provided by the vendor with the PDB), pierce the sampler near the bottom with discharge tube and allowing water to flow through the tube into the VOA vials.
    b. Do not reuse discharge tubes. If needed, the flow rate can be controlled by tilting or manipulating (e.g. folding) the sampler.
    c. Be sure the sample flow is laminar and there are no air bubbles in the sample flow.
    d. There should be a convex meniscus on the top of the vial without overtopping the vial (diluting the preservative). You can fill the vial cap and top off the vial to create the convex meniscus for VOC samples, if needed.

e. Once filled, check that the cap has not been contaminated and carefully cap the vial.
f. Place the cap directly over the top and screw down firmly. Do not over-tighten and break the cap.
g. Invert the vial and tap gently. If an air bubble appears, uncap and attempt to add a small volume of sample to achieve the convex meniscus without excessively overfilling the vial. If this has to be repeated more than twice, discard the sample and begin again with a new preserved container.
h. Immediately place the vial in the protective foam sleeve (if available) and place on ice in the sample cooler.
i. When the samples are retrieved, extreme care must be taken to ensure the vertical placement of the samplers within the well are accurately recorded on the chain of custody (in the comments section if not in the sample ID) and in the field-sampling logbook.
j. Any unused water from the PDB sampler can be discarded on the ground surface unless specified otherwise in the FAP.

6. Repeat steps 3 to 5 for each PDB sampler present in the well.
7. Upon completion of sampling at the well, attach new PDBs for each sampling interval and re-deploy for the next sampling event.
8. Samples will be labelled and handled consistent with the procedures in the QAPP and **Chain of Custody SOP (Table A-1)**.

Field data and observation should be recorded on the water grab sample field data record (**example attached**).

5.0 ATTACHMENTS

Water Grab Sampling Record

GRAB SAMPLING RECORD - WATER

MACTEC

511 Congress Street
Suite 200
Portland, Maine 04101

PROJECT NAME		LOCATION ID	DATE
PROJECT NUMBER		START TIME	END TIME
SAMPLE ID	SAMPLE TIME	SITE NAME/INSTALLATION	PAGE OF

SAMPLE TYPE: ☐ GROUNDWATER ☐ SURFACE WATER ☐ STORM WATER ☐ DRINKING WATER ☐ PORE WATER ☐ OTHER: ______

FIELD PARAMETERS WITH PROGRAM STABILIZATION CRITERIA (AS LISTED IN THE FAP)

TIME	DTW (FT)	PURGE RATE (mL/min)	TEMP. (°C) ±3%	SP. CONDUCTANCE (mS/cm) ±3%	DISS. O_2 (mg/L) ±10% or 3 values <0.5 mg/L	pH (units) ±0.1	REDOX (mv) ±10 mv	TURBIDITY (ntu) ±10% and <10 ntu or 3 values <5 ntu	PUMP INTAKE DEPTH (ft)	COMMENTS

FINAL STABILIZED FIELD PARAMETERS (rounded to appropriate significant figures)

TEMP.: nearest degree (ex. 10.1 = 10)
COND.: 3 significant figure (SF) max (ex. 1.686 = 1.69)
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	DECON FLUIDS USED	TUBING/PUMP/BLADDER MATERIALS		EQUIPMENT USED
☐ PERISTALTIC	☐ ALCONOX	☐ SILICON TUBING	☐ S. STEEL PUMP MATERIAL	☐ WL METER ______
☐ SUBMERSIBLE	☐ DEIONIZED WATER	☐ HDPE TUBING	☐ PVC PUMP MATERIAL	☐ PID ______
☐ BLADDER ______	☐ POTABLE WATER	☐ LDPE TUBING	☐ GEOPROBE SCREEN	☐ WQ METER ______
☐ PDB	☐ NITRIC ACID	☐ OTHER ______	☐ OTHER ______	☐ TURB. METER ______
☐ HYDRASLEEVE ______	☐ HEXANE	☐ OTHER ______	☐ OTHER ______	☐ PUMP ______
☐ OTHER ______	☐ METHANOL		☐ OTHER ______	☐ OTHER ______
	☐ OTHER ______			☐ FILTERS NO. ____ TYPE ______

ANALYTICAL PARAMETERS

	PARAMETER	METHOD NUMBER	ANALYTE LIST	FIELD FILTERED	PRESERVATION METHOD	VOLUME REQUIRED	QC COLLECTED
☐							
☐							
☐							
☐							
☐							
☐							
☐							

PURGE OBSERVATIONS

PURGE WATER CONTAINERIZED YES ☐ NO ☐ NUMBER OF GALLONS GENERATED ______

NO-PURGE METHOD UTILIZED YES ☐ NO ☐

NOTES:

DEVIATIONS FROM THE WORK PLAN:

Sampler Signature: Print Name:

Checked By: Date:

SOP # S7

MACTEC STANDARD OPERATING PROCEDURE #S7

SURFACE WATER SAMPLING

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

Charles R Staples

______________________________ April 27,2020

Charles Staples, PG, Program Technical Lead Date

Reviewed Date

__________________ __________________

__________________ __________________

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SURFACE WATER SAMPLING

1.0 PURPOSE

The purpose of this technical procedure is to describe the methodology for collecting surface water samples for laboratory analyses and the associated water quality measurements.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure must be approved by the project manager and documented in the field logbook and/or field data record.

2.0 REFERENCES

U.S. Environmental Protection Agency (EPA), 1987, *Compendium of Superfund Field Operations Methods*, EPA 540/P-87/001a, OSWER 9355.0-14, September.

EPA, 1988, *EPA Guidelines for Conducting Remedial Investigation and Feasibility Studies under CERCLA*, Interim Final OSWER Directive 9355.3-01, August.

De Vera, E.R., B.P. Simians, R.D. Stephens, and D.L. Storm. 1990. *Samplers and Sampling Procedures for Hazardous Waste Streams*. EPA-600/2-80-018.

Korte, N. and P. Kearl. 1984. *Procedures for the Collection and Preservation of Groundwater and Surface Water Samples and for the Installation of Monitoring Wells*. U.S. Department of Energy, Grand Junction, Colorado.

3.0 DEFINITIONS

Surface water – Includes all water on the surface of the ground directly exposed to the atmosphere, including, but not limited to, lakes, ponds, reservoirs, artificial impoundments, streams, rivers, springs, seeps, and wetlands.

4.0 PROCEDURE

This section contains both the responsibilities and procedures involved with surface water sampling. Proper procedures are necessary to ensure the quality and integrity of the samples.

Surface water samples may be collected either as composite or discrete samples, as described. Actual sampling locations will be confirmed in the field prior to initiation of the sampling program. Samplers should anticipate accommodating on-site adjustment to changing field conditions. When surface water and sediment samples are collected from the same location, water samples shall be collected first. Refer to **Sediment Sampling SOP (Table A-1)** for sediment sample collection guidance.

4.1 Responsibilities

Project Manager

The project manager (PM) is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and any other appropriate procedures based on the objectives of the sampling.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL and documenting the deviation in the field logbook and/or field data record.

4.2 Preparation

Equipment Selection

For most sites, a decontaminated bottle sampler attached to a pole (e.g. polyvinyl chloride [PVC] pipe) can be used as the sampling device, or the sample container itself can serve as the sampling device.

There are several more sophisticated sampling devices that can be used to collect water at discrete depths in deep bodies of water (e.g. Van Dorn, Kemmerer). However, for most routine site investigations of shallow lakes, ponds, and streams, this equipment is not necessary.

The following equipment will typically be used during surface water sampling:

- Water Quality Meter for measuring pH, temperature, conductivity (and/or specific conductance), dissolved oxygen (DO) and oxidation/reduction potential (ORP), and a standalone turbidity meter (e.g. Hach),
- Calibration solutions for the water quality parameter probes
- Laboratory-provided sample containers,
- Self-adhesive sample bottle labels,
- High-density polyethylene (HDPE) or stainless-steel, dippers, bailers or another sampling device,
- Appropriate personal protective equipment (PPE) and other health and safety equipment specified in the Health and Safety Plan,

- Previous field notes and blank field data sheets (e.g., sample collection form and Chain of Custody),
- Pen with indelible ink,
- Plastic bags,
- Cooler with ice and,
- GPS receiver (if required).

Pre-Sample Planning

In general, surface water sample locations may include shallow or deep lakes, ponds and other types of impoundments, creeks and streams, ditches, low-lying areas, and intermittently wet drainage areas. These bodies of water may receive contaminant input from surface runoff; groundwater; or from direct discharge through a sluice, ditch, or pipe.

If current information is not available, conduct a reconnaissance of all surface water sample locations to determine accessibility to the water body, depth of water, dangerous conditions (strong currents, boggy bottoms, log jams or beaver dams, waterfalls, steep banks, thick vegetation, etc.), and sampling and personal protection equipment selection criteria. Access to water bodies such as streams may be hampered by thick vegetation, and lakes and ponds that will require the use of a boat may not be accessible by road. Therefore, the logistics of getting sampling equipment and containers to and from the sites must be considered before attempting to sample.

Surface water samples should not be collected sooner that 24-hours after heavy rains because they will not be representative samples reflecting normal (i.e., baseline) conditions.

Surface water samples should be collected from downstream to upstream locations so that if sediments are disturbed it will not affect the subsequent samples. When surface water samples are collected at sediment sample locations, the surface water sample should be collected prior to the sediment sample (which will suspend the fines), no more than 1 foot above the sediment, unless samples are to be collected in a stratified water column.

4.3 Sample Location Selection Considerations

Streams, Tributaries, and Creeks

In moving water bodies such as streams, tributaries, and creeks, sample points should be located where the water is homogeneous both horizontally and vertically. Samples should be taken far enough downstream from the source input for the discharge to be completely mixed. Locations immediately below riffle areas will be vertically mixed and narrow channel areas promote horizontal or cross-channel mixing. Sampling should take place downstream of riffle areas and narrow channel areas where low flow and minimal turbulence conditions are present. The selection of strategically located sample sites may depend on several factors, such as homogeneity, accessibility, intake points for water supplies, stream velocity, and geomorphology.

In general, a single grab sample collected at mid-depth in the center of the channel is adequate to represent the entire mixed cross-section of small streams less than 20 feet wide. If vertical profile samples are specified in the site-specific Field Activities Plan (FAP) for larger and deeper streams or creeks, these samples should be taken from mid-stream just below the surface, at mid-depth, and just above the bottom and composited. The pH, temperature, specific conductivity, and dissolved oxygen should be measured for each sample point when vertical composite samples are collected. Water depth can either be measured with a graduated staff (e.g. yardstick) at shallow depths or with one of various manual or electronic devices available for deeper depths.

Stagnant areas or pools in a stream or creek could contain different contaminant concentrations from the flowing areas, depending on the physical and chemical properties of the contaminant and the proximity of these areas to the source. A sample may be taken at mid-depth to determine if these areas represent contaminant sinks.

Lakes, Lagoons, Ponds, and Impoundments

The selection of representative sample points in standing bodies of water depends on the size, shape, and depth of the basin, and will be specified in the site-specific FAP. Samples can be collected along a vertical transect and/or horizontal grid. The site-specific work plan will designate whether a single mid-point sample, vertical profile samples, or discrete depth samples are required. In larger basins, stratification may inhibit uniform vertical mixing. In these instances, discrete depth samples may be collected at each stratification layer. In smaller basins, such as ponds, lagoons, and impoundments, the entire water column is generally uniformly mixed and one sample at the deepest point may be adequate. The deepest point is usually in the center of small ponds and other containment catch basins. For impoundments with a dam, the deepest point is generally near the base of the dam. Water depth can either be measured with a graduated staff (e.g. yardstick) at shallow depths or with one of various manual or electronic devices for deeper depths.

Wading into the water body to collect samples is not recommended in shallow lakes and ponds. Wading will disturb bottom sediments, which may contaminate the water column resulting in a false positive parameter result. Therefore, a boat is typically used to collect representative water samples in lakes, lagoons, ponds, and impoundments.

4.4 Field Procedures

Sampling Procedures

Laboratory-provided sample containers will be used to directly collect water samples if sample containers do not contain preservatives. Where required by site conditions, remote sampling into sample containers will be allowed by clamping the container onto the end of a clean extension rod. The extension rod must be made of material that does not include contaminants of interest.

Beakers or dippers (i.e. transfer containers), which may be attached to extension rods, may be used if sample containers have preservatives or remote sampling site conditions prevent sampling by direct sample container immersion. The beakers or dippers will be obtained from a scientific instrument supplier so that the material composition of such a sampling container may be documented. The selected type of transfer device, the composition of this device, and the volume of the device will be recorded on a sample field data record (FDR) (example **attached**). Alternatively, tubing may be affixed to the extension rod with a sample collected using a peristaltic pump. Bailers may be used if direct access to the sampling point can be reached. Sample transfer containers must be disposable or decontaminated prior to each use. Discrete depth sampling devices may be used when the site-specific FAP directs that specific depth intervals be sampled.

Water quality parameter measurements shall be made using instrumentation and a commercially manufactured flow through cell or direct immersion of the probes into the surface water body. Water quality parameter instruments will be calibrated daily as per the manufacturer’s instructions. Equipment information (make, model, and serial number) and calibration readings shall be recorded on the field instrument calibration record (example **attached**).

Equipment Decontamination

Before sampling begins, reusable sampling devices (e.g. metal bailers, beakers, dippers, etc.) shall be decontaminated. Mobile decontamination supplies may be utilized so that equipment can be decontaminated on-site. Each piece of sampling equipment shall be decontaminated before sampling operations and between sampling locations. Decontamination of field equipment will be performed in accordance with the **Equipment Decontamination SOP (Table A-1)**. Typically, decontamination will consist of scrubbing equipment with potable water and Alconox® followed by a scrub with deionized (DI) water and a final DI water rinse. The FAP should specify decontamination requirements.

General Surface Water Sampling Procedures

- Samples will be collected first from areas that are suspected of being the least contaminated to minimize the risk of sample cross-contamination. Typically, in flowing water bodies, sampling shall progress from downstream to upstream to avoid sediment disturbance affecting subsequent samples.
- Prior to sampling, the water body characteristics (e.g. size and depth) should be observed and described in the field logbook. Observations that should be noted include:
    - Estimate of surface area of water body
    - Surface water and site conditions (e.g. floating oil or debris, gassing)
    - Location of any discharge pipes, sewers, or tributaries
    - Weather observations (e.g. wind speed, is it sunny or cloudy, and approximate wave height)

- Collect X-Y coordinates of the sample location using a portable global positioning system (GPS) instrument. If a GPS is ineffective due to the terrain or tree canopy, mark the location in the field with a stake or flag and document the location in the field logbook to allow identification of location on aerial photograph, if possible.

- Don a clean pair of nitrile or equivalent gloves.
- Surface debris (i.e. sticks, leaves, vegetation) will be cleared from the sample location prior to sample collection, taking care not to disturb bottom or bank sediments.
- Measure water quality parameters (pH, dissolved oxygen, specific conductivity, and temperature) at each sample location prior to collecting a water sample. Samples for water quality parameters will be collected either through direct immersion of water quality probe or collection of water in a separate container at a like location and depth as the samples for laboratory analysis.
- Collect the sample in accordance with the appropriate method-specific procedures outlined in section 4.5 of this SOP.
- Identify, handle, and document the samples in accordance with the QAPP and the **Chain of Custody SOP (Table A-1)**.
- Document the sampling event on a Surface Water Sample FDR. Including:
    - Distance of sample collection point from right or left edge of water (include cardinal direction).
    - Water depth.
    - Sample depth interval.
    - Sample collection method (grab, discrete)

Note: Collection of surface water samples in deep-water areas may require the use of a boat. The Health and Safety Manager or Site Coordinator shall be consulted for additional health and safety requirements.

4.5 Method Specific Sample Collection Procedures

Samples Collected by Container Immersion

Surface water sample collection by container immersion will be conducted in accordance with the following procedures:

- The outside of all capped sample containers shall be triple rinsed with the surface water being sampled before filling the containers with the sample to be analyzed.
- Submerge the sample container or transfer container below the water surface with minimal surface disturbance and with the open end pointed upstream.
- If possible, the sample container or transfer container will be lowered no closer than 3 to 6 inches above the bottom sediments.
- Note: sample containers with preservatives should not be collected by the container immersion method.

Samples Collected by Dipper

Surface water sample collection with a dipper on an extension rod will be conducted in accordance with the following procedures:

- A disposable dipper or decontaminated dipper container will be used.
- Depth of water at each sampling site will be measured and the dipper will be lowered using the extension rod to the appropriate sampling location in accordance with the FAP.
    - If possible, the dipper will be lowered no closer than 3 to 6 inches above the bottom sediments.
- The dipper will be inserted facing downstream and withdrawn very slowly and carefully to avoid agitation of the bottom sediments; and
- Transfer the sample from the dipper directly into the sample container. Minimize aeration of the sample as much as possible.

Samples Collected by Peristaltic pump

Surface water sample collection with a peristaltic pump will be conducted in accordance with the following procedures:

- Disposable tubing will be attached (e.g. zip tied) to a decontaminated extension rod.
- Depth of water at each sampling site will be measured and the tubing intake will be lowered to the appropriate sampling location in accordance with the FAP.
    - If possible, the tubing intake will be lowered no closer than 3 to 6 inches above the bottom sediments.
- The tubing will be connected to the peristaltic pump head and pre-sample purging will begin.
    - an appropriate purge rate will be selected to avoid disturbance of the bottom sediments and to prevent volatilization of the sample
    - Purging will occur for a minimum of time to completely purge the tubing volume 5x, generally 1 minute of purging will suffice
- The sample will be collected by pumping directly into the sample container.

Samples Collected by Bailer

Surface water sample collection with a bailer will be conducted in accordance with the following procedures:

- A disposable HDPE bailer or equivalent will be used.

- Depth of water at each sampling site will be measured and the bailer will be lowered to the appropriate sampling location in accordance with the FAP.
- If possible, the bailer will be lowered no closer than 3 to 6 inches above the bottom sediments.
- The bailer will be inserted facing downstream and withdrawn very slowly and carefully to avoid agitation of the bottom sediments; and,
- Transfer the sample from the bailer directly into the sample container. Minimize aeration of the sample as much as possible.

Samples Collected by Discrete Depth Sampling Devices

Surface water sample collection with a discrete depth sampling device will be done in accordance with the following procedure:

- A Van Dorn, Kemmerer sampler or equivalent will be used.
- Depth of water at each sampling site will be measured and the sampling device will be lowered to the appropriate sampling depth in accordance with the site-specific work plan.
- If possible, the sampling device will be lowered no closer than 3 to 6 inches above the bottom sediments.
- The sampling device will be lowered facing upstream and opened once at the desired sampling depth. The device will be withdrawn very slowly and carefully to avoid agitation of the bottom sediments.
- Transfer the sample from the device directly into the sample container. Minimize aeration of the sample as much as possible.

5.0 ATTACHMENTS

Water Grab Sampling Record

Surface Water and Sediment Sampling Record

Field Instrument Calibration Record

SURFACE WATER AND SEDIMENT SAMPLING RECORD

MACTEC

511 Congress Street, Portland Maine 04101

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 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

		Deviations from the work Plan:
Sampler Signature:	Print Name:	
Checked By:	Date:	

GRAB SAMPLING RECORD - WATER

MACTEC

511 Congress Street
Suite 200
Portland, Maine 04101

PROJECT NAME		LOCATION ID	DATE
PROJECT NUMBER		START TIME	END TIME
SAMPLE ID	SAMPLE TIME	SITE NAME/INSTALLATION	PAGE OF

SAMPLE TYPE: ☐ GROUNDWATER ☐ SURFACE WATER ☐ STORM WATER ☐ DRINKING WATER ☐ PORE WATER ☐ OTHER: ____________

FIELD PARAMETERS WITH PROGRAM STABILIZATION CRITERIA

TIME	DTW (FT)	PURGE RATE (mL/min)	TEMP. (^{o}C) ±3%	SP. CONDUCTANCE (mS/cm) ±3%	DISS. O_2 (mg/L) ±10% or 3 values <0.5 mg/L	pH (units) ±0.1	REDOX (mv) ±10 mv	TURBIDITY (ntu) ±10% or <10 ntu	PUMP INTAKE DEPTH (ft)	COMMENTS

FINAL STABILIZED FIELD PARAMETERS (rounded to appropriate significant figures)

TEMP.: nearest degree (ex. 10.1 = 10)
COND.: 3 significant figure (SF) max (ex. 1.686 = 1.69)
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	DECON FLUIDS USED	TUBING/PUMP/BLADDER MATERIALS		EQUIPMENT USED
☐ PERISTALTIC	☐ ALCONOX	☐ SILICON TUBING	☐ S. STEEL PUMP MATERIAL	☐ WL METER ________
☐ SUBMERSIBLE	☐ DEIONIZED WATER	☐ HDPE TUBING	☐ PVC PUMP MATERIAL	☐ PID ________
☐ BLADDER ________	☐ POTABLE WATER	☐ LDPE TUBING	☐ GEOPROBE SCREEN	☐ WQ METER ________
☐ PDB	☐ NITRIC ACID	☐ OTHER ________	☐ OTHER ________	☐ TURB. METER ________
☐ HYDRASLEEVE ________	☐ HEXANE	☐ OTHER ________	☐ OTHER ________	☐ PUMP ________
☐ OTHER ________	☐ METHANOL		☐ OTHER ________	☐ OTHER ________
	☐ OTHER ________			☐ FILTERS NO. ____ TYPE ________

ANALYTICAL PARAMETERS

	PARAMETER	METHOD NUMBER	ANALYTE LIST	FIELD FILTERED	PRESERVATION METHOD	VOLUME REQUIRED	QC COLLECTED
☐							
☐							
☐							
☐							
☐							
☐							
☐							

PURGE OBSERVATIONS

PURGE WATER CONTAINERIZED YES ☐ NO ☐

NUMBER OF GALLONS GENERATED ________

NO-PURGE METHOD UTILIZED YES ☐ NO ☐

NOTES:

DEVIATIONS FROM THE WORK PLAN:

Sampler Signature: Print Name:

Checked By: Date:

FIELD INSTRUMENT 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	^{o}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: Laboratory provided
Sample Preservatives Source: Laboratory provided
Disposable Filter Type: in-line 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.

MACTEC
511 Congress Street, Portland Maine 04101

FIELD INSTRUMENT CALIBRATION RECORD

SOP # S8

MACTEC STANDARD OPERATING PROCEDURE #S8

CHAIN OF CUSTODY PROCEDURES

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

__________________________________ April 27,2020

Bradley LaForest, NRCC-EAC, Project Manager Date

Reviewed Date

CHAIN OF CUSTODY PROCEDURES

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to describe the chain of custody (COC) procedures and sample handling considerations when collecting environmental samples at a site. This SOP also describes a tiered approach that should be used to assist with field decisions. This procedure applies to all MACTEC personnel and subcontractors who collect or otherwise handle samples of environmental samples and should be reviewed by all on-site personnel prior to implementation of field activities.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure in planning or in the execution of planned activities must be approved by the project manager.

2.0 REFERENCES

American Society for Testing and Materials. 1996. Standard Guide for Sampling Chain-of-Custody Procedures. D 4840-95.

3.0 DEFINITIONS

COC Record – legal documentation of custody of sample materials and instructions for analytical laboratory.

Custody – physical possession or control. A sample is under custody if it is in possession or under control so as to prevent tampering or alteration of its characteristics.

Sample Label – a record attached to samples to ensure legal documentation of traceability.

4.0 PROCEDURES

Field data sheets and COC records must be completed by the appropriate sampling 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.

Field data records (FDRs), sample labels and COC forms are used to document identification and handling of samples from the time of collection through the completion of chemical analysis. In some projects, analytical data may be used in litigation. Accountability of the history of a sample must be available to demonstrate that the data are a true representation of the environment. The COC record is used as evidence in legal proceedings to demonstrate that a sample was not tampered with or altered in any way that may bias the analytical accuracy of the laboratory results. It is extremely important that COC records be complete, accurate and consistent.

4.1 Responsibilities

Project Manager

The project manager (PM) shall provide the Quality Assurance Program Plan (QAPP) and is responsible for the overall compliance with this SOP.

Field Operations Lead

The field operations lead (FOL) shall ensure that the samples are correctly collected, labeled, tracked by chain-of-custody, and stored until they are delivered directly to the shipper or laboratory (i.e., on-site or off-site).

Field Personnel

Field personnel (sample collectors) shall ensure the samples are correctly collected, labeled, tracked by chain-of-custody, and stored until they are delivered directly to the FOL or laboratory (i.e. on-site or off-site). The sample collector shall maintain custody of the samples until they are relinquished to the FOL or laboratory. The sample collector shall be responsible for informing the FOL of sampling conditions and if any of the samples are potentially hazardous. Appropriate comments should be made on the COC form to inform the laboratory of potentially hazardous samples which will provide a more efficient testing method.

4.2 COC Protocol Consideration

The COC protocol followed by the sampling personnel involves the following steps:

- recording sampling locations, sample bottle identification, and specific sample collection procedures on the appropriate field data records.
- using pre-prepared sample labels that contain all information necessary for effective sample tracking; and
- completing standard COC forms to establish analytical sample custody in the field before sample shipment.

Sample Custody

Sample custody procedures are designed to ensure that sample integrity is maintained from collection to final disposition. A critical aspect of sound sample collection and analysis protocols is the maintenance of strict COC procedures as described in this SOP. COC procedures include tracking and documentation during sample collection, shipment, and laboratory processing. A sample is considered to be in an individual's custody if it is (1) in the physical possession of the responsible party; (2) in view of the responsible party after being in their possession (3) secured to prevent tampering; or (4) placed in a designated, secure area that is controlled and restricted by the responsible party.

Custody will be documented throughout all sampling activities on the COC record for each day of sampling. This record will accompany the samples from the site to the laboratory. FOLs or other designated personnel are required to sign, date, and note on the record the time when relinquishing samples from their custody. Any discrepancies will be noted at this time. Samples will be shipped to subcontract laboratories via overnight air courier (e.g. FedEx or other approved shipping carrier). Shipping tracking numbers will be used as custody documentation during this time and will be retained as part of the permanent sample custody documentation. In some cases, samples may be hand delivered to the laboratory; hand delivery will be noted on the COC form. The subcontractor laboratory is responsible for sample custody once samples are received.

Sample Labels

Each sample container will be affixed with a self-sticking, waterproof, adhesive label. Each contracted laboratory will provide sample labels for every sample container. Each label shall be completed with a pen of indelible ink and contain the following information:

- Client Name: MACTEC
- Site Name: “Site Name” for the sampling event
- Client Sample ID: 828133-SD30, for example
- Date collected: (month/day/year)
- Sample Time given as military time (for example: 1400)
- Name/Initials of Collector: MACTEC Field Sampler
- Analytical method/analyte request (for example, VOCs - 8260)
- Preservative: (for example – None, HNO_3, H_2SO_4, NaOH, HCl, $Na_2S_2O_3$, or Other)

COC Record

COC forms will be used to document the integrity of all samples to maintain a record of sample collection, transfer of samples between personnel, shipment of samples, and receipt of samples at the laboratory, COC forms will be filled out for each sample/analysis at each sampling location. The COC forms shall include the following information:

- Project name and project number if applicable.
- Project PM contact information.
- Name and address of laboratory to receive the samples.

- COC control number.
- Sample type, sample method.
- Location ID, sample ID.
- Sample collection date and time.
- Matrix code.
- Analyses requested.
- Field QC for matrix spike (MS)/matrix spike duplicate (MSD), if applicable.
- Container type, size and number.
- Preservatives used.
- Data deliverable type.
- Field sampling personnel names and initials.
- Turn-around-time for laboratory analysis; and,
- Comments to the laboratory, if applicable.

The FOL will perform the following duties:

- Receive the samples from the sample collector(s).
- Check sample labels against the FDRs or other sample collection documentation.
- Complete the COC entry for each sample.
- Sign and enter the date and time relinquished to the shipper; and,
- Prepare the samples for shipment from the field to the laboratory.

The FOL will sign the "Sampled By" and "Relinquished By" fields on the COC record, marking the date and time custody is transferred to the shipping agency or other authorized person (e.g. courier or laboratory).

Any corrections to the COC form entries will be made by a single-line strike mark through the incorrect item, and then entering the correct entry adjacent to the strikeout item. Corrections will be initialed and dated by the person making the change.

The original COC will be sealed in a plastic bag and taped to inside lid of the shipping container (e.g. sample cooler). A copy of the COC will be sent to the PM as a scanned image or picture if equipment is unavailable for scanning. Any hard copies (e.g. carbonless copy paper duplicate records) will be retained by the FOL and placed in the project files upon completion of the field program.

Overnight Sample Storage

In some cases, samples that cannot be shipped immediately to a laboratory must be temporarily stored on ice in a secured location or in a MACTEC controlled sample refrigerator until arrangements can be made for delivery. A temperature blank must accompany samples.

MACTEC STANDARD OPERATING PROCEDURE #S9

PORE WATER SAMPLING

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

Charles R Staples

April 27,2020

Charles Staples, PG, Program Technical Lead

Date

Reviewed

Date

PORE WATER SAMPLING

1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes guidelines and procedures for use by field personnel in the collection and documentation of pore water samples for chemical analysis.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure must be approved by the project manager and documnted in the field logbook and/or field data record.

2.0 REFERENCES

Maine Department of Environmental Protection (ME DEP), 2009, Protocol for Groundwater/Surface Water Interface Sampling Using a Pore Water Sampler, RWM- DR-023, April.

3.0 PROCEDURE

This section contains both the responsibilities and procedures involved with pore water sampling. Proper pore water sampling procedures are necessary to ensure the quality and integrity of the samples.

3.1 Responsibilities

Project Manager

The project manager (PM) is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and any other appropriate procedures based on the objectives of the sampling.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL and documenting them in the field logbook and on the field data records.

3.2 Preparation

Equipment Selection and Sampling Considerations

The following three types of samplers are typically used for pore water sampling:

Push Point Sampler – A push point pore water sampler is comprised of a strengthening rod and the pore water sampler itself, both made of stainless steel. The pore water sampler is a hollow tube slotted at its tip to allow pore water to percolate through. The strengthening rod slides into the pore water sampler, and while in place, adds strength and minimizes water from entering the pore water sampler during installation of the device.

Pore Water Observation Device (POD) – A POD pore water sampler constructed of two nested PVC slotted screens, an inner and an outer, with silicon tubing attached to the inner screen for sample collection. The inner screen is constructed of a section of 1-inch diameter slotted screen. The outside screen is constructed of a section of 2-inch diameter slotted screen. The annular space between the two nested screens is filled with filter sand. The samplers are approximately 3 inches long with length of silicon tubing inserted through the caps on the outer and inner screen from which the sample is drawn.

Drive Point Piezometer – A drive point piezometer is a 6-inch long stainless-steel pipe with holes in it that are screened to allow pore water to flow into the sampler. The top of the sampler has a ¾ inch NPT coupling on top for attaching pipe to drive the sampler into the substrate using a slide hammer. Inside the coupling is a barbed fitting used to attach silicon tubing to draw out the sample. Drive-point piezometers typically are used for single point installation only.

Push point samplers are temporary points whereby they are inserted in the sediment, sampled, and then removed. PODs and drive point piezometers are permanent (i.e., dedicated) sample points that are typically installed at a sample location and left in place, which is more conducive to collection of pore water over multiple sampling events.

If non-dedicated sampling equipment is to be used and the contaminant histories of the sample locations are known, it is advisable to establish a sampling order starting with the least contaminated area and progressing to the most contaminated last.

The following equipment will typically be used during pore water sampling:

- Pore water sampler (i.e., push point sampler, POD, or drive point piezometer)
- Water Quality Meter for measuring dissolved oxygen (DO)
- Calibration solutions for the DO probe
- Peristaltic pump and power supply (12-volt battery),
- Laboratory-provided sample containers,
- Self-adhesive sample bottle labels,
- ¼-inch outside High-density polyethylene (HDPE) and ¼-inch inside diameter silicon tubing,

- Rubber boots or hip waiters (as appropriate),
- Appropriate personal protective equipment (PPE),
- Previous field notes and blank field data sheets (e.g., sample collection form and Chain of Custody),
- Pen with indelible ink,
- Cooler with ice and,
- GPS receiver (if required).

Inspect the sampling bottles (obtained from the analytical laboratory prior to the sampling event) to be used to ensure that they are appropriate for the samples being collected, are undamaged, and have had the appropriate types and volumes of preservatives added. The types of sample containers to be used and sample preservation requirements will be provided in the Site-Specific FAP.

3.3 Field Procedures

Pore Water Purging and Sampling with a Peristaltic Pump

The standard procedure for pore water purging and sampling using a peristaltic pump will be conducted as described below.

Push Point Sampler, Drive Point Piezometer and POD Sampling

1. Inspect the equipment to ensure that it is in good working order.
2. If using water quality instrumentation, it should be calibrated per the instrument manufacturers' specifications. Calibration results will be recorded on the appropriate form (**example attached**)
3. Install the sampling point using one of the following methods:
    a. Using a push point sampler, carefully insert it into river/streambed to the desired depth (do not remove strengthening rod until instrument has been securely placed in sediment). Remove the strengthening rod from the push point sampler and connect the pore water sampler to the peristaltic pump using appropriate tubing (i.e., silicon and HDPE).
    b. Using a drive point piezometer, the piezometer is attached to a 4 – foot length of steel pipe (threaded on one end with a ¾ npt thread) and a slide hammer is used to install the piezometer to the desired depth. Prior to attaching the steel pipe, a length of silicon tubing is attached to the barb fitting at the top of the piezometer. The tubing should be long enough to account for the depth of water and depth the sampler is installed, so the tubing is above the level of the water at the sample locations.
    c. Using at POD sampler, a small hole is excavated in the sediment and the sampler installed and backfilled with native sediment. The pore water sampler should be inserted deep

enough to ensure the sample collected will contain only groundwater and no surface water (between 8 to 12 inches). Sampling tubing will need to be attached to the barbed fitting on the POD prior to backfilling activities.

4. The peristaltic pump is connected to the tubing attached to the sampler.
5. Turn pump on and purge water for several minutes until purge water is relatively clear. Pumping rate should be low enough to ensure that surface water is not drawn down into the sample. Once the water appears clear the dissolved oxygen should be measured from the pore water and in the surface water. The difference between the surface water and pore water should be evaluated as a measure of potential surface water infiltration. Ideally the DO in pore water is less than 2 mg/l and surface water are generally greater than 5 mg/l. The greater the difference between the readings the more likely the sample is representative of pore water.
6. If the formation intercepted by the screen is not transmissive enough for sample collection, gently advance and/or pull back the sampler in an attempt to find a more transmissive zone. If the formation does not allow adequate transmission of water, it may require a change in sampling location. This change should be made at the discretion of the field personnel and should be documented in field notes.
7. Neither the tubing nor the pore water sampler should be reused at subsequent sampling locations without appropriate decontamination. Do not put the strengthening rod back in the pore water sampler once sample has been collected, as sediment in the sampler must be flushed out first and properly decontaminated.
8. If pore water sampling is to be collected for multiple sampling events at the same location, use of permanent pore water samplers should be considered. The sampling point should be marked in a permanent manner. Additionally, all points should be located/identified with a global positioning system (GPS).
9. Document each sample on a water grab sampling record (**example attached**).
10. Appropriately seal, store, handle, and ship samples in accordance with the **Chain of Custody SOP (Table A-1)**, the QAPP and site specific FAP.

4.0 ATTACHMENTS

Water Grab Sampling Record

Field Instrument Calibration Record

GRAB SAMPLING RECORD - WATER

MACTEC

511 Congress Street
Suite 200
Portland, Maine 04101

PROJECT NAME		LOCATION ID	DATE
PROJECT NUMBER		START TIME	END TIME
SAMPLE ID	SAMPLE TIME	SITE NAME/INSTALLATION	PAGE OF

SAMPLE TYPE: ☐ GROUNDWATER ☐ SURFACE WATER ☐ STORM WATER ☐ DRINKING WATER ☐ PORE WATER ☐ OTHER: ______

FIELD PARAMETERS WITH PROGRAM STABILIZATION CRITERIA

TIME	DTW (FT)	PURGE RATE (mL/min)	TEMP. (°C) ±3%	SP. CONDUCTANCE (mS/cm) ±3%	DISS. O_2 (mg/L) ±10% or 3 values <0.5 mg/L	pH (units) ±0.1	REDOX (mv) ±10 mv	TURBIDITY (ntu) ±10% or <10 ntu	PUMP INTAKE DEPTH (ft)	COMMENTS

FINAL STABILIZED FIELD PARAMETERS (rounded to appropriate significant figures)

TEMP.: nearest degree (ex. 10.1 = 10)
COND.: 3 significant figure (SF) max (ex. 1.686 = 1.69)
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	DECON FLUIDS USED	TUBING/PUMP/BLADDER MATERIALS		EQUIPMENT USED
☐ PERISTALTIC	☐ ALCONOX	☐ SILICON TUBING	☐ S. STEEL PUMP MATERIAL	☐ WL METER ______
☐ SUBMERSIBLE	☐ DEIONIZED WATER	☐ HDPE TUBING	☐ PVC PUMP MATERIAL	☐ PID ______
☐ BLADDER ______	☐ POTABLE WATER	☐ LDPE TUBING	☐ GEOPROBE SCREEN	☐ WQ METER ______
☐ PDB	☐ NITRIC ACID	☐ OTHER ______	☐ OTHER ______	☐ TURB. METER ______
☐ HYDRASLEEVE ______	☐ HEXANE	☐ OTHER ______	☐ OTHER ______	☐ PUMP ______
☐ OTHER ______	☐ METHANOL		☐ OTHER ______	☐ OTHER ______
	☐ OTHER ______			☐ FILTERS NO. ____ TYPE ______

ANALYTICAL PARAMETERS

	PARAMETER	METHOD NUMBER	ANALYTE LIST	FIELD FILTERED	PRESERVATION METHOD	VOLUME REQUIRED	QC COLLECTED
☐							
☐							
☐							
☐							
☐							
☐							
☐							

PURGE OBSERVATIONS

PURGE WATER CONTAINERIZED YES ☐ NO ☐

NUMBER OF GALLONS GENERATED ______

NO-PURGE METHOD UTILIZED YES ☐ NO ☐

NOTES:

DEVIATIONS FROM THE WORK PLAN:

Sampler Signature: Print Name:

Checked By: Date:

REV. 3/29/2019

FIELD INSTRUMENT 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	^{o}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: Laboratory provided
Sample Preservatives Source: Laboratory provided
Disposable Filter Type: in-line 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.

MACTEC
511 Congress Street, Portland Maine 04101

FIELD INSTRUMENT CALIBRATION RECORD

SOP # S10

MACTEC STANDARD OPERATING PROCEDURE #S10

SEDIMENT SAMPLING PROCEDURES

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

Charles R Staples

_________________________________ April 27,2020

Charles Staples, PG, Program Technical Lead | Date

Reviewed | Date

______________________ ______________________

______________________ ______________________

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SEDIMENT SAMPLING PROCEDURE

1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes guidelines and procedures for use by field personnel in the collection and documentation of sediment samples for chemical and physical analysis. This SOP does not include the procedures and equipment selection for sediment sampling for biological analysis, which is very specific to the aquatic environment and type of analysis (toxicological and bioaccumulation tests, benthic community analysis, etc.), This SOP is only applicable to bedload sediment sampling and does not include suspended load sampling.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure must be approved by the project manager and documented in the field logbook and/or field data records.

2.0 REFERENCES

ASTM International (ASTM), 1995, *Standard Guide for Core Sampling Submerged, Unconsolidated Sediments*, ASTM D 4823-95, reapproved 2019.

EPA, 2001, *Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual*, Office of Water, EPA 823-B-01-002.

EPA, 2020, *Sediment Sampling,* Region 4 Laboratory Services and Applied Science Division (LSASD), Operating Procedure, Number LSASDPROC-200-R4, February.

3.0 DEFINITIONS

Sediment – Sediment is generally considered as unconsolidated mineral and organic deposits found underwater, such as on the bottom of rivers, streams, creeks, ponds, lakes, lagoons, and estuaries or deposited by a water body. Broadly speaking, sediment is “eroded material which lies below surface water the majority of the time where the surface water is capable of providing for an aquatic biota habitat.”

Disturbed Sediment Sample – A sediment sample where the in situ physical structure and fabric has been disturbed as the direct result of sample collection. Disturbed sediment samples can be collected using hand augers, spoons, or scoops.

Undisturbed Sediment Sample – A sediment sample who’s in situ physical structure and fabric has not been disturbed as the result of sample collection. Undisturbed sediment samples can be collected using the core samplers.

Grab Samples – A disturbed sediment sample that is collected by using such devices as the sample container (e.g., wide-mouth jar), or a stainless-steel spoon, scoop, or hand auger, and is representative of the current conditions at the location sampled.

Composite Samples – Composite samples are comprised from at least two grab samples that are thoroughly mixed in a decontaminated bowl to be representative of an area, transect, or vertical section. The result typically is considered an average concentration of the area or column of sediment sampled.

4.0 PROCEDURE

This section contains both the responsibilities and procedures involved with sediment sampling. Proper procedures are necessary to ensure the quality and integrity of the samples.

4.1 Responsibilities

Project Manager

The project manager (PM) is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and any other appropriate procedures based on the objectives of the sampling.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL and documenting the deviation in the field logbook and/or field data record.

4.2 Preparation

Equipment Selection and Sampling Objective Considerations

Several devices are available for the collection of sediment samples, the proper selection of which is dependent on:

1. the sampling objectives,
2. whether the sediment is above or below water,
3. the sediment thickness
4. the depth of water above the sediment,
5. the accessibility and conditions of the sampling locations, and
6. the analytical requirements.

Therefore, it is prudent to conduct a site visit to the sampling locations before the development of the work plan. Two types of sediment sampling devices will typically be used: core samplers and grab samplers. Most of these devices are constructed of stainless steel, and some core samplers allow a disposable sleeve to be inserted into the core barrel to retain the sample. The sleeve should be made of high-density polyethylene (HDPE) or acetate. Teflon or low-density polyethylene (LDPE) should not be used.

Core Samplers

The collection of submerged sediment samples and most sediment deposits above water (both grab and composite samples) may be conducted with a core sampler. The advantage of a core sampler over a grab sampler is that discrete and minimally disturbed samples can be collected with no loss of the finer grained material as the sample is raised to the surface (ASTM, 2019). The simplest core sampler is a hand-driven, hollow, stainless steel or polycarbonate core barrel, with a beveled edge on the head assembly at the leading end and a check valve or flapper valve at the opposite end to keep the sample in the barrel by partial vacuum (end-filling type). The trailing end has a T-handle to push and/or twist the core barrel into the soft sediment. Core barrels are typically 1- to 2-inches in diameter and are available in 2- and 4-foot lengths. For deeper submerged sediments (> 2 feet), usually collected from a boat, handle extensions can be added to the top of the hand core sampler.

A sample sleeve, or core liner can be inserted into some core samplers to obtain discrete samples that are handled and shipped in the sleeve. Upon extrusion from the core barrel, cores can be subsampled or homogenized. One disadvantage to core samplers is that the volume of sediment retrieved in one core barrel may be insufficient if full suites of analyses are needed, thus requiring multiple cores to be collected at each location.

Grab Samplers

Grab samplers will disturb the sediment during collection, which may be a limiting factor for some sampling parameters and objectives. If sampling dry to moist surficial sediments is the sampling objective, then a sample can be collected by using grab samplers such as stainless-steel hand augers, spoons, or scoops, or the sample containers themselves. If sampling shallow submerged sediment (< 6 inches deep), then the sample container may be used as the preferred collection device to minimize loss of fines upon raising the sample to the surface. The lid of the sample container may be used to cover the mouth of the sample container before raising it to the surface.

For deeper submerged sediments (> 2 feet), usually collected from a boat, a Ponar grab sampler or equivalent is an option for surficial deposits. This type of sampler has a jaw-type mechanism that is tripped from above in order to close the jaws and collect the sample. The dredge is lowered slowly through the water to the sediment with the jaws in the open position. As the dredge is retrieved, the jaws close and the isolated sediment is brought to the surface. The disadvantage to using these grab samplers is that a pebble or stick can often prevent the jaws from shutting completely, and the sample will be washed or lost upon raising the sampler to the surface. If sample collection is not successful using a grab sampler, then use of a core sampler may be required.

Additional Sampling Equipment

In addition to the chosen sampling devices described above, sediment sampling will generally consist of the following equipment:

- Personal protection equipment (PPE)
- Rubber boots or waders
- Stainless steel bowls, spoons, spatulas, if compositing or homogenizing samples
- Decontamination supplies (e.g., DI water, Liquinox® soap, paper towels)
- Documentation material (pens, logbook, Field Data Records (FDR) [**example attached**]
- Sample containers and cooler (provided by the laboratory)
- Ice for sample preservation
- Clean plastic sheeting
- Paper towels

Field Sample Planning

If current site information is not available, conduct a reconnaissance of all sediment sampling locations to determine:

- accessibility of the water body,
- depth of water,
- potentially dangerous conditions (strong currents, boggy bottoms, log jams or beaver dams, waterfalls, steep banks, thick vegetation, etc.),
- sediment accumulation points to flag for sampling (e.g. pools, convex side [outer side] of meanders, mid-channel islands, downstream side of boulders, deltas, etc.), and
- sampling and personal protection equipment selection criteria.

Access to water bodies such as streams may be hampered by thick vegetation, and lakes and ponds that will require the use of a boat may not be accessible by road. Therefore, the logistics of getting the sampling equipment and containers to and from the sites must be considered before attempting to sample.

The timing of sediment sampling relative to stream flow is critical, even when fluctuation in stream flow is not a variable of concern in the project objectives. Avoid sampling during high water or flood conditions, not only for safety reasons, but also because most sediment deposits will be submerged under deeper water, will be eroding due to turbulent flow, and will be migrating and/or in suspension. If the same locations are being sampled on a periodic basis (e.g., quarterly, semi-annually, yearly), it is critical to sample under the same flow conditions (e.g., base flow) each time.

Plan to collect sediment (and co-located surface water) samples along a water body in the upstream direction, starting from the most downstream sampling location. This procedure will ensure that any mobilized contaminants or fine particles from sampling activities, which will migrate downstream, do not affect the representativeness of the subsequent samples. This procedure must be followed even in lakes or ponds that are stream fed.

Select biased locations where sediment occurs. Transects may have to be diagonal to stream flow instead of perpendicular to include point bars on opposite sides. For establishing a grid or transects in a lake, placing buoys at the nodes/sampling locations works well. At small ponds, transects can be marked by stretching a cord or cable between stakes on opposing shores, using turnbuckles to provide tautness and flagging tape to mark sampling locations.

If accessing and reaching the sampling locations is difficult, taking a portable global positioning system (GPS) instrument to obtain X-Y coordinates during sampling is recommended, to avoid repeating trips. Such difficult locations will be costly to land survey. If a GPS is ineffective due to the terrain or tree canopy, marking the locations on a topographic map or aerial photograph at the time of sampling is the next best alternative.

When surface water samples are collected at sediment sampling locations, collect the surface water prior to the sediment sample (which will suspend the fines), no more than 1 foot above the sediment, unless samples are to be collected in a stratified water column as specified in the site-specific work plans. See Surface Water Sampling SOP (SOPs listed in Table A-1) for further details on surface water sampling methodology.

When selecting a boat to access sampling locations on lakes, ponds, or rivers, make sure the hull design will not disturb the bottom and is stable enough to haul loaded samplers to the surface (flat vs V-shaped). Jon boats or small pontoons work well in most situations. Care must be given to avoid disturbing the bottom near the sampling locations with oars or a motor’s propeller. If necessary, use two anchors to anchor both ends of the boat to prevent rotation during sampling.

Prior to sampling, decontaminate non-disposable sample equipment according to the Field Equipment Decontamination SOP (SOPs listed in Table A-1) and procedures outlined in the site-specific FAP.

4.3 Field Procedures

1. Review carefully the Site Health and Safety Plan (HASP) and appropriate Activity Hazards Analysis (AHA).
2. Don appropriate personal protection equipment (PPE), such as tall rubber boots or waders and personal floatation devices, as specified in the site-specific FAP, prior to entering the water. A walking stick or trekking pole is often needed when wading in unclear water, to probe the bottom for sure footing and depth of water.
3. Due to uneven terrain, water hazards (currents, holes, ice, drowning, etc.), hazardous biota (snakes, spiders, stinging nettles, etc.), remoteness, and the hauling of equipment, gear, and sample

containers, always sediment sample as a team of at least two personnel, with one team member as a site health and safety officer.

4. Approach submerged sampling locations from downstream and collect the sample facing upstream. Wading disturbs the sediment bottom and the suspended fine-grained material migrates downstream.
5. Never wade in water deeper than 2 feet, and generally no deeper than the top of the knee. Instability increases in deeper water, especially in a current, and it becomes more difficult to sample. If the water is not clear (unable to see the bottom), proceed with extreme caution, probing the bottom ahead with a walking stick for depth and unevenness. One of the team members should stay on or close to shore to hand equipment and supplies back and forth. If deemed necessary, the sampler may need to don a seat harness and be on a safety rope that is controlled by the other team member.
6. When using a hand coring device, slowly push the corer into the sediment until there is a noticeable resistance (usually indicating the channel or basin floor), or until the top of the core barrel is at the sediment surface.
7. For sediment sampling using a boat, gently lower all grab and core samplers to the bottom so as not to create a bow wave and disturb the fine sediment on the bottom. After the sample is collected at a given location, measure the depth of water with a weighted fiberglass tape and record this information on the sample FDR (**example attached**). These data are also useful for profiling the bottom of the water body (e.g., lake or pond).
8. Retrieve the sampling device slowly through the water to avoid washout by creating turbulent flow. Immediately extrude (for core samplers) or directly transfer (for grab samplers) the sample to a stainless-steel bowl and check to see that sediment recovery is acceptable (no visible signs of sediment loss or washing). If sediment recovery is unacceptable or the volume is insufficient, collect another sample close to, but upstream of, the previous attempt.
9. Unless collecting a sample for volatile organic compound (VOC) analysis, thoroughly homogenize the collected sediment sample in a mixing bowl (due to the stratified nature of sediment deposits), whether from a grab or core sampler, after removing excess water (being careful not to lose the fines in the process), rocks, sticks, leaves, and other organic debris. Then transfer the sediment into the sample containers using a stainless-steel spoon or spatula. Fill the sample container such that little to no headspace exists.
    a. Samples for VOCs should be collected without homogenization directly from the sampler or immediately after transfer to the stainless-steel bowl.

10. Collect X-Y coordinates of the sample location using a portable GPS instrument. If a GPS is ineffective due to the terrain or tree canopy, mark the location in the field with a stake or flag and indicate the sample location on the site map.
11. Appropriately label and number the sample containers. The label will be filled out with a pen containing indelible ink and will contain, at a minimum, the following information:
    a. Project number
    b. Location ID
    c. Sample number
    d. Sample location
    e. Sample depth
    f. Sample type
    g. Date and time of collection
    h. Parameters for analysis
    i. Sampler's initials
12. Document the sampling event on a sediment sample collection FDR (**example attached**). Note any pertinent field observations, conditions, or problems on the FDR and in the field book.
13. Any encountered problems (access issues, flooding by beaver dams, etc.) or unusual conditions should also be immediately brought to the attention of the FOL and PM.
14. Appropriately preserve, handle, package, and ship the samples in accordance with the chain of custody SOP (See SOP Table A-1), the QAPP, and the site-specific FAP.

5.0 ATTACHMENTS

Surface Water and Sediment Sampling Record

SURFACE WATER AND SEDIMENT SAMPLING RECORD

MACTEC

511 Congress Street, Portland Maine 04101

PROJECT NAME	
PROJECT NUMBER	
SAMPLE ID	SAMPLE TIME

SAMPLE LOCATION	DATE
START TIME	END 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 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:	**SURFACE WATER AND SEDIMENT SAMPLING RECORD**
Checked By:	Date:	

SOP # S11

MACTEC STANDARD OPERATING PROCEDURE #S11

DESCRIPTION AND IDENTIFICATION OF SOIL SAMPLES

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

Charles R Staples
______________________________ April 27,2020

Charles Staples, PG, Program Technical Lead Date

Reviewed Date

______________________ ______________________

______________________ ______________________

______________________ ______________________

DESCRIPTION AND IDENTIFICATION OF SOIL SAMPLES

1.0 PURPOSE

This Standard Operating Procedure (SOP) is to be used for field descriptions of soil observed in natural exposures, in exploratory excavations, and in test boring samples. Field descriptions are typically based on macroscopic visual observations (i.e., with no magnification).

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure must be approved by the project manager and documented in the field logbook and/or field data records.

2.0 REFERENCES

ASTM International (ASTM), 2014. Standard Terminology Relating to Soil, Rock, and Contained Fluids; ASTM D653-14.

ASTM, 2017. Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); ASTM D2487-17e1.

ASTM, 2017. Standard Practice for Description and Identification of Soils (Visual-Manual Procedure); ASTM D2488-17e1, Philadelphia, PA.

3.0 PROCEDURE

Soil will be classified in accordance with the Unified Soil Classification System (ASTM D2488). A summary of this system is attached. For environmental investigations, the hydrogeologic characteristics of the soil are generally more important than its mechanical properties. Soil descriptions should include the following minimum information (where applicable and obtainable) and logged in the following order (with examples):

1) **Name** (SAND, silty GRAVEL, etc. including portions**-** little, trace, some, etc.)
2) **Gradation** (well-graded, poorly graded, uniform, etc.) or **Plasticity** (non-plastic, slightly plastic, etc.)
3) **Consistency/Density** (if available from SPT blow counts)
4) **Moisture** (dry, damp, moist, wet, saturated)
5) **Color** (Mensell color chart if available)
6) **Structure** (layering, fractures, cracks, etc.)
7) **Geologic Origin** (e.g., till, lake deposit, loess) and/or formal or local name (e.g., Magothy Formation, Gardiners Clay, Lloyd Sand Member). Formal and local names should only be used based on professional judgement and knowledge of the local geology.
8) **Unified Soil Classification Symbol (USCS)**. Refer to **Attachment**.

Additional details on some of the descriptors are included below.

Name

Based principally on gradation (e.g. grain size) characteristics. Grain sizes encountered during environmental investigations include:

Unified Soil Classification System (USCS)

	MILLIMETERS	INCHES	SIEVE SIZES
BOULDERS	> 300	> 11.8	-
COBBLES	75 - 300	2.9 - 11.8	-
GRAVEL: COARSE	75 - 19	2.9 - .75	-
FINE	19 - 4.8	.75 - .19	3/4" - No. 4
SAND: COARSE	4.8 - 2.0	.19 - .08	No. 4 - No. 10
MEDIUM	2.0 - .43	.08 - .02	No. 10 - No. 40
FINE	.43 - .08	.02 - .003	No. 40 - No. 200
FINES: SILTS	< .08	< .003	< No. 200
CLAYS	< .08	< .003	< No. 200

The predominant (>50%) grain size should be written in capital letters (e.g. SAND, SILT, GRAVEL).

Include rough percentages for the secondary, tertiary, etc. grain sizes (particles >3 inches [cobbles], coarse/fine gravel, coarse/medium/fine sand, and fines) or qualitative particle size descriptions. Qualitative descriptions are most used and provide further definition by using specific terms to describe major and minor soil constituents as follows:

- Name = major component (e.g. SAND)
- Name modifier (added as a prefix) = 35 to 50% of soil fraction (e.g. clayey, silty, sandy, gravelly)
- With some = 20 to 35% of soil fraction (e.g. some clay)
- With little = 10 to 20% of soil fraction (e.g. little clay)
- With trace = 1 to 10% of soil fraction (e.g. trace silt)

Gradation

Coarse vs Fine gained soils

Coarse- and fine-grained soils are described differently in the USCS, and although based on specific grain measurements, field crew can approximate grain size based visual observations and comparison to USCS figure included above. Coarse grained soils (sands and gravels) are defined as soils in which greater than 50% of the soil fraction is retained on a #200 sieve. Fine grained soils (silts and clays) are defined as soils in which greater than 50% of the soil fraction will pass through a #200 sieve.

Coarse grained soils are further broken down as having little or no fines (<12% passing the #200 sieve) or appreciable amounts of fines (>12% passing the #200 sieve). For coarse-grained soils that are contain little or no fines, the overall gradation is characterized as follows:

- **Well graded** soils are soils whose coarse fraction has a wide and continuous gradation of grain sizes
- The coarse fraction of **poorly graded** soils has a limited range of grain sizes.
- The coarse fraction of **uniform** soils is essentially equigranular.

For fine-grained soils state whether the fines are predominantly **silt** or **clay**. The field classification of fine-grained soil relies on the qualitative determination of plasticity and cohesiveness characteristics (refer to Attachment S11A and see below). The determination is complex and may not be necessary for soil descriptions for most environmental investigations.

Consistency

Describe the consistency of the soil. For soil samples obtained using the Standard Penetration Test (split spoon sampling with a standard hammer – See SOP S16 for details), the terminology to be used is as follows:

COARSE-GRAINED SOILS		FINE-GRAINED SOILS	
CONSISTENCY	BLOWS/FOOT[1]	CONSISTENCY	BLOWS/FOOT[1]
Very loose	0 to 4	Very soft	0 to 2
Loose	5 to 10	Soft	2 to 4
Medium dense	11 to 30	Firm	4 to 8
Dense	31 to 50	Stiff	8 to 15
Very Dense	> 50	Very stiff	15 to 30
		Hard	> 30

[1] Blows per foot (Standard Penetration Resistance) = number of blows required to drive a 2-inch OD by 1-3/8-inch ID split-spoon sampler with 140-pound hammer falling 30 inches, after initial penetration of 6 inches.

For non-standard penetration test sampling, consistency (density) values should not be recorded for coarse grained soils. Fine grained soils may be qualitively measured and descriped using the thumb and thumbnail procedures indcated on Attatchment S11A.

Examples of Soil Descriptions

The following are examples of soil descriptions. It is recommended that descriptive information be recorded in the order NAME, GRADATION/PLASTICITY, CONSISTENCY, MOISTURE CONTENT, COLOR, STRUCTURE, GEOLOGIC ORIGIN or NAME, UNIFIED SOIL CLASSIFICATION SYSTEM SYMBOL.

- SAND, well graded, 5-10% sub rounded gravel to 0.5-inch max diameter., < 5% fines, medium dense, moist, yellowish brown, possible root holes (SW).
- Silty CLAY, slightly to moderately plastic, trace fine sand, stiff, wet, yellowish-green, massive, Beaufort Formation (CL).
- Clayey SAND, medium to fine, some clay, medium dense, damp, light gray (SC).
- Silty SAND, widely graded, 20-25% sub rounded gravel, 15-20% silt, 10-15% rounded boulders and cobbles, dense, saturated, olive gray, boulder till (SM).
- Gravelly SAND, poorly graded, mostly sub angular coarse sand, some sub angular gravel to 0.6-inch max diameter, < 5% fines, dense, moist, reddish brown, alluvium (SP).
- SILT, non-plastic, trace fine sand, very loose, saturated, light gray, micaceous, Lacustrine (ML).
- SAND, uniform, fine, < 5% fines, loose, dry, light brown (SP).
- Silty CLAY, slightly to moderately plastic, firm, medium gray, grades downward within varve to sandy silt, non-plastic, little fine sand, light gray, varves 0.3 - 0.4-inch-thick, varved clay (CL to ML).

- Clayey SAND, coarse to fine, mostly medium to fine, some clay, very dense, dark greenish gray, micaceous, infrequent marine shells (SC).

4.0 ATTACHMENTS

Key to Soil Descriptions and Terms

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 $\geq$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: 0 - 10%	Occasional: Particles present, but < 10%
Little: 10% - 25%	Some: 10% to 25%
Some: 25% - 45%	Frequent: >25%

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	> 50

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	>30	over 4000	Indented by thumbnail with difficulty

ROCK QUALITY DESIGNATION (RQD)

RQD = sum of the lengths of intact pieces of core* >100mm (0.3ft.)
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	>90%

Desired Soil Observations: (in this order)

Name (SAND, silty SAND, CLAY, etc., including portions - trace, little, etc)
Gradation/Plasticity (well-graded, poorly graded, uniform)/(non-plastic, slightly plastic, etc.)
Density/Consistency (if available from SPT blow counts, or observable for consisency)
Moisture (dry, damp, moist, wet, saturated)
Color (Mensell color chart if available)
Structure (layering, fractures, cracks, etc.)
Geologic Origin (e.g., till, lake deposit, loess) - formal name if known (e.g., Gardiners Clay)
Unified Soil Classification Symbol (USCS - above)
Odor, PID data, Torvane or pocket penetrometer data, etc.

Example Descriptions:

Silty CLAY, slightly to moderately plastic, trace fine sand, stiff, wet, yellowish-green, massive, Beaufort Formation (CL).

SAND, poorly graded, fine, trace silt, trace rounded gravel, loose, wet, light brown, ALLUVIUM, SP

- 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, etc.)
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.

MACTEC

511 Congress Street, Portland, Maine

USCS KEY TO SOIL DESCRIPTIONS

SOP # S13

MACTEC STANDARD OPERATING PROCEDURE #S13

SOIL SAMPLE COLLECTION PROCEDURE

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

Charles R Staples

April 27,2020

Charles Staples, PG, Program Technical Lead | Date

Reviewed | Date

SOIL SAMPLE COLLECTION PROCEDURE

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to describe the methods used for obtaining surface and subsurface soil samples for physical, geotechnical, or chemical analysis. Collection of soil samples for laboratory analysis for volatile organic compounds may require specially prepared containers, syringes, or Encore samplers. This SOP also describes the procedures for using the various types of sampling equipment, which include shovels, trowels, and hand-augers.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure must be approved by the project manager and documented in the field logbook and/or field data records.

2.0 REFERENCES

ASTM International (ASTM), 2018. Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils, Method D1586-18.

ASTM, 2017a. Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System), Method D2487-17e1.

ASTM, 2017b. Standard Practice for Thick Walled, Ring-Lined, Split Barrel, Drive Sampling of Soils, Method D-3550-17.

ASTM, 2015. Standard Practice for Thin-Walled Tube Sampling of Fine-Grained Soils for Geotechnical Purposes, Method D1587-15.

Barth, D.S. and B.J. Mason. 1984. Soil Sampling Quality Assurance User's Guide. EPA-600/4-84-043. Revised 4/16/2004.

Mason, B.J. 1983. Preparation of Soil Sampling Protocol: Techniques and Strategies. EPA-600/4-83-020.

Hewitt, Alan D., et al. 2007. Protocols for Collection of Surface Soil Samples at Military Training and Testing Ranges for the Characterization of Energetic Munitions Constituents. U.S. Army Corps of Engineers. ERDC/CRREL TR-07-10..

3.0 DEFINTITIONS

Borehole - Any hole drilled or hydraulically driven into the subsurface for the purpose of identifying lithology, collecting soil samples, and/or installing monitoring wells.

Core Sampler – A metal tube (probe rod), generally 4- to 5-feet long by 2.25- to 3.25-inch OD, typically utilized along with drive rods and a polyvinyl chloride (PVC) or acetate or equivalent liner that is used to collect soil cores utilizing a direct-push rig.

Composite Samples – Composite samples are comprised from at least two grab samples that are thoroughly mixed in a decontaminated bowl to be representative of an area, transect, or vertical section. The result typically is considered an average concentration of the depth interval sampled.

Shelby Tube Sampler – A thin-walled metal tube used to recover relatively undisturbed samples. These tubes are available in various sizes, ranging from 2 to 5 inches in outside diameter and 18 to 54 inches in length. A stationary piston device is included in the sampler to reduce sampling disturbance and increase sample recovery.

Split-Spoon Sampler – A steel tube, split in half lengthwise, with the halves held together by threaded collars at either end of the tube.

Grab Samples – A soil sample that is collected from a specific discrete interval by using such devices as stainless-steel spoon, scoop, sampling device (e.g. syringe, EnCore samplers), or sample container (e.g., wide-mouth jar).

4.0 PROCEDURES

This section contains both the responsibilities and procedures involved with soil sampling. Proper procedures are necessary to ensure the quality and integrity of the samples.

4.1 Responsibilities

Project Manager

The project manager (PM) is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and any other appropriate procedures based on the objectives of the sampling.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL and documenting them in field data records (FDRs) and/or the field logbook.

4.2 Preparation

Equipment Selection and Sampling Objective Considerations

Specific sampling equipment and methodology will be dictated by the characteristics of the soil to be sampled, field conditions, the type of soil samples required by the project, and the analytical procedures to be employed.

Surface Soils

Soil samples obtained from the near surface (0-2 ft bgs) may be collected using a shovel, trowel, bucket auger, or stainless-steel spoon and bowl. The type of analysis required (e.g., grain-size distribution, physical, chemical) will require specific soil amounts or the use of specialized sampling equipment. Sampling locations or sampling design will be identified in the site specific Field Activities Plan (FAP).

A hand-auger can be used to extract shallow soil samples from depths as deep as three to four feet below the surface. Representative samples are collected directly from the bucket auger after withdrawal from the ground, or in soft soils from a tube sampler attached to the end of auger rods.

Subsurface Soils

Soil samples collected from greater than 2 ft bgs, typically require speciailized equipment such as a drill rig or excavator, depending on site conditions.

Equipment used to collect surface or subsurface soil samples may include, but is not limited to, the following items:

Sample devices and processing materials:

- Stainless steel spoons/trowels.
- Stainless steel hand auger.
- Stainless steel split spoon, split barrel, or continuous sampler.
- Stainless steel bowls/pans.
- Aluminum foil/pans.
- Metal/plastic scraper
- Sample jars and labels.
- Plastic sheeting.
- Appropriate decontamination equipment (e.g. stainless-steel deionized water spraying devices).
- Appropriate personnel protective equipment and safety equipment as specified in the Health and Safety Plan.

Sample handling materials:

- Sample cooler with bagged ice.
- Bubble wrap.
- Paper towels.
- Tape.
- Ziplock freezer bags

Sample description/Record keeping materials:

- Field logbook and boring log.
- Pens with waterproof ink.
- Field data records (FDRs; **examples attached**)
- Chain-of-Custody forms.
- Munsell Soil Color charts.
- Grain size charts; and
- Hand lens.

4.3 Field Procedures

Decontamination

Each piece of sampling equipment shall be decontaminated before initiation of sampling operations and between each sample location and interval. Decontamination procedures will be described in the project work plan but typically consist of a wash and scrub with potable water, brushes and Alconox®/Liquinox® soap followed by a DI water rinse. Refer to the **Field Equipment Decontamination SOP** for guidance. Spent decontamination fluids will be containerized properly, labeled, and appropriately disposed of as addressed in the FAP.

Sample Collection – Surface soils

Upon reaching the sampling location specified in the FAP. Prepare the sampling location by removing all surface materials that are not to be included in the sample (i.e., rocks, twigs, and leaves). Sod (grass and roots) should be remove using a shovel and placed to one side prior to sampling. Record pre-existing surface conditions on the Surface Soil FDR (**examples attached**).

Advance the sampler (shovel, trowel, hand auger, or tube sampler) to the required sample depth. Obtain a sufficient quantity of soil for the desired chemical or physical analyses. If volatile organic compound (VOC) or volatile petroleum hydrocarbon (GRO) samples are scheduled, they should be collected immediately based on the requirements and containers provided by the analytical laboratory. See the **Field Preservation of VOC and GRO Soil Samples SOP** for specific procedures for collection and field preservation of VOC Soil Samples. These samples should be collected directly from the sampler or from the excavated area.

The remaining soil should then be composited in a stainless-steel bowl for all other analytical parameters. Select the appropriate sample container and place the sample in the container. Describe the soil in accordance with Unified Soil Classification System (USCS) soil classification system (Refer to the **Description and Identification of Soil Samples SOP**).

Upon completion of collection of the surface soil sample, backfill the location using the excavated soils and replace sod if required.

Record all observations on the appropriate FDR (surface soil or soil boring; **example attached**) and field logbook. Mark and label sample location with flagging or a pin flag and survey the point using GPS or collect measurements from three identifiable points and record measurements and a diagram in the field logbook or field data record.

Sample Collection – Subsurface soils

Subsurface soils are typically collected during a drilling program and are collected from sample tooling as specified in the FAP. Upon reaching the required sample depth utilizing one of the drilling methods outlined in the FAP and appropriate drilling method SOP (**See SOP Table A-1 for appropriate SOP**), retrieve the sample tooling and prepare for sample collection. Alternatively samples may be collected from a test pit excavation (**Test Pit Oversight SOP**).

Complete core splitting and logging as described in the **Drilling - Soil Boring and Rock Coring Oversight SOP**. Describe the soil in accordance with USCS soil classification system (Refer to the **Description and Identification of Soil Samples SOP**).

If VOC or GRO samples are scheduled, they should be collected immediately after field screening based on the requirements and containers provided by the analytical laboratory. See the **Field Preservation of VOC and GRO Soil Samples SOP** for specific procedures for collection and field preservation of VOC Soil Samples. These samples should be collected directly from the sampler.

The remaining soil should then be composited in a stainless-steel bowl for all other analytical parameters. Select the appropriate sample container and place the sample in the container. If sufficient soil was not obtained for all analysis, additional borehole attempts at the same sample depth may be required.

Repeat this sampling procedure at the intervals specified in the project FAP until the bottom of the borehole is reached and/or last sample collected.

Record all observations on the appropriate FDR (**example attached**) and field logbook. Mark and label sample location with flagging or a pin flag and survey the point using GPS or collect measurements from three identifiable points and record measurements and a diagram in the field logbook or field data record.

Sample Handling

Upon collecting the required amount of soil, cap and label the sample container. Care should be taken to clean the sample container threads using paper towels prior to capping. The outside of the container should also be cleaned.

Clear tape should be used to wrap around the completed label to preserve legibility and prevent loss of the label during handling in wet conditions. Do not tape labels for samples collected for VOC or GRO analysis (See the **Field Preservation of VOC and GRO Soil Samples SOP**).

Place samples into a cooler with ice and begin specified storage and preservation procedures.

Samples will be labelled, handled, and transported in accordance with **Chain of Custody Procedures SOP**, the QAPP, and site-specific FAP.

5.0 ATTACHMENTS

Surface Soil Sampling Field Data Record

Soil Boring Field Data Record

Test Pit Field Data Record

SURFACE WATER AND SEDIMENT SAMPLING RECORD

MACTEC

511 Congress Street, Portland Maine 04101

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 SAMPLE INFORMATION

TYPE OF SAMPLE

- ☐ DISCRETE
- ☐ COMPOSITE

SAMPLE INTERVAL:

TOP ______

BOTTOM ______

COLLECTION EQUIPMENT

- ☐ HAND AUGER/CORER
- ☐ S.S. SPLIT BARREL
- ☐ ALUMINIUM PAN
- ☐ S.S. SHOVEL
- ☐ HAND SPOON/SPATULA
- ☐ S.S. BUCKET
- ☐ OTHER ______

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

QC SAMPLES

- ☐ DUPLICATE ______
- ☐ EQ BLK ______

TYPE OF MATERIAL:

- ☐ ORGANIC
- ☐ SAND
- ☐ GRAVEL
- ☐ CLAY
- ☐ FILL
- ☐ OTHER______

MS/MSD:

- ☐ YES
- ☐ NO

SAMPLE OBSERVATIONS

ODOR ______

COLOR ______

OTHER ______

PID ______

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:	Deviations from the work Plan:
Checked By:	Date:	

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 OD:
Weather:	Soil Drilled:	Drilling Method:	Casing Size:
Subcontractor:	Rock Drilled:	Protection Level:	Sampler:
Driller:	Date Started:	Date Completed:	Sampler ID/OD:
Rig Type/Model:	Logged By:	Checked By:	
Reference Elevation:	Water Level:	Time:	

Drilling Information					Sample Information					
Depth (feet bgs)	Sample Number	Penetration (ft) / Recovery (ft)	Blow Counts	N Value	PID Field Screening (ppm)	PID Head Space Reading (ppm)	Analytical Sample Depth (ft)	Sample Description and Classification	USCS Classification	Remarks

NOTES:

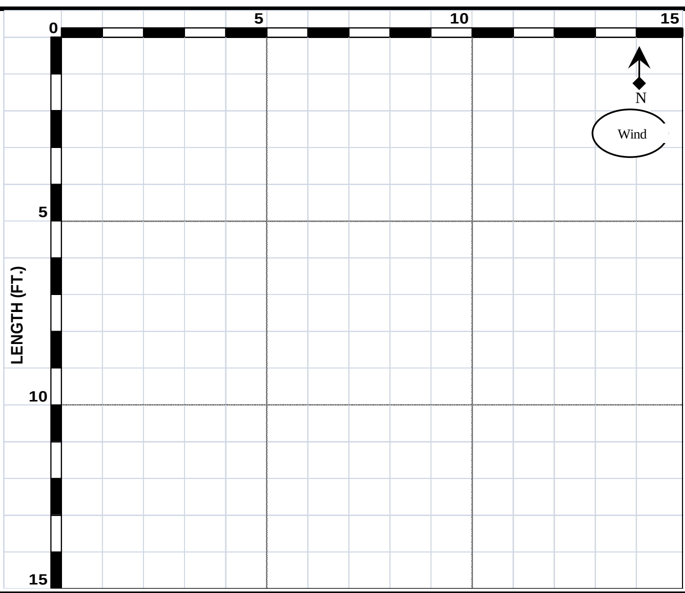
TEST PIT RECORD

MACTEC 511 Congress Street, Portland Maine 04101	Project Name:		Test Pit ID:	
	Project Location:		Page No.	1
	Project No.:	Client: NYSDEC	of:	1

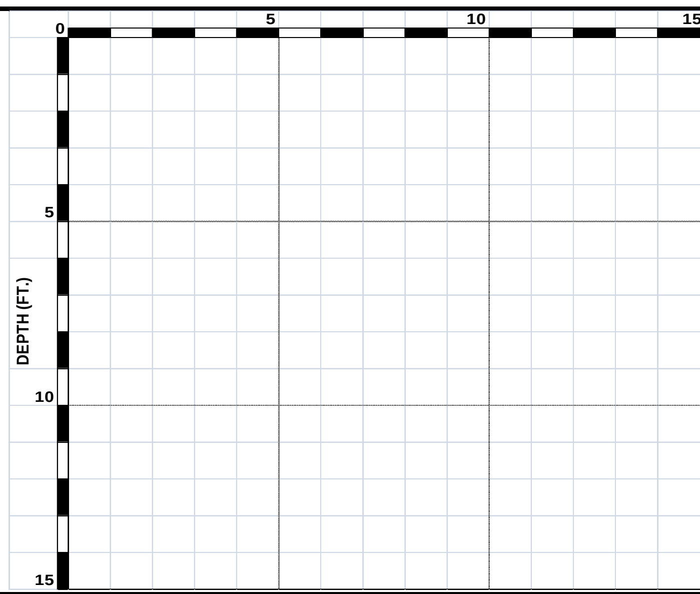
Test Pit Location:	Monitoring Equipment:		**Location Sketch** N Wind
Weather:	Photographs (Y/N):	Protection Level:	
Surface Conditions:	Length of Exc:	Width of Exc:	
Subcontractor:	Date Started:	Date Completed:	
Operator:	Logged By:	Checked By:	
Equipment:	Refusal Depth:	Total Depth:	
Reference Elevation:	Water Level:	Time:	

Sample Information			Monitoring						
Depth (ft. bgs)	Sample No. & Type	Pocket Pen/ Torvane (Kg/cm^2)	PID Field Scan	PID Headspace	Lab Tests Performed	Lab Sample ID	Sample Description and Classification	USCS Group Symbol	Remarks

PLAN VIEW



CROSS-SECTIONAL VIEW



NOTES:

TEST PIT RECORD

SOP # S14

MACTEC STANDARD OPERATING PROCEDURE #S14

FIELD PRESERVATION OF VOA AND GRO SOIL SAMPLES

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

Bradley B. LaF

____ April 27,2020

Bradley LaForest, NRCC-EAC, Project Manager Date

Reviewed Date

______________________ ______________________

______________________ ______________________

______________________ ______________________

FIELD PRESERVATION OF VOA AND GRO SOIL SAMPLES

1.0 PURPOSE

This purpose of this Standard Operating Procedure (SOP) is to outline the steps associated with field preservation of soil samples for volatile organic analysis (VOA) in accordance with U.S. Environmental Protection Agency (USEPA) Method 5035 (USEPA, 1996). Specific steps and details are described for the primary tasks of sample container preparation, soil sample collection, sample container management and documentation.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure in the execution of planned activities must be approved by the project manager and documented in the field logbook and/or field data records.

2.0 REFERENCES

New Hampshire Department of Environmental Services (NHDES), "Recommended Analytical Methods for Evaluating Petroleum Contaminated Sites"; revised January 2008.

U.S. Environmental Protection Agency (USEPA), December 1996. "Test Methods for Evaluating Solid Waste"; Laboratory Manual Physical/Chemical Methods; Office of Solid Waste and Emergency Response; Washington, DC; SW-846; November 1986; Revision 4.

3.0 DEFINITIONS

En Core® Sampler – sampling device made of an inert composite polymer, designed to collect, store, and deliver soil in a sealed-headspace free state.

GRO – gasoline range organics include volatile petroleum hydrocarbons purged from a sample in the laboratory using an inert gas.

Terra Core™ Sampler – a syringe like coring device that is pushed into soils and then extruded into pre-preserved vials.

4.0 PROCEDURE

This section contains both the responsibilities and procedures involved with soil sampling for volatile organic compounds (VOCs) and GRO. Proper procedures are necessary to ensure the quality and integrity of the samples.

4.1 Responsibilities

Project Manager

The project manager (PM) is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and any other appropriate procedures. This will be accomplished through staff training. The PM will select the appropriate sampling methodology and analytical program based on the objectives of the sampling.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL and for documenting deviations in the filed logbook and/or field data record.

4.2 Preparation

Equipment Selection and Sampling Objective Considerations

Sample containers used for the collection of off-site VOAs and GRO samples will be prepared in advance at the off-site analytical 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.

Upon receipt from the lab, the sample containers should be inspected to verify that the following have been included:

- 40 milliliter (ml) glass VOA vial with Teflon lined silicone septa lids filled with preservatives by the laboratory and pre-weighed with a water-resistant sample label.
    - Check the amount of preservative in the VOA vials. These volumes are important for determining the sample volume required in section 4.3.
        - 5mL = 2.1-2.5 mm (0.08-0.1 in) of liquid
        - 10mL = 4.2-5 mm (0.16-0.2 in) of liquid
- Sample syringe (20 mL plastic sampling syringe with end cut off) or Terra Core™ T-samplers or

En Core® samplers with a T-handle sampling device.

- A separate sample vial or container for percent moisture determination in association with each soil sample.

Containers will be stored in a dedicated area away from samples of sources of contamination (e.g. gas cans, marking paint, bug spray). A standard sample set will include three preserved VOA vials for each sample location (1 methanol, 2 deionized water) and a percent moisture container.

4.3 Field Procedures

Soil will be preserved in de-ionized water (low VOC concentration analyses) and methanol (high VOC concentration analyses) at the time of sample collection. Soils will be obtained directly from sampling devices (e.g., hand augers, split spoons, Geoprobe cores) using plastic syringe type samplers to reduce exposure of the samples to air.

For VOA, approximately 5 grams of soil is required for each analysis for low level and high-level concentration VOA vials. A good rule of thumb is that for VOA preservative volume to soil sample volume should be 1:1 (5mL preservative to 5g soil).

A soil mass of 10 grams will be added to vials for GRO analysis. For GRO analysis soil volumes should be at a 2:1 ratio to the preservative (10g to 5 mL).

Upon collection soils for VOA and GRO analysis will be immediately transferred to a vial containing a pre-measured amount of preservation fluid.

- For low concentration VOCs, two vials will be collected at each location. Vials must be shipped to the laboratory each day or frozen within 48 hours of collection. When freezing water preserved samples, vials should rest on their side to prevent glass from cracking during freezing.
- En Core ® samplers must be shipped to the laboratory each day or preserved (i.e., frozen) within 48 hours of collection.
- For VOA and GRO, one high concentration methanol vial will be collected at each location.
- For locations selected for quality assurance/quality control (QA/QC) procedures, the number of vials will be doubled or tripled for the required sample counts.
- One additional unpreserved vial of soil will be collected for percent solids analysis.

Sample Collection

Sample collection will be performed with a disposable plastic syringe (20 mL open end syringe or Terra Core™ T-handle) or En Core® sampler.

Personnel will make note of preservation fluid levels on the sample containers to ensure no significant loss had occurred. If loss of the preservative occurs during sampling, discard the sample and re-collect in a new container. The specific steps and details for soil sample collection are outlined below:

1. If samples are collected using split spoons, a direct push sampler or sonic sampler, samples will be collected from the soil core immediately upon opening the sampling device. Perform core splitting activities as described in the drilling SOPS (see Table A-1 for specific methodologies). Complete field screening using the photoionization detector (PID) for the sample surface. VOA and GRO samples are typically collected from the interval of highest PID response. For surficial soils or test pits, samples will be collected directly from the sampling location substrate (see Table A-1 for soil sampling SOPs).
2. For En Core® and Terra Core™ samplers, prepare the sampler as per the manufacturer's instructions (instructions attached). For open ended syringes move the plunger back to the 5 mL mark.
3. Push/advance the sampler into the center of the sample core/location filling the soil sampler to the target volume (5 grams). For the syringe, pull the plunger back slightly to apply suction on the soil sample which will help it to remain in the syringe during removal. Remove the sample and wipe excess soil from the outside of the sampler.
4. If the proper volume of soil is not present in the sampler, 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 with very few rocks or pebbles.
5. Remove a sample container from the cooler. Carefully extrude the soil sample from the syringe or T-sampler into the sample container. This task should be done slowly and carefully to ensure that the preservation fluid does not splash from the sample container.
    a. Note: En Core® samples do not require to be extruded from the sampler. The sampler is capped as per the manufacturer's instructions.
6. Repeat as necessary to fill the required number of sample vials. A sample for moisture determination will be collected for all soils in the lab provided unpreserved container. The samples will be collected using the same sample syringe and coring technique used for the actual field sample.
7. 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).

8. Replace container cap as soon as possible.
9. 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. **Do not tape over the sample container label as this would add weight to the lab pre-weighed vial.**
10. Make sure the sample container lid is screwed down tightly. If necessary, wipe excess soil from the mouth of the container to get an air-tight seal. 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.
11. Transport sample containers in cooler with bagged ice. Keep sample containers in individual zip lock bags.
12. Follow Chain of Custody Procedures.
13. Complete the appropriate Field Data Record (FDR) and proceed with sample handling procedures as outlined in the FAP. Vials will be transported to the laboratory for analysis using procedures specified in the Quality Assurance Project Plan (QAPP).

5.0 ATTACHMENTS

En Core® Sampling Procedures

Terra Core™ Sampling Kit Fact Sheet

Quality Environmental Containers
607 Industrial Park Road
P.O. Box 1160 • Beaver, WV 25813
Ph. 800-255-3950 • Fx. 304-255-3901
qecusa.com

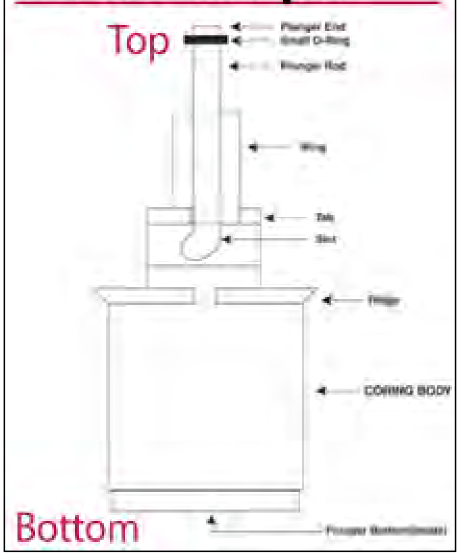
Sampling Procedures

Using En Core® Disposable Sampler and T-Handle

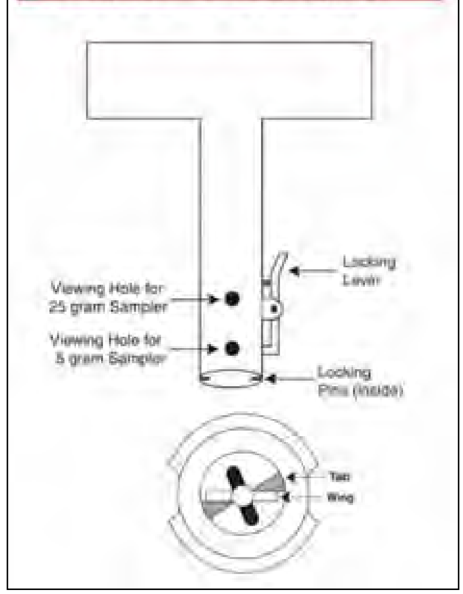
Note:

1. En Core® Sampler is a single-use device. ***It cannot be cleaned or reused.***
2. En Core® Sampler is designed to store soil. Do not use to store solvent or free product!
3. En Core® Sampler must be used with En Core® T-handle and En Core® Extrusion tool exclusively (all items sold separately).

En Core® Sampler



En Core® T-Handle

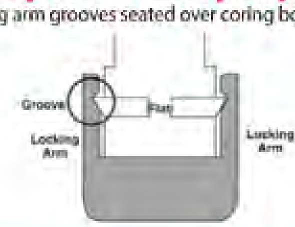


Soil Sampling Procedures:

1. Hold coring **body** and **push plunger** down until **small o-ring** rests against tabs.
2. Depress **locking lever** on En Core® T-handle. Place coring body, **plunger end first**, into open end of T-handle, *aligning the (2)* ***slots*** *on the coring body with the (2)* ***locking pins*** *on the T-handle*. Twist coring body clockwise to lock pins in slots. Check to ensure Sampler is locked in place. Sampler is ready to use.
3. Turn T-handle with T up and coring body down. This positions plunger bottom flush with bottom of coring body (ensure that plunger bottom is in position). Using T-handle, push Sampler into soil until coring body is completely full. When full, small o-ring will appear centered in T-handle **viewing hole**. Remove Sampler from soil. Wipe excess soil from coring body exterior.
4. Cap coring body while still on T-handle. *Push* **cap** over **flat** area of **ridge** *and twist* to lock **cap** into place. **CAP MUST BE SEATED TO SEAL SAMPLER** (see diagram).
5. Remove the capped Sampler by depressing locking lever on T-handle while twisting and pulling Sampler from T-handle.
6. Lock plunger by rotating extended plunger rod fully counter-clockwise until wings rest firmly against tabs (see plunger diagram).
7. Fill in sample description on En Core® Sampler bag.
8. Return En Core® Sampler to zipper bag. Seal bag and put on ice.

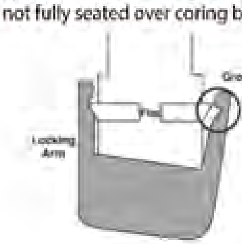
Sampler Correctly Capped

(Locking arm grooves seated over coring body ridge.)



Sampler Incorrectly Capped

(Cap appears crooked; locking arm grooves are not fully seated over coring body.)



Extrusion Tool Procedures

QEC Quality Environmental Containers

607 Industrial Park Road
P.O. Box 1160 • Beaver, WV 25813
Ph. 800-255-3950 • Fx. 304-255-3901
qecusa.com

Extrusion Procedures

Using En Core® Extrusion Tool

Caution: Always use the Extrusion Tool to extrude soil from the En Core® Sampler. If the Extrusion Tool is not used, the Sampler may fragment, causing injury.

1. To attach the En Core Sampler to the En Core Extrusion Tool: Depress **locking lever** on Extrusion tool and place Sampler, plunger end first, into open end of Extrusion Tool, aligning slots on coring body with pins in Extrusion Tool. Turn coring body clockwise until it locks into place. Release locking lever.

2. Rotate and gently push Extrusion Tool plunger knob clockwise until plunger slides over wings of coring body. When properly positioned, plunger knob will not rotate further.

3. Hold Extrusion Tool with capped sampler pointed upward so soil does not fall out when cap is removed. Remove cap from Sampler by rotating cap until locking arms are aligned with the flat area of ridge and pull cap off. To release soil core push down on plunger knob of Extrusion Tool. Remove and properly dispose of Sampler.

Warranty and Disclaimers

IMPORTANT; FAILURE TO USE THE EN CORE SAMPLER IN COMPLIANCE WITH THE WRITTEN INTRODUCTIONS PROVIDED HEREIN VOIDS ALL EXPRESS AND IMPLIED WARRANTIES, INCLUDING WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR USE.

PRINCIPLE OF USE: The En ore Sampler Cartridge System is a volumetric sampling system designed to collect, store and deliver a soil sample. The En Core Sampler comes in two sizes for sample volumes of approximately 25 or 5 grams.. There are four components: the cartridge with a movable plunger; a cap with two locking arms; a T-handle (purchased separately); and an Extrusion Tool (purchased separately). NOTE: the En Core Sampler is designed to store soil. It is not designed to store solvent or free product.

The soil is stored in a sealed headspace-free state. The seals are achieved by three special Viton® o-rings, two located on the plunger and one on the cap of the sampler. At no time and under no condition should these o-rings be removed or disturbed.

QUALITY CONTROL: The cartridge is sealed in an airtight package to prevent contamination prior to use. Due to the stringent quality control requirements associated with the use of this system, the disposable cartridge is designed to be used only once.

WARRANTY: En Novative Technologies warrants that the En Core Sampler shall perform consistent with the research conducted under En Novative Technologies' approval, within 30 days from the date of delivery, provided that the customer gives En Novative Technologies prompt notice of any defect or failure to perform and satisfactory proof thereof. THIS WARRANTY DOES NOT APPLY TO THE FOLLOWING, AS SOLELY DETERMINED BY EN NOVATIVE TECHNOLOGIES: (a) Damage caused by accident, abuse, mishandling or dropping; (b) Samplers that have been opened, taken apart or mishandled; (c) Samplers not used in accordance with the directions; and (d) Damages exceeding the cost of the Sampler. Seller warrants that all En Core Samplers shall be free from defects in title. THE FOREGOING WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, WHETHER ORAL, WRITTEN, EXPRESSED, IMPLIED OR STATUTORY, INCLUDING ANY INFORMATION PROVIDED BY SALES REPRESENTATIVES OR IN MARKETING LITERATURE. IMPLIED WARRANTIES OF FITNESS AND MERCHANTABILITY SHALL NOT APPLY. En Novative Technologies' warranty obligations and customer's remedies, except as to title, are solely and exclusively as stated herein.

LIMITATION OF LIABILITY: IN NO EVENT SHALL EN NOVATIVE TECHNOLOGIES, INC. AND/OR QUALITY ENVIRONMENTAL CONTAINERS, INC. BE LIABLE FOR ANTICIPATED PROFITS, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO, DAMAGES FOR LOSS OF REVENUE, DOWN TIME, REMEDIATION ACTIVITIES, REMOBILIZATION OR RESAMPLING, COST OF CAPITAL, SERVICE INTERRUPTION OR FAILURE OF SUPPLY, LIABILITY OF CUSTOMER TO A THIRD PARTY, OR FOR LABOR, OVERHEAD, TRANSPORTATION, SUBSTITUTE SUPPLY SOURCES, OR ANY OTHER EXPENSE, DAMAGE OR LOSS, INCLUDING PERSONAL INJURY OR PROPERTY DAMAGE. En Novative Technologies' and/or Quality Environmental Containers' liability on any claim of any kind shall be replacement of the En Core Sampler or refund of the purchase price. En Novative Technologies and/or Quality Environmental Containers shall not be liable for penalties of any description whatsoever. In the event the En Core Sampler will be utilized by customer on behalf of a third party, such third party shall not occupy the position of a third party beneficiary of the obligation or warranty provided by En Novative Technologies, and no such third party shall have the right to enforce same. All claims must be brought within one (1) year, regardless of their nature.

Terra Core™ Sampling Kit

5035A Soil Sampling for VOCs, BTEX/MTBE, GRO 8015 & TPH-TX 1005

EPA SW-846 Sampling Method 5035A reduces the amount of disturbance when collecting solid/soil samples for the analysis of Volatile Organic Compounds (VOCs) by 8260, BTEX/MTBE by 8021, GRO 8015, and TPH-TX 1005. A Terra Core™ sampling kit is provided for each sample being collected, and allows for a 5 gram sample aliquot for VOCs or BTEX/MTBE or GRO and a 10 gram sample aliquot for TPH-TX 1005 (collect and extrude twice) to be collected and immediately extruded into a pre-weighed, pre-preserved 40 mL VOA vial.

Terra Core™ Sample Containers

VOCs 8260 or BTEX/MTBE 8021 or GRO 8015:

- 1 - Terra Core™ sampler that collects a 5 gram aliquot
- 1 - Methanol-preserved 40 mL VOA vial for high level analysis
- 2 - Neat 40 mL VOA vials containing stir bars for undiluted/low-level analysis
- 1 - 60 gram sample jar for percent moisture analysis or screening

TPH-TX 1005:

- 2 - Neat 40 mL VOA vials (without stir bars)

SERVICE

- On-time data delivery and rapid TAT
- Experienced staff with expertise
- Available after-hours and weekends

VALUE

- Instant access to data with Webtrieve™ and Webtrieve™ Mobile App
- Custom bottle kits with pre-printed labels and COCs

RELIABILITY

- Technical experts that can answer your most difficult questions
- A real focus on quality and process control with a rigorous QA/QC program

Get Connected!

Check out our helpful video about this service on our YouTube Channel!

Scan the QR Code with your smartphone or search for "ALS Environmental" on YouTube.

Continued on reverse side...

10450 Stancliff Road • Suite 210 • Houston, TX 77099
+1 281 530 5656

www.alsglobal.com

... continued from reverse side

Collecting a Sample Using the Terra Core™ Kit

Step 1: With the plunger seated in the handle, push the Terra Core™ sampler into freshly exposed soil until the sample chamber is filled. A filled chamber will deliver approximately 5 grams of soil.

Step 2: Wipe all soil or debris from the outside of the Terra Core™ sampler. The soil plug should be flush with the mouth of the sampler. Remove any excess soil that extends beyond the mouth of the sampler.

Step 3: Rotate the plunger that was seated in the handle top 90° until it is aligned with the slots in the body. Place the mouth of the sampler into the 40 mL VOA vials listed in these instructions and extrude the sample by pushing the plunger down. Quickly place the lid back on the 40 mL VOA vial.

Note: When capping the 40 mL VOA vial, be sure to remove any soil or debris from the top and/or threads of the vial.

Step 4: Collect sample for the 60 gram jar using the bulk soil collection technique.

Holding Times:

Samples collected via 5035A must be submitted to the laboratory as soon as possible and frozen within 48 hours of collection.

Special Labeling Instructions:

Each Terra Core™ sampling kit is a foam container that includes the bottles listed in these instructions. Each bottle is pre-weighed and pre-labeled, and it is imperative that the weight is legible upon receipt at the laboratory. In addition, please complete each pre-labeled vial.
DO NOT affix an additional label to the vials as it will alter the tared weight. A large label will be affixed to the outside of the ziplock bag that has a space for your Sample ID. Please complete this portion of the label.

QA/QC Requirements:

For each sampling event (or every 20 samples), please collect triple volume (three Terra Core™ Sampling Kits) for one sample location. This is needed for internal laboratory QA/QC (MS/MSD).

Special TPH-TX 1005 Sampling Instructions:

If you are collecting soil samples for Total Petroleum Hydrocarbons (TPH-TX 1005) using Method 5035A, you will receive two pre-weighed neat 40 mL VOA vials (without stir bars) contained in the Terra Core™ sampling kit (or enclosed in a separate bubble bag if no other 5035 parameters are requested). During sample collection, please collect 10 grams of sample (or extrude twice) and place into the vials.

Contact us now for more information!

10450 Stancliff Road • Suite 210 • Houston, TX 77099
+1 281 530 5656
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SOP # S16

MACTEC STANDARD OPERATING PROCEDURE #S16

DRILLING - SOIL BORING AND ROCK CORING OVERSIGHT

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

______________________________ April 27, 2020

Jean Firth, PG, Program Manager Date

Reviewed Date

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DRILLING - SOIL BORING AND ROCK CORING OVERSIGHT

1.0 PURPOSE

This Standard Operating Procedure (SOP) was prepared to direct field personnel in the methods for advancing soil and rock borings to characterize subsurface conditions during site hydrogeological and geotechnical investigations. The objective of soil and rock boreholes is to provide samples for description and characterization of subsurface conditions, and obtain samples for geotechnical and/or chemical analyses, often prior to installation of a monitoring well. This objective requires the use of consistent procedures for documenting observations and collecting samples.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure must be approved by the project manager and documented in the field logbook and/or field data records.

2.0 REFERENCES

ASTM International (ASTM), 2018. Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils, Method D1586-18

ASTM, 2017. Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); ASTM D2487-17e1.

ASTM, 2014. Standard Practice for Rock Core Drilling and Sampling of Rock for Site Exploration, Method D2113-14, ASTM International, West Conshohocken, PA.

Barth, D.S. and B.J. Mason. 1984. Soil Sampling Quality Assurance User's Guide. EPA-600/4-84-043.

Mason, B.J. 1983. Preparation of Soil Sampling Protocol: Techniques and Strategies. EPA-600/4-83-020.

3.0 SOIL BORING METHODS

Test borings can be advanced by a variety of drilling methods. The quality of the information obtained from the various boring methods varies with the character of the subsurface geologic conditions, and careful consideration should be given in selecting the desired method. It may be necessary to employ more than one boring method to advance a particular borehole. The drilling techniques used on any particular project will be selected by the project manager and/or project geologist.

Commonly employed soil test boring techniques are described in the following subsections:

Auger Borings

This method involves advancing helical solid-flight or hollow-stemmed augers. This is a fast method for advancing the borehole, without the use of drilling fluid, and particularly effective for boring through partially saturated or unsaturated material above the groundwater table. Conventional sampling procedures are employed (e.g., split-spoon sampling). Some disturbance of the natural soil is caused by the advancing augers. Auger borings are primarily used for environmental investigations because they are cost effective and do not involve the introduction of drilling fluids and muds to the subsurface environment which may adversely impact samples for chemical analyses.

Auger borings are difficult to advance below the groundwater table in some types of granular soils because the soils can liquefy and move up inside the auger stem and/or collapse against the auger flights and cause excessive friction which may exceed the power of the drill rig to spin the augers. This condition is commonly referred to as "running sands" or "blowing sands" in the drilling industry. Running sands can be counteracted with limited success by maintaining a constant hydraulic head in hollow-stemmed augers during the sampling operations. However, the constant head technique is not very effective when drilling more than approximately ten feet below the water table in granular soils.

Hollow-stemmed augers are advanced hydraulically into the overburden to the required sampling depth. The auger acts as a casing during the advancement of the borehole. Augers are usually in five-foot sections. Some disturbances of the sampling zone may be created during the augering operation.

Soil sampling may either be conducted continuously from the ground surface or at predetermined specific depths. The site specific FAP will outline the soil sampling methodology. For discrete sample locations, a removable center plug is installed during advancement of the augers to prevent buildup of soil within the augers. This allows passage of the sampling equipment (typically a split-spoon sampler or Shelby tube) to the required depth of sample collection. A typical center plug utilized by drillers is a roller bit connected to an inner set of drilling rods.

Solid stem augers are not recommended for environmental investigations because soil samples cannot be obtained from discrete depth intervals. Soil samples from solid stem auger borings are typically collected from the surface of the auger flights as the cuttings are brought to the ground surface.

Cased Borings

This drilling method advances threaded steel casing to support the borehole as it is advanced. The casing can be driven or rotated to a given depth and soil within the casing removed using drilling fluid (e.g., water, drilling mud) or air. Split spoon samples can be retrieved from undisturbed soils below the bottom of the casing.

The borehole is advance by constant blows of a drive hammer (typically 300 pounds, falling over a distance of 24 inches) upon a drive head, which is attached to the casing. The casing can also be spun and pushed to the desired depth. The casing is driven/spun in five-foot increments, with representative soil samples being obtained on a continuous basis or at the completion of each five-foot drive (depending upon the project objectives outlined in the FAP).

After the casing is seated at the required depth, the borehole must be cleaned-out prior to obtaining a soil sample. The two most commonly used methods for clearing cased borings in environmental drilling are as follows are the drive and wash or rotary drilling methods.

Drive and Wash Drilling Method - Drive and wash methods are most commonly used in soils which do not contain large cobbles and boulders, or cemented horizons. The technique uses a chopping bit that is driven by a rotating drill rods to break up the material in the casing. The loosened material (cuttings) is removed from the casing by injecting drilling water or drilling mud down through the drill rods to openings in the cutting head and which then rises to the surface of the casing to settle in a wash tub adjacent to the borehole.

Rotary Technique – This method is a variation of the wash boring technique, utilizing a rotary drill bit, rather than a chopping bit. This is the method generally preferred for exploratory test borings in the geo-technical 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 feet below the ground surface.

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 geologist should determine the source and quality of the drilling water to be used in the boring process. The field geologist 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 geologist should consider obtaining a sample of the drilling fluid for potential analysis, at the discretion of the project manager and quality assurance/quality control (QA/QC) officer.

Drilling Mud - Drilling mud may be prepared from commercially available products. Employing mud in a boring makes identification of the cuttings more difficult and hinders groundwater level observations. The use of drilling mud is typically avoided when conducting environmental investigations. The use of drilling mud can reduce the permeability of the walls of the borehole, and therefore, lead to erroneous water level measurements. Additionally, the use of drilling mud introduces foreign material to the subsurface environment, which is not completely removed upon completion of the boring. The results of chemical analyses conducted on soil samples from boreholes advanced with drilling mud may not be representative of the natural (undisturbed) formation. Water samples obtained from wells installed in these boreholes may contain contaminants or parameters, which were not originally present in the groundwater prior to the use of the drilling mud.

The basic mud mixture employed in the drilling industry is bentonite and fresh water (approximately 6 percent bentonite by weight: 50 pounds of bentonite per 100 gallons of water). Attapulgite clay is commonly used and will mix with salt water to prevent flocculation. Weight additives such as pulverized barite, hematite, galena, or other heavy minerals may be added to the mixture to increase the specific gravity in troublesome soils or under artesian conditions. The precise ingredients and their proportions in the mixture must be recorded for future reference, particularly when groundwater from wells installed in their borings is to be tested for dissolved metals and pH.

Borehole Cleaning

Thorough and careful cleaning of the borehole is mandatory for obtaining representative, undisturbed soil samples. Careful measurement of tool length is required. The washing operation should not usually extend below the bottom of the casing (cohesive soils would be an exception). Special bits that deflect the wash water outward or upward should be employed, and only enough wash water should be pumped down the hole to bring the cuttings to the surface. Special shielded auger cleanouts should be employed in cohesive soils prior to obtaining undisturbed piston samples.

4.0 ROCK DRILLING METHODS

There is no universal core barrel or drilling equipment for rock coring. The geologic and topographic conditions, in addition to the requirements of the project will dictate the type of equipment to be employed on any specific project.

For environmental drilling, typically a soil boring will be completed to the top of bedrock using one of the soil boring drilling methods discussed above. Upon refusal of the soil boring at the bedrock surface a bedrock socket will be advanced 2-3 feet below the top of rock and a threaded steel casing will be inserted and grouted in place. This casing effectively seals off bedrock from the overburden soils, groundwater, and/or contamination.

There are two fundamental drilling methods for rock: non-core (destructive) or core drilling.

Non-Core (destructive) Drilling

Non-core drilling is a relatively quick and inexpensive means for advancing a rock borehole when an intact rock sample or detailed logging is not required. Non-core drilling is completed by advancing a cutting bit, rotary roller bit, or rotary drag bit to a predetermined depth with the pulverized rock cuttings removed from the borehole through the use of compressed air, drilling water, or drilling mud. Compressed air (e.g. air hammer drilling methods) is typically not used for environmental drilling as the cuttings are typically blasted to the surface away from the rig which may redistribute contamination. Sample quality considerations with regards to drilling using water or drilling mud are the same as those noted for soil borings.

Because intact rock samples are not recovered in non-core drilling, it is important for the field geologist/engineer to carefully record observations during drilling.

Rock Core Drilling

Bedrock coring for environmental drilling utilizes a rock coring barrel with a diamond or carbide tipped cutting shoe to retrieve relatively undisturbed lengths of rock cores. These core barrels come in various diameters and lengths. The required diameter of the sampler will be outlined in the FAP. NX, NQ, and HQ core sizes are most used for environmental drilling. Generally, a larger core size will produce greater recovery and less mechanical breakage.

Core barrels may consist of a single-tube, double-tube, or triple-tube configuration. Double-tube and is typical standard will provide less disturbed core samples than those from single barrel as the rock core is isolated from the drilling fluids. Triple-tube configurations will provide the least disturbed rock core samples but are less commercially available in some regions.

Core samplers are retrieved using either conventional or wireline equipment. Conventional methods require the entire drill string or rods and the core sampler need to be removed from the borehole to retrieve the rock core. Wireline methods allow for the inner tube in double and triple-tube setups to uncoupled from the outer tube and then raised rapidly to the surface using a wire line hoist. Wireline retrieval has its advantages in that it allows for improved quality of the rock core by limiting the handling of the drill string (raising through the borehole and hammer blows on the casing to separate sections or the core barrel) and allows for rapid retrieval and deployment on deeper bedrock borehole.

5.0 PROCEDURES

This section contains both the responsibilities and procedures involved with drilling oversight and sampling. Proper procedures are necessary to ensure the quality and integrity of the samples.

5.1 Responsibilities

Project Manager

The project manager (PM) is responsible for ensuring that drilling activities are conducted in accordance with this SOP and any other appropriate procedures. This will be accomplished through staff training. The PM will select the appropriate drilling methodology based on the objectives of the project.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to drilling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL.

As with any heavy equipment, caution should be taken to minimize the potential for injuries such as crushing and pinching. Additionally, the drill rig has overhead hazards and in most cases noise hazards which should also be considered. Before any drilling is completed, the rig should be set level and the operator should inspect the location to verify that the unit is stable and secure enough to operate. All personnel shall be familiar with the location of the rig's emergency kill switch. All non-essential personnel should be kept clear of exclusion zone or from an area surrounding the rig. Due to the potential of noise, ear protection is required. If needed, hand signals should be developed for communication between engineer and the driller.

5.2 Preparation

Utility Locate

Prior to mobilizing to a site, the PM or FOL will ensure that the local utility "one call" service has been notified (e.g. Dig Safely New York). Typically the drilling subcontractor will be resposnsible to call in the utlity ticket. Confirmation of the notifcation and the ticket number will be requested by the PM or FOL for the public records. No work may procede at the site until the ticket has been logged and all ultilities have responded/marked out.

If conducting borings at an active site, the project or field engineer/geologist must contact the appropriate site personnel necessary to receive clearance to drill at specified locations. The names of the personnel authorizing clearance will be documented in the field logbook. The exact location of each boring shall also be reviewed by responsible site personnel to ensure that the area is free of the facility-owned buried utilities. Surface geophysics may be conducted to identify the locations of subsurface facility-specific structures (e.g., drain lines, septic tanks, etc..) and soft dig methods (hand clearing with shovels, post hole diggers, hand augers) may be required.

Drilling locations shall be no closer than 25 feet to overhead utilities or within 10 feet of buried utilities.

Upon arrival at the site the FOL will complete the Utility Clearance Form (**example attached**) to document that utility locate activities and mark out have been completed prior to the initialization of drilling activities.

Equipment Selection

The following materials will be available, as required, during drilling activities:

- Materials (e.g. drums, roll-offs, fractionation tanks) for investigation derived wastes (IDW) as specified in the FAP.
- Personal protective equipment (PPE), monitoring equipment, and other health and safety equipment as specified in the project specific health and safety plan.
- Appropriate decontamination equipment (steam cleaner, materials for a decon pad, etc.) as

specified in the QAPP or FAP.

- Monitoring well and other construction materials if specified in the FAP.
- Stainless steel trowels or spatulas.
- Aluminum Foil.
- Paper Towels.
- Measuring device (e.g. engineer's scale tape or rule).
- Appropriate sample containers and Field Data Records.
- Photoionization detector (PID).
- Camera.
- Field notebook.

5.3 Field Procedures

5.3.1 Documentation

In the field book, the supervising geologist/engineer shall record the name of the drilling firm and the names of the driller and his assistant(s). The date, project location, project number, and weather conditions shall be recorded as well.

An accurate time log of drilling activities shall be kept. This log shall be kept in the field logbook and shall include at a minimum, the following:

- Time driller and rig arrive on site
- Time drilling begins
- Any delays in the drilling activities and the cause of such delays
- Time drillers go off site
- Duration of decontamination and investigation derived waste handling
- Down time (those periods when drilling activities cease due to equipment malfunctions, weather, and ordered stoppages)

Monitoring equipment for field screening (PID) and community air monitoring programs (CAMP) will be calibrated daily as per manufacturer's instructions. Equipment information (make, model, and serial number) and calibration readings shall be recorded on the field instrument calibration record (**Attachment S16D**). Make note of calibration variances or spanning to non-standard specifications.

Soil boring information including standard penetration depth information, sampling intervals, and soil descriptions will be recorded on the Soil Boring Log FDR (**example attached**). See the **Description and Identification of Soil Samples SOP (SOP # listed on Table A-1)**.

5.3.2 Standard Penetration Tests (SPT) – Split Spoon Soil Sampling

Standard penetration tests (split spoon sampling) can be employed to collect subsurface soils samples during auger and cased-boring drilling methods. Split spoon sampling is described in ASTM Designation D 1586.

This technique should be conducted as follows (assembly, drive and retrieval of the split spoon will be completed by the driller):

1. The split-spoon sampler (spoon) consists of a 2-inch (outside diameter) by1-3/8 inch (inside diameter) 24-inch length, heat-treated, case-hardened steel head, split-spoon, and shoe assembly. Split-spoon or split-tube samplers are the most generally accepted method for obtaining representative soil samples however, from a geotechnical perspective, the samples obtained using a split-spoon are disturbed and unsatisfactory for some analyses. The head is vented to prevent pressure buildup during sampling and must be kept clean. A steel ball check valve is located in the head to prevent downward water pressure from displacing on the sample out the bottom of the spoon during retrieval. Failure of the check due to soil buildup in the head, frequently causes sample loss. Specialized sampling baskets can be inserted into the spoon nose to prevent sample loss in soft and cohesive soils.
2. The drive rods, which connect the spoon to the drive head, should have stiffness equal to or greater than that of the A-rod. In order to maintain only minimal rod deflection, on exceptionally deep holes, it may be preferable to use N-rods. The size of the drive rods must be kept constant throughout a specific exploration program, as the energy absorbed by the rods will vary with the size and weight of the rod employed. This is most important in geotechnical investigations.
3. The drive head consists of a drop hammer (140 pounds) with 30-inch free-fall drop free fall in order to strike the anvil attached to the top of the drill rods. Automatic trip hammers are commercially available which insure the 30-inch free-fall drop and are the preferred tools for environmental and geotechnical investigations. Automatic trip hammers are also inherently safer than older rope and cathead methods.
4. Attach the split-spoon sampler to the drill rods and lower the assembly to the bottom of the borehole. Measure the drill rod stickup to determine if heave or blow-up of the stratum has occurred. The automatic triphammer will raise the 140-pound hammer, 30 inches above the drive head anvil and then allowed to free fall and strike the anvil. This procedure is repeated until the sampler has penetrated the full length of the sampler into the stratum at the bottom of the borehole. Note any penetration of the sampler into the stratum under the weight of the rods or hammer alone.

5. The number of blows of the hammer required for each 6-inch penetration is counted and recorded on the soil boring log. When the number of blow counts exceeds 50 per 6 inches, the split spoon sampling shall be terminated and the number of blow counts per tenths of foot (for the last one-half foot) shall be recorded and noted as sampler refusal.
6. The penetration resistance (N) is determined by adding the second and third 6-inch resistance blow counts together. The blow counts will be tracked by the driller and verbally given to the field geologist/engineer after each SPT. Nomenclature for 6” penetration intervals under just the weight of the rods or hammer can use WR – weight of rods or WH – weight of hammer. When other sizes and types of sampling and drive equipment are employed, ASTM reference tables may be used in converting the obtained blow count to the accepted SPT value.
7. The sampler is then withdrawn from the borehole, preferably by using a threaded lifting plug and with the winch attached to the drill mast. Remove the sampler from the bottom of the borehole slowly to minimize disturbance. Keep the casing full of water during the removal operation.
8. Careful measurement of all drilling tools, samplers, and casing must be exercised during all phases of the test boring operations, to ensure maximum quality and recovery of the sample.
9. The split-spoon will be opened by the driller and handed to the field geologist/engineer. Upon the sampling table the spoon will be opened (split) and a fresh face will be prepared by using a clean flat edged scraper (e.g. paint scraper) in perpendicular motions to the split spoon. The resultant fresh face will be screened using a PID for volatiles and carefully examined, noting all soil characteristics, color seam, disturbance, etc. (See **Description and Identification of Soil Samples SOP [SOP # listed on Table A-1]**). For the field screening of the sample the PID inlet should be just above the soil surface and a hand should be cupped over both for an interval for a period of several seconds to get an accurate reading. This allows for the buildup of VOCs for measurement without interference from ambient air. Colder temperatures will inhibit volatilization and may require longer screening times to get accurate readings.
10. Collect photographs of the soil in the sampler. The spoon and sample should be placed in a good light, preferably against a solid colored background. A ruler for scale and a tag identifying the sample should be placed in the picture. The identifier tag must have the sample number, depth and project name or number written so as to be legible in the photograph. Any photographs taken must be recorded in the field logbook.
11. A representative sample is selected based on the sampling objectives outlined in the FAP and is collected using the appropriate sampling method and container as outlined in (**Soil Sampling and Field Preservation of VOC and GRO Samples [SOP #s listed on Table A-1]**).

12. Following the collection of representative samples for chemical and/or geotechnical analyses, remaining soil material will be collected into a separate container for VOC headspace screening (see below).
13. Steps 4 to 11 will be repeated, as necessary, until the bottom of the borehole, as outlined in the FAP, is reached (e.g. refusal or a predetermined depth). Frequency of sample collection will either be continuous or at predetermined depths. The casing or augers will be advanced through each interval once SPT has been completed.
14. After the terminal depth of the borehole has been achieved, and an environmental monitoring well will not be installed, the borehole should be backfilled with a cement/bentonite grout. Grout will be injected using a small diameter pipe to the base of the borehole. Drilling fluids within the borehole will be displaced upwards, collected in the drilling wash tub, and will be containerized as investigation derived waste. Alternatively, grout may be injected using the drill string in the same manner as the drilling fluids. Care should be taken to ensure the grout does not bridge forming gaps or voids in the grout column. Casing and augers will be slowly retracted during borehole abandonment to prevent the bottom of the casing/auger from rising above the top of the grout column. Grout will be mixed and injected in multiple lifts until flush with the ground surface. Following grouting, barriers should be placed over grouted boreholes as the grout is likely to settle in time, creating a physical hazard. Grouted boreholes will typically require at least a second visit to "top off" the hole.
12. If a monitoring well is to be installed see the **Monitoring Well and Microwell Installation SOP** for methodology and installation details.
13. Decontaminate non-disposable equipment or tools that may have come into contact with subsurface soil in accordance with the FAP.
14. Discard all disposable equipment used during sampling activities in a designated location.
15. The approximate location of the boring will be marked with a wood stake colored with highly visible spray paint and/or flagging. The boring number will also be written on the stake to identify the sample location for surveying purposes.

Records of each exploration shall be made on a Soil Boring Log and in the field logbook. All cuttings or other waste will be containerized or disposed of in accordance with planning documents.

5.3.3 Soil Headspace Screening

The purpose of the soil headspace screening procedure is to screen soil sample headspaces for total ionizing VOCs. This is a semi-quantitative method used to identify the presences, absence, and relative concentrations of VOCs in soil. Headspace screening is performed with a photoionization detector (PID).

Headspace readings may be completed in between sample runs. Headspace readings should be transcribed on to the soil boring log FDR.

1. Record and document background VOC readings in ambient air. If it is not feasible to screen samples in an area with a clean background, document the highest background reading.
2. Half fill a clean jar or Ziplock™ type plastic bag with soil. Quickly cover the jar with aluminum foil or close the plastic bag and label the container.
3. Vigorously shake the sample to disperse soil and wait for approximately 5 minutes. Record the ambient temperature at which screening is performed. If outside temperatures are below 50°F, try to warm the samples in a heated vehicle or building.
4. Shake the sample again after 5 minutes.
5. Insert the tip of the PID through the foil or into the plastic bag and record the highest meter response, typically after approximately 3 to 15 seconds.
6. After screening all samples, re-check background and record significant variations.

The PID has a reliable reporting limit of 1 part per million in air. Readings at or below the reporting limit should be reported as not-detected “ND”.

Screening results will vary based on sample temperature, compounds present, age of the sample, and the degree to which the sample has been agitated and crumbled. Field personnel should remain consistent in their headspace measurement methodology to avoid biasing samples.

5.3.4 Rock Coring

There is no universal core barrel or drilling equipment for rock coring. The geologic and topographic conditions, in addition to the requirements of the project will dictate the type of equipment to be employed on any specific project. Specific methods, equipment, and core sizes will be specified in the FAP.

<u>Non-Core Procedures</u>

The following general procedures will apply to non-coring drilling methods:

1. Upon encountering boring refusal at the soil/bedrock interface, a rock socket will be advanced 2 to 3 feet below the top of rock and a threaded steel casing should be firmly seated and grouted in place. The casing should be allowed to sit for 24-hours to allow the grout to cure.
2. After the grout has cured, a selected cutting bit will be advanced down the casing to the terminal drilling depth Drilling water will be recirculated through the borehole to bring fines to the surface and be contained in a settling basin/wash tub.

3. Pump drill water down the drill rods and observe a return flow before commencing drilling operations.
4. Carefully measure all length of rods, core barrel, and stick-up through all phases of the drilling to insure accurate depth determination.
5. During the drilling a strainer will be used to catch rock chips being carried by the drilling water. Basic descriptions of these rock chips will be recorded on the FDR.
6. Other descriptions that should be included on the FDR include:
    a. Penetration rate (feet per minute)
    b. Sudden dropping of the rods (voids or large fractures)
    c. Unusual drill action (bouncing, chatter, binding)
    d. Loss of drilling fluid or color change of the fluid

Rock Core Procedures

The following general procedures are applicable to rock coring drilling methods:

1. Upon encountering boring refusal at the soil/bedrock interface, a rock socket will be advanced 2 to 3 feet below the top of rock and a threaded steel casing should be firmly seated and grouted in place. The casing should be allowed to sit for 24-hours to allow the grout to cure.
2. After the grout has cured, a roller tri-cone bit will be advanced down the casing to remove any grout inside the casing an create a fresh surface for coring. Drilling water will be recirculated through the borehole to bring fines to the surface and be contained in a settling basin/wash tub.
3. Mount the core barrel on the drilling rods and lower it into the borehole until the bit touches the bedrock surface.
4. Pump drill water down the drill rods and observe a return flow before commencing drilling operations.
5. Carefully measure all length of rods, core barrel, and stick-up through all phases of the drilling to insure accurate depth determination.
6. The diamond-bit core barrel should be started in the hole and the rock drilled in continuous 5-foot length intervals (runs) until the required depth is reached. Runs longer than 5-ft should be avoided as it will reduce core recovery and poor quality in fractured and weathered rock.
7. Drill with minimal vertical pressure and rotation. Most rigs are equipped with a selection of gear ratios and a variable hydraulically controlled feed mechanism. Driller expertise in

selecting the correct combination of speed and feed rate is invaluable. Faster rotation and high down pressures can mechanically fracture the rock, reducing the quality of the retrieved rock core.

8. Water return should be no more than what is just sufficient to bring the borehole cuttings to the surface.
9. Record the start and stop time for each run and factor out stoppages due to drill rod additions to complete a run. These times should be recorded in the field book and a penetration rate of ft/min should be recorded on the FDR.
10. Upon completing each 5-foot core run, the core barrel is spun and lifted to break the core at the bottom of the run. After the core is broken off it should be withdrawn, labeled, and stored in an approved core box.
11. Cores should be carefully handled to ensure their proper identification and placement in correct order. Carefully place the rock core in the core box with wooden partitions so that the cores from each run will be kept separate. The core should always be placed in the core box in book fashion with the top of the run at the upper left corner and the remaining core placed sequentially from left to right and from the top left corner to the lower right corner. Place a wooden partition labelled with the start and end depths at the beginning and end of each core run. The core should fit snugly in the box so that it will not roll or slide and suffer additional breakage.
12. Each core box should only contain cores from a single boring. Never place the core from more than one test boring in a core box. In addition, wherever core is lost due to the presence of a cavity or large discontinuity (open or filled), a spacer should be placed in the proper position in the core box. The spacer should be labeled with the depth range and thickness of the missing core, and the reason for the missing core (e.g., cavity, large joint, etc.).
13. A straight line should be drawn down the length of the core with character markers (e.g. arrows) on fractures to preserve original orientations if the rock core becomes disturbed. Masonry chalk markers are suitable marking tools. If a core is required to be broken in order to fit in the core box, notes of the break depth should be reported on the FDR and in the field book. This break will not be factored into rock quality designation (RQD) calculations.
14. Carefully examine and classify the rock and measure the recovery and RQD in percent (See **Description and Identification of Rock Samples** for guidance). Record all information on the FDR (**example Attached**).

15. If 100% recovery was not obtained, sound the borehole to determine if the missing core still remains in the bottom of the borehole. Always terminate each boring with 100% recovery, in order to ensure that appropriate knowledge is available of their materials.
16. The core box should be marked on the top and two ends with the client's name, site identification, boring number, depth range, and box number. The inner core box lid should include the run number, depth range, recovery, and RQD.
17. The core barrel and drilling tools must be steam-cleaned or washed upon completion of the bore hole to preclude cross contamination between successive bore holes.

The following information shall be included in a rock core run log:

- The depth and length of the core run.
- The coring rates.
- The color of the core wash water. Any changes, loss of return water, or gain of return water will be noted.
- The recovery of the core run recorded as length of rock recovered over the length of the core run.
- The RQD of the run is reported as the sum of inches of all naturally fractured rock core pieces larger than four inches over the total number of inches in the run. The length of the piece will be determined by the distance between naturally occurring fractures.
- The rock type(s) and their location in the core run, rotating color, mineralogy, texture, fossil content, effervescence in HCL, and any other data of geologic significance.
- Any structure in the core, including fractures, clay seams, vugs, bedding, fissility, and any other data of geologic or geotechnical significance.

Rock core samples are photographed in the wooden core box. The rock should be wetted to enhance the color and textural changes in the rock. Due to the relatively large size of most core boxes, the photographer (when possible) should stand up on a chair, tail gate, car bumper or other perch in order to photograph the box from directly above, and get the entire box in the camera's field of view. The photograph must include a ruler for scale and an identifier tag indicating the project name and number, the boring number, the date, and the depths of the various core runs.

5.3.5 Monitoring Well Installation

Bedrock boreholes may either be left open or have discrete monitoring wells installed for groundwater sampling. Well completion details will be outlined in the FAP. Further guidance is available in the **SOP for Monitoring Well and Microwell Installation.**

6.0 ATTACHMENTS

Utility Clearance Form

Soil Boring Log

Rock Coring Log

Field Instrument Calibration Record

Utility Clearance Form

Site Name: ______________________________ Project No./Task No.: ____________

Site Address: ______________________________ One Call Ticket No.: ____________

Ticket Good until: ____________

Project Manager Name: ______________________________ PM Phone No.: ____________

Locations cleared by facility? ______________________________ Date Cleared: ____________

Utility Clearance:

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

*Contact local municipality

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

Private Utility Locator/Geophysical Survey

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

Non-Destructive Excavation Method to be used

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

* Use electrically insulated gloves if potential for power lines

Field Clues Observed/Evaluated:

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

Additional Notes/Remarks: ______________________________

____

Confidence Level that All Utilities have been identified:

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

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

*Cleared by PM? ____________________ *Discussed with OM? ____________________

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 OD:
Weather:	Soil Drilled:	Drilling Method:	Casing Size:
Subcontractor:	Rock Drilled:	Protection Level:	Sampler:
Driller:	Date Started:	Date Completed:	Sampler ID/OD:
Rig Type/Model:	Logged By:	Checked By:	
Reference Elevation:	Water Level:	Time:	

Drilling Information					Sample Information					
Depth (feet bgs)	Sample Number	Penetration (ft) / Recovery (ft)	Blow Counts	N Value	PID Field Screening (ppm)	PID Head Space Reading (ppm)	Analytical Sample Depth (ft)	Sample Description and Classification	USCS Classification	Remarks

NOTES:

ROCK CORING LOG

MACTEC 511 Congress Street, Portland Maine 04101	Project Name:		Boring ID:
	Project Location:		Page No.
	Project No.:	Client:	of:
Boring Location:	Top of Rock:	Total Depth:	Casing Type:
Weather:	Casing Depth:	Drilling Method:	Casing Size:
Subcontractor:	Rock Drilled:	Protection Level:	
Driller:	Date Started:	Date Completed:	Core Barrel Type:
Rig Type/Model:	Logged By:	Checked By:	Core Size:
Reference Elevation:	Water Level:	Time:	Core Length:

Drilling Information				Sample Quality						
Depth (feet bgs)	Run Number	Run Length (ft) / Recovery (ft)	Penetration Rate (ft/min)	RQD (%)	Fracture Depth (feet)	Fracture Type	Fracture Angle	Sample Description and Classification	Lithologic Type	Remarks

NOTES:

FIELD INSTRUMENT 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	^oC		______			______	
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: Laboratory provided
Sample Preservatives Source: Laboratory provided
Disposable Filter Type: in-line 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.

MACTEC
511 Congress Street, Portland Maine 04101

FIELD INSTRUMENT CALIBRATION RECORD

SOP # S17

MACTEC STANDARD OPERATING PROCEDURE #S17

DIRECT PUSH SAMPLING

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

____ April 27. 2020

Jean Firth, PG, Program Manager Date

Reviewed Date

_____________________ _____________________

_____________________ _____________________

_____________________ _____________________

DIRECT PUSH SAMPLING

1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes methodologies using a direct-push sampling system (e.g. GeoProbe®) that may be used to conduct soil, groundwater, or soil vapor sampling surveys. This technology can be used to collect samples for off-site laboratory analysis or provide screening information that can be used to optimize the future location of soil borings and monitoring well installations and to assess contamination in the vadose zone and saturated overburden.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure must be approved by the project manager and documented in the field logbook and/or field data records.

2.0 REFERENCES

ASTM International (ASTM), 2017. Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); ASTM D2487-17e1.

Barth, D.S. and B.J. Mason. 1984. Soil Sampling Quality Assurance User's Guide. EPA-600/4-84-043.

Mason, B.J. 1983. Preparation of Soil Sampling Protocol: Techniques and Strategies. EPA-600/4-83-020.

3.0 DRILLING METHODOLOGY

The direct push drilling technique consists of a hydraulic ram unit, usually mounted on a vehicle (ATV, cargo van, or pick-up truck) or drill rig that advances small diameter drill rods to obtain overburden soil, install piezometers and temporary wells for groundwater sampling, and install sample points for vapor samples. Advantages utilizing the method over traditional test boring drilling methods for environmental investigations include low cost, increased maneuverability and access to irregular terrain, and minimization of investigation derived wastes. Disadvantages include depth limitations and small sample volumes for chemical analyses.

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 within the lead rod.

In the dual-tube method borings are advanced by simultaneously driving an outer stainless-steel casing and inner polycarbonate (Lexan®) or acetate tube into the ground. Upon reaching the desired penetration depth, the inner sample tube is withdrawn 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 to 5-ft sections depending on the length of the sampler. The lead section is fitted with an inner acetate 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. This process may be modified to collect groundwater samples or soil gas samples. Procedures for collecting groundwater or vapor samples will be outlined in the FAP, if required.

4.0 PROCEDURES

This section contains both the responsibilities and procedures involved with direct push sampling oversight and sampling. Proper procedures are necessary to ensure the quality and integrity of the samples.

4.1 RESPONSIBILITIES

Project Manager

The project manager (PM) is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and any other appropriate procedures. This will be accomplished through staff training. The PM will select the appropriate sampling methodology and analytical program based on the objectives of the sampling.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL.

4.2 Preparation

Utility Locate

Prior to mobilizing to a site, the PM or FOL will ensure that the local utility “one call” service has been notified (e.g. Dig Safely New York). Typically the drilling subcontractor will be resposnsible to call in the utlity ticket. Confirmation of the notifcation and the ticket number will be requested by the PM or FOL for the public records. No work may procede at the site until the ticket has been logged and all ultilities have responded/marked out.

If conducting borings at an active site, the project or field engineer/geologist must contact the appropriate site personnel necessary to receive clearance to drill at specified locations. The names of the personnel authorizing clearance will be documented in the field logbook. The exact location of each boring shall also be reviewed by responsible site personnel to ensure that the area is free of the facility-owned buried utilities. Surface geophysics may be conducted to identify the locations of subsurface facility-specific structures (e.g., drain lines, septic tanks, etc..) and soft dig methods (hand clearing with shovels, post hole diggers, hand augers) may be required.

Direct push locations shall be no closer than 25 feet to overhead utilities or within 5 feet of buried utilities. Direct push methodology allows for small diameter borings that minimize ground disturbance. If project requirements dictate use in proximity to utilities, borings may be advanced if the proper health and safety considerations are applied (e.g. pre-clearing)

Upon arrival at the site the FOL will complete the Utility Clearance Form (**example attached**) to document that utility locate activities and mark out have been completed prior to the initialization of drilling activities.

Equipment Selection and Sampling Considerations

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

- Personal protective equipment (PPE), monitoring equipment, and other health and safety equipment as specified in the project specific health and safety plan.
- decontamination equipment as specified in the QAPP.
- Stainless steel trowels or spatulas.
- Aluminum Foil.
- Paper Towels.
- Measuring device (e.g. engineer's scale tape or rule).
- Appropriate sample containers and Field Data Records (FDR).
- Photoionization detector (PID).
- Camera
- Field knife with hook blades (if liner sleeves are used to collect the soil samples).
- Field notebook.
- Appropriate decontamination equipment (steam cleaner, materials for a decon pad, etc.) as necessary.
- Drums for IDW containment as specified in the work plans.
- Piezometer construction materials if specified in the FAP.

4.3 Field Procedures

Documentation

In the field book, the supervising geologist/engineer shall record the name of the drilling firm and the names of the driller and his assistant(s). The date, project location, project number, and weather conditions shall be recorded as well.

An accurate time log of drilling activities shall be kept. This log shall be kept in the field logbook and shall include at a minimum, the following:

- Time driller and rig arrive on site
- Time drilling begins
- Any delays in the drilling activities and the cause of such delays
- Time drillers go off site
- Duration of decontamination and investigation derived waste handling
- Down time (those periods when drilling activities cease due to equipment malfunctions, weather, and ordered stoppages)

Monitoring equipment for field screening (PID) and community air monitoring programs (CAMP) will be calibrated daily as per manufacturer's instructions. Equipment information (make, model, and serial number) and calibration readings shall be recorded on the field instrument calibration record (**example attached**). Make note of calibration variances or spanning to non-standard specifications.

Soil boring information including standard penetration depth information, sampling intervals, and soil descriptions will be recorded on the Soil Boring Log FDR (**example attached**). See **the Description and Identification of Soil Samples SOP (see Table A-1 for SOP #)** for soil identification and description methodology.

Field Methodology

The direct-push explorations shall be completed by a qualified direct-push subcontractor, and directed by a qualified field person.

The following procedures will be employed to collect subsurface soil samples. Assembly, advancement, retrieval and opening of the sampler will be completed by the driller.

1. Identify sample locations from the FAP and note the locations in field notebook by measuring 3-point ties to physical features.
2. Drilling contractor will set up an equipment decontamination area and decontaminate equipment as described in the FAP and in accordance with the **Equipment Decontamination SOP S20 (see Table A-1 for SOP #)**. Use new, clean materials for when decontamination is not appropriate

(e.g., disposable gloves and dedicated drive points). Document the decontamination procedure in the field notebook.

3. The driller will assemble the appropriate direct-push sampling apparatus or other direct push tool. Soil samples will be collected using a four to five-foot long 1-to-2-inch diameter core sampler. The FAP will determine if a dual tube split-spoon system or a single rod acrylic liner method will be used for the collection of subsurface soil samples.
4. The driller will drive the sampling tools to the appropriate sampling zone and collect a sample. Retrieve the sampler using an appropriate lifting apparatus (winch or lift hook). Remove the sampler shoe and retrieve the sample in the sample liner.
5. Upon the sampling table the liner will be opened by cutting lengthwise using a hook bladed utility knife or similar cutting implement. Once opened the field staff will prepare a fresh face by using a clean flat edged scraper (e.g. paint scraper) in perpendicular motions to the liner. The resultant fresh face will be screened using a PID for volatiles and carefully examined, noting all soil characteristics, color seam, disturbance, etc. (see the **Description and Identification of Soil Samples SOP identified on Table A-1**). For the field screening of the sample the PID inlet should be just above the soil surface and a hand should be cupped over both for an interval for a period of several seconds to get an accurate reading. This allows for the buildup of VOCs for measurement without interference from ambient air. Colder temperatures will inhibit volatilization and may require longer screening times to get accurate readings.
6. Field staff will take photographs of the soil in the sampler. The sampler should be placed in a good light, preferably against a solid colored background. A ruler for scale and a tag identifying the sample should be placed in the picture. The identifier tag must have the sample number, depth and project name or number written so as to be legible in the photograph. Any photographs taken must be recorded on the FDR.
7. Field staff will collect a representative sample, selected based on the sampling objectives outlined in the FAP and is collected using the appropriate sampling method and container as outlined in **SOPs for Soil Sampling and Field Preservation of VOC and GRO Soil Samples (see Table A-1 for SOP #s)**.
8. Following the collection of representative samples for chemical and/or geotechnical analyses, remaining soil material will be collected into a separate container for VOC headspace screening (see below).
9. Steps 4 to 8 will be repeated, as necessary, until the bottom of the borehole, as outlined in the FAP, is reached (e.g. refusal or a predetermined depth). Frequency of sample collection will either be continuous or at predetermined depths.

10. If a temporary well or piezometer is to be installed see **the Monitoring Well and Microwell Installation SOP (see Table A-1 for SOP#)** for methodology and installation details.
11. The approximate location of the boring will be marked with a wood stake colored with highly visible spray paint and/or flagging. The boring number will also be written on the stake to identify the sample location for surveying purposes.
12. Decontaminate non-disposable equipment or tools that may have come into contact with subsurface soil in accordance with the FAP.
13. Discard all disposable equipment used during sampling activities in a designated location.

Records of each exploration shall be made on a Soil Boring Log (**example attached**) and in the field logbook. All cuttings or other waste will be containerized or disposed of in accordance with planning documents.

Abandonment of Boreholes

After drilling, logging and/or sampling, boreholes should be backfilled by the method required by the applicable agency and described in the project FAP. This typically consists of backfilling to the surface with bentonite chips, pellets or bentonite-cement grout. If bentonite chips or pellets are used, they should be added to the borehole in two-foot lifts and hydrated with water from a potable water supply. This process should be repeated until the entire borehole is plugged using no less than five gallons' water per ten feet of borehole. The surface hole condition should match the pre-drilling condition (asphalt, concrete, or smoothed flush with native surface), unless otherwise specified in the FAP.

Soil Headspace Screening

The purpose of the soil headspace screening procedure is to screen soil sample headspaces for total ionizing VOCs. This is a semi-quantitative method used to identify the presences, absence, and relative concentrations of VOCs in soil. Headspace screening is performed with a photoionization detector (PID). Headspace readings may be completed in between sample runs. Headspace readings should be transcribed on to the soil boring log FDR.

1. Record and document background VOC readings in ambient air. If it is not feasible to screen samples in an area with a clean background, document the highest background reading.
2. Half fill a clean jar or Ziplock™ type plastic bag with soil. Quickly cover the jar with aluminum foil or close the plastic bag and label the container.
3. Vigorously shake the sample to disperse soil and wait for approximately 5 minutes. Record the ambient temperature at which screening is performed. If outside temperatures are below 50°F, try to warm the samples in a heated vehicle or building.
4. Shake the sample again after 5 minutes.

5. Insert the tip of the PID through the foil or into the plastic bag and record the highest meter response, typically after approximately 3 to 15 seconds.
6. After screening all samples, re-check background and record significant variations.

The PID has a reliable reporting limit of 1 part per million in air. Readings at or below the reporting limit should be reported as not-detected “ND”.

Screening results will vary based on sample temperature, compounds present, age of the sample, and the degree to which the sample has been agitated and crumbled. Field personnel should remain consistent in their headspace measurement methodology to avoid biasing samples.

5.0 ATTACHMENTS

Utility Clearance Form

Soil Boring Log

Field Instrument Calibration Record

Utility Clearance Form

Site Name: ______________________________ Project No./Task No.: __________

Site Address: ______________________________ One Call Ticket No.: __________

Ticket Good until: __________

Project Manager Name: ______________________________ PM Phone No.: __________

Locations cleared by facility? ______________________________ Date Cleared: __________

Utility Clearance:

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

*Contact local municipality

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

Private Utility Locator/Geophysical Survey

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

Non-Destructive Excavation Method to be used

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

* Use electrically insulated gloves if potential for power lines

Field Clues Observed/Evaluated:

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

Additional Notes/Remarks: ______________________________

____

Confidence Level that All Utilities have been identified:

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

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

*Cleared by PM? ______________ *Cleared by OM? ______________

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 OD:
Weather:	Soil Drilled:	Drilling Method:	Casing Size:
Subcontractor:	Rock Drilled:	Protection Level:	Sampler:
Driller:	Date Started:	Date Completed:	Sampler ID/OD:
Rig Type/Model:	Logged By:	Checked By:	
Reference Elevation:	Water Level:	Time:	

Drilling Information					Sample Information					
Depth (feet bgs)	Sample Number	Penetration (ft) / Recovery (ft)	Blow Counts	N Value	PID Field Screening (ppm)	PID Head Space Reading (ppm)	Analytical Sample Depth (ft)	Sample Description and Classification	USCS Classification	Remarks

NOTES:

FIELD INSTRUMENT 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: Laboratory provided
Sample Preservatives Source: Laboratory provided
Disposable Filter Type: in-line 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.

MACTEC
511 Congress Street, Portland Maine 04101

FIELD INSTRUMENT CALIBRATION RECORD

SOP # S20

MACTEC STANDARD OPERATING PROCEDURE #S20

HEAVY EQUIPMENT DECONTAMINATION OVERSIGHT

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

_______________________________________ April 27, 2020

Bradley LaForest, NRCC-EAC, Program Manager Date

Reviewed Date

_________________ _________________

_________________ _________________

_________________ _________________

HEAVY EQUIPMENT DECONTAMINATION

1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes guidelines for use by field personnel overseeing the decontamination of heavy equipment when conducting environmental investigations.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure in the execution of planned activities must be approved by the project manager and documented in the field logbook and/or field data records.

2.0 REFERENCES

U.S. Environmental Protection Agency (USEPA), 1985. "Guide for Decontaminating Buildings, Structures, and Equipment at Superfund Sites." EPA/600/2 85/028.

USEPA, 1987, Compendium of Superfund Field Operations Methods, EPA 540/P-87/001a, OSWER 9355.0-14, September.

USEPA, 1988, EPA Guidelines for Conducting Remedial Investigation and Feasibility Studies under CERCLA, Interim Final OSWER Directive 9355.3-01, August.

USEPA, 1991, Management of Investigation Derived Wastes During Site Inspections, EPA 540/G-191/009, May.

3.0 DEFINITIONS

Heavy Equipment – Drill rigs, excavators, dozers, back-hoes, trucks or other similar type machinery used to drill soil borings, break concrete, excavate soil or other similar type activity.

Laboratory Grade Detergent – A standard brand of laboratory-grade detergent, such as Alconox® or Liquinox®. If investigating for PFAS, Decon 90 or other detergents containing PFAS and will not be utilized for decontamination. Sites being sampled for 1,4-dioxane should use Alconox® detergent instead of Liquinox®.

Potable Water – Water dispensed from a municipal water system or well used and approved for drinking.

4.0 PROCEDURE

This section provides requirements for heavy equipment decontamination procedures to be followed. Decontamination at sites being investigated for PFAS will require a source of PFAS free water.

4.1 Responsibilities

Compliance with this procedure is the responsibility of project management and field personnel. This SOP and the project work plans should be reviewed before overseeing heavy equipment decontamination at the project site.

Project Manager

The Project Manager (PM) has the responsibility for ensuring that decontamination of heavy equipment is properly performed through staff training.

Field Operations Lead

The Field Operations Lead (FOL) has the responsibility for periodic review of procedures and documentation associated with the decontamination of heavy equipment. If perceived variances occur, the FOL is also responsible for issuing notices of nonconformances and requesting corrective actions. Additionally, the FOL will perform inspections and monitoring of the decontamination activities.

Field Personnel

Project staff assigned to field activities are responsible for ensuring that subcontractors or equipment operators properly decontaminate heavy equipment associated with those tasks. Project staff are also responsible for documenting the decontamination activities in a field logbook as specified in the FAP.

4.2 Preparation

Equipment Selection Considerations

Subcontractor personnel will provide decontamination materials and operate steam cleaning equipment. The following list of equipment and materials may be used for heavy equipment decontamination:

- Cleaning materials which may include tap (potable) water, soap and/or detergent solutions, nitric acid solutions, and methanol. Specific requirements based on the site contaminants of concern will be detailed in the site- specific FAP.
- Personal protective equipment (PPE) as defined in project Health and Safety Plan (HASP).
- Investigation Derived Waste (IDW) containers (drums, roll offs, fractionation tanks)
- Scrub brushes.
- Pressure washer or steam cleaner.

4.3 Field Procedures

Decontamination Area

A decontamination area will be set up in an area exclusively for decontamination of heavy equipment. which will be conducted within the station.

At a minimum, the station will be constructed such that all rinsates, liquid spray, soil, debris and other decontamination wastes are fully contained and may be collected for appropriate waste management and disposal. The area may be as simple as a bermed pad lined with polyethylene sheeting. More sophisticated designs involving self-contained metal decontamination pads in combination with bermed polyethylene sheeting may also be used, depending on project-specific requirements. These requirements along with specific equipment and construction specifications for the decontamination area will be provided in the FAP.

Decontamination of Downhole Equipment

Downhole drilling equipment (including but not limited to drill pipe, drive casing, drill rods, bits, tools, etc.) will be thoroughly decontaminated before mobilization to site and between borings or wells at each site or as required in the FAP. The standard procedure will be performed as described below. Appropriate PPE (as specified in the project HASP) must be worn by all personnel involved with the task to limit personal exposure.

- Equipment caked with drill cuttings, soil, or other material will initially be scraped or brushed to remove gross soil contamination. The scrapings will be containerized and appropriately disposed of in accordance with the FAP.
- Equipment may be washed with a laboratory grade detergent prior to high-pressure washing or steam cleaning.
- Equipment will then be sprayed with potable water using a high-pressure washer or steam cleaner.
- Rinsate blanks will be collected from washed equipment that directly contacts soils that will be sampled (e.g. split spoon samplers) which will be reused. This will consist of water from the final rinse which is collected directly into sample containers.
- Decontaminated downhole equipment (such as drill pipe, drive casing, bits, tools, bailers, etc.) will be placed on clean polyethylene plastic sheeting to prevent contact with contaminated soil and allowed to air dry.

Decontamination of Heavy Equipment

Heavy equipment (e.g. drill rigs, development rigs, backhoes, trucks, and other earthmoving equipment) will be decontaminated between drilling sites. Decontamination will be performed in accordance with the FAP. The standard procedure will be performed as described below. Appropriate personal protective equipment (as specified in the project HASP) must be worn by all personnel involved with the task to limit personal exposure.

- Heavy equipment caked with drill cuttings, soil, or other material will be initially scraped or brushed to remove bulk soil at the drilling or work location. The scrapings will be containerized and appropriately disposed of in accordance with the FAP.
- Heavy equipment will then be moved to the decontamination pad and configured so that fluids from decontamination activities will be collected by the impermeable liner.

- Equipment may be washed with a laboratory grade detergent prior to high-pressure washing or steam cleaning.
- The equipment is then sprayed with potable water using a high-pressure washer or steam cleaner as outlined in the FAP.
- Between boreholes at the same site, the back end and equipment decks of the drilling rigs will be washed with potable water until surfaces are visibly free of soil buildup.
- During the decontamination effort, fluid systems should be inspected for any leaks or problems, which might potentially result in an inadvertent release at the site, thereby contributing to the volume of waste or contamination.

Decontamination activities will be documented by the field geologist/engineer in the field logbook. Decontamination fluids will be containerized in IDW handling containers as specified in the FAP. Decontamination areas should be covered with plastic when not in use to prevent collection of rainwater which will then be required to be handled as IDW.

SOP # S21

MACTEC STANDARD OPERATING PROCEDURE #S21

FIELD EQUIPMENT DECONTAMINATION

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

______________________________________ April 27, 2020

Bradley LaForest, NRCC-EAC, Program Manager Date

Reviewed Date

________________ ________________

________________ ________________

________________ ________________

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the methods to be used for the decontamination of all field equipment which becomes potentially contaminated during a sample collection task.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure in the execution of planned activities must be approved by the project manager and documented in the field logbook and/or field data records.

2.0 REFERENCES

U.S. Environmental Protection Agency (USEPA), January 1986. "Decontamination Techniques for Mobile Response Equipment Used at Waste Sites (State-of-the-Art Survey)." EPA/600/52-85/105.

USEPA, March 1985. "Guide for Decontaminating Buildings, Structures, and Equipment at Superfund Sites." EPA/600/2 85/028.

3.0 PROCEDURE

All reuseable field equipment that comes in contact with site media to be samples should be included in the decontamination process. Decontamination is performed as a quality assurance measure and a safety precaution. It prevents cross-contamination between samples and helps to maintain a clean working environment for the safety of all field personnel.

Decontamination at sites being investigated for PFAS will require a source of PFAS free water. A standard brand of laboratory-grade detergent, such as Alconox® or Liquinox® will be used. If investigating for PFAS, Decon 90 or other detergents containing PFAS and will not be utilized for decontamination. Sites being sampled for 1,4-dioxane should use Alconox® detergent instead of Liquinox®.

Decontamination is mainly achieved by rinsing with liquids which may include: soap and/or detergent solutions, tap-water, deionized water, acid solutions, and methanol. Equipment will be allowed to air dry after being cleaned or may be wiped dry with clean clothes or paper towels if immediate re-use is needed.

The frequency of equipment use dictates that most decontamination be accomplished at each sampling site between collection points. Waste products produced by the decontamination procedures, such as waste liquids, solids, rags, gloves, etc. must be collected and disposed of properly in accordance with the FAP.

3.1 Responsibilities

Compliance with this procedure is the responsibility of project management and field personnel. This SOP and the project work plans should be reviewed before implementing field equipment decontamination at the project site

Project Manager

The Project Manager (PM) has the responsibility for ensuring that decontamination of field equipment is properly performed through staff training.

Field Operations Lead

The Field Operations Lead (FOL) has the responsibility for periodic review of procedures and documentation associated with the decontamination of field equipment. If perceived variances occur, the FOL is also responsible for issuing notices of nonconformances and requesting corrective actions. Additionally, the FOL will perform inspections and monitoring of the decontamination activities.

Field Personnel

Project staff assigned to field activities are responsible for ensuring that subcontractors or equipment operators properly decontaminate field equipment associated with those tasks. Project staff are also responsible for documenting the decontamination activities in a field logbook.

It is the responsibility of all personnel involved with sample collection or decontamination to maintain a clean working environment and to ensure that any contaminants are not negligently introduced to the environment.

3.2 Preparation

Equipment Selection and Sampling Considerations

Cleaning materials may include tap (potable) water, deionized water, and soap and/or detergent solutions, nitric acid solutions, and methanol. Specific requirements will be detailed in the site-specific FAP. The following list of equipment and materials includes the necessary items for field equipment decontamination:

- Personal protective equipment (PPE) as defined in project Health and Safety Plan (HASP).
- Paper towels
- Disposable gloves
- Waste storage containers (drums, boxes, plastic bags)
- Cleaning containers (Plastic buckets, galvanized steel pail)
- Cleaning brushes
- Laboratory-grade detergent
- Stainless steel spray bottles
- Deionized water or other approved water.

3.3 Field Procedure

Soil, Sediment, Surface Water and Air Sampling Equipment

1. Remove any solid particles from the equipment or material by brushing and then rinsing with clean water. This initial step is performed to remove gross contamination.
2. Wash equipment with a soap or detergent solution and brush.
3. Rinse with tap-water.
4. Rinse with deionized water.
5. Repeat entire procedure or any parts of the procedure if necessary, to remove all traces of solids.
6. If sampling equipment is not to be used immediately at another location, wrap the equipment in aluminum foil and store in a safe place.

Submersible Pump Decontamination Procedures

This procedure will be used to decontaminate submersible pumps between groundwater sample collection points and at the end of each day of use. Dedicated tubing should be used for each well so no decontamination of the tubing is needed. The dedicated tubing will be placed back into the monitoring well and only the pump will be decontaminated as described in the following subsections.

The following materials will be used:

- plastic or PVC upright cylinder or bucket
- 5-10-gallon plastic water storage containers
- soap or detergent solution and brush
- Deionized water or other approved water
- Stainless steel spray bottle
- Paper towels

During decontamination, the submersible pump will be placed on a clean surface (sheet of plastic) or held away from ground.

1. Decontaminate the outer surface of the submersible pump using a potable water rinse followed by a deionized water rinse.
2. Connect discharge tubing to the end of the pump and place the submersible pump upright in the cylinder and fill the cylinder with potable water and detergent. The end of the tubing should be clamped to an empty water storage container
3. Activate the pump in the forward mode withdrawing water from the cylinder.
4. Continue pumping until the water in the cylinder is pumped down and air is drawn through the pump. At this time air pockets, will be observed in the discharge line. Shut off the pump immediately.
5. Using the water remaining in the cylinder, rinse the power cord (excepting the plug or battery connectors) by pouring the water carefully over the coiled lines.
6. Repeat steps 3 to 5 twice using deionized water. Pump or drain all the remaining water from the

tubing.

7. When reaching the next monitoring well place the pump in the well casing and wipe dry both the power lines with a clean paper towel as the pump is lowered.

SOP # S22

MACTEC STANDARD OPERATING PROCEDURE #S22

MONITORING WELL AND MICROWELL INSTALLATION

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

Jean Firth

____ April 27, 2020

Jean Firth, PG, Program Manager Date

Reviewed Date

______________________ ______________________

______________________ ______________________

______________________ ______________________

MONITORING WELL AND MICROWELL INSTALLATION

1.0 PURPOSE

This Standard Operating Procedure (SOP) provides procedures and requirements for the installation of monitoring wells and microwells using various drilling techniques, including but not limited to, direct push technology (DPT), hollow-stem auger (HSA), rotary, and sonic. The details within this SOP should be used in conjunction with the site-specific field activities plan (FAP).

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure must be approved by the project manager and documented in the field logbook and/or field data records.

2.0 REFERENCES

ASTM International (ASTM), 2010 *Standard Guide for Installation of Direct Push Ground Water Monitoring Wells, Method D-6724-04*

ASTM, 2010 *Standard Practice for Design and Installation of Groundwater Monitoring Wells, Method D-5092-04*

ASTM, *Standard Guide for the Use of Hollow Stem Auger Drilling for Geoenvironmental Exploration and Installation of Subsurface Monitoring Devices, Method D5784/5784M-13*

ASTM, 2012 *Standard Guide for the Use of Direct Air Rotary Drilling for Geoenvironmental Exploration and Installation of Subsurface Monitoring Devices, Method D5782-95*

ASTM, *Standard Guide for the Use of Dual Wall Reverse Circulation Drilling for Geoenvironmental Exploration and Installation of Subsurface Monitoring Devices, Method D5781/5781M-13*

ASTM, *Standard Guide for the Use of Casing Advancement Drilling Methods for Geoenvironmental Exploration and Installation of Subsurface Monitoring Devices, Method D5872/5872M-13*

U.S. Environmental Protection Agency (USEPA), 1986, *Resource Conservation and Recovery Act (RCRA) Ground Water Monitoring Technical Enforcement Guidance Document*, OSWER-9950.1, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, U.S. Government Printing Office, Washington D.C.

USEPA, 1987, *A Compendium of Superfund Field Operations Methods*, EPA-500/P-87/001, U.S. Government Printing Office, Washington D.C.

3.0 DEFINITIONS

Cuttings – Pieces of soil, sediment, or rock cut by a bit in the process of drilling borings.

Borehole – Any hole drilled into the subsurface for the purpose of identifying lithology, collecting soil samples, and/or installing groundwater wells.

Grout – For the purposes of this SOP, the term "grout" consists of a neat cement grout generally containing one 94-pound bag of Portland cement mixed with clean water and bentonite. The grout is emplaced as a slurry, and once properly set and cured, is capable of restricting movement of water.

Monitoring Well/Microwell – A well that provides for the collection of representative groundwater samples, (including the detection and collection of representative light and dense non-aqueous phase organic liquids), and the measurement of fluid levels.

Annular Space – The space between the well screen or casing and the borehole wall.

Filter Pack – Granular filter material (sand, gravel, etc.) placed in the annular space between the well screen and the borehole to increase the effective diameter of the well and prevent fine-grained material from entering the well.

Well Screen – A commercially available, factory-perforated, wire wound, continuous wrap, or slotted casing segment used in a well to maximize the entry of water from the producing zone and to minimize the entrance of sand.

Tremie – A tubular device or pipe used to place grout, bentonite, or filter pack in the annular space.

4.0 PROCEDURE

This section contains both main responsibilities and procedures for well installation activities. Well installation is typically completed during an environmental drilling program after completion of a soil or rock borehole. Tasks and responsibilities in this SOP will apply to only the act of installing the monitoring well/microwell. Tasks and procedures associated with drilling and borehole advancement are described in the following SOPs:

- Drilling – Soil Boring and Rock Coring Oversight
- Direct Push Sampling
- Sonic Drilling Oversight

Site-specific factors need to be considered in the selection of well construction and completion materials, specification of well designs. The project FAP will contain the following information related to well installation:

- Objectives of the monitoring well/microwell.
- Specific location of the well to be installed.

- Zone or depth well is to be installed.
- Well construction materials to be used.
- Specification of well design(s) including Well Construction Diagrams; and,
- Additional procedures or requirements beyond this SOP.

4.1 Responsibilities

Project Manager

The project manager (PM) is responsible for ensuring that well installation collection activities are conducted in accordance with this SOP and any other appropriate procedures. This will be accomplished through staff training. The PM will select the appropriate well installation methodology based on the objectives of the installation.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL.

4.2 Preparation

Equipment Selection and Sampling Considerations

The following list of equipment includes the necessary items to be used by field personnel during well installations. Subcontractor personnel typically provide and operate all installation equipment and materials. Site-specific conditions may warrant the use of additional or deletion of items from this list.

- Electronic water level indicator.
- Measuring tape.
- Appropriate personal protective equipment (PPE), as specified in HASP.
- Well construction field data records (FDR).
- Field logbook; and
- Camera.

4.1 Field Procedures

Well Installation Procedures

Upon completion of a borehole remove all drill tooling except for the outer casing or augers. For direct push borings, disengage the expendable drive point. The well construction materials will then be installed inside the open borehole or through the center of the outer casing or augers.

Measure the total depth of the completed boring using a weighted sounding line. The borehole depth is checked to assure that formation material has not heaved to fill the borehole. If heaving has taken place, options for cleaning, re-drilling, or installation in the open section of the boring should be discussed with lead technical personnel.

If the borehole depth is deeper than the proposed well installation (e.g. over-drilled or specific targeting of shallower layers), bentonite pellets or bentonite chips (as specified in the FAP) may be added to the bottom of the boring to raise the bottom of the hole to the desired depth. The bentonite should be pumped through a tremie pipe and fill from the bottom of the boring upward. During pumping of bentonite slurry, the tremie pipe should be submerged below the top of the bentonite column in the borehole to prevent free-fall and bridging. If bentonite chips or pellets are used, it should be added gradually to prevent bridging. Bentonite addition will stop when its level has reached approximately one foot below the desired base of the well string (casing, screen, end plug or sump, etc.). The bentonite plug will be hydrated for at least one hour before installation of a filter pack.

Calculate volumes of filter pack, bentonite pellets/slurry, and grout required, based on borehole and well casing dimensions. If required by the FAP, determine the filter pack and well screen slot size for the well. For most well installations, the filter pack and well screen slot size will be determined in the FAP prior to the start of the installation activities (typically 10 slot screen [0.010” diameter slots] and 20/40 sieve sands [e.g. #1 sand]).

Inspect the casing, screen, and any other well construction materials prior to installation to assure that no damage has occurred during shipment and decontamination activities and the materials comply with the well design.

Connect and carefully lower the well string through the open borehole, drive rods or casing, or inside of the augers until the well string is at the desired depth. The well string should be suspended slightly by the installation rig and should not rest on the bottom of the boring. In the event the well string was dropped, lowered abruptly, or for any other reason suspected of being damaged during placement, the string should be removed from the boring and inspected. In certain instances, the well string may rise after being placed in the borehole due to heaving sands. If this occurs, the driller must not place any drilling equipment (drill pipe, hammers, etc.) to prevent the casing from rising. The amount of rise should be noted by the rig geologist or engineer who should then consult lead technical personnel for an appropriate course of action.

Record the following information on the appropriate field data records and field logbook per the project work plans:

- Well construction material (type, diameter, and screen size).
- Length of well screen.
- Total depth of well boring.
- Depth from ground surface to top of grout or bentonite plug in bottom of borehole (if present).
- Depth to base of well string; and,
- Depth to top and bottom of well screen.

When using the mud rotary drilling technique, tremie the filter pack into the annular space around the screen. Clean, potable water may be used to assist with the filter pack tremie operation. For all other drilling techniques, the filter pack may be allowed to free fall or be tremied per the FAP. For direct push-installed wells, a pre-pack filter may be attached to or fitted around the screen and placed concurrently with the well string.

Drill tooling (casing, augers, and rods) should be removed slowly during filter pack installation in increments no greater than 5 feet. At no time should the bottom of the tooling be pulled above the top of the filter pack during installation.

Filter pack settlement should be monitored by initially measuring the sand level (before beginning to withdraw the drive casing/augers). In addition, depth soundings using a weighted tape shall be taken repeatedly to continually monitor the level of the sand. The top of the well casing shall also be monitored to detect any movement due to settlement or lifting from tooling removal. If the top of the well casing moves upwards at any time during the well installation process, the driller should not be allowed to set drilling equipment (downhole hammers, drill pipe, etc.) on the top of the casing to prevent further movement.

Filter pack should be added until its height is approximately 2 feet above the top of the screen (unless otherwise specified in the FAP), and verification of its placement by sounding with the weighted tape should be conducted. Once the placement of the filter pack is completed, the depth to the top of the pack is measured and recorded on the appropriate forms per the project work plans.

A three-foot thick (unless otherwise specified in the FAP) bentonite seal is then installed on top of the filter pack. If pellets or chips are used, they should be added gradually to avoid bridging. Repeated depth readings will be taken using a weighted tape to ascertain the top of the bentonite seal. Granular bentonite must be used if the seal is placed above the water table.

After hydration of the bentonite seal, neat cement grout (mixture consisting of approximately 9 gallons of water and 94 pounds of Portland cement with bentonite to aid seal, is then pumped through tremie pipe and filled from the top of the bentonite seal upward. The bottom of the tremie pipe should be maintained below the top of the grout to prevent free fall and bridging. When using casing or auger techniques, the drive casing/augers should be raised in incremental intervals, keeping the bottom of the drive casing/augers below the top of the grout. Grouting will cease when the grout level has risen to within approximately one to 2 feet of the ground surface. Grout levels should be monitored to assure that grout taken into the formation is replaced by additional grout. If settling of the grout occurs, additional topping off of the grout may be necessary. In deep wells (including bedrock wells), grout lifts should be limited to prevent excessive grout infiltrating transmissive zones and potentially impacting neighboring monitoring wells. If suspected grout loss is occurring grouting will cease to allow for grout within the zone to harden and block off further loss on subsequent grout lifts.

Once grouting activities have been completed an above ground protective steel casing or a flush mounted road box will be installed with concrete aprons designed to shed water. A minimum of 24 hours after grouting should elapse before installation of the concrete pad and street boxes or vaults for flush mount completions.

After the protective casing has set, a drainage hole may be drilled into the protective casing if required by the project work plans. The drainage hole is positioned approximately 2 inches above ground surface. The protective casing will be painted with a rust-preventive colored paint.

The well head will be labelled with the well ID and a mark or notch will be placed on the casing as a measuring point for survey and subsequent measurements.

Following well completion and demobilization of the rig, the well site should be cleared of all debris and trash and restored to a neat and clean appearance per the project work plans. All investigation-derived waste (IDW) generated at the well site should be appropriately contained and managed per the FAP.

A well construction FDR must be completed for each monitoring well installed (**examples attached**).

5.0 ATTACHMENTS

Well/Piezometer Construction Record – Stickup

Well/Piezometer Construction Record – Flushmount

WELL/PIEZOMETER CONSTRUCTION RECORD
STICKUP

LOCATION ID:

Project Name: ____________________ Date Started: __________ Date Completed: __________

Project Location: ____________________ Logged By: __________

Project Number: __________ Task Number __________ Checked By: __________ Checked Date: __________

Subcontractor: __________ Drilling Method: __________

Development Method: __________ Development Date: __________

Bucking Posts/Ballards: __________

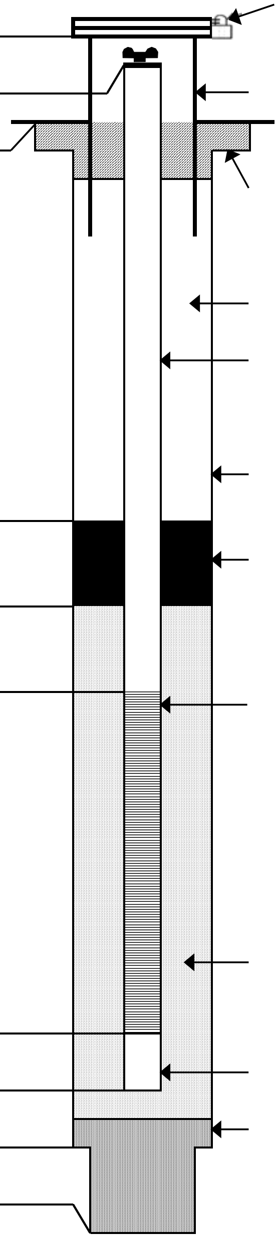
Notes: ____________________

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

MACTEC
511 Congress Street, Portland Maine 04101

WELL/PIEZOMETER CONSTRUCTION RECORD 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: __________

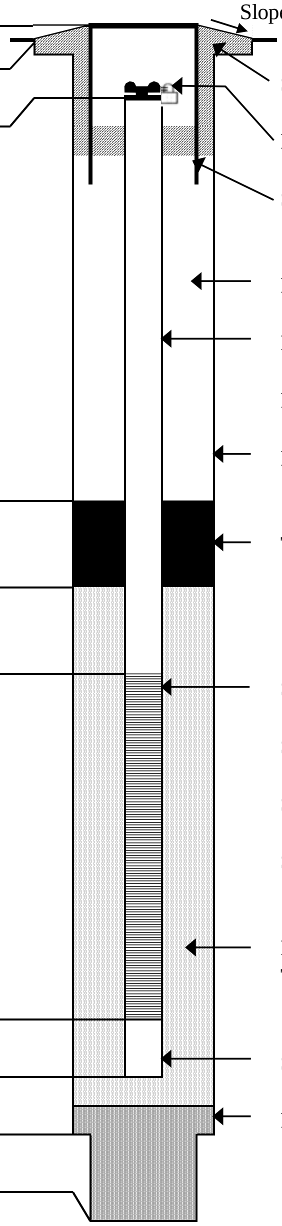
Checked By: __________ Checked Date: __________

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

SOP # S23

MACTEC STANDARD OPERATING PROCEDURE #S23

MONITORING WELL DEVELOPMENT PROCEDURE

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

____ April 27, 2020

Bradley LaForest, NRCC-EAC, Project Manager Date

Reviewed Date

______________________ ______________________

______________________ ______________________

______________________ ______________________

MONITORING WELL DEVELOPMENT PROCEDURE

1.0 PURPOSE

This standard operating procedure (SOP) describes the protocol to be followed during the development of monitoring wells. The objectives of monitoring well development are to remove sediment that may have accumulated during well installation, to consolidate the filter pack around the well screen, and to enhance the hydraulic connection between the target zone and the well.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure in the execution of planned activities must be approved by the project manager and documented in the field logbook and/or field data records.

2.0 PROCEDURE

Well development shall be performed as soon as practical after well installation, but not sooner than 48 hours following placement of the grout seal. Weather conditions may increase grout set time and, consequently, further delay development. If the well does not contain a grout seal (e.g. an open rock borehole), then well development can commence immediately after well installation.

The primary objective of well development of environmental monitoring wells is to ensure that an appropriate hydraulic connection is established so that the well will serve its intended purpose to provide water quality and/or groundwater head elevation data. Well development takes on more significance for wells intended for water supply or hydraulic control of groundwater plumes.

This procedure may not be appropriate for wells where gross contamination is observed (e.g., the presence of NAPL).

2.1 Responsibilities

Project Manager

The project manager (PM) is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and any other appropriate procedures. This will be accomplished through staff training. The PM will select the appropriate sampling methodology and analytical program based on the objectives of the sampling.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL and document the deviation in the field logbook and/or field data record.

2.2 Preparation

Equipment

The following equipment may be used during well development. Site-specific conditions may warrant addition or deletion of items from this list.

- Submersible pump, peristaltic pump, inertial (e.g. Waterra) pump, and/or bailer.
- Surge block.
- Appropriate size/type tubing for selected pump.
- Container for purge water (5-gallon bucket or carboy)
- Container with known volume (e.g., measuring cup) for flow estimation.
- Container for investigation derived purge water (drums or fractionation tank).
- Water level indicator.
- Water quality measurement equipment (YSI, Turbidity meter)
- Stopwatch or timer.
- Clear glass jars (at least 2).
- Well Development Field Data Record.
- Field notebook; and
- Pens with indelible ink.

Extraction Method Considerations

Development of wells will be accomplished with a submersible pump, peristaltic pump, and/or bailer. Bailers should be used to develop wells only where the volume of water is so small that other development methods are clearly inappropriate. Pumps used for well development will be periodically raised and allowed to drain back into the hole in order to induce flow out through the well screen.

A surge block may be used to flush the well screen filter pack of fine sediment in instances where field personnel expect that development may be improved by surging. Surging will be conducted slowly to reduce disruption to the filter pack and screen. Following surging, the well will be pumped or bailed again to remove sediment drawn in by the surging process until suspended sediment is reduced to acceptable levels (see below). Water should not be added to the well to aid in development.

Pump selection for well development will depend on variables specific to each monitoring well program. Factors that must be considered include:

- Depth to water at the site.
- diameter of the well; and
- site specific development criteria (e.g. required minimum purge volumes).

Extraction equipment pros and cons:

Peristaltic Pumps:

Pros: user friendly, suitable for use in small diameter wells (<1-inch), minimal effort to setup, controllable flow rates
Cons: limited to wells with groundwater <25 ft below ground surface, pump head can easily clog in turbid wells, limited flow rates (insufficient for large purge volumes), limited capacity to surge well screens

Submersible Pumps: Bladder Pumps, Impeller Pumps, Pneumatic Pumps.

Pros: capable of pumping in wells with depths to water up to 200 ft bgs, capable of evacuating water at a high flow rate (1 to 5 gpm), less prone to clogging in turbid wells (impeller pumps less so), pumps can serve as surge blocks
Cons: less user friendly, requires additional equipment such as a generator or compressed gases

Note: PVC impeller pumps should be selected over stainless-steel construction as they are typically designed for the harsh conditions observed during well development and are less prone to failure (overheating, seizing).

Inertial Pumps: Waterra Pumps

Pros: suitable for use in small diameter wells (<1-inch), capable of removing water from wells with depths to water up to 200 ft bgs, capable of evacuating water at a high flow rate (up to 4 gpm), less prone to clogging in turbid wells, minimal down well tooling (tubing, check valve, surge block)
Cons: can require additional equipment such as a generator, health and safety considerations to secure pump actuator and tubing, tubing may need to be pulled from the well periodically to replace worn foot valves.

Bailers

Pros: no limit to water depth, simplest evacuation method with minimal equipment, capable of evacuating water at a decent flow rate (0.5 gpm), suitable for evacuating very turbid water, bailer serves as a surge block

Cons: labor intensive, unlikely to meet turbidity goals, impractical for continuous water quality measurements for well stabilization

2.3 Field Procedures

1. Don personal protective equipment (PPE).
2. Upon reaching the well assess the condition of the well and record preliminary measurements:
    a. measure depth to water and depth to bottom of the well (if a measuring point has not been marked, mark on the casing using a permanent marker or notch the casing using a small saw).
    b. compare the measured depth to bottom to the well construction, estimate the amount of accumulated material in the well.
    c. complete calculations for the amount of water in the well (see the field data record for calculations)
3. Set up equipment for desired development method and surge (long up and down motion) the well screen and bottom of the well using the pump, stainless steel bailer or tubing with surge block. This will mobilize fines that have settled in the bottom of the well and in the well screen filter pack for removal during well development.
4. Initiate well development, water should be evacuated at a high enough rate to stress the well without dewatering the well screen.
5. Record flow measurements, depth to water, and water quality measurements periodically (~ 5 to 10 intervals).

For wells where sampling will not occur for at least 14 days the following criteria will be met:

1. the well water is clear to the unaided eye (based on observations of water clarity through a clear glass jar).
2. the sediment thickness remaining in the well is less than one percent of the screen length; or
3. development has been conducted for more than 2 hours.

For wells that will be sampled sooner than 14 days the following criteria should be met:

1. Water quality parameter measurements shall be made using instrumentation. Due to flow rates and methodology the water quality measurements may be collected from a clean container rather than a flow through cell. Water quality parameter instruments will be calibrated daily as per the manufacturer's instructions. Equipment information (make, model, and serial number) and

calibration readings shall be recorded on the field instrument calibration record (**example attached**).

2. water quality parameters have stabilized or 2) the total volume of water removed from the well equals three times the standing water volume in the well plus the volume of drilling fluid lost (whichever occurs first).

Non-dedicated pumps shall be decontaminated prior to use in the next well and dedicated shall be used during subsequent sample collection from the well. The handling of development fluids (IDW) shall be specified in the site-specific FAP.

Documentation

The following data shall be recorded for development on the field data record and in the field book:

- well designation.
- date of well installation.
- date of development.
- static water level before and after development.
- quantity of drilling fluid lost during drilling.
- quantity of standing water in well prior to development.
- depth from top of well casing to bottom of well.
- screen length.
- depth from top of well casing to top of sediment inside well, before and after development.
- physical character of removed water, including changes during development in clarity, color, particulates, and odor.
- type and size/capacity of pump and/or bailer used.
- height of well casing above/below ground surface.
- typical pumping rate.
- estimate of recharge rate; and
- quantity of water removed and time for removal.

3.0 ATTACHMENTS

Well Development Record

Field Instrument Calibration Record

WELL DEVELOPMENT RECORD

MACTEC
511 Congress Street, Portland Maine 04101

PROJECT NAME		**LOCATION ID**	**PAGE** OF
PROJECT NUMBER		**START TIME**	**START DATE**
WELL INSTALLATION DATE	**WELL DEVELOPMENT DATE**	**END TIME**	**END DATE**

WELL DIAMETER	IN	**CASING DIAMETER**	IN	**MEASUREMENT POINT (MP)**			
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:

WELL DEVELOPMENT RECORD

FIELD INSTRUMENT 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	^{o}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: Laboratory provided
Sample Preservatives Source: Laboratory provided
Disposable Filter Type: in-line 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.

MACTEC
511 Congress Street, Portland Maine 04101

FIELD INSTRUMENT CALIBRATION RECORD

SOP # S24

MACTEC STANDARD OPERATING PROCEDURE #S24

MONITORING WELL DECOMMISSIOING PROCEDURE

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

Bradley B. LaF

______________________________ April 27, 2020

Bradley LaForest, NRCC-EAC, Project Manager | Date

Reviewed | Date

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MONITORING WELL DECOMMISSIOING PROCEDURE

1.0 PURPOSE

This Standard Operating Procedure (SOP) provides procedure for decommissioning monitoring wells. The methods provided in this SOP are designed to prevent contaminant migration from the ground surface to the water table or between separate aquifer systems through penetrations created by monitoring wells.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure in the execution of planned activities must be approved by the project manager and documented in the field logbook and/or field data records.

2.0 REFERENCES

NYSDEC, 2009. Commissioners Policy (CP) 43 - Groundwater Monitoring Well Decommissioning Procedures", August 2009.

3.0 DEFINITIONS

Borehole – Any hole drilled into the subsurface for the purpose of identifying lithology, collecting soil samples, and/or installing groundwater wells.

Grout – For the purposes of this SOP, the term "grout" consists of a mixture of Portland cement, clean water and bentonite. The grout is placed as a slurry, and once properly set and cured, is capable of restricting movement of water.

Monitoring Well – A well that provides for the collection of representative groundwater samples (including the detection and collection of representative light and dense non-aqueous phase organic liquids) and the measurement of fluid levels.

Annular Space – The space between the well screen or casing and the borehole wall.

Filter Pack – Granular filter material (sand, gravel, etc.) placed in the annular space between the well screen and the borehole to increase the effective diameter of the well and prevent fine-grained material from entering the well.

Well Screen – The casing segment used in a well which maximizes the entry of water from the aquifer and minimizes the entrance of the filter pack and formation materials.

Tremie – A tubular device or pipe used to place grout or bentonite in the well or annular space generally from the bottom of the bore hole to the surface.

4.0 PROCEDURE

The NYSDEC presents four primary methods of well abandonment in its guidance document "CP-43: Groundwater Monitoring Well Decommissioning Policy" (**Attached**). These methods include:

1. Grouting in-place.
2. Casing perforation followed by grouting in-place.
3. Grouting in-place followed by removing the casing; and
4. Over-drilling and grouting.

The method of abandonment selected depends on the construction and condition of the monitoring well to be abandoned. The first step in the abandonment process is to review all available well construction information. Figure 2 of the New York State Department of Environmental Conservation **Groundwater Monitoring Well Decommissioning Procedures guidance CP-43** (See **Attached**) presents a flow chart to provide guidance on the selection of the abandonment method. Frequently due to the age of monitoring wells at many sites, available information may be limited making use of the flow chart difficult.

4.1 Responsibilities

Project Manager

The project manager (PM) is responsible for determining the appropriate well abandonment procedures and that these procedures will be conducted in accordance with this SOP and any other appropriate procedures. This will be accomplished through staff training.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to well abandonment activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL and documenting the deviation in the field logbook and/or the field data record.

4.2 Preparation

Equipment Selection and Sampling Considerations

The following list of equipment includes the necessary items to be used by field personnel during monitoring well abandonment. Subcontractor personnel typically provide and operate all monitoring well abandonment equipment and materials. Site-specific conditions may warrant the use of additional or deletion of items from this list.

- Appropriate personal protective equipment (PPE) as specified in the site-specific health and safety plan (HASP).
- Appropriate monitoring equipment (e.g. photoionization detector [PID] or particulate monitors)
- Camera.
- Calculator.
- Field logbook; and
- Field data records (FDRs; **example Attached**).

4.3 Field Procedure

Once the well is located identified the well should be opened and screened with a PID to determine if volatile organic compound contamination is present so that appropriate PPE and health and safety related concerns can be addressed. The depth to water and total well depth will then be measured and recorded on an FDR. This information should be checked against the well construction details to ensure that the correct well is being decommissioned. If a well is unlabeled or the label/well ID is not legible then the well measurements may provide evidence that the correct well is being abandoned.

Grouting In-place

Grouting in-place is the most common and simplest method of abandoning a monitoring well. Most shallow monitoring wells that do not penetrate a confining layer can be abandoned by grouting in-place. Overburden monitoring wells that were constructed with grout in the annular space as a seal are also very difficult to remove and are generally abandoned using the grouting in place abandonment method.

Grouting in place is generally the only method that can be used in open borehole bedrock wells with a steel casing seated in bedrock.

The drilling subcontractor will grout the well using a cement and/or bentonite grout injected with a tremie pipe to place the grout from the bottom of the well to 5 feet below ground surface. The drilling subcontractor will then remove the protective casing or road box. Removal of the protective casing may require breaking concrete away from the protective casing and using the drilling rig winch to pull the casing from the ground. Once the protective casing is out of the way the top section of the PVC riser may be unscrewed using hand tools. If the PVC cannot be unscrewed, then the PVC will be cut as far below ground surface as possible and the monitoring well casing will be backfilled with material similar to native soils.

Bedrock wells with steel casing that cannot be removed from the ground will be cut off flush with the ground surface or slightly below the ground surface if possible and backfilled with material similar to native soils.

Casing Perforation

Casing perforation is a specialized grouting in-place method that is the preferred method for abandoning monitoring wells that have poor records regarding well construction (including grouting and backfill details) and are typically large diameter wells (e.g. four inches in diameter or greater). Commercial equipment is available for perforating the riser casings and screens of the larger diameter wells and will be provided by the driller.

In this method the perforating tool is lowered into the PVC casing and the well screen and riser will be punctured to allow for enhanced passage of the grout into the annular space and filter pack.

Once the casing and screen is perforated the monitoring well is then grouted to five feet below ground surface. Surface restoration will be carried out as described in the grouting in-place methodology.

Casing Pulling

Casing pulling is a grouting in-place method in instances where the well riser/casing must be removed to clear the site for future excavation or redevelopment. The casing pulling method can be used when:

1) no contamination is present in the overburden.
2) there is contamination in the overburden, but there are no confining layers present.
3) there is contamination in the overburden and a confining layer is present, but the confining layer will remain sealed after grouting the well.

Casing pulling involves using drill rods, or a downhole casing cutter to puncture the bottom of the monitoring well or cut off the bottom of the screen. Once the monitoring well is punctured, it is grouted to five feet below ground surface using a tremie pipe. The protective casing and well materials are then pulled from the borehole using the drill rig winch or other suitable equipment. Grout will be added to within five feet of the ground surface as sections of the well riser are removed. Once the well materials have been removed, the borehole shall then be backfilled with material similar to native soils.

If the riser pipe breaks during removal, the subcontractor may need to over-drill the original borehole using a hollow-stem auger to remove any remaining well materials. Over-drilling methods are described below.

Over-drilling

Over-drilling is a method that uses hollow stem augers or a rotary bit and casing to physically remove all well materials including the well screen, riser, sand pack, bentonite seals, and grout. It should be used for deeper wells where casing pulling is not a feasible method or will not prevent cross contamination across a confining layer. It is the slowest most labor-intensive method. An experienced drilling subcontractor should be used or consulted if this method is chosen for well abandonment activities.

The protective casing will be removed, and a drill rig will be set up on the monitoring well. Hollow stem augers or large diameter casing will be advanced to around the well to follow the borehole down to the terminal depth. The auger head or rotary bit if using casing will drill out the old well materials as the boring is advanced. Following the old borehole can be difficult and care must be taken to prevent the augers or bit to “walk” off the old borehole and create a new borehole. Once the borehole has been drilled and cleaned out to a depth at least a foot beyond the former well boring, the borehole will be grouted to the surface using a tremie pipe. The augers or casing will slowly be removed from the borehole, adding grout as needed to top off the borehole.

Upon completion of well abandonment activities, the surface should be backfilled with native soils or clean backfill. Ideally the top five feet should be backfilled with materials similar to the natural soils of the area and the surface of the borehole restored to the condition of the surrounding area using soil, concrete, or asphalt as appropriate.

Notes will be taken of all materials removed from the monitoring well, all materials left in place, and the amount of grout used and will be recorded on the Monitoring Well Decommissioning FDR (**example attached**).

5.0 ATTACHMENTS

Well Decommissioning Record

NYSDEC CP-43: Groundwater Monitoring Well Decommissioning Policy

WELL DECOMMISSIONING RECORD

MACTEC

511 Congress Street, Portland Maine 04101

PROJECT NAME		LOCATION ID	PAGE OF
PROJECT NUMBER		Driller	DATE
WELL INSTALLATION DATE	WELL DECOMMISSIONING DATE	Drilling Company	Inspector

WELL DIAMETER (INCHES) ☐ 1-IN. ☐ 2-IN. ☐ 4-IN. ☐ 6-IN. ☐ 8-IN. ☐ OTHER ______

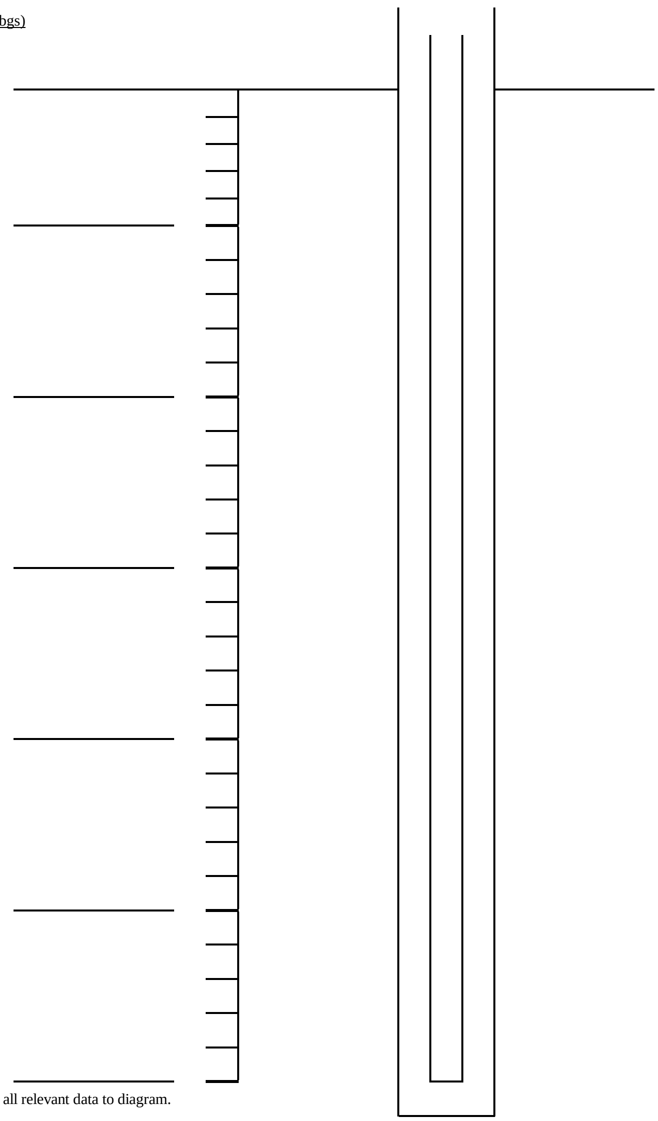
CASING DIAMETER (INCHES) ☐ 4-IN. ☐ 6-IN. ☐ 8-IN. ☐ 10-IN. ☐ 12-IN. ☐ OTHER ______

MEASUREMENT POINT (MP) ☐ TOP OF RISER (TOR) ☐ TOP OF CASING (TOC) ☐ OTHER ______

INITIAL WELL DEPTH (BMP)	FT	**PROT. CASING STICKUP (AGS)**	FT
INITIAL DTW (BMP)	FT	**TOC/TOR DIFFERENCE**	FT
SCREEN LENGTH	FT	**SCREENED INTERVAL (BMP)**	FT

Well Diagram

Depth (ft bgs)



Add all relevant data to diagram.

Decommissioning Data

Grouting

Interval Grouted (ft) ______

Type of Grout ______

Quantity Used (Gal) ______

Type of cement ______

Amount of cement (bags) ______

Type of Bentonite ______

Amount of Bentonite used (bags) ______

Casing Pulling

Method used ______

Casing retrieved (ft) ______

Casing type/diameter ______

Over drilling

Interval Drilled ______

Drilling Method ______

Borehole Diameter ______

Casing Perforation

Equipment used ______

Number of perforations/foot ______

Size of perforations ______

Interval perforated ______

NOTES

DEVIATIONS

Well Decommision Signature:

Print Name:

Checked By:

Date:

LOCATION SKETCH

SOP # S25

MACTEC STANDARD OPERATING PROCEDURE #S25

SOIL VAPOR AND AIR SAMPLING

April 22, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

Charles R Staples

April 27, 2020

Charles Staples, PG, Program Technical Lead

Date

Reviewed

Date

SOIL VAPOR AND AIR SAMPLING

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the methods to be used for substructure soil vapor, exterior soil vapor, indoor air and/or ambient air sampling used to evaluate human exposure to VOCs through vapor intrusion.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure must be approved by the project manager and documnted in the field logbook and/or field data record.

2.0 PROCEDURE

This section contains both the responsibilities and procedures involved with substructure soil vapor, exterior soil vapor, indoor air, and/or ambient air sampling. Proper sampling procedures are necessary to ensure the quality and integrity of the samples.

2.1 Responsibilities

Project Manager

The project manager (PM) is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and any other appropriate procedures based on the objectives of the sampling.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL and documenting them in the field logbook and on the field data records.

2.2 Preparation

In Office Preparation

If collecting soil vapor and indoor air samples:

- Make contact with property owners to explain sampling and ensure access.
- Schedule time for sample collection and sample retrieval (if collecting time-averaged samples (e.g., 8-hour or 24-hour). Anticipate one to 1.5 hours per location for completing indoor air questionnaire and building inventory form and set up for collection of subslab soil vapor and indoor air samples. Anticipate 30 minutes for sample retrieval.
- Prepare equipment for anticipated sampling (see below).

Equipment Selection and Sampling Considerations

General Considerations – For SUMMA® type canisters;

- Canisters should arrive from the laboratory with approximately 30-inches mercury of vacuum (guages may be a little innacurate-tap lightly to double check reading). If initial canister vacuums are observed in the field to be less than 25-inches mercury, canister should be replaced and not used, since it is not known if air has already entered the canister.
- If possible for canisters that will collect samples for 8-hours or 24-hours, the canisters should be reviewed after initially opened to ensure that 1) the canister vacuum is dropping, and 2) that the canister vacuum did not drop immediately to zero (i.e., a leak in the regulator). For residential samples, it is often not possible, practical to review canisters after the sampling crew has left the property and before the scheduled canister pick up.
- At sample completion, canisters should have between one and five inches mercury vacuum. If canister has greater than 10-inches mercury vacuum and the field crew has access and time, the canisters should be allowed to sit for longer to lower the vacuum. If there are questions, discuss readings with the FOL and/or PM. Larger vacuums could result in elevated detection limits.

Subslab Soil Vapor Sampling – Subslab 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 either a "time-averaged" (e.g., 8-hour or 24-hour) soil vapor sample, or a “grab” (e.g., less than one hour) soil vapor sample. Typically, substructure soil vapor samples are collected as subslab soil vapor sample obtained via a temporary installed sampling port through apparent vapor barrier (such as floor slab or plastic liner). Substructure samples collected from a crawl space or basement without an apparent vapor barrier will be collected similar to indoor air samples, described further below.

<u>Subslab Soil Vapor Sampling will require the following equipment:</u>

- stainless steel (e.g., 1.4 or 6-liter), pre-evacuated SUMMA®-type canister - laboratory provided
- Pressure gauge with integrated metering valve based on sample duration desired (e.g., 20 minute, 8-hour, 24-hour) - laboratory provided
- Two, 9/16-inch, open-end wrenches
- PID – part per billion range -for screening crawl space/cracks
- Helium Leak Testing Setup (if conducted)
    - Stainless steel shroud with sample ports and pipe insulation foam backing
    - Helium detector capable of measuring parts per million and percent helium (LACO Technologies LHHLD-2002 or equivalent)

    - Helium canister with regulator (check for lab availability)

- Utility Knife
- Electric hammer drill with 3/8-inch diameter drill bits
- 50-ft long electrical extension cord
- ¼-inch O.D. Teflon® tubing (confirm with laboratory that sizing matches canister type)
- ¼-inch stainless steel valve and stainless steel "tee" type fitting
- 60 cc polyethylene syringe for purging tubing
- Non-hardening, non-VOC emitting modeling clay (e.g., Plastalina by VanAken)
- Quick-drying expansive Portland cement
- Wristwatch
- Flashlight
- Dustpan and broom
- Chain of Custody (COC) form - laboratory provided
- Field Data Forms (FDRs) (**example attached)**, pens
- NYSDEC Structure Sampling Questionnaire and Building Inventory (**attached)**
- Personal Protective Equipment

Indoor and Ambient Air Sampling – Indoor air samples will be collected from residential, commercial, industrial, institutional, and multiuse buildings. Ambient air sample will be collected from exterior locations. For the purposes of sampling procedures, crawl space samples can be collected following procedures for indoor air. Indoor air and ambient air samples will be collected 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 8-hour or 24-hour sample collection and may be collected in conjunction with 8-hour or 24-hour substructure soil vapor sampling.

Indoor and ambient air sampling will require the following equipment:

- stainless steel (e.g., 1.4 or 6-liter), pre-evacuated SUMMA®-type canister - laboratory provided
- Pressure gauge with integrated 8- or 24-hour metering valve - laboratory provided
- Two, 9/16-inch, open-end wrenches
- PID – part per billion range detectors for screening indoor air
- Wristwatch
- Indoor Air Quality Questionnaire and Building Inventory Form (**Form Attached**)
- COC form -laboratory provided
- FDRs, pens
- NYSDEC Structure Sampling Questionnaire and Building Inventory (**attached)**

- Personal Protective Equipment

Direct Push (GeoProbe®) Deep and Shallow Soil Vapor Sampling – Soil vapor grab samples can be collected at exterior locations from shallow (3 to 5 feet below ground surface [bgs] or shallower if located under parking lot pavement) and deep (greater than five feet bgs) depths. Permanent or semi-permanent sampling points can be installed, allowed to equilibrate over a 24-hour period, and sampled using SUMMA® type air canisters equipped with metering flow controllers. This technique is intended for collection of a grab sample (i.e., less than one hour).

<u>Exterior soil vapor grab sampling will require the following equipment:</u>

- GeoProbe® soil vapor implant installation equipment – subcontractor provided
- stainless steel (e.g., 1.4-liter or 6-liter), pre-evacuated SUMMA® canister - laboratory provided
- Pressure gauge with integrated metering valve such that sampling will not proceed faster than 200 ml per minute (sample time dependent on canister size)- laboratory provided
- ¼-inch outside diameter, six-inch-long soil vapor implants
- Hand auger
- Glass beads – 60 to 100 mesh
- Bentonite chips -16 mesh
- funnel
- PID
- Utility Knife
- 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 or geopump for purging tubing
- Wristwatch
- COC form - laboratory provided
- FDRs, pens
- Personal Protective Equipment

2.3 Field Procedures

Sub-Slab Soil Vapor Sampling

Procedure for Subslab Soil Vapor Sample Collection:

Subslab soil vapor sample obtained via temporary installed sampling port through apparent vapor barrier (i.e. floor slab or plastic liner) will be collected as follows:

1. **Select and prepare the sample collection point.**

- 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 FDR 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.
- 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 hole through thickness of the slab using a 3/8-inch drill bit. Extend the hole 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 hole and 1/4-inch tubing using the non-hardening modeling clay. Be sure that clay sticks to floor.
- Connect the ¼ -inch Teflon® tubing to a stainless-steel valve using compression fittings (unless the laboratory canisters are fitted with quick connectors). 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. Conduct helium leak test, if required

- After purging the tubing, connect the PID to collect a measurement for VOC concentration and record on the Soil Vapor Sampling FDR.
- Connect the sample tubing to the inside of a stainless-steel shroud using a short piece of silastic tubing. Carefully install the stainless-steel shroud over the sampling point.
- The shroud has three sampling ports: one that connects to the sub-slab tubing and two that are connected to the air pocket under the shroud. Insert the helium detector through one of the air pocket sample ports and introduce helium through the remaining air pocket sample port. Release helium in a controlled manner to avoid over pressurizing the shroud (if using a laboratory provided shroud and helium, refer to their directions for use).
- Helium concentration within the air pocket should reach a minimum concentration in the percent range. If values remain low, remove shroud and check for leaks. Pipe insulation or hydrated bentonite on the base of the shroud creates a good seal with minimal pressure.
- Once helium concentration within the shroud has reached an acceptable level (e.g.,

10% or more helium), connect the helium detector to the sample tubing or sample port using silicone tubing and continue purging the sample line with the helium detector for approximately one minute. Record the final concentration of helium in both the shroud and the sample tubing on the FDR. The helium test is considered successful if the concentration of helium from the sample tubing is less than 10% of the concentration that is observed in the shroud (e.g. 90ppm He in the sample tubing and 10% He in the shroud is considered a successful test).

- If the helium test passes, carefully disassemble and remove the helium testing apparatus and cap the sample tubing in preparation for connecting to the sample canister. If the test is unsuccessful, reseal the sampling point and re-attempt.

4. Preparation of SUMMA®-type canister and collection of samples

- 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.
- Connect subsurface probe to end of in-line particular filter on gauge/metering valve via ¼-inch O.D. Teflon® tubing and "swagelok®-type" fittings (unless canisters use quick release fittings).
- Open canister valve and in-line stainless steel valve to initiate sample collection.
- Record initial 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.
- 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.

5. Termination of sample collection

- Revisit SUMMA®-type canister approximately at end of sample collection period (e.g., 8-hour or 24 hours after initiation of sample collection) and record gauge pressure on sampling form and COC. If collecting grab sample, monitor vacuum during sampling. Vacuum should read between 1 and 5- inches mercury.
- 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 fill the hole with quick drying hydraulic cement. Finish

flush with floor surface.

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 chain of custody per the **Chain of Custody Procedures SOP** 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 sample duplicates to the analytical laboratory for analyses of target compounds, refer to the site-specific Field Activities Plan (FAP). 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.

Indoor Air Sampling

Procedure for Indoor Air Sample Collection

The following section provides a general guidance on the collection of indoor air samples.

For the purposes of evaluating the potential vapor migration from soils and groundwater into indoor air, samples will typically be collected from the lowest usable area of the building but may include samples from upper floors based on the site-specific FAP. Indoor air samples may be collected from the following areas:

1. Unfinished or finished basement (special note should be taken if dirt floor)
2. Finished first floor (either over basement, or in slab-on-grade building
3. Although not technically indoor air samples, samples collected from unoccupied crawl space will follow the same procedure.

Selection and Preparation of indoor air sample collection area

- Conduct interview with occupant/owner. Complete Indoor Air Quality Questionnaire and Building Inventory Form (**Form Attached**).
- 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.

Preparation of SUMMA®-type canister and collection of indoor air sample

- Place SUMMA®-type canister at breathing zone height (approximately 3 to 5 ft above floor) (crawl space samples can be placed on the ground). 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 and store for later use.
- Install pressure gauge / metering valve on canister valve fitting and tighten.
- Open canister valve to initiate sample collection.
- 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.
- 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.

Termination of indoor air sample collection

- Revisit SUMMA®-type canister approximately at end of sample collection period (e.g., 8-hour or 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.

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 chain of custody per the **Chain of Custody Procedures SOP** 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. Duplicate samples will be collected "side-by-side" over the same time interval.

Ambient Air Sampling

Procedure for Ambient (outdoor) Air Sample Collection

The following section provides a general guidance on the collection of ambient air samples.

Selection and Preparation of ambient sample collection area

- 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.
- 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.
- 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 samples

- 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.
- 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 and store for later use.
- Install pressure gauge/metering valve on canister valve fitting and tighten.
- Open canister valve to initiate sample collection.
- 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
- 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.

Termination of ambient sample collection

- Revisit SUMMA®-type canister approximately at end of sample collection period (e.g., 8-hours or 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.

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.

Direct Push (GeoProbe®) Soil Vapor Sampling

Procedure for Direct Push (GeoProbe®) Soil Vapor Grab Sample Collection

Survey the known site characteristics including source areas, groundwater data, utility trench locations, groundwater flow, and potentially impacted areas to assess applicability of sampling technique. The steps provided below should be considered a general guidance on the collection soil vapor samples (shallow or deep).

Selection and preparation of sample collection point

- Identify utilities prior to the selection of deep soil vapor sample locations (**utility clearance form attached)**.

- Assess utility clearance at all locations. Review the proposed location or locations with the site representative.

- Mark the proposed location(s) and describe the location(s) on the sampling form (**example**

attached).

Installation of soil vapor sample point

- Collect continuous soil samples using direct push technology to characterize subsurface soils (See **Direct Push Drilling SOP**). Soil characteristics (such as soil type, moisture, color) and photoionization detector (PPB-Rae) field screening results will be recorded on a field data record. PID screening, as well as soil characteristics will be used to select vapor implant depths. Consideration will be given to more permeable soils encountered during sampling. The PID will be calibrated to a 10 parts per million isobutylene standard and set point of 1.0.
- Soil vapor implants will be installed by either lowering the implant down the direct push rods to the desired depth or attaching the implant to a GeoProbe® implant Anchor/Drive point (GeoProbe® PR-14) prior to driving the rods to the desired depth.
- Attach quarter inch outside diameter Teflon tubing to the soil vapor implant allowing approximately two feet to extend above the ground surface and be sealed at the surface with a plastic cap.
- Using the funnel, pour a sufficient volume of glass beads down the rods to fill the space around the implant. Depending on project, sand may be used in place of glass beads – see site-specific FAP).
- Using the funnel, pour a sufficient volume of bentonite chips to create an approximate two-foot bentonite seal above the glass beads.
- Retract the rods prior to hydrating the bentonite.
- Pour a sufficient volume of ASTM Type II water down the direct push hole to hydrate the volume of bentonite chips installed, being careful not to saturate the hole and the sampling screen.
- Use native backfill, or a cement/bentonite grout mixture to backfill the boring to the ground surface.
- If shallow and deep implants are to be installed at one location, both implants can be placed within the same boring. The upper implant will be surrounded by glass beads and a bentonite seal will be installed both below and above the glass beads.
- If sample points will be permanent, install four-inch flush mount casing with concrete apron.
- Complete a Soil Vapor Probe Construction Diagram for each sample location and record field data and observations on the GeoProbe® Soil Vapor Sampling Record (**example attached)**.

Preparation of SUMMA® canister and collection of samples

- 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 or brass fitting from canister and attach pressure gauge/flow controller.
- Connect canister to silastic tubing already connected to the subsurface probe (may be Swagelok fittings or by quick connect tubing, depending on canister type).
- Open canister valve and in-line stainless steel valve (if present) to initiate sample

collection.

- 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.
- Record date and local time of valve opening on sampling summary form and COC.
- Take digital photograph of SUMMA® canister and surrounding area.

Termination of sample collection

- Sample collection duration may vary based on the size of the canister and the direction of the client but is typically less than one hour (flow should be less than 200 milliliters per minute). If canisters are equipped with flow controllers, sample valves should remain open until the vacuum in the canister is at 3 to 5-inches Hg.
- Upon completion of sample collection, record gauge pressure on sampling form and COC.
- Record date and local time of valve closing on sampling form and COC.
- Close canister valve.
- Disconnect tubing and recap pressure gauge (or remove gauge depending on canister set up.
- Remove SUMMA® canister from sample collection area.
- If permanent sampling point, cap tubing and close flush mount casing. If temporary point, remove temporary probe from hole and backfill to match surrounding ground (e.g., native soil, asphalt, concrete).

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.

3.0 ATTACHMENTS

NYSDEC Structure Sampling Questionnaire and Building Inventory

Soil Vapor Intrusion Sampling Record

Soil Vapor Implant Sampling Record

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

Site Name: ______ Site Code: ______ Operable Unit: ______

Building Code: ______ Building Name: ______

Address: ______ Apt/Suite No: ______

City: ______ State: ______ Zip: ______ County: ______

Contact Information

Preparer's Name: ______ Phone No: ______

Preparer's Affiliation: ______ Company Code: ______

Purpose of Investigation: ______ Date of Inspection: ______

Contact Name: ______ Affiliation: ______

Phone No: ______ Alt. Phone No: ______ Email: ______

Number of Occupants (total): ______ Number of Children: ______

☐ Occupant Interviewed? ☐ Owner Occupied? ☐ Owner Interviewed?

Owner Name (if different): ______ Owner Phone: ______

Owner Mailing Address: ______

Building Details

Bldg Type (Res/Com/Ind/Mixed): ______ Bldg Size (S/M/L): ______

If Commercial or Industrial Facility, Select Operations: ______

If Residential Select Structure Type: ______

Number of Floors: ______ Approx. Year Construction: ______ ☐ Building Insulated? ☐ Attached Garage?

Describe Overall Building 'Tightness' and Airflows(e.g., results of smoke tests): ______

Foundation Description

Foundation Type: ______ Foundation Depth (bgs): ______ Unit: FEET

Foundation Floor Material: ______

Foundation Wall Material: ______

Foundation Floor Thickness: ______

Foundation Wall Thickness: ______ Unit: INCHES

☐ Floor penetrations? Describe Floor Penetrations: ______

☐ Wall penetrations? Describe Wall Penetrations: ______

Basement is: ______ Basement is: ______ ☐ Sumps/Drains? Water In Sump?: ______

Describe Foundation Condition (cracks, seepage, etc.) : ______

☐ Radon Mitigation System Installed? ☐ VOC Mitigation System Installed? ☐ Mitigation System On?

Heating/Cooling/Ventilation Systems

Heating System: ______ Heat Fuel Type: ______ ☐ Central A/C Present?

Vented Appliances

Water Heater Fuel Type: ______ Clothes Dryer Fuel Type: ______

Water Htr Vent Location: ______ Dryer Vent Location: ______

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

PRODUCT INVENTORY

Building Name: ______________________ Bldg Code: ____________ Date: ____________

Bldg Address: ______________________________________ Apt/Suite No: ____________

Bldg City/State/Zip: ____

Make and Model of PID: ______________________ Date of Calibration: ____________

Location	Product Name/Description	Size (oz)	Condition *	Chemical Ingredients	PID Reading	COC 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.

Product Inventory Complete? ☐ Were there any elevated PID readings taken on site? ☐ ☐ Products with COC?

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

Site Name: ______ Site Code: ______ Operable Unit: ______

Building Code: ______ Building Name: ______

Address: ______ Apt/Suite No: ______

City: ______ State: ______ Zip: ______ County: ______

Factors Affecting Indoor Air Quailty

Frequency Basement/Lowest Level is Occupied?: ______ Floor Material: ______

☐ Inhabited? ☐ HVAC System On? ☐ Bathroom Exhaust Fan? ☐ Kitchen Exhaust Fan?

Alternate Heat Source: ______ ☐ Is there smoking in the building?

☐ Air Fresheners? Description/Location of Air Freshener: ______

☐ Cleaning Products Used Recently?: Description of Cleaning Products: ______

☐ Cosmetic Products Used Recently?: Description of Cosmetic Products: ______

☐ New Carpet or Furniture? Location of New Carpet/Furniture: ______

☐ Recent Dry Cleaning? Location of Recently Dry Cleaned Fabrics: ______

☐ Recent Painting/Staining? Location of New Painting: ______

☐ Solvent or Chemical Odors? Describe Odors (if any): ______

☐ Do Any Occupants Use Solvents At Work? If So, List Solvents Used: ______

☐ Recent Pesticide/Rodenticide? Description of Last Use: ______

Describe Any Household Activities (chemical use,/storage, unvented appliances, hobbies, etc.) That May Affect Indoor Air Quality:

☐ Any Prior Testing For Radon? If So, When?: ______

☐ Any Prior Testing For VOCs? If So, When?: ______

Sampling Conditions

Weather Conditions: ______ Outdoor Temperature: ______ °F

Current Building Use: ______ Barometric Pressure: ______ in(hg)

Product Inventory Complete? ______ ☐ Building Questionnaire Completed?

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

Building Code: ____________ Address: ____________

Sampling Information

Sampler Name(s): ____________ Sampler Company Code: ____________

Sample Collection Date: ____________ Date Samples Sent To Lab: ____________

Sample Chain of Custody Number: ____________ Outdoor Air Sample Location ID: ____________

SUMMA Canister Information

Sample ID:					
Location Code:					
Location Type:					
Canister ID:					
Regulator ID:					
Matrix:					
Sampling Method:					

Sampling Area Info

Slab Thickness (inches):					
Sub-Slab Material:					
Sub-Slab Moisture:					
Seal Type:					
Seal Adequate?:	☐	☐	☐	☐	☐

Sample Times and Vacuum Readings

Sample Start Date/Time:					
Vacuum Gauge Start:					
Sample End Date/Time:					
Vacuum Gauge End:					
Sample Duration (hrs):					
Vacuum Gauge Unit:					

Sample QA/QC Readings

Vapor Port Purge:	☐	☐	☐	☐	☐
Purge PID Reading:					
Purge PID Unit:					
Tracer Test Pass:	☐	☐	☐	☐	☐

Sample start and end times should be entered using the following format: MM/DD/YYYY HH:MM

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

LOWEST BUILDING LEVEL LAYOUT SKETCH

Please click the box with the blue border below to upload a sketch of the lowest building level .
The sketch should be in a standard image format (.jpg, .png, .tiff)

Clear Image

Design Sketch

Design Sketch Guidelines and Recommended Symbology

- Identify and label the locations of all sub-slab, indoor air, and outdoor air samples on the layout sketch.
- Measure the distance of all sample locations from identifiable features, and include on the layout sketch.
- Identify room use (bedroom, living room, den, kitchen, etc.) on the layout sketc
- Identify the locations of the following features on the layout sketch, using the appropriate symbols:

B or **F**	Boiler or Furnace	o	Other floor or wall penetrations (label appropriately)
HW	Hot Water Heater	**xxxxxxx**	Perimeter Drains (draw inside or outside outer walls as appropriate)
FP	Fireplaces	**######**	Areas of broken-up concrete
WS	Wood Stoves	● SS-1	Location & label of sub-slab samples
W/D	Washer / Dryer	● IA-1	Location & label of indoor air samples
S	Sumps	● OA-1	Location & label of outdoor air samples
@	Floor Drains	● PFET-1	Location and label of any pressure field test holes.

FIRST FLOOR BUILDING LAYOUT SKETCH

Please click the box with the blue border below to upload a sketch of the first floor of the building. The sketch should be in a standard image format (.jpg, .png, .tiff)

Clear Image

Design Sketch

Design Sketch Guidelines and Recommended Symbology

- Identify and label the locations of all sub-slab, indoor air, and outdoor air samples on the layout sketch.
- Measure the distance of all sample locations from identifiable features, and include on the layout sketch.
- Identify room use (bedroom, living room, den, kitchen, etc.) on the layout sketc
- Identify the locations of the following features on the layout sketch, using the appropriate symbols:

B or **F**	Boiler or Furnace	o	Other floor or wall penetrations (label appropriately)
HW	Hot Water Heater	**xxxxxxx**	Perimeter Drains (draw inside or outside outer walls as appropriate)
FP	Fireplaces	**######**	Areas of broken-up concrete
WS	Wood Stoves	● SS-1	Location & label of sub-slab samples
W/D	Washer / Dryer	● IA-1	Location & label of indoor air samples
S	Sumps	● OA-1	Location & label of outdoor air samples
@	Floor Drains	● PFET-1	Location and label of any pressure field test holes.

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

OUTDOOR PLOT LAYOUT SKETCH

Please click the box with the blue border below to upload a sketch of the outdoor plot of the building as well as the surrounding area. The sketch should be in a standard image format (.jpg, .png, .tiff)

Clear Image

Design Sketch

Design Sketch Guidelines and Recommended Symbology

- Identify and label the locations of all sub-slab, indoor air, and outdoor air samples on the layout sketch.
- Measure the distance of all sample locations from identifiable features, and include on the layout sketch.
- Identify room use (bedroom, living room, den, kitchen, etc.) on the layout sketc
- Identify the locations of the following features on the layout sketch, using the appropriate symbols:

B or **F**	Boiler or Furnace	o	Other floor or wall penetrations (label appropriately)
HW	Hot Water Heater	**xxxxxxx**	Perimeter Drains (draw inside or outside outer walls as appropriate)
FP	Fireplaces	**######**	Areas of broken-up concrete
WS	Wood Stoves	● SS-1	Location & label of sub-slab samples
W/D	Washer / Dryer	● IA-1	Location & label of indoor air samples
S	Sumps	● OA-1	Location & label of outdoor air samples
@	Floor Drains	● PFET-1	Location and label of any pressure field test holes.

SOIL VAPOR INTRUSION 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 Basement		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:

MACTEC

511 Congress Street, Portland, ME 04101

SOIL VAPOR INSTRUSION SAMPLING RECORD

SOIL VAPOR IMPLANT SAMPLING RECORD

MACTEC

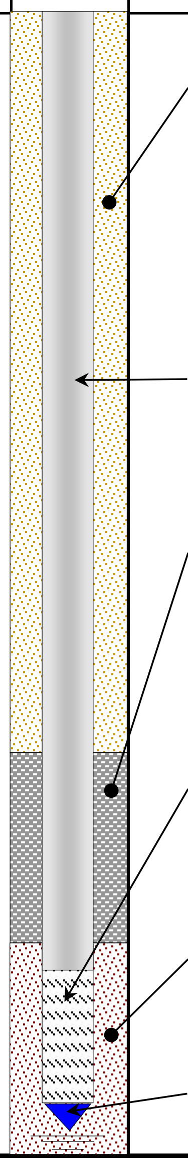
511 Congress Street, Portland Maine 04101

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:
He Breakthrough %:	Initial He %:	Final He %:	

Sample Information					Monitoring						Overburden Drilling Notes:
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	

Soil Vapor Point Construction Notes:



NOTES:

SOIL VAPOR IMPLANT SAMPLING RECORD

ATTACHMENT 3

Field Data Records

FIELD INSTRUMENTATION CALIBRATION RECORD

PROJECT NAME: Robeson Industries, Inc. TASK NO: ____ DATE: ____
PROJECT NUMBER: 3616206112 FIELD CREW: ____
PROJECT LOCATION: 5540 Sutton Road, Castile, NY 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/PM 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	____	+/- 0.1 pH Units			
ORP	+/- mV	240	____	+/- 10 mV	240	____	+/- 10 mV
Specific Conductivity	mS/cm	1.413	____	+/- 3% 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 sat. value
DO (<0.1)	mg/L	<0.1	____	< 0.5 mg/L	<0.1	____	< 0.5 mg/L
Temperature	°C		____			____	°C
Barometric Pressure	mmHg		____			____	mmHg

TURBIDITY METER

METER TYPE ____
MODEL NO. ____
UNIT ID NO. ____

	Units	Standard Value	Meter Value	Standard Value	Meter Value	*Acceptance Criteria (PM)
Standard	NTU	10	____	10	____	+/- 5% of standard
Standard	NTU	20	____	20	____	
Standard	NTU	100	____	100	____	
Standard	NTU	800	____	800	____	

PHOTOIONIZATION DETECTOR (PID)

METER TYPE
MODEL NO. ____
UNIT ID NO. ____

	Units	Standard Value	Meter Value	Standard Value	Meter Value	
Background	ppmv	<0.1	____	<0.1	____	within 5 ppmv of background
Span Gas	ppmv	100	____	100	____	+/- 10% of standard

O_2-LEL 4-GAS METER

METER TYPE ____
MODEL NO. ____
UNIT ID NO. ____

	Units	Standard Value	Meter Value	Standard Value	Meter Value	
Methane	%	50	____	50	____	+/- 10% of standard
O_2	%	20.9	____	20.9	____	
H_2S	ppmv	25	____	25	____	
CO	ppmv	50	____	50	____	

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 Field Operations Support (FOS)
Lot #/Date Produced: ____
Trip Blank Source: Laboratory provided
Sample Preservatives Source: Laboratory provided
Disposable Filter Type: In-line 0.45 µm cellulose
Calibration Fluids / Standard Source:
- DO Calibration Fluid (<0.1 mg/L): Portland FOS
- Other: ____
- Other: ____
- Other: ____

	Calibration Standard Lot Number	Expiration Date
pH (4)		
pH (7)		
pH (10)		
ORP		
Conductivity		
<10 Turb. Standard		
20 Turb. Standard		
100 Turb. Standard		
800 Turb. Standard		
PID Span Gas		
O_2-LEL Span Gas		
DO		

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. Additional 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 backup 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.

GRAB SAMPLING RECORD - WATER

MACTEC
511 Congress Street
Suite 200
Portland, Maine 04101

PROJECT NAME		LOCATION ID	DATE
Robeson Industries, Inc.			
PROJECT NUMBER		START TIME	END TIME
3616206112			
SAMPLE ID	SAMPLE TIME	SITE NUMBER	PAGE
		961008	OF

SAMPLE TYPE: ☐ GROUNDWATER ☐ SURFACE WATER ☐ STORM WATER ☐ DRINKING WATER
☐ PORE WATER ☐ OTHER: ____________

FIELD PARAMETERS WITH PROGRAM STABILIZATION CRITERIA

TIME	DTW (ft.)	PURGE RATE (mL/min)	TEMP. (°C) ±3%	SPECIFIC COND. (mS/cm) ±3%	pH (pH units) ±0.1	DISS. O_2 (mg/L) ±10% or 3 values <0.5 mg/L	REDOX/ORP (mv) ±10 mv	TURBIDITY (NTU) ±10% or <10 ntu	PUMP INTAKE DEPTH (ft.)	COMMENTS

FINAL STABILIZED FIELD PARAMETERS (to appropriate significant figures [SF])

TEMP: nearest degree (ex. 10.1 = 10)
COND: 3 SF max (ex. 1.686 = 1.69)
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	DECON FLUIDS USED	TUBING/PUMP/BLADDER MATERIALS	EQUIPMENT USED
☐ PERISTALTIC	☐ ALCONOX	☐ SILICON TUBING	☐ WL METER ______
☐ SUBMERSIBLE	☐ DEIONIZED WATER	☐ HDPE TUBING	☐ PID ______
☐ BLADDER ______	☐ POTABLE WATER	☐ LDPE TUBING	☐ WQ METER ______
☐ PASSIVE DIFFUSION BAG	☐ NITRIC ACID (HNO_3)	☐ STAINLESS STEEL PUMP MATERIAL	☐ TURB. METER ______
☐ HYDRASLEEVE	☐ HEXANE (C_6H_{14})	☐ PVC PUMP MATERIAL	☐ PUMP ______
☐ OTHER ______	☐ METHANOL (CH_3OH)	☐ GEOPROBE SCREEN	☐ OTHER ______
	☐ OTHER ______	☐ OTHER ______	☐ FILTERS NO. ____ TYPE ____

ANALYTICAL PARAMETERS

	PARAMETER	METHOD NUMBER	ANALYTE LIST	FIELD FILTERED	PRESERVATION METHOD	QC COLLECTED
☐						
☐						
☐						
☐						
☐						

PURGE OBSERVATIONS

PURGE WATER CONTAINERIZED? YES ☐ NO ☐
NUMBER OF GALLONS GENERATED ______
NO-PURGE METHOD UTILIZED? YES ☐ NO ☐

SKETCH/NOTES

DEVIATIONS FROM THE WORK PLAN

Sampler Signature: ____________
Print Name: ____________
Checked By: ____________ Date: ______

LOW FLOW GROUNDWATER SAMPLING RECORD

MACTEC

511 Congress Street
Suite 200
Portland, Maine 04101

PROJECT NAME Robeson Industries, Inc.		LOCATION ID	DATE
PROJECT NUMBER 3616206112		START TIME	END TIME
SAMPLE ID	SAMPLE TIME	SITE NAME/NUMBER 961008	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	gal.	PID WELL MOUTH	PPM	DISCHARGE TIMER SETTING	sec.
CALCULATED GAL/VOL	gal.	TOTAL VOL. PURGED	gal.	DRAWDOWN/ TOTAL PURGED		PRESSURE TO PUMP	PSI

Drawdown volume: (final DTW- intial DTW) x (well diameter)^2 x (0.041)

Calculated gal/vol: (water column) x (well diameter)^2 x (0.041)

Total vol. purged: (mL per minute x total minutes) x (0.00026 gal/mL)

FIELD PARAMETERS WITH PROGRAM STABILIZATION CRITERIA (AS LISTED IN THE QAPP)

TIME	DEPTH TO WATER (ft.) ±0.3 ft.	PURGE RATE (mL/min) (100-400 mL/min)	TEMP. (^oC) ±3%	SPECIFIC CONDUCTANCE (mS/cm) ±3%	pH (pH units) ±0.1	DISS. O_2 (mg/L) ±10% or 3 values <0.5 mg/L	REDOX/ORP (mV) ±10 mV	TURBIDITY (NTU) ±10% and <10 NTU or 3 values <5 NTU	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: ☐ ALCONOX ☐ LIQUINOX ☐ DEIONIZED WATER ☐ POTABLE WATER ☐ NITRIC ACID ☐ METHANOL ☐ OTHER ________

TUBING/PUMP/BLADDER MATERIALS: ☐ SILICON TUBING ☐ HDPE TUBING ☐ LDPE TUBING ☐ OTHER ________ ☐ OTHER ________ ☐ STAINLESS STEEL PUMP MATERIAL ☐ PVC PUMP MATERIAL ☐ GEOPROBE SCREEN ☐ TEFLON BLADDER ☐ OTHER ________ ☐ OTHER ________

EQUIPMENT USED: ☐ WL METER ________ ☐ PID ________ ☐ WQ METER ________ ☐ TURB. METER ________ ☐ PUMP ________ ☐ OTHER ________ ☐ FILTERS NO. ________ TYPE ________

ANALYTICAL PARAMETERS

	PARAMETER	METHOD NUMBER	ANALYTE LIST	FIELD FILTERED	PRESERVATION METHOD	VOLUME REQUIRED	QC COLLECTED
☐							
☐							
☐							
☐							
☐							
☐							

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: ________

WELL/PIEZOMETER CONSTRUCTION RECORD FLUSHMOUNT

LOCATION ID:

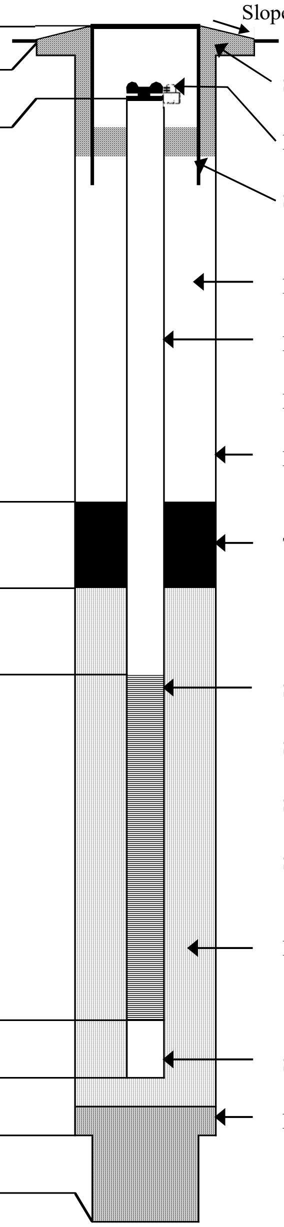
Project Name:	Robeson Industries, Inc. NYSDEC Site No. 961008	Date Started:	Date Completed:
Project Location:	Castile, New York	Logged By:	
Project Number:	3616206112	Task Number	
Checked By:		Checked Date:	
Subcontractor:		Drilling Method:	
Development Method:		Development Date:	
Bucking Posts/Ballards:			
Notes:			

Measuring Point Information

Measuring Point (MP) Type: Top of Riser

MP Elevation (ft):

Item	Depth BMP (ft)	Elevation (ft)
Surface Casing Elevation:		
Ground Surface Elevatioı		
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 Inner Diameter:

Borehole Diameter:

Type of Seal:

Screen Type:

Screen Inner Diameter:

Screen Slot Size:

Screen Length:

Filter/Sand Pack Type:

Sump:

Fallback/Backfill:

NOT TO SCALE

BMP = below measuring point

ft. = feet

WELL/PIEZOMETER CONSTRUCTION RECORD STICKUP

LOCATION ID:

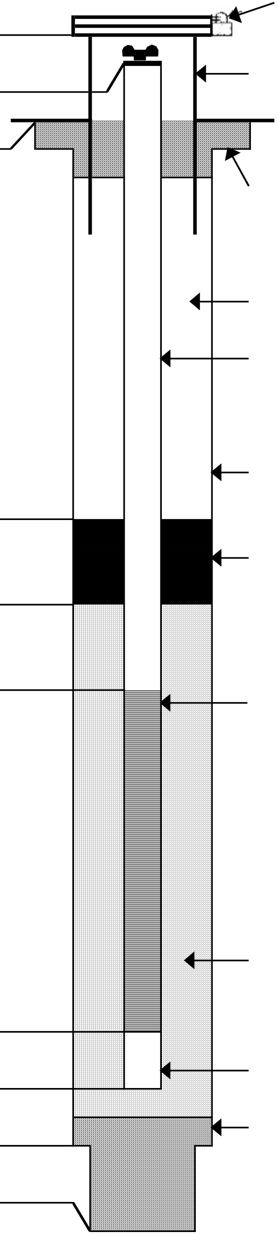
Project Name: Robeson Industries, Inc. NYSDEC Site No. 961008
Project Location: Castile, New York
Project Number: 3616206112 Task Number
Subcontractor: Drilling Method:
Development Method: Development Date:
Bucking Posts/Ballards:
Notes:

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 Inner Diameter:	
Borehole Diameter:	
Type of Seal:	
Screen Type:	
Screen Inner Diameter:	
Screen Slot Size:	
Screen Length:	
Filter/Sand Pack Type:	
Sump:	
Fallback/Backfill:	

NOT TO SCALE

BMP = below measuring point
ft. = feet

MACTEC
511 Congress Street, Portland Maine 04101

SOIL BORING LOG

MACTEC 511 Congress Street, Portland, Maine 04101	Project Name: Robeson Industries, Inc., NYSDEC Site No. 961008		Boring ID:
	Project Location:		Page No.
	Project No.: 3616206112	Client: NYSDEC	of:
Boring Location:	Refusal Depth:	Total Depth:	Bore Hole OD:
Weather:	Soil Drilled:	Drilling Method:	Casing Size:
Subcontractor:	Rock Drilled:	Protection Level:	Sampler:
Driller:	Date Started:	Date Completed:	Sampler ID/OD:
Rig Type/Model:	Logged By:	Checked By:	
Reference Elevation:	Water Level:	Time:	

Drilling Information					Sample Information					
Depth (feet bgs)	Sample Number	Penetration (ft) / Recovery (ft)	Blow Counts	N Value	PID Field Screening (ppm)	PID Head Space Reading (ppm)	Analytical Sample Depth (ft)	Sample Description and Classification	USCS Classification	Remarks

NOTES:

bgs = below ground surface
ID = identification or inner diameter
ft = feet
OD = outder diameter
PID = photoionization detector
ppm = parts per million
USCS = Unified Soil Classification System

SURFACE WATER AND SEDIMENT SAMPLING RECORD

MACTEC
511 Congress Street
Portland, ME 04101

PROJECT NAME Robeson Industries, Inc		**SAMPLE LOCATION**	**DATE**
PROJECT NUMBER 3616206112		**START TIME**	**END TIME**
SAMPLE ID	**SAMPLE TIME**	**SITE NUMBER** 961008	**PAGE** OF

SURFACE WATER DATA

Water depth at sample location: ________ **ft.** **Depth of sample below water surface:** ________ **ft.** **Flow rate:** ________ **mL/min.**

TYPE OF SURFACE WATER
- ☐ Stream
- ☐ River
- ☐ Lake
- ☐ Pond
- ☐ Seep
- ☐ ____________

QUALITY PARAMETERS
- Temperature ________ ^oC
- Specific Cond. ________ mS/cm
- pH ________ pH Units
- ORP ________ mV
- Turbidity ________ NTU
- DO ________ mg/L
  - ☐ DO Probe
  - ☐ Winkler Method

EQUIPMENT USED
- ☐ Beaker
- ☐ Bottle
- ☐ Bomb Sampler
- ☐ Pump ____________
- ☐ Filter No.________ Type:________
- ☐ Water Quality Meter
  - Model No. ____________
  - Unit No. ____________
- ☐ Turbidity Meter
  - Model No. ____________
  - Unit No. ____________

DECON FLUIDS USED
- ☐ All used
- ☐ Liquinox/Deionized H_2O solution
- ☐ Deionized water
- ☐ Potable water
- ☐ Nitric Acid
- ☐ Hexane
- ☐ 25% methanol/75% ASTM Type II H_2O
- ☐ Ethyl alcohol
- ☐ Other: ____________

FIELD SKETCH SHOWN/ATTACHED? Yes / No (circle one)
FIELD DUPLICATE COLLECTED? Yes / No (circle one)
DUP ID: ____________________

SEDIMENT SAMPLE INFORMATION

TYPE OF SAMPLE
- ☐ Discrete
- ☐ Composite

SAMPLE INTERVAL
- Top: ________
- Bottom: ________

TYPE OF MATERIAL
- ☐ Organic
- ☐ Sand
- ☐ Gravel
- ☐ Clay
- ☐ Fill
- ☐ Other: ________

SAMPLE OBSERVATIONS
- Odor: ____________
- Color: ____________
- Other: ____________
- PID (ppm): ________

COLLECTION EQUIPMENT
- ☐ Hand auger/corer
- ☐ Stainless steel split barrel
- ☐ Aluminum Pan
- ☐ Stainless steel shovel
- ☐ Hand spoon/spatula
- ☐ Stainless steel bucket
- ☐ Other: ____________

QC SAMPLES
- ☐ Duplicate ____________
- ☐ Equipment Blank ____________

DECON FLUIDS USED
- ☐ All used
- ☐ Liquinox/Deionized H_2O solution
- ☐ Deionized water
- ☐ Potable water
- ☐ Nitric Acid
- ☐ Hexane
- ☐ 25% methanol/75% ASTM Type II H_2O
- ☐ Ethyl alcohol
- ☐ Other: ____________

MS/MSD COLLECTED? Yes / No (circle one) **FIELD SKETCH SHOWN/ATTACHED?** Yes / No (circle one)

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: ________

DEVIATIONS FROM THE WORK PLAN:

WELL DEVELOPMENT RECORD

MACTEC
511 Congress Street
Portland, Maine 04101

PROJECT NAME	LOCATION ID	
Robeson Industries, Inc.		
PROJECT NUMBER	START TIME	START DATE
3616206112		
WELL INSTALL DATE	END TIME	END DATE

PAGE OF

MEASUREMENT POINT (MP)
- TOP OF RISER (TOR)
- TOP OF CASING (TOC)
- OTHER

WELL DIAMETER	ft.	CASING DIAMETER	in.	PROT. CASING STICKUP (AGS)	ft.	TOC/TOR DIFFERENCE	ft.
INITIAL WELL DEPTH (BMP)	ft.	FINAL WELL DEPTH (BMP)	ft.	SCREEN LENGTH	ft.	PID AMBIENT AIR	ppm
INITIAL DTW (BMP)	ft.	SEDIMENT REMOVED (final well depth - initial well depth)	ft.	SCREENED INTERVAL (BMP)	to		
WATER COLUMN (initial well depth - initial depth to water)	ft.	DTW AFTER DEVELOP. (BMP)	ft.	PUMPING DEPTH (BMP)	ft.	PID WELL MOUTH	ppm
CALCULATED GAL./VOL. (water column x well diameter^2 x 0.041)	gal.	FINAL RECOVERY DEPTH (BMP)	ft.	APPROXIMATE RECHARGE RATE	ft./min.	END OF WELL DEVELOPMENT SAMPLE TAKEN?	YES / NO
TOTAL VOL. PURGED (mL/min. x total minutes x 0.00026 gal/mL)	gal.	FINAL RECOVERY TIME (elapsed)	min.	FLUIDS LOST DURING DRILLING	gal.		

FIELD PARAMETERS

TIME	DTW (ft. BMP)	PURGE RATE (mL/min.)	TEMP. (^oC)	SPECIFIC COND. (mS/cm)	pH (pH units)	DISS. O_2 (mg/L)	REDOX/ ORP (mV)	TURBIDITY (NTU)	VOLUME PURGED (gal.)	TOTAL GAL.	COMMENTS

EQUIPMENT DOCUMENTATION

- Dedicated Submersible Pump
- Surge Block
- Bailer: ______in. diameter
- Grundfos Pump: ______in. diameter
- PID:
- Turbidity Meter:
- Water Level Meter:
- Water Quality Meter:
- Pump:
- Other:

WELL DEVELOPMENT CRITERIA

	Yes	No
Well water clear to unaided eye?		
Sediment thickness remaining in well <1.0% of screen length?		
Total water removed equal to a minimum of 5x the calculated well volume plus 5x the drilling fluids lost?		
Turbidity < 5NTUs?		
10% change in field parameters?		
WAS DEVELOPMENT CRITERIA MET?		

ADDITIONAL OBSERVATIONS

Purge water containerized? Yes / No

Number of Gallons Generated ________

SKETCH

NOTES

Well Developer Signature:

Print Name:

Checked By: Date:

WELL DEVELOPMENT RECORD

SOIL VAPOR INTRUSION SAMPLING RECORD

PROJECT NAME: Robeson Industries, Inc., NYSDEC Site No. 961008 LOCATION ID: ______ DATE: ______

PROJECT NO./TASK NO.: 3616206112.05.**** CLIENT: NYSDEC

PROJECT LOCATION: Castile, New York 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 Basement		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?	

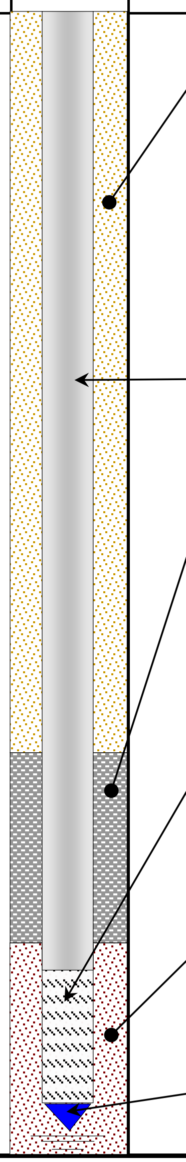
Comments/Location Sketch:

MACTEC
511 Congress Street, Portland, ME 04101

SOIL VAPOR INSTRUSION SAMPLING RECORD

SOIL VAPOR IMPLANT SAMPLING RECORD

MACTEC 511 Congress Street, Portland Maine 04101	Project Name: Robeson Industries, Inc., NYSDEC Site No. 961008		Boring ID:
	Project Location: Castile, New York		Page No.
	Project No.: 3616206112	Client: NYSDEC	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						Overburden Drilling Notes:
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	
											**Soil Vapor Point Construction Notes:**

NOTES:

SOIL VAPOR IMPLANT SAMPLING RECORD

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

Site Name: ______ Site Code: ______ Operable Unit: ______

Building Code: ______ Building Name: ______

Address: ______ Apt/Suite No: ______

City: ______ State: ______ Zip: ______ County: ______

Contact Information

Preparer's Name: ______ Phone No: ______

Preparer's Affiliation: ______ Company Code: ______

Purpose of Investigation: ______ Date of Inspection: ______

Contact Name: ______ Affiliation: ______

Phone No: ______ Alt. Phone No: ______ Email: ______

Number of Occupants (total): ______ Number of Children: ______

☐ Occupant Interviewed? ☐ Owner Occupied? ☐ Owner Interviewed?

Owner Name (if different): ______ Owner Phone: ______

Owner Mailing Address: ______

Building Details

Bldg Type (Res/Com/Ind/Mixed): ______ Bldg Size (S/M/L): ______

If Commercial or Industrial Facility, Select Operations:

If Residential Select Structure Type:

Number of Floors: ______ Approx. Year Construction: ______ ☐ Building Insulated? ☐ Attached Garage?

Describe Overall Building 'Tightness' and Airflows(e.g., results of smoke tests):

Foundation Description

Foundation Type: ______ Foundation Depth (bgs): ______ Unit: FEET

Foundation Floor Material: ______

Foundation Wall Material: ______

Foundation Floor Thickness: ______

Foundation Wall Thickness: ______ Unit: INCHES

☐ Floor penetrations? Describe Floor Penetrations: ______

☐ Wall penetrations? Describe Wall Penetrations: ______

Basement is: ______ Basement is: ______ ☐ Sumps/Drains? Water In Sump?: ______

Describe Foundation Condition (cracks, seepage, etc.) : ______

☐ Radon Mitigation System Installed? ☐ VOC Mitigation System Installed? ☐ Mitigation System On?

Heating/Cooling/Ventilation Systems

Heating System: ______ Heat Fuel Type: ______ ☐ Central A/C Present?

Vented Appliances

Water Heater Fuel Type: ______ Clothes Dryer Fuel Type: ______

Water Htr Vent Location: ______ Dryer Vent Location: ______

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

PRODUCT INVENTORY

Building Name:______________________ Bldg Code:______________ Date:______________

Bldg Address:______________________________________ Apt/Suite No:______________

Bldg City/State/Zip:____

Make and Model of PID:______________________________ Date of Calibration:______________

Location	Product Name/Description	Size (oz)	Condition *	Chemical Ingredients	PID Reading	COC 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.

Product Inventory Complete? ☐ Were there any elevated PID readings taken on site? ☐ ☐ Products with COC?

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

Site Name: ______ Site Code: ______ Operable Unit: ______

Building Code: ______ Building Name: ______

Address: ______ Apt/Suite No: ______

City: ______ State: ______ Zip: ______ County: ______

Factors Affecting Indoor Air Quailty

Frequency Basement/Lowest Level is Occupied?: ______ Floor Material: ______

☐ Inhabited? ☐ HVAC System On? ☐ Bathroom Exhaust Fan? ☐ Kitchen Exhaust Fan?

Alternate Heat Source: ______ ☐ Is there smoking in the building?

☐ Air Fresheners? Description/Location of Air Freshener: ______

☐ Cleaning Products Used Recently?: Description of Cleaning Products: ______

☐ Cosmetic Products Used Recently?: Description of Cosmetic Products: ______

☐ New Carpet or Furniture? Location of New Carpet/Furniture: ______

☐ Recent Dry Cleaning? Location of Recently Dry Cleaned Fabrics: ______

☐ Recent Painting/Staining? Location of New Painting: ______

☐ Solvent or Chemical Odors? Describe Odors (if any): ______

☐ Do Any Occupants Use Solvents At Work? If So, List Solvents Used: ______

☐ Recent Pesticide/Rodenticide? Description of Last Use: ______

Describe Any Household Activities (chemical use,/storage, unvented appliances, hobbies, etc.) That May Affect Indoor Air Quality:

☐ Any Prior Testing For Radon? If So, When?: ______

☐ Any Prior Testing For VOCs? If So, When?: ______

Sampling Conditions

Weather Conditions: ______ Outdoor Temperature: ______ °F

Current Building Use: ______ Barometric Pressure: ______ in(hg)

Product Inventory Complete? ______ ☐ Building Questionnaire Completed?

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

Building Code: ____________________ Address: ____

Sampling Information

Sampler Name(s): ______________________________ Sampler Company Code: ________________

Sample Collection Date: [ ] Date Samples Sent To Lab: ________________

Sample Chain of Custody Number: ______________________ Outdoor Air Sample Location ID: ____________

SUMMA Canister Information

Sample ID:					
Location Code:					
Location Type:					
Canister ID:					
Regulator ID:					
Matrix:					
Sampling Method:					

Sampling Area Info

Slab Thickness (inches):					
Sub-Slab Material:					
Sub-Slab Moisture:					
Seal Type:					
Seal Adequate?:	☐	☐	☐	☐	☐

Sample Times and Vacuum Readings

Sample Start Date/Time:					
Vacuum Gauge Start:					
Sample End Date/Time:					
Vacuum Gauge End:					
Sample Duration (hrs):					
Vacuum Gauge Unit:					

Sample QA/QC Readings

Vapor Port Purge:	☐	☐	☐	☐	☐
Purge PID Reading:					
Purge PID Unit:					
Tracer Test Pass:	☐	☐	☐	☐	☐

Sample start and end times should be entered using the following format: MM/DD/YYYY HH:MM

LOWEST BUILDING LEVEL LAYOUT SKETCH

Please click the box with the blue border below to upload a sketch of the lowest building level .
The sketch should be in a standard image format (.jpg, .png, .tiff)

Clear Image

Design Sketch

Design Sketch Guidelines and Recommended Symbology

- Identify and label the locations of all sub-slab, indoor air, and outdoor air samples on the layout sketch.
- Measure the distance of all sample locations from identifiable features, and include on the layout sketch.
- Identify room use (bedroom, living room, den, kitchen, etc.) on the layout sketc
- Identify the locations of the following features on the layout sketch, using the appropriate symbols:

B or **F**	Boiler or Furnace	o	Other floor or wall penetrations (label appropriately)
HW	Hot Water Heater	**xxxxxxx**	Perimeter Drains (draw inside or outside outer walls as appropriate)
FP	Fireplaces	**######**	Areas of broken-up concrete
WS	Wood Stoves	● SS-1	Location & label of sub-slab samples
W/D	Washer / Dryer	● IA-1	Location & label of indoor air samples
S	Sumps	● OA-1	Location & label of outdoor air samples
@	Floor Drains	● PFET-1	Location and label of any pressure field test holes.

FIRST FLOOR BUILDING LAYOUT SKETCH

Please click the box with the blue border below to upload a sketch of the first floor of the building.
The sketch should be in a standard image format (.jpg, .png, .tiff)

Clear Image

Design Sketch

Design Sketch Guidelines and Recommended Symbology

- Identify and label the locations of all sub-slab, indoor air, and outdoor air samples on the layout sketch.
- Measure the distance of all sample locations from identifiable features, and include on the layout sketch.
- Identify room use (bedroom, living room, den, kitchen, etc.) on the layout sketc
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S	Sumps	● OA-1	Location & label of outdoor air samples
@	Floor Drains	● PFET-1	Location and label of any pressure field test holes.

OUTDOOR PLOT LAYOUT SKETCH

Please click the box with the blue border below to upload a sketch of the outdoor plot of the building as well as the surrounding area. The sketch should be in a standard image format (.jpg, .png, .tiff)

Clear Image

Design Sketch

Design Sketch Guidelines and Recommended Symbology

- Identify and label the locations of all sub-slab, indoor air, and outdoor air samples on the layout sketch.
- Measure the distance of all sample locations from identifiable features, and include on the layout sketch.
- Identify room use (bedroom, living room, den, kitchen, etc.) on the layout sketc
- Identify the locations of the following features on the layout sketch, using the appropriate symbols:

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HW	Hot Water Heater	**xxxxxxx**	Perimeter Drains (draw inside or outside outer walls as appropriate)
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S	Sumps	● OA-1	Location & label of outdoor air samples
@	Floor Drains	● PFET-1	Location and label of any pressure field test holes.

ATTACHMENT 4

NYSDEC CP-43: Groundwater Monitoring Well Decommissioning Policy

CP-43:Groundwater Monitoring Well Decommissioning Policy

New York State Department of Environmental Conservation

DEC POLICY

Issuing Authority: Commissioner Alexander B. Grannis	
Date Issued: November 3, 2009	**Latest Date Revised:**

I. Summary:

Groundwater monitoring wells provide essential access to the subsurface for scientific and engineering investigations (including monitoring wells installed for leak detection purposes). To a degree, every monitoring well is an environmental liability because of the potential to act as a conduit for pollution to reach the groundwater. To limit the environmental risk, a groundwater monitoring well must be properly decommissioned when its effective life has been reached. This document provides procedures to satisfactorily decommission groundwater monitoring wells in New York State. This policy also pertains to other temporary wells such as observation wells, test wells, de-watering wells and other small diameter, non-potable water wells. It does not pertain to water supply wells.

II. Policy:

Environmental monitoring wells should be decommissioned when:

1. they are no longer needed and re-use by another program is not an option; or
2. the well's integrity is suspect or compromised.

The method for decommissioning will be determined based upon well construction and environmental parameters. The method selected must be designed to protect groundwater and implemented according to current best engineering practices while following all applicable federal, state and local regulations. *Groundwater Monitoring Well Decommissioning Procedures* shall be maintained as an addendum to this policy.

This policy is applicable to all New York State Department of Environmental Conservation (DEC) programs that install, utilize and maintain monitoring wells for the study of groundwater, except monitoring wells for landfills regulated under 6 NYCRR Part 360 decommissioned in accordance with those regulations [*see* 6 NYCRR 360-2.11(a)(8)(vi)] and wells installed under the Oil, Gas and Solution Mining Law, Environmental Conservation Law Article 23. There is no specific time frame to dictate when to decommission a well; timing is dependent upon the use and condition of the well and shall be determined on an individual basis. Best professional judgment must be exercised when using the decommissioning procedures. Outside of DEC use, this policy is mandatory when incorporated into the specifications of a state contract, an Order on Consent or a permit. In all other situations, it shall serve as guidance.

III. Purpose and Background:

This document establishes a monitoring well decommissioning policy and provides technical guidance. Synonyms for well decommissioning include "plugging," "capping" and "abandoning. For consistency, only the term "decommissioning" is used within this document.

Unprotected, neglected and improperly abandoned monitoring wells are a serious environmental liability. They can function as a pollution conduit for surface contaminants to reach the subsurface and pollute our groundwater. They also can cause unwanted mixing of groundwater, which degrades the overall water quality within an aquifer. Improperly constructed, poorly maintained or damaged monitoring wells can yield anomalous poor data that can compromise the findings of an environmental investigation or remediation project. Unneeded or compromised monitoring wells should be properly decommissioned in order to prevent harm to our groundwater.

Since 1980, the DEC has installed, directed or overseen the installation of thousands of monitoring wells throughout New York for various state and federal programs, such as Superfund, solid waste, Resource Conservation and Recovery Act (RCRA), spill response, petroleum bulk storage and chemical bulk storage. This guidance addresses the environmental liability associated with this aging network of wells.

Within its boring zone, a successfully decommissioned well prevents the following:

1. Migration of existing or future contaminants into an aquifer or between aquifers;
2. Migration of existing or future contaminants within the vadose zone;
3. Potential for vertical or horizontal migration of fluids in the well or adjacent to the well; and
4. Any change in the aquifer yield and hydrostatic head, unless due to natural conditions.

Monitoring well construction in New York varies considerably with factors such as age of the well, local geology and either the presence or absence of contamination. The predominant type of monitoring well in New York is the shallow, watertable monitoring well constructed of polyvinyl chloride plastic (PVC). The best method for decommissioning should be selected to suit the conditions and circumstances. Each decommissioning situation is to be evaluated separately using this guidance before a method is chosen and implemented.

IV. Responsibility:

The Division of Environmental Remediation (DER) is responsible for updating this policy and the *Groundwater Monitoring Well Decommissioning Procedures* (addendum) in consultation with the Division of Solid and Hazardous Materials (DSHM) and the Division of Water (DOW). Compliance with the guidance does not relieve any party of the obligation to properly decommission a monitoring well. Oversight responsibility will be carried out by the DEC Regional Engineer.

V. Procedure:

Groundwater Monitoring Well Decommissioning Procedures, the addendum to this policy, provides guidance on proper decommissioning of monitoring wells in New York State.

VI. Related References:

- Groundwater Monitoring Well Decommissioning Procedures, October 1986. Prepared by Malcolm Pirnie, Inc. for the New York State Department of Environmental Conservation, Division of Environmental Remediation.
- Standard Guide for the Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities, ASTM D 5299-99. American Society for Testing and Materials (ASTM). Philadelphia. 2005.
- 6 NYCRR Part 360 Solid Waste Management Facilities, New York State Department of Environmental Conservation, Division of Solid and Hazardous Materials.
- Specifications for Abandoning Wells and Boreholes in Unconsolidated Materials, New York State Department of Environmental Conservation, Region 1 - Water Unit, undated.
- Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells, EPA 600/4-89/034, United States Environmental Protection Agency (EPA).

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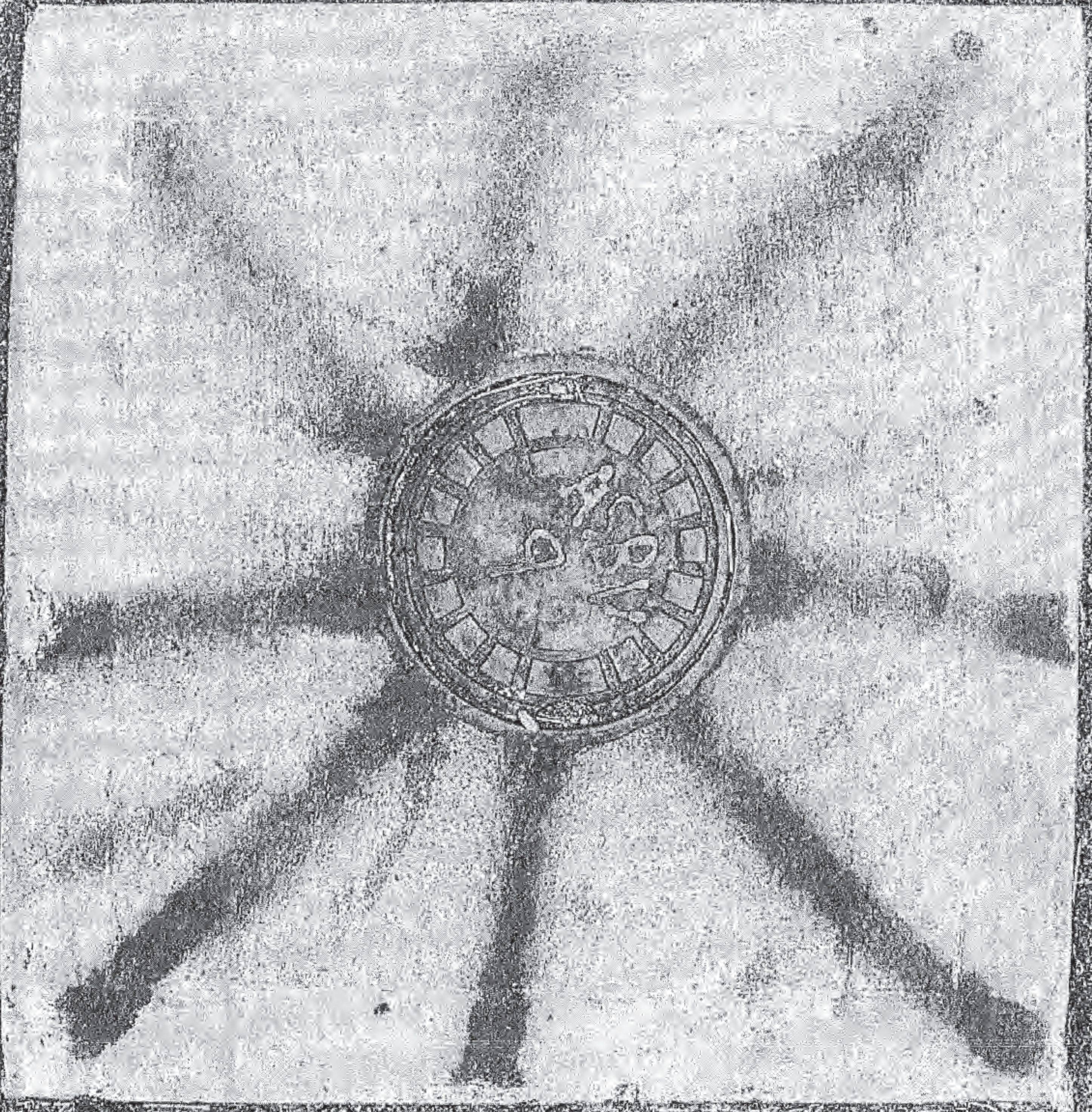
Final - August 2009

GROUNDWATER MONITORING WELL DECOMMISSIONING PROCEDURES



New York State Department of Environmental Conservation
Division of Environmental Remediation

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INTRODUCTION

This document, *Groundwater Monitoring Well Decommissioning Procedures*, is the addendum to CP-43, Groundwater Monitoring Well Decommissioning Policy, which provides acceptable procedures to be used as guidance when decommissioning monitoring wells in New York State. Please note that this document does not address some site-specific special situations that may be encountered in the field. Compliance with the procedures set forth in this document does not relieve any party of the obligation to properly decommission a monitoring well.

Unprotected, neglected and improperly abandoned monitoring wells are a serious environmental liability. They can function as a pollution conduit for surface contaminants to reach the subsurface and pollute our groundwater. They also can cause unwanted mixing of groundwater, which degrades the overall water quality within an aquifer. Improperly constructed, poorly maintained or damaged monitoring wells can yield anomalous poor data that can compromise the findings of an environmental investigation or remediation project. Unneeded or compromised monitoring wells should be properly decommissioned in order to prevent harm to our groundwater.

Previous versions of this guidance have been issued since 1995. Originally developed as a specification for well decommissioning at Love Canal, the procedures were rewritten to make them applicable across the state. From an engineering standpoint, the guidance has changed very little. Most situations do not require a complex procedure.

If you have any questions, please contact Will Welling at (518) 402-9814.

Sincerely,

Gerald J. Rider, Jr., P.E.
Chief, Remedial Section D
Remedial Bureau E
Division of Environmental Remediation

1.0 PREPARATION

If an unneeded monitoring well remains in good usable condition, an alternative to decommissioning might be the reuse by another agency program. DEC encourages reuse in situations where a well will continue to be used and cared for responsibly.

When reuse is not an option, the first step in the well decommissioning process is to review all pertinent well construction information. One must know the well depth and construction details. GPS coordinates and permanent labeling (if available) will be useful in confirming the well to be decommissioned. An inspection must be performed prior to decommissioning in order to verify the construction and condition of each well. Specific details and subsurface conditions form the basis for decisions throughout the decommissioning process.

Well Details

1. Is the well a single stem riser (all one diameter)?
2. Is the well a simple overburden well (no penetration into bedrock)?
3. Does the well riser consist of telescoping diameters of pipe which decrease with depth?
4. Is the well seal compromised (leaking, inadequate or damaged)?
5. If the well is PVC, is it 25 feet or shallower and not grouted into rock?
6. Can the riser be pulled and is removal of the well desired?
7. Is the well a bedrock well?
8. If the monitoring well is a bedrock well, does it have an open hole?
9. Is there a well assembly (riser and screen) installed within the bedrock hole?

Subsurface Conditions

10. Is the soil contaminated?
11. Does the well penetrate a confining layer?
12. If the well penetrates a confining layer, might overdrilling or casing pulling cause contamination to travel up or down through a break in the confining layer?
13. Does the screened interval cross multiple water-bearing zones?

For additional collection and verification of information, the "Monitoring Well Field Inspection Log" (Figure 1) can be used during a field inspection. After the well has been located and the information gathered, one is ready to select the decommissioning procedure in accordance with Section 2.

Special conditions, such as access problems, well extensions through capped and covered non-Part 360 landfills and seasonal weather patterns affecting construction, should be assessed in the planning stage. Decommissioning work requiring the use of heavy vehicular equipment on landfill caps should be scheduled during dry weather (if possible) so as to minimize damage to the cover. If work must be performed during the spring, winter or inclement weather, special measures to reduce ruts should be employed to maintain the integrity of a completed landfill cover system. As an example, placement of plywood under vehicular equipment can eliminate deep ruts that would require repair.

2.0 DECOMMISSIONING METHODS

The primary rationale for well decommissioning is to remove any potential groundwater pathway. A secondary rationale, often important to the property owner or owner of the well, is to physically remove the well. Removed well materials may be recycled and will not interfere with future construction excavation. The previous versions of these decommissioning procedures have stressed that physical removal of the well by pulling is preferable to leaving casing in the ground. Due to the added effort, expense and risk involved with pulling, the decision of whether to pull or not should be a separate consideration aside from selecting the sealing procedure.

One should select a decommissioning procedure that takes into account the geologic and hydrogeologic conditions at the well site; the presence or absence of contamination in the groundwater; and original well construction details. The selection process for well decommissioning procedures is provided by the flow chart, Figure 2. Answers to the questions in the preceding section are the input for this flow chart. The four primary well decommissioning methods are:

1. Grouting in-place;
2. Perforating the casing followed by grouting in-place;
3. Grouting in-place followed by casing pulling;
4. Over-drilling and grouting with or without a temporary casing.

In a complex situation, one or more decommissioning procedures may be used for different intervals of the same well.

The remainder of Section 2 discusses the well decommissioning methods and the selection process. Refer to Figure 2 for a flow chart diagram of the complete procedure selection process. The DEC Project Manager has the discretion to deviate from the flow chart, (Figure 2), based on site conditions and professional judgment.

2.1 Grouting In-Place

Grouting in-place is the simplest and most frequently used well decommissioning method and grouting itself is the essential component of all the decommissioning methods. The grout seals the borehole and any portion of the monitoring well that may be left in the ground. Because dirt and foreign objects can fall into an open well, whenever possible a well should be sealed first with grout before attempting subsequent decommissioning steps.

For the purpose of these decommissioning procedures, the well seal is defined as the bentonite seal above the sand pack. Aside from obvious channeling by in-flowing surface water around the well, an indication of the well seal integrity may be obtained through review of the boring logs and/or a comparison of groundwater elevations if the well is part of a cluster. Any problems noted on the boring logs pertaining to the well seal, such as bridging of bentonite pellets or running sands, or disparities between field notes (if available) and the well log would indicate the potential for a poor (compromised) well seal.

If the well seal is not compromised and there is no confining layer present, a single-stem, 2-inch PVC, monitoring well can be satisfactorily decommissioned by grouting it in-place. If the seal is compromised, casing perforation may be called for as discussed in Section 2.2.

As discussed in Section 2.4 and its sub-sections, this method is specified for the bedrock portion of a well, and is used for decommissioning small diameter cased wells. Grouting in-place involves filling the casing with grout to a level of five feet below the land surface, cutting the well casing at the five-foot depth, and removing the top portion of the casing and associated well materials from the ground. The casing must be grouted according to the procedures in Section 6. In addition, the upper five feet of the borehole is filled to land surface and restored according to the procedures described in Section 7.

For open-hole bedrock wells, the procedure involves filling the opening with grout to the top of rock according to the procedures in Section 5. A thicker grout may be required to fill any bedrock voids. If excessive grout is being lost down-hole, consider grouting in stages to reduce the pressure caused by the height of the grout column.

The standard mix with the maximum amount of allowable water will be required to penetrate the well screen and sand pack when a well assembly has been installed within a bedrock hole. For an assembly such as this, the grout should be mixed thinly enough to penetrate the slots and sand pack. The grout mixes are discussed in Sections 6.1 and 6.2.

2.2 Casing Perforating/Grouting In-Place

Casing perforation followed by grouting in-place is the preferred method to use if there is poor documentation of the grouting of the well annulus, or the annulus was allowed to be back-filled with cuttings. The grout will squeeze through the perforations to seal any porous zones along the outside of the casing. The procedure involves puncturing, cutting or splitting the well casing and screen followed by grouting the well. A variety of commercial equipment is available for perforating casings and screens in wells with four-inch or larger inside diameters. Due to the diversity of applications, experienced contractors must recommend a specific technique based on site-specific conditions. A minimum of four rows of perforations several inches long around the circumference of the pipe and a minimum of five perforations per linear foot of casing or screen is recommended (American Society for Testing and Materials, Standard D 5299-99, 1999). After the perforating is complete, the borehole must be grouted according to the procedures in Section 6 and the upper five feet of borehole restored according to the procedures in Section 7.

2.3 Casing Pulling

Casing pulling should be used in cases where the materials of the well assembly are to be recycled, or the well assembly must be removed to clear the site for future excavation or re-development. Casing pulling is an acceptable method to use when no contamination is present; contamination is present but the well does not penetrate a confining layer; and when both contamination and a confining layer are present but the contamination cannot cross the confining layer. Additionally, the well construction materials and well depth must be such that pulling will not break the riser. When contamination is likely to cross the confining layer during pulling, a temporary casing can be used. See Section 2.4.

Casing pulling involves removing the well casing by lifting. Grout is to be added during pulling; the grout will fill the space once occupied by the material being withdrawn. An acceptable procedure to remove casing involves puncturing the bottom of the well or using a casing cutter to cut away the screen, grouting, using jacks to free casing from the hole, and lifting the casing out by using a drill rig, backhoe, crane, or other suitable equipment. Additional grout must be added to the casing as it is withdrawn. Grout mixing and placement procedures are provided in Section 6. In wells or well points in which the bottom cannot be punctured, the casing or screened interval will be perforated or cut away prior to being filled with grout. This procedure should be followed for wells installed in collapsible formations or for highly contaminated wells.

At sites in which well casings have been grouted into the top of bedrock, the casing pulling procedure should not be attempted unless the casing can be first cut or freed from the rock.

2.4 Over-Drilling

Over-drilling is the technique used to physically remove an entire monitoring well, its sand pack and the old grout column and fill. In situations where PVC screens and risers are expected to sever and removal of all well materials is required, over-drilling will be required. Over-drilling is called for when a riser can't be pulled and it penetrates a confining layer. Compared to the other procedures, over-drilling is the least common method of well decommissioning.

A "temporary casing" may be necessary when extraordinary conditions are present, such as a high concentration of mobile contaminants in the overburden, depth to water is shallow, there is poor construction documentation or shoddy construction practices. The approach involves installing a large diameter steel casing around the outside of the well followed by drilling / pulling /grouting within this casing. The casing is withdrawn at the end of pulling, grouting and (perhaps) drilling. If the confining layer is less than 5 feet thick, the casing should be installed to the top of the confining layer. Otherwise, it is installed to a depth of 2 feet below the top of the confining layer. After the outer casing has been set, the well can be removed and grouted through pulling if possible or removed and grouted by drilling inside the casing.

Over-drilling is used where casing pulling is determined to be unfeasible, or where installation of a temporary casing is necessary to prevent cross-contamination, such as when a confining layer is present and contamination in the deeper aquifer could migrate to the upper aquifer as the well is pulled. The over-drilling method should:

- Follow the original well bore;
- Create a borehole of the same or greater diameter than the original boring; and
- Remove all of the well construction materials.

In over-drilling the difficulty lies in keeping the augers centered on the old well as the bit is lowered; it will tend to wander off. As a precaution, the well column should be filled with grout before over-drilling. Then without allowing the grout to dry, the driller proceeds with over-drilling the well. Grouting first guarantees that if the drill wanders off the old well and the effort is less than 100% successful, the remaining well portion will at least have been grouted. There are many methods for over-drilling. Please note that the following methods are not suitable for all types of casing, and the advice of an experienced driller should be sought.

- Conventional augering (i.e., a hollow stem auger fitted with a pilot bit). The pilot bit will grind the well construction materials, which will be brought to the well surface by the auger.
- A conventional cable tool rig to advance "temporary" casing having a larger diameter than the original boring. The cable tool kit is advanced within the casing to grind the well construction materials and soils, which are periodically removed with large diameter bailer. This method is not applicable to bedrock wells.

- An over-reaming tool with a pilot bit nearly the same size as the inside diameter of the casing and a reaming bit slightly larger than the original borehole diameter. This method can be used for wells with steel casings.

- A hollow-stem auger with outward facing carbide cutting teeth having a diameter two to four inches larger than the casing.

Prior to over-drilling, the bottom of the well should be perforated or cut away, and the casing filled with grout as with casing removal by pulling.

In all cases above, over-drilling should advance beyond the original bore depth by a distance of half a foot to ensure complete removal of the construction materials. Oversight attention should be focused on the drill cuttings, looking for fragments of well materials. Absence of these indicators is a sign that the drill has wandered off the well. If wandering is suspected, having previously filled the well with grout, the remaining portion which cannot be over-drilled can be considered grouted in-place. When the over-drilling is complete, grout should be tremied within the annular space between the augers and well casings. The grout level in the borehole should be maintained as the drilling equipment and well materials are sequentially removed. As with all the other methods, the upper five feet of borehole should be restored according to the procedures in Section 7.

3.0 SELECTION PROCESS AND IMPLEMENTATION

The decommissioning procedure selection flow chart, Figure 2, is to be used to select decommissioning methods. The selection process first identifies the basic monitoring well type. There are only two types of monitoring wells described in this guidance, overburden wells and bedrock wells. Bedrock wells typically have an overburden portion which in the selection process is to be treated as an overburden well. Techniques are specified for wells based upon their type and the other physical conditions present. Decommissioning techniques called for by the selection process have their practical limits; construction details dictate when a well stem can be pulled without breaking and when it cannot be pulled. The DEC project manager has the discretion to deviate from the flow chart, (Figure 2), based on site conditions, budgetary concerns and professional judgment. The remainder of this section will discuss types of monitoring wells in various settings along with recommended decommissioning techniques.

3.1 Bedrock Wells

Referring to Figure 2 and Section 2.1, if the well extends into bedrock, the rock hole portion of the well is to be grouted in-place to the top of the rock. The grout mix, however, may vary according to the conditions. A thicker grout may be required to fill voids and a thinner grout may be necessary to penetrate well screen and sand pack. Refer to the grout mixture specifications given in Section 6.1 and 6.2.

Prior to grouting, the depth of the well will be measured to determine if any silt or debris has plugged the well. If plugging has occurred, all reasonable attempts to clear it should be made before grouting. The borehole will then be tremie grouted according to Section 6.4 from the bottom of the well to the top of bedrock to ensure a continuous grout column.

After the rock hole is grouted, the overburden portion of the well is decommissioned using appropriate techniques described below. If the bedrock extends to the ground surface, grouting can extend to the ground surface or to slightly below so that the site can be restored as appropriate in accordance with Section 7.

3.2 Uncontaminated Overburden Wells

For overburden wells and the overburden portion of bedrock wells, the first factor in determining the decommissioning method is whether the overburden portion of the well exhibits contamination, as determined through historical groundwater and/or soil sampling results. If the overburden is uncontaminated, the next criteria considers whether the well penetrates a confining layer. In the case that the overburden portion of the well does not penetrate a confining layer, the casing can either be tremie-grouted and pulled or tremie grouted and left in place. As a general rule, PVC wells greater than 25-feet deep should not be pulled unless site-specific conditions or other factors indicate that the well can be pulled without breaking. If the well cannot be pulled, the well should be grouted in-place as accordance with Sections 2.1 and 2.2.

If a non-telescoped overburden well penetrates a confining layer, the casing should be removed by pulling (if possible) in accordance with Section 2.3. If the casing cannot be removed by pulling, the well should be grouted in-place or where complete removal is required, removed by over-drilling. Over-drilling will be based upon the site-specific conditions and requirements. If pulling is attempted and fails (i.e., a portion of the riser breaks) the remaining portion of the well should be removed by using the conventional augering procedure identified in Section 2.4. Note that if the riser is broken during pulling, it is highly unlikely that the driller will be able to target it to over-drill it. This is the reason why all wells should be grouted first. In all cases, after the well construction materials have been removed to the extent possible, the borehole will be grouted in accordance with Section 6 and the upper five feet will be restored in accordance with Section 7.

3.3 Contaminated Overburden Monitoring Wells/Piezometers

Contamination in the overburden plays a role in the selection process. Any contamination present in the overburden must not be allowed to spread as a result of the decommissioning construction. For wells and piezometers suspected or known to be contaminated with light non-aqueous phase liquid (LNAPL) and/or dense non-aqueous phase liquid (DNAPL), often referred to as "product," the decision to decommission the well should be reviewed. Such gross contamination is a special condition and requires design of the decommissioning procedure. If decommissioning is determined to be the proper course of action, measurement of the non-aqueous phase liquid volume will be determined and this liquid will be removed.

If an overburden well (or the overburden portion of a bedrock well) is contaminated with LNAPL, DNAPL and /or dissolved fractions as indicated by historical sampling results, one must evaluate the potential for contamination to cross an overburden confining layer (if one exists) during decommissioning. A rock or soil horizon of very low permeability is known as a confining layer. Contamination in the overburden lying above a confining layer is a significant condition to recognize. To prevent mobile contaminants from crossing a confining layer during pulling or over-drilling, a temporary casing should be installed to isolate the work zone. One should follow the procedure selection flow chart. Some contaminated conditions call for over-drilling or a specially designed procedure.

A well in contaminated overburden may be grouted in-place as long as the grout fully seals the well and boring zone. If a well in contaminated overburden was constructed allowing formation collapse as annular backfill or if the well has a compromised well seal, one must either physically remove the well or thoroughly perforate the riser and grout it in-place.

If physical removal of the well is required and the overburden contaminants are likely to be dragged upward or downward during decommissioning, a temporary casing should be used to seal off the construction work zone. Casing pulling and overdrilling can be safely accomplished within the temporary casing. Section 2.4 discusses the temporary casing technique.

3.4 Telescoped Riser

If the riser is telescoped in one or more outer casings, the decommissioning approach depends upon the integrity of the well seal. If there is no evidence that the well seal integrity is compromised, the riser should be grouted in-place in accordance with Sections 2.1 or 2.2 and the upper 5 feet of the well surface should be restored in accordance with Section 7. If indications are that the well seal is not competent, it will be necessary to design and implement a special procedure to perforate and grout or remove the well construction materials. The presence and configuration of the outer casing(s) will be specific in the individual wells and will be a key factor in the decommissioning approach. The special procedure must mitigate the potential for cross-contamination during removal of the well construction materials.

4.0 LOCATING AND SETTING-UP ON THE WELL

Prior to mobilizing to decommission a monitoring well, one should notify the property owner and/or other interested parties including the governing regulatory agency. It is advisable that when at the well location, one should review the proposed well decommissioning procedure. Verify well locations and identification by their identifying markers and GPS coordinates. Lastly, verify the depth of each well with respect to depth recorded on the well construction log.

5.0 REMOVING THE PROTECTIVE CASING

Most monitoring wells installed in non-traffic locations are finished with an elevated, protective casing (guard pipe) and a concrete rain pad. Wells at gasoline stations, usually being in high-traffic areas, are typically finished with a flush-mount, curb box and protective 8" dia steel inspection plate rather than a stick-up riser. The curb box is usually easily removed from around the flush-mount well before pulling or over-drilling. In the case of stick-up wells, the riser pipe may be bonded to the guard pipe and rain pad. When the protective casing and concrete pad of a stick-up monitoring well are "yanked out," a PVC riser will typically break off at the bottom of the guard pipe several feet below grade. Once this happens, it may become impossible to center a drill rig upon the well. The riser may become splintered and structurally unstable for pulling. Unless grouted first, the well may fill with dirt. Before pulling a casing or over-drilling a well, a method must be devised for removing these protective surface pieces without jeopardizing the remaining decommissioning effort.

Generally, unless the protective casing is loose and can be safely lifted off by hand, *one* *should fill the monitoring well with grout before removing the outer protective casing.* This will ensure that the well is properly sealed regardless of any problems later when removing the protective casing. Remove the protective casing or road box vault initially only if the stick-up or vault will interfere with subsequent down-hole work which must be done before grouting. This down-hole work may include puncturing, perforating or cutting the screen or riser. But as a general procedure don't remove the protective casing or road box until after initial grouting is complete.

The procedure for removing the protective casing of a well depends upon the decommissioning method specified for the monitoring well. The variety of protective casings available preclude developing a specific removal procedure but often one can simply break up the concrete seal surrounding the casing and jack or hoist the protective casing out of the ground. A check should be made during pulling to ensure that the inner well casing is not being hoisted with the protective casing. If this occurs, the well casing should be cut off after the base of the protective casing is lifted above the land surface. At well locations where the riser has been extended, the burial of a previous concrete pad may require the excavation of soil to the top of the concrete pad to remove the well.

Steel well casing should be removed approximately five feet below the land surface so as to be below the frost line and out of the way of any subsequent shallow digging. The upper five feet of casing and the protective casing can be removed in one operation if a casing cutter is used.

Waste handling and disposal must be consistent with the methods used for the other well materials unless an alternate disposal method can be employed (i.e., steam cleaning followed by disposal as non-hazardous waste).

6.0 SELECTING, MIXING, AND PLACING GROUT

This section gives recipes for the "standard grout mixture" and the thicker "special grout mixture." Mixing and placing grout is also discussed in this section. The goal of well decommissioning is to eliminate the capability of water to travel up or down within the volume of the former well and its boring. Success depends upon the correct grout mixture and placement where it is needed. There are two types of grout mixes that may be used to seal monitoring wells: a standard mix and a special mix. Both mixes use Type 1 Portland cement and four percent bentonite by weight. However, the special mix uses a smaller volume of water and is used in situations where excessive loss of the standard grout mix is possible (e.g., highly-fractured bedrock or coarse gravels).

6.1 Standard Grout Mixture

For most boreholes, the following standard mixture will be used:

- One 94-pound bag Type I Portland cement;
- 3.9 pounds powdered bentonite; and
- 7.8 gallons potable water.

Slightly more water may be used in order to penetrate a sand pack when a well screen transects multiple flow zones. This mixture results in a grout with a bentonite content of four percent by weight and will be used in all cases except in boreholes where excessive use of grout is anticipated. In these cases a special thicker mixture will be used.

6.2 Special Mixture

In cases where excessive use of grout is anticipated, such as high permeability formations and highly fractured or cavernous bedrock formations, the following special mixture will be used:

- one 94-pound bag type I Portland cement;
- 3.9 pounds powdered bentonite;
- 1 pound calcium chloride; and
- 6.0-7.8 gallons potable water (depending on desired thickness).

The special mixture results in a grout with a bentonite content of four percent by dry weight. It is thicker than the standard mixture because it contains less water. This grout is expected to set faster than the Standard Grout Mixture due to the added calcium chloride. The least amount of water that can be added for the mixture to be readily pumpable is 6 gallons per 94-pound bag of cement.

6.3 Grout Mixing Procedure

To begin the grout-mixing procedure, calculate the volume of grout required to fill the borehole. If possible, the mixing basin should be large enough to hold all of the grout necessary for the borehole.

Mix grout until a smooth, homogeneous mixture is achieved. Grout can be mixed manually or with a mechanized mixer. Colloidal mixers should not be used as they tend to excessively decrease the thickness of the grout for the above recipes.

6.4 Grout Placement

This guidance requires that grout be placed in the well from the bottom to the top by means of a "tremie." A tremie is a pipe, a hose or a tube extending from the grout supply to the bottom of the well. The tremie delivers the grout all the way down through the water column without its being diluted and mixed with the water that may be present in the well. The tremie pipe or tube is withdrawn as (or after) the well is filled with grout.

Using the tremie, grout is placed in the borehole filling from the bottom to the top. Two-inch and larger wells should use tremie tubing of not less than 1-inch diameter. Smaller diameter wells will call for a smaller tremie pipe. Grout will then be pumped in until the grout appears at the land surface (when grouting open holes in bedrock, the grout level only needs to reach above the bedrock surface). Any groundwater displaced during grout placement, if known to be contaminated, will be contained for proper disposal.

At this time the rate of settling should be observed. If grouting the well in place, the well casing remains in the hole. But if the decommissioning method has involved down-hole tools such as hollow-stem augers or temporary casing for overdrilling, these will be removed from the hole. As each section is removed, grout will be added to keep the level between 0 and 5 feet below grade. If the grout level drops below the land surface to an excessive degree, an alternate grouting method must be used. One possibility is to grout in stages; i.e., the first batch of grout is allowed to partially cure before a second batch of grout is added.

As previously described in Section 5.0, the outer protective casing "stick-up" should be removed only after a well has been properly filled with grout. This will ensure that the well is properly sealed regardless of any breakage which may occur when removing the stick-up. It is important to reiterate that when either casing pulling or over-drilling are required, due to the uncertainty of successfully pulling a well or over-boring a well, we insist that the driller tremie grout the well first. Then without allowing the grout to dry, the driller proceeds with pulling the casing or over-drilling the well.

Upon completion of grouting, ensure that the final grout level is approximately five feet below land surface. A ferrous metal marker will be embedded in the top of the grout to indicate the location of the former monitoring well. Lastly, a fabric "utility" marking should be placed one foot above the grout so an excavator can see it clearly.

7.0 BACKFILLING AND SITE RESTORATION

The uppermost five feet of the borehole at the land surface should be filled with material physically similar to the natural soils. The surface of the borehole should be restored to the condition of the area surrounding the borehole. For example, concrete or asphalt will be patched with concrete or asphalt of the same type and thickness, grassed areas will be seeded, and topsoil will be used in other areas. All solid waste materials generated during the decommissioning process must be disposed of properly.

8.0 DOCUMENTATION

A form which may be used in the field to record the decommissioning construction is included as Figure 3. Additional documentation may be required by a DEC project manager and samples are included in Appendix A. Programs within the DEC that maintain geographic data on monitoring wells strive to keep that data up to date. Owners of these data sets must be notified when a well is decommissioned. Historical groundwater quality data is linked to monitoring well locations so when a well is decommissioned, existing GIS data must be updated to reflect that fact but the coordinate location in the GIS database should not be eliminated. A metal detector may not be able to detect a deeply buried marker so if this locator is important for future utility runs or foundations, a map should be submitted to the property owner and the town engineer showing the decommissioned well locations. Global Positioning System (GPS) coordinates should be indicated on this map. Lastly, whatever documentation is produced should be provided to the property owner, the DEC, and all other parties involved.

9.0 FIELD OVERSIGHT

Over-drilling requires careful observation to detect whether the drill has wandered off the well. Grout preparation and tremie work should be carefully observed. The successful implementation of a decommissioning work plan depends upon proper direction, observation and oversight. Methods to be employed must be clearly worked through and all parties must understand what they have to do before going into the field. Flexibility is allowed where necessary but the work effort must be thorough and effective to protect our groundwater.

10.0 RELATED REFERENCES

- *Groundwater Monitoring Well Decommissioning Procedures*, October 1986. Prepared by Malcolm Pirnie, Inc., for the New York State Department of Environmental Conservation, Division of Environmental Remediation.

- American Society for Testing and Materials, A.S.T.M. D 5299-99, Standard Guide for the Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities. A.S.T.M.. Philadelphia. 2005.

- New York State Department of Environmental Conservation, Division of Solid and Hazardous Materials, 6 NYCRR Part 360, Solid Waste Management Facilities.

- New York State Department of Environmental Conservation, Region I - Water Unit, Specifications for Abandoning Wells and Boreholes in Unconsolidated Materials, undated.

- United States Environmental Protection Agency, The Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells, EPA 600/4-89/034.

FIGURES

APPENDICES

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FIGURE 1

MONITORING WELL FIELD INSPECTION LOG

FIGURE 1

SITE NAME:

SITE ID.: ________
INSPECTOR: ________
DATE/TIME: ________
WEll ID.: ________

MONITORING WELL FIELD INSPECTION LOG
NYSDEC WELL DECOMMISSIONING PROGRAM

	YES	NO
WELL VISIBLE? (If not, provide directions below)		
WELL I.D. VISIBLE?		
WELL LOCATION MATCH SITE MAP? (if not, sketch actual location on back)		

WELL I.D. AS IT APPEARS ON PROTECTIVE CASING OR WELL: ....

	YES	NO
SURFACE SEAL PRESENT?		
SURFACE SEAL COMPETENT? (If cracked, heaved etc., describe below)		
PROTECTIVE CASING IN GOOD CONDITION? (If damaged, describe below)		

HEADSPACE READING (ppm) AND INSTRUMENT USED........................ ________
TYPE OF PROTECTIVE CASING AND HEIGHT OF STICKUP IN FEET (If applicable) ________
PROTECTIVE CASING MATERIAL TYPE: .... ________
MEASURE PROTECTIVE CASING INSIDE DIAMETER (Inches): .... ________

	YES	NO
LOCK PRESENT?		
LOCK FUNCTIONAL?		
DID YOU REPLACE THE LOCK?		
IS THERE EVIDENCE THAT THE WELL IS DOUBLE CASED? (If yes,describe below)		
WELL MEASURING POINT VISIBLE?		

MEASURE WELL DEPTH FROM MEASURING POINT (Feet): .... ________
MEASURE DEPTH TO WATER FROM MEASURING POINT (Feet): .... ________
MEASURE WELL DIAMETER (Inches): .... ________
WELL CASING MATERIAL: .... ________
PHYSICAL CONDITION OF VISIBLE WELL CASING: .... ________
ATTACH ID MARKER (if well ID is confirmed) and IDENTIFY MARKER TYPE .... ________
PROXIMITY TO UNDERGROUND OR OVERHEAD UTILITIES........................ ________

DESCRIBE ACCESS TO WELL: (Include accessibility to truck mounted rig, natural obstructions, overhead power lines, proximity to permanent structures, etc.); ADD SKETCH OF LOCATION ON BACK, IF NECESSARY.

DESCRIBE WELL SETTING (For example, located in a field, in a playground, on pavement, in a garden, etc.) AND ASSESS THE TYPE OF RESTORATION REQUIRED.

IDENTIFY ANY NEARBY POTENTIAL SOURCES OF CONTAMINATION, IF PRESENT (e.g. Gas station, salt pile, etc.):

REMARKS:

FIGURE 2

DECOMMISSIONING PROCEDURE SELECTION

NYSDEC Monitoring Well Decommissioning Procedure Selection

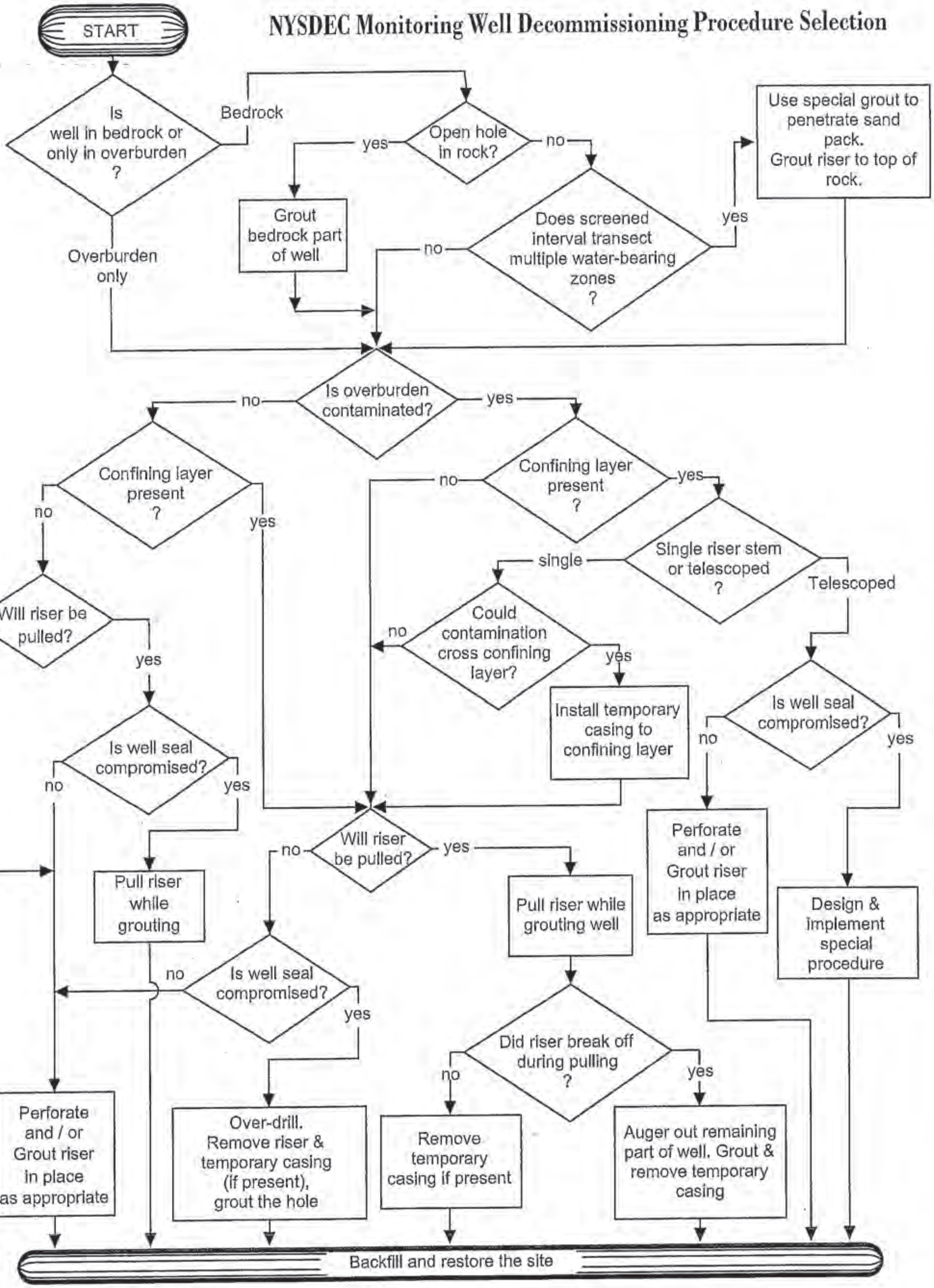

FIGURE 2

FIGURE 3

WELL DECOMMISSIONING RECORD

FIGURE 3

WELL DECOMMISSIONING RECORD

Site Name:	Well I.D.:
Site Location:	Driller:
Drilling Co.:	Inspector:
	Date:

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING

Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	

CASING PULLING

Method employed	
Casing retrieved (feet)	
Casing type/dia. (in)	

CASING PERFORATING

Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	

GROUTING

Interval grouted (FBLS)	
# of batches prepared	

For each batch record:

Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*

Depth
(feet)

COMMENTS:

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

APPENDIX A - REPORTS

APPENDIX A1 - INSPECTOR'S DAILY REPORT

APPENDIX A2 - PROBLEM IDENTIFICATION REPORT

APPENDIX A3 - CORRECTIVE MEASURES REPORT

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Appendix A1

Inspector's Daily Report

CONTRACTOR:
ADDRESS:

TELEPHONE:
LOCATION ______ FROM ______ TO ______
WEATHER ______ TEMP ______ A.M. ______ P.M. ______ DATE ______

CONTRACTOR'S WORK FORCE AND EQUIPMENT

DESCRIPTION	*H*	*#*	*DESCRIPTION*	*H*	*#*	*DESCRIPTION*	*H*	*#*	*DESCRIPTION*	*H*	*#*
Field Engineer						Equipment			Front Loader Ton		
Superintendent			Ironworker			Generators			Bulldozer		
						Welding Equip.					
Laborer Foreman			Carpenter								
Laborer									Backhoe		
Operating Engineer			Concrete Finisher								
Carpenter						Paving Equip. & Roller					
						Air compressor					

SEE REVERSE SIDE FOR SKETCH YES ☐ NO ☐ ______
WORK PERFORMED: ______

PAY ITEMS

CONTRACT		STA		DESCRIPTION	QUANTITY	REMARKS
Number	ITEM	FROM	TO			

TEST PERFORMED: ______
PICTURES TAKEN: ______
VISITORS: ______

QA PERSONNEL
SIGNATURE ______
REPORT NUMBER ______
SHEET ______ Of ______

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PROBLEM IDENTIFICATION REPORT

Date ____________

Project ____________ Job Number ________

Contractor ____________

Subject ____________

Day	Su	M	T	W	Th	F	Sa

Sky/Precip.	Clear	Partly Cloudy	Cloudy	Rainy	Snow
TEMP.	<32F	32-40F	40-70F	70-80F	80-90F
WIND	No	Light	Strong		
HUMIDITY	Dry	Mod.	Humid		

PROBLEM DESCRIPTION Reference Daily Report Number 1: ____________

PROBLEM LOCATION - REFERENCE TEST RESULTS AND LOCATION (Note: Use sketches on back of form as appropriate):

PROBABLE CAUSES: ____________

SUGGESTED CORRECTIVE MEASURES: ____________

APPROVALS:

QA ENGINEER: ____________

PROJECT MANAGER: ____________

Distribution:
1. Project Manager
2. Field Office
3. File
4. Owner

QA Personnel
Signature: ____________

MEETINGS HELD AND RESULTS

REMARKS

REFERENCES TO OTHER FORMS

SKETCHES

SAMPLE LOG

SAMPLE NUMBER

APPROXIMATE LOCATION OF STOCKPILE

NUMBER OF STOCKPILE

DATE OF COLLECTION

CLIMATIC CONDITIONS

FIELD OBSERVATION

SHEETS OF

Appendix A3

CORRECTIVE MEASURES REPORT

Date __________

Project __________ Job Number__________

Contractor __________

Subject __________

Day	Su	M	T	W	Th	F	Sa

Sky/Precip.	Clear	Partly Cloudy	Cloudy	Rainy	Snow
TEMP.	<32F	32-40F	40-70F	70-80F	80-90F
WIND	No	Light	Strong		
HUMIDITY	Dry	Mod.	Humid		

CORRECTIVE MEASURES TAKEN (Reference Problem Identification Report No.): __________

RETESTING LOCATION: __________

SUGGESTED METHOD OF MINIMIZING RE-OCCURRENCE: __________

SUGGESTED CORRECTIVE MEASURES: __________

APPROVALS:

QA ENGINEER: __________

PROJECT MANAGER: __________

Distribution:
1. Project Manager
2. Field Office
3. File
4. Owner

QA Personnel
Signature: __________

ATTACHMENT 5

NYSDEC Treatment Systems Decommissioning Email

From:	Long, Payson D (DEC)
To:	Amann, Katie
Cc:	Salotto, Samantha R (DEC); Ardon, Ehud
Subject:	RE: Robeson Treatment Equipment
Date:	Thursday, February 9, 2023 8:39:07 AM
Attachments:	image001.png image002.png image003.png image004.png

---

CAUTION: External email. Please do not click on links/attachments unless you know the content is genuine and safe.

Katie,

Due to the poor condition of the equipment, I would scrap the whole system.
Unless there is a component or 2 that you would recommend keeping.

I will be heading out that way in a month or 2. Maybe I can stop in and take a quick look.

Please let me know if you have any questions.
Thank you,

Payson Long, P.E.
Pronouns: he/him/his
Project Manager, Remedial Section D, Remedial Bureau E
Division of Environmental Remediation

New York State Department of Environmental Conservation
625 Broadway, Albany, NY 12233-7017
P: (518) 402-9651 | F: (518) 402-9819
payson.long@dec.ny.gov

www.dec.ny.gov | |

From: Amann, Katie <katie.amann@woodplc.com>
Sent: Wednesday, February 1, 2023 4:39 PM
To: Long, Payson D (DEC) <payson.long@dec.ny.gov>
Cc: Salotto, Samantha R (DEC) <Samantha.Salotto@dec.ny.gov>; Ardon, Ehud <ehud.ardon@woodplc.com>
Subject: FW: Robeson Treatment Equipment

ATTENTION: This email came from an external source. Do not open attachments or click on links from unknown senders or unexpected emails.

Payson,

Attached is a photo log of system components. It contains photos of some equipment nameplates, but not all. Are you looking for nameplate information before decommissioning activities occur?

Some of the equipment was damaged or not functioning as observed by MACTEC personnel in November 2020 and might not be salvageable. See table below for details.

System Components and Observations from November 12, 2020	
GWETS	
Item	**Observations**
Air stripper unit 1 (ShallowTray® low profile air stripper)	- Overall poor condition; missing rivets and clips between trays, heavy scaling, visible epoxy repairs on tower - Blower in fair condition, operational - Spare blower and motor appear operational - Could not confirm function of air flow/pressure gauges. No provisions for control due to removal of PLC and associated wiring.
Air stripper unit 2 (ShallowTray® low profile air stripper)	- Overall poor condition; disassembled, missing rivets and clips, extensive scaling - Appears to have been used as spare parts.
Bag filter system (2 treatment trains w/ two bag filter housings)	- Two filter housings on one treatment train broken due to freezing; other treatment train appears functional - Could not confirm function of solenoid valves or pressure switch. No provisions for control due to removal of PLC and associated wiring.
Chemical feed/metering system	- Metering pump, static mixer, switch outlet all present, operation of each could not be verified
Equalization tank (approx. 1,225-gallon)	- Intact - Pressure transmitter operational
Feed pump (208V, 1.5 HP Goulds centrifugal pump)	- Poor condition, highly corroded - Evidence of leakage due to field repairs that likely sacrificed pump integrity
Motor starter panel	- Intact, operation of contactors verified via HOA switched on control panel
System control panel	- PLC absent/removed - Four pump standalone pump controllers operational - Auto dialer disconnected and not functional - Internal wiring and control wiring conduit to various bypassed/faulty components absent/removed
Miscellaneous piping, instrumentation, conduits	- Influent header flow sensor did not register a response when manually spun
	- Flow controllers (6), all powered up but keypads were unresponsive.
	- Effluent discharge pipe insulation is degraded and could not determine heat trace function.
	- Several runs of conduit and associated control wiring removed between some system components/sensors and the control panel
GWEW-01	- Paddlewheel registers flow - Pump present in well, function not determined - No transducer present
GWEW-02	- Paddlewheel registers flow - No pump present - No transducer present
GWEW-03, GWEW-07 (combined header)	- Paddlewheel broken - Both wells abandoned
GWEW-04, GWEW-08 (combined header)	- Paddlewheel registers flow - Both wells have pump & transducer present, function not determined
GWEW-05, GWEW-09 (combined header)	- Unable to remove paddlewheel to test function. - Both wells have pump & transducer present, function not determined
GWEW-06, GWEW-10 (combined header)	- Unable to remove paddlewheel to test function. - GWEW-06: Pump present, no transducer present - GWEW-10: No pump or transducer present
SVETS	
Items	**Observations**
The system appeared to be in reasonably sound condition; however, the power source for the SVE blowers was off and not included in the main breaker panel in the equipment room. Therefore, the operability of the SVET system was not able to be confirmed at the time of the Site visit. Efforts to determine the power source for the SVE blowers were inconclusive.	
Air velocity transmitter	- Function unknown
Blowers (2)	- Function unknown
Differential pressure transmitter	- Function unknown
Flow sensor (pitot tube)	- Function unknown
Flow transmitter	- Function unknown
Moisture separator	- Function unknown

Katie Amann
Senior Geologist

M+ 1 518-612-0314

WSP USA
300 Great Oaks Blvd., Suite 300-014
Albany, New York
12203 USA

wsp.com

From: Salotto, Samantha R (DEC) <Samantha.Salotto@dec.ny.gov>
Sent: Wednesday, December 7, 2022 3:19 PM
To: Amann, Katie <katie.amann@woodplc.com>
Cc: Ardon, Ehud <ehud.ardon@woodplc.com>
Subject: RE: Robeson Treatment Equipment

Hi Katie,

That is a good question. I did not realize that was not decommissioned yet either. We would probably want to include it, yes.

Thanks!
Sam

From: Amann, Katie <katie.amann@woodplc.com>
Sent: Wednesday, December 7, 2022 3:13 PM
To: Salotto, Samantha R (DEC) <Samantha.Salotto@dec.ny.gov>
Cc: Ardon, Ehud <ehud.ardon@woodplc.com>
Subject: RE: Robeson Treatment Equipment

Sam,

Photos in the attached Remedial Systems Report may have some of the information Payson is looking for. Would the NYSDEC also be interested in decommissioning/salvaging parts from the SVE system?

Thanks,

Katie Amann
Senior Geologist

M+ 1 518-612-0314

From: Salotto, Samantha R (DEC) <Samantha.Salotto@dec.ny.gov>
Sent: Thursday, December 1, 2022 2:37 PM
To: Amann, Katie <katie.amann@woodplc.com>
Subject: FW: Robeson Treatment Equipment

CAUTION: External email. Please do not click on links/attachments unless you know the content is genuine and safe.

Hi Katie,

Do we have the information Payson is requesting?

Thanks!
Sam

From: Long, Payson D (DEC) <payson.long@dec.ny.gov>
Sent: Thursday, December 1, 2022 2:36 PM
To: Salotto, Samantha R (DEC) <Samantha.Salotto@dec.ny.gov>
Subject: RE: Robeson Treatment Equipment

Sam,

I will need all of the name plate information for all the main components.
If there is an hour meter, I will need the time.

Please let me know if you have any questions.
Thank you,

Payson Long, P.E.
Pronouns: he/him/his
Project Manager, Remedial Section D, Remedial Bureau E
Division of Environmental Remediation

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NEW YORK STATE | Department of Environmental Conservation

www.dec.ny.gov | |

From: Salotto, Samantha R (DEC) <Samantha.Salotto@dec.ny.gov>
Sent: Thursday, December 1, 2022 11:47 AM
To: Long, Payson D (DEC) <payson.long@dec.ny.gov>
Subject: Robeson Treatment Equipment

Hi Payson,

My Robeson site has a groundwater pump and treat system that we are planning on decommissioning and will no longer need the equipment. Mike mentioned you deal with excess equipment, so I figured I'd reach out to see if you could help with getting it off-site? Attached is a photo log of the equipment.

Thanks!
Sam

Samantha Salotto, PE
(she/her)
Professional Engineer I (Environmental)
Division of Environmental Remediation, Remedial Bureau E, Remedial Section A
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P: (518) 402-9903 | C: (518) 956-3794 | samantha.salotto@dec.ny.gov
www.dec.ny.gov

MACTEC

engineering and constructing a better tomorrow

February 24, 2021

Ms. Samantha Salotto
Project Manager
NYS Department of Environmental Conservation
625 Broadway
Albany, NY 12233

Subject: **Remedial Systems Report**
NYSDEC Robeson Industries, Inc. Site
Castile, Wyoming County, New York
NYSDEC Work Assignment No. D009809-14
Wood Project No.: 3616206112

Dear Ms. Salotto:

MACTEC Engineering and Geology, P.C., (MACTEC) has prepared this Remedial Systems Report for the New York State Department of Environmental Conservation (NYSDEC) Robeson Industries, Inc., (Site) in Castile, Wyoming County, New York. This work was performed under NYSDEC Work Assignment No. D009809-14 of the November 2019 Superfund Standby Contract No. D009809 between NYSDEC and MACTEC. The Site is currently classified as a Class 2 site that poses a significant threat to the public health and environment, and action is required. Remedial systems previously active at the Site include a Groundwater Extraction and Treatment (GWET) system and a Soil Vapor Extraction and Treatment (SVET) system. The SVET system was reportedly shutdown or became inoperative sometime after November 2009, as mass recovery from vadose zone soils was found to be no longer effective (MACTEC, 2009). It is MACTEC's understanding that the GWET system has not been functional since sometime after shutdown of the SVET system, but the final operational date of the GWET system was not known to MACTEC at the time of this report. This report provides an overview of the current status of remedial system equipment associated with both the GWET and SVET systems and a Rough Order of Magnitude (ROM) cost estimate for repairs necessary to bring the GWET system back to operational status. A ROM cost estimate was not provided for repairs necessary to bring the SVET system back to operational status since the SVET was determined to have effectively remediated VOC impacts in vadose zone soils (MACTEC, 2009).

1.0 Site Background

The Robeson Industries Inc., Site #961008 is a Class 2 inactive hazardous waste site located in a rural setting on View Road, approximately one mile east of Main Street (New York State 39) in the town of Castile, Wyoming County, New York (**Figure 1)**. From 1983 to 1989, cutlery products and small electrical household appliances were manufactured at the Site. Operations included caustic etching, nitric acid brightening, solvent degreasing, and solvent based spray painting of metal and plastic components for small appliances and cutlery. Degreasing solvents used in the manufacturing processes were improperly disposed on Site through spills, leaks, and other discharges (MACTEC, 2009). The Site is currently owned and used by Mr. Tim Calmes, Paradise Boat Works, for boat storage and repair (Wyoming County, 2021).

Access to the Site is from View Road, immediately east after the intersection with Bennion Road. Site features include paved parking areas and a large one-story concrete block-constructed building, consisting of an older and newer section. The older section has a footprint of approximately 150 feet by 200 feet. The newer section is comprised primarily of a 250-foot by 275-foot section, with an additional 100 feet by 150 feet extending behind (to the west) the original section (MACTEC, 2009). The GWET and SVET system equipment is housed within one of the rooms located in the older section. Electrical service to the Site is three-phase, required by the SVET blower. The 20-acre Site is surrounded by large tracts of rural farmland and wooded areas. There are four residences within ½ mile of the Site along Bennion Road, located to the west and northwest of the Site. The Site is 1 ½ miles northwest of Letchworth State Park (MACTEC, 2009).

Site drainage flows to a tributary of Wolf Creek and ultimately to Wolf Creek, which is a Class C stream (suitable for fish propagation and survival and primary and secondary recreation) that is a tributary of the Genesee River. A large berm located west of the Site extends along the top of a steep slope. Bennion Road, which is maintained seasonally, is located at the base of the steepest portion of this slope and crosses a small drainage which is contributed to by both groundwater seeps from the Site and discharge of treated groundwater. The primary groundwater seep and the GWET effluent originate as separate drainages but converge approximately halfway down the slope. The combined drainage passes through a culvert beneath Bennion Road and eventually discharges to Wolf Creek. Historically, URS Corporation (URS) collected surface water samples from the groundwater seep drainage, the combined drainage immediately downstream of the convergence, and from the combined drainage near Bennion Road (MACTEC, 2009).

Based on environmental assessments conducted at the Site in association with the transfer of the property, chlorinated solvents were detected in soil, groundwater, and surface water (URS, 2005b). The Site was placed on the New York State Registry in 1991. A Remedial Investigation (RI) (D&M, 1993a) and a Feasibility Study (FS) (D&M, 1993b) were performed from July 1992 to February 1993 under Dames & Moore (D&M). In 1993, due to bankruptcy of Robeson Industries Inc., D&M stopped work and NYSDEC performed a Phase II RI followed by a NYSDEC Supplemental RI/FS report (NYSDEC, 1994). In conformance with a Record of Decision (ROD) issued in March 1995 (NYSDEC, 1995), URS performed a Pre-Design Investigation and SVE Pilot Study in support of remedial design (URS, 1996). Tyree Corporation was contracted to perform the installation of a GWET system and SVET system at the Site. Installation was completed at the Site in January 1998. The GWET and SVET systems began operational status on February 13, 1998. Tyree Organization operated the GWET system and SVET system for one year, after which operations were conducted by URS beginning in February 1999 through shutdown of the systems (MACTEC, 2009). MACTEC was contracted in October 2005 to prepare a Remedial System Optimization and Focused Feasibility Study for the Site based on the discovery of significant contamination below the water table, including residual dense non-aqueous phase liquid (DNAPL) during investigation activities undertaken by URS in September 2004 (URS, 2005a).

2.0 Remedial Systems

The GWET and SVET systems began operations at the Site in February 1998 (URS, 2005a). Major components of the SVET system at the time of installation include the following:

- eleven vapor extraction wells with total depths ranging from 9.5 to 17 feet;
- an air/moisture separator;
- two ten-horsepower vacuum blowers for extracting soil gas;
- carbon adsorption units for air treatment; and
- associated piping and instrumentation.

The major components of the GWET system at the time of installation include the following:

- ten 4-inch diameter groundwater extraction wells constructed to depths ranging from 39 to 56 feet with pumps;
- an approximately 1,200-gallon equalization tank that is used to store water pumped from the wells prior to treatment;

- a chemical addition system that adds a sequestering agent (Calsperse) to reduce scale build-up on equipment and piping;
- A feed pump (P-101) to provide transfer of water from the equalization tank to the system duplex filters and air stripper units;
- Two duplex 10 micron bag filter skids to provide filtration of influent water to the air stripper units;
- two low profile air strippers and associated blowers to remove VOCs – each with a capacity of 20 gallons per minute (gpm);
- a catalytic oxidizer to treat air emissions from the air strippers;
- process pumps, piping, and instrumentation; and
- a main control panel with hand-off-auto (HOA) switches and a motor starter panel for operation and control of the system.

Based on information provided in (MACTEC, 2009), an analysis was performed by URS demonstrating that air emissions were in compliance with applicable regulatory standards without any air emissions control. On this basis, the NYSDEC directed URS to take the air emissions control units, which included both the catalytic oxidizer and carbon adsorption units, off-line. These air emission controls were taken off-line in June 2000. Although there are two air strippers on-Site, only one air stripper has been used based on the relatively low groundwater extraction rate (<10 gpm observed during remedial system operations) (MACTEC, 2009). The layout of the GWET and SVET systems during operations is presented as **Figure 2** (NYSDEC, 2009). It was observed during the November 2020 Site visit that the second air stripper was largely disassembled and appeared to have been used for spare parts as discussed in **Section 3.2.6**.

GWET and SVET system operations are documented to have occurred through at least November 2009 (MACTEC, 2009), however documentation of the final operational dates of the GWET and SVET systems was not available at the time of this report. It is MACTEC's understanding that the GWET system was shutdown or became inoperative at some point after the SVET system was no longer operational. From February 1999 through August 2005, the GWET extracted 13.1 million gallons of contaminated water at an average extraction rate of 3.3 gpm. Over this period, more than 400 pounds (lbs) of Volatile Organic Compounds (VOCs) were removed, about 98 percent of which was trichloroethene (TCE) (MACTEC, 2009). It is noted that removal rates associated with the GWET system fluctuated over the operational period due to extraction well fouling and system down-time (URS, 2005b; MACTEC, 2009). It is suspected that extraction well clogging or fouling occurred due to either: extraction well screens that straddled the water table, promoting bio-fouling of the screen above the water table; or higher permeability zones introduced higher flow rates into the extraction well screens, resulting in the introduction of fine-grained sediments into the wells (MACTEC, 2009). Review of available data indicates that, as of 2005, all of the GWET extraction wells were being utilized throughout operation of the GWET systems. URS contracted Rockwell Automation and Nothnagle Drilling to perform reprogramming and well cleaning or redevelopment from October 2004 to September 2005, and measured system operational data and TCE concentrations from the GWET system extraction wells (URS, 2005a). It is unknown to MACTEC whether the wells were simply redeveloped, or if a cleaning agent was applied to the wells during the activities performed in 2004. However, based on observations made during the November 2020 Site visit, as discussed below, it is suspected that only three (GWEWs 04, 05 and 09) of the ten extraction wells installed in association with the GWET system were utilized at the time of the system shut-down.

During the operational period of February 1999 through August 2005, approximately 3,500 lbs of VOCs were removed via the SVET system, of which approximately 94 percent was TCE. The SVET system demonstrated decreasing removal rates over time, beginning with approximately 150 lbs/month during the first year of operation, compared to approximately 14 lbs/month during the period of February 2004 to August 2005 (MACTEC, 2009). The identified threshold for a significant removal rate by NYSDEC is 10 lbs/month (URS, 2005b). It was demonstrated that mass removal has decreased primarily because some areas of treatment have become effectively remediated of VOC impacts in vadose zone soils (MACTEC, 2009). Due to the decreasing mass removal, targeted removal was applied to the SVET system operations by decreasing the number of operational extraction wells over time. Initially eleven extraction wells were utilized from February 1998 to May 2002, followed by six wells being utilized from May 2002 to October 2003, and finally two wells being utilized from October 2003 through at least November 2009 (MACTEC, 2009).

During the timeframe that the remedial systems were operating, operations, management, and maintenance (OM&M) activities included monthly GWET and SVET system sampling and water level measurements. The air stripper was typically cleaned every other monthly visit to remove precipitated metals (primarily calcium) (URS, 2005b). Groundwater extraction wells were typically redeveloped at least every two years by surging to remove silt and sand from the wells (MACTEC, 2009). A recommendation was made (URS, 2005b) to increase the frequency of well redevelopment to an annual basis, but it is not known to MACTEC whether this increased frequency was implemented at any point. Off-Site groundwater monitoring wells and groundwater seeps were sampled on a semi-annual basis. The system performance was also evaluated by monitoring downgradient (west of the on-Site building) groundwater monitoring wells and groundwater seep. Over the period of February 1998 to August 2005, the data showed that, in general, the downgradient water quality remained relatively constant while the seep water quality improved with respect to VOC concentrations (MACTEC, 2009). Renewal of the groundwater monitoring well and seep sampling program is scheduled to occur in First Quarter of 2021.

3.0 November 2020 Site Visit

MACTEC staff visited the Site on November 12, 2020 and met with the NYSDEC personnel responsible for the Site, as well as the current property owner. The following MACTEC staff were in attendance: Brad LaForest, Katie Amann, Eric Thompson, and Tyler Hengen. Samantha Salotto (NYSDEC), and the current property owner, Tim Calmes, were also in attendance.

The Site visit included a tour of the existing SVET and GWET systems, a Site walk over, obtaining photographs of the treatment systems and Site features, and a groundwater gauging event, to be reported under separate cover. Photographs are presented in Appendix A of this report. The following subsections present the information obtained and discussed during the Site visit.

3.1 Current Remedial System Conditions

The Site GWET and SVET systems have been inoperative since sometime after November 2009. It is MACTEC's understanding that the SVET system was inoperative at some point prior to the GWET system becoming inoperative. However, documentation of the final operational dates or data after 2009 regarding the GWET and SVET systems was not available to MACTEC at the time of this report. It does not appear that any of the equipment was prepared for long term shutdown at the time of final operation, as water was still present within system lines and the equalization tank associated with the GWET system.

Currently within the remediation system room there are large amounts of debris (old/broken equipment associated with the remediation systems and extraction wells, scrap materials and waste paint) as well as cat feces. The following sub-sections describe the current condition of the various system components associated with the GWET and SVET systems, as well as the general conditions of the remediation system equipment room.

3.1.1 GWET System

As discussed previously, the major components of the original GWET system included the following:

- ten 4-inch diameter groundwater extraction wells constructed to depths ranging from 39 to 56 feet with pumps and level transducers;
- an influent header system with flow meters and a chemical addition system that added a sequestering agent (Calsperse) to reduce scale build-up on equipment and piping;
- an approximately 1,200-gallon equalization tank that is used to store water pumped from the wells prior to treatment;
- A feed pump (P-101) upstream of the air stripper units to provide transfer of water from the equalization tank to the system duplex filters and air stripper units;
- Two duplex 10 micron bag filter skids to provide filtration of influent water to the air stripper units;
- two low profile air strippers and associated blowers to remove VOCs – each with a capacity of 20 gpm;
- a catalytic oxidizer and carbon absorption units for off gas treatment;
- associated piping, and instrumentation; and
- a main control panel with hand-off-auto (HOA) switches and a motor starter panel for operation and control of the system.

The catalytic oxidizer and carbon adsorption units, as well as one of the air strippers and 7 of the 10 extraction wells were removed from service prior to operational shut-down. Documentation of the removal of the catalytic oxidizer and carbon adsorption units was provided (MACTEC, 2009) The catalytic oxidizer and carbon adsorption units were not observed to present on Site at the time of MACTEC's November 2020 visit. Documentation of the removal of extraction wells from service was not available to MACTEC at the time of the Site visit.

The control panel has been modified since its original installation. The Programmable Logic Controller (PLC) has been removed and replaced with standalone pump controllers and the autodialer has been disconnected. Much of the internal wiring within the control panel as well as the control wiring conduit to various bypassed/faulty components has been removed.

The motor starter panel, which appears to be intact, handles both 220 single phase and 208 three phase power distribution for all well/process pumps, the air stripper blower, and the SVET blowers. Operation of the contactors via the HOA switches on the control panel was verified during the Site visit.

3.1.2 GWET System Extraction Wells

According to Site documentation (MACTEC, 2009), the extraction wells are constructed of stainless steel pipe and have 6-inch diameter risers which taper to 4 inches near the water table. The well screens likely have 0.010-inch slots, and the extraction wells have been documented to clog with sediment or be prone to bio-fouling over time (MACTEC, 2009). The location of the wells at the Site are presented in **Figure 3**. During the Site visit, each of the system GWEW wells were observed. It should be noted that these observations were visual only and no electrical testing of the groundwater extraction components was undertaken at the well extraction points. Each well, if operational, would be expected to contain both a pump and level transducer to communicate with the GWET system control panel. **Table 1** outlines the current status of each of the groundwater extraction wells.

Table 1 – Groundwater Extraction Well Observations

Groundwater Extraction Well	Observations
GWEW-01	Pump present, no transducer
GWEW-02	No pump, no transducer present
GWEW-03	Abandoned
GWEW-04	Pump and transducer present
GWEW-05	Pump and transducer present
GWEW-06	Pump present, no transducer
GWEW-07	Abandoned
GWEW-08	Pump and transducer present
GWEW-09	Pump and transducer present, electrical cover missing
GWEW-10	Manhole filled with water, no pump or transducer present

Based on the extraction well observations and the observations made within the remediation system equipment room, it appears that only wells GWEW-04, GWEW-05, and GWEW-09 were utilized during the final operation of the GWET system. These wells were controlled by individual Mercoid pump controllers via on/off control based on well level. The other wells do not currently have any means of operation and/or control due to prior modifications to the control system and removal of the PLC. Based on observations made at the three operational flow controllers within the remediation system equipment room, the level transducer signals from GWEW-04 and GWEW-09 appear to be functioning; however, GWEW-05 is registering above rated signal range (20 mA) and appears to be faulty. Level transmitters from the remainder of the GWET extraction wells on-Site are not terminated within the control panel and could not be tested. Due to the system not being currently operational and not authorized to begin discharging of groundwater, the system was not powered to verify groundwater extraction well pump operation. It should be noted that MACTEC did not attempt to remove any pumps or transducers from the GWET extraction wells. The observations made regarding the presence of a pump or transducer were based on the observed presence or lack of wiring and/or associated components of the well pumps and transducers. As a result, the quality and condition of these components was not assessed at the time of the Site visit.

3.1.3 GWET System Storage Tank

The GWET system has an equalization storage tank with a Dwyer pressure transmitter which controls the on/off operation of the system feed pump (P101) based on tank level via a Mercoid pump controller. The Dwyer pressure transmitter is a model 645-1, which registers 0-2 psid pressure, and has a 4-20 mA output. The Mercoid controller indicates a water level within the tank of 0.9 feet and is set to begin discharging when the water level in the equalization tank registers 1.5 feet. MACTEC staff performed a visual assessment of the water levels within the equalization tank via measurement against the written level depths on the exterior of the tank. Based on these observations, it appears that this controller is measuring the level correctly, and the pressure transmitter and Mercoid pump controller appear to be operational.

3.1.4 GWET System Chemical Addition System

A chemical pump for injection of Calsperse, a calcium sequestering agent (MACTEC, 2009), was present in association with empty chemical storage drums. The chemical pump appeared to be controlled via a switched outlet that would energize when the system was running. Operation of the pump or control system could not be verified during the Site visit.

3.1.5 GWET System Duplex Filter Skids

The feed pump (P-101) routes water into a dual-duplex bag filter system for solids removal prior to entering the air stripper. P-101 is a 208 Volt (V), 1 ½ Horsepower (HP) Goulds centrifugal pump with a Franklin Electric motor. P-101 is highly corroded and shows evidence of leakage due to field repairs that likely have sacrificed the integrity of the pump. Replacement of this pump would be required prior to start-up of the GWET system.

The original dual duplex bag filter system consisted of two trains of two bag filter housings each in parallel with a pressure switch and solenoid valves to direct flow. This system originally operated with one train online and one in standby that would be put into service via the solenoid valves upon detection of a high pressure condition within the online train. This type of operation would have allowed longer run times and fewer shutdowns between operator visits for maintenance.

During the Site visit, it was observed that the filter housings of two of the filters of one train were broken due to freezing, while the remaining two filters of the second train appeared to be functional. Piping modifications have been made to isolate the broken filters from the process and the wiring/conduit for the pressure switch and solenoids valves has been removed. The condition of the solenoid valves and pressure switch was not able to be determined during the Site visit since there are currently no provisions for control due to the removal of the PLC and associated wiring.

A single filter train may be acceptable for future operations at the Site, however additional modifications to the piping will be needed in order to eliminate the two damaged filter units from service. If duplex operation is desired from an operational standpoint replacement of the filter housings and potentially the solenoid valves/pressure switch and associated control wiring will be required prior to start-up of the GWET system.

3.1.6 GWET System Air Stripper

Filtered water from the duplex filters is discharged to the air stripper for removal of VOCs via Feed Pump P-101. In order for air to be introduced into the air stripper to volatilize contaminants from the influent groundwater, an air blower and motor is present and connected to the system. The observed motor associated with the air stripper is a three-phase 208V, 3 HP Baldor motor.

The motor was confirmed to be operational and rotating in the correct direction during the November 2020 Site visit. Additionally, the blower associated with the air stripper appeared to be in good condition and a spare blower and motor, both appearing to be in operational condition, were noted within the remediation system equipment room.

It is MACTEC's understanding that two air strippers were originally installed in the system but operations dictated that only one air stripper was necessary due to relatively low groundwater flow rates through the system. Several sections of the second air stripper were observed to be laying disassembled in the remediation system equipment room and in the larger main building area and appear to have been used as spare parts. The assembled air stripper connected to the GWET system was observed to be missing rivets and clips between the air stripper trays and heavy scaling and epoxy repairs were apparent on the exterior of the air stripper tower trays. Extensive scaling and similar damage to clips and rivets was observed on the disassembled air stripper components as well.

Magnehelic and Capsuhelic gauges used for monitoring of air flow and pressure drop through the air stripper are present in the discharge air stack, however, there are no provisions for monitoring in the current control panel configuration due to removal of the PLC.

3.1.7 GWET Piping and Instrumentation

The GWET system historically operated at a documented total flow rate of 7 to 8 gpm extracted from ten groundwater extraction wells (MACTEC, 2009). Based on observations made within the control panel and in the extraction well investigation, described in **Section 3.2.2**, it appears that only extraction wells GWEW-04, GWEW-05, and GWEW-09 were used during final GWET system operations.

GWET system flowrates are measured via paddlewheel flow sensors for the extraction wells located on the influent header and the combined air stripper influent in the remediation system equipment room. The signals from the flow sensors are monitored and displayed on the primary control panel via six GF Signet flow controllers. Although these controllers all powered up, the keypads on three were unresponsive.

Investigation indicated that shared influent lines within the system building were present for groundwater extraction well pairings:

- GWEW-03 and GWEW-07;
- GWEW-04 and GWEW-08;
- GWEW-05 and GWEW-09; and
- GWEW-06 and GWEW-10.

Because these influent lines are paired, the associated flowmeters for these groundwater extraction wells are shared as well. As a result, the flow from groundwater extraction wells GWEW-03 through GWEW-10 are not able to be individually measured within the remediation system room, unless one of the extraction wells within each of the pairings is non-operational. The flow as measured by the influent flowmeters is representative of the combined flow from the groundwater extraction well pairings. Preliminary testing of the flowmeters was conducted by removing and manually spinning the paddlewheel sensor while observing response of the respective flow controller. This testing indicated partial operation of the system components as outlined in **Table 2.**

Table 2 – GWET System Flowmeter Assessment

Well ID – Flowmeter	Status
GWEW-01	Registers flow
GWEW-02	Registers flow
GWEW-03, GWEW-07	Paddlewheel broken
GWEW-04, GWEW-08	Registers flow
GWEW-05, GWEW-09	Was not able to be removed for testing
GWEW-06, GWEW-10	Was not able to be removed for testing
Air Stripper Influent	No response

As noted in previous sections, it was apparent that a PLC was present with the system historically but had been removed. Four Mercoid pump controllers were installed in place of the PLC to operate GWEW-04, GWEW-05, GWEW-09 and the air stripper feed pump (P-101) with no interlock for shutdown other than a high level in the EQ tank. The air stripper low air pressure switch, which would prevent the flow of untreated water to be discharged in the event of a blower failure, is not tied into the current control system. An autodialer was also present but had been disconnected from both the phone line and power source and is no longer functional.

It was also noted that several runs of conduit and associated control wiring had been removed between certain system components/sensors and the control panel. This will require further evaluation depending on future operational requirements of the system.

No significant issues were noted associated with system piping, aside from the issues described with the filtration system piping as discussed in **Section 3.2.5.**

The influent well lines and gravity discharge pipe associated with the GWET system where visible, both in the interior of the remediation system equipment room and on the exterior of the building where the lines are present above grade. These lines were heat traced, insulated, and appeared to be enclosed in the past. The enclosure and insulation have been degraded over time and the functionality of the heat trace was not able to be determined during the site visit. The outfall for the gravity discharge was not observable to MACTEC staff at the time of the Site visit.

3.2 SVET System

The SVET system within the remediation system equipment room appeared to be in reasonably sound condition. However, the power source for the SVE blowers was off and not included in the main breaker panel in the equipment room. Therefore the operability of the SVET system was not able to be confirmed at the time of the Site visit. Efforts to determine the power source for the SVE blowers were inconclusive. It is MACTEC's understanding that the SVET system likely will not be targeted for repair or reoperation. Should it be deemed necessary to again target contaminant removal in vadose zone soils via the SVET system at the Site, further investigation will be required to determine or re-install power for the SVE system to allow for assessment.

4.0 Recommendations

In order for the GWET system to be brought back to operational status, a number of items including process equipment, instrumentation, and electrical will need to be addressed. These recommendations are dependent on future goals for operation that need to be identified prior to finalizing recommendations. The following sections only provide recommendations related to the primary operational issues identified in section 3.

4.1 Extraction Wells

The operational status of the pumps in the extraction wells is unknown and the desired extraction wells to be utilized for future operation will need to be identified. Dependent on the wells to be utilized, these pumps would require removal from the well for verification of condition and testing prior to operation. While the level transmitters in GWEW-04 and GWEW-09 appear to be functioning, the status of the transducers in the other wells which are not monitored by the existing control scheme is unknown. MACTEC recommends field evaluation of existing equipment only for wells to be utilized in the future.

Only three of the flowmeters associated with the extraction system were responsive. The other flowmeters were broken/nonresponsive either due to a malfunction of the paddlewheel assembly or the GF Signet flow controller. Due to the age and unknown condition/accuracy of the flow sensors/monitors MACTEC recommends replacement with new analog capable (4-20mA output) flowmeters that could be monitored directly by a PLC only for wells to be utilized in the future.

4.2 Feed Pump and Bag Filter System

MACTEC recommends replacing the feed pump (P-101) with a like-in-kind Goulds pump (i.e., 208V, 1 ½ HP) due to corrosion and leaks noted during the Site visit.

The two remaining bag filters could be utilized for operation of the system, however, the piping should be modified to fully eliminate the two damaged housings. Restoring the system to automated duplex operation would require replacement of the two damaged filter housings, re-piping of the manifold, and replacement/rewiring of the solenoid valves and pressure switch to the control panel. Automated duplex operation would allow longer run times between maintenance visits and reduced downtime. MACTEC recommends replacement of the damaged filter housings, piping, control wiring, and automated valving/pressure sensor to allow duplex operation.

4.3 Air Stripper

Due to the number of issues associated with the air stripper noted during the Site visit, including missing rivets and clips, aged epoxy repair, and scaling, it is MACTEC's recommendation that it be replaced with a new or refurbished similar sized unit.

4.4 Exterior Influent Well Lines and Discharge Pipe

The exterior influent well lines and discharge pipe are currently exposed with little protection. MACTEC recommends testing of the heat trace system, replacement of pipe insulation, and reconstruction of the structure protecting these lines from the elements.

4.5 Control System and Electrical

As noted in **Section 3,** the PLC has been removed along with portions of the conduit and control wiring associated with the original system operation. There were numerous sensors that were not able to be tested/evaluated during the site visit due to lack of monitoring devices and/or termination within the existing panel. Based on the intended goals of future remediation at the Site, electrical and controls upgrades will be required. MACTEC recommends re-installation of a PLC based controller and replacement of removed conduit and wiring to allow tie of sensors deemed critical to operation.

4.6 General Housekeeping

During the time of the Site visit, it was noted that extensive debris, equipment that had been removed from service, chemical storage, and animal waste were present throughout the remediation system equipment room. MACTEC recommends chemical disposal, general housekeeping, and cleaning services be performed prior to the performance of system repair work. It is MACTEC's opinion that chemical disposal largely should be the responsibility of the property owner, as it is apparent that much of the chemical storage occurring within the remediation room is small (5 gallon or less) containers of paints and various commercial chemicals that are likely associated with the operations occurring at the Site. Chemical disposal that would be attributable to the system is primarily limited to empty drums of calcium sequestering agents.

5.0 Rough Order of Magnitude Cost Estimate

Based on the anticipated work associated with returning the GWET system to service, MACTEC has compiled a Rough Order of Magnitude (ROM) cost estimate to perform the necessary repairs associated with the GWET system, as shown in **Table 3**. Reflected in the ROM cost estimate is the cost of new or refurbished equipment and installation including upgrades of associated controls or electrical systems, housekeeping and cleaning within the remediation system equipment room, MACTEC's oversight for the installation of system equipment, preparation of a report summarizing the installation and repair activities, and drafting of updated system drawings.

Table 3 – ROM Cost	
Item	ROM Cost
Equipment/Controls/Electrical Upgrades	$175,000-$200,00
Housekeeping/Cleaning Services	$2,750-$4,500
Oversight	$37,250-$45,500
Total	$215,000-$250,000

This cost is based on utilization of the three extraction wells (GWEW-04, GWEW-05 and GWEW-09) that were assumed to be in operation prior to the system shutdown. It should be noted that this is only a ROM cost and more defined costs will be obtained should NYSDEC desire to pursue the repair of the GWET system further. The ROM cost is reflective of system conditions as MACTEC understands and interprets them and additional issues may arise as components of the system are repaired. The lack of information regarding the current state of the groundwater extraction well pumps, sensors that were not able to be tested during the site visit, or the desired remedial approach (i.e., utilization of more than the three wells currently wired to be operational), introduces significant variability to the anticipated costs.

6.0 Conclusions

MACTEC performed a remedial systems assessment Site visit to the NYSDEC Robeson Industries Inc., property to evaluate the current status of the installed GWET and SVET systems at the Site. The GWET system was found to be non-operational as a whole, however certain elements of the system were determined to be functional. Improvements recommended include: 1) installation of a new PLC based controller for overall control of the system; 2) replacement of feed pump P-101; 3) replacement or re-configuration of the filtration system; 4) replacement of the air stripper; 5) repair of the heat tracing, insulation and exterior enclosure for the influent well lines and discharge pipe; and, 6) replacement of various system components such as piping, system sensors and conduit/control wiring where applicable. In addition, testing of the extraction well pumps must be undertaken prior to start-up of the system.

The SVET system was found to be non-operational. It is MACTEC's understanding that this system may not be desired to be brought back to service based on low VOC recovery from vadose zone soils. Should this system be desired to be brought back to service, power to this system will be required for further evaluation of the system components.

A ROM cost estimate was prepared for NYSDEC's consideration with this report. Based on MACTEC's current assessment of the GWET system, it is anticipated that repair and optimization of the system will likely cost in the range of $215,000-250,000, as shown in **Table 3**. We appreciate the opportunity to provide this Remedial Systems Report. Additional reports associated with Site activities under MACTEC's contract with NYSDEC at the Robeson Industries Inc., Site will be provided under separate cover.

Sincerely,

MACTEC Engineering and Geology, P.C.

Tyler Hengen	Bradley B. LaForest, NRCC-EAC
Project Engineer	Project Manager/Senior 2 Scientist

TH/BL/:

Attachments

Figure 1:	Site Map
Figure 2:	Remedial Systems Layout
Figure 3:	Well Locations
Appendix A:	Photo Log

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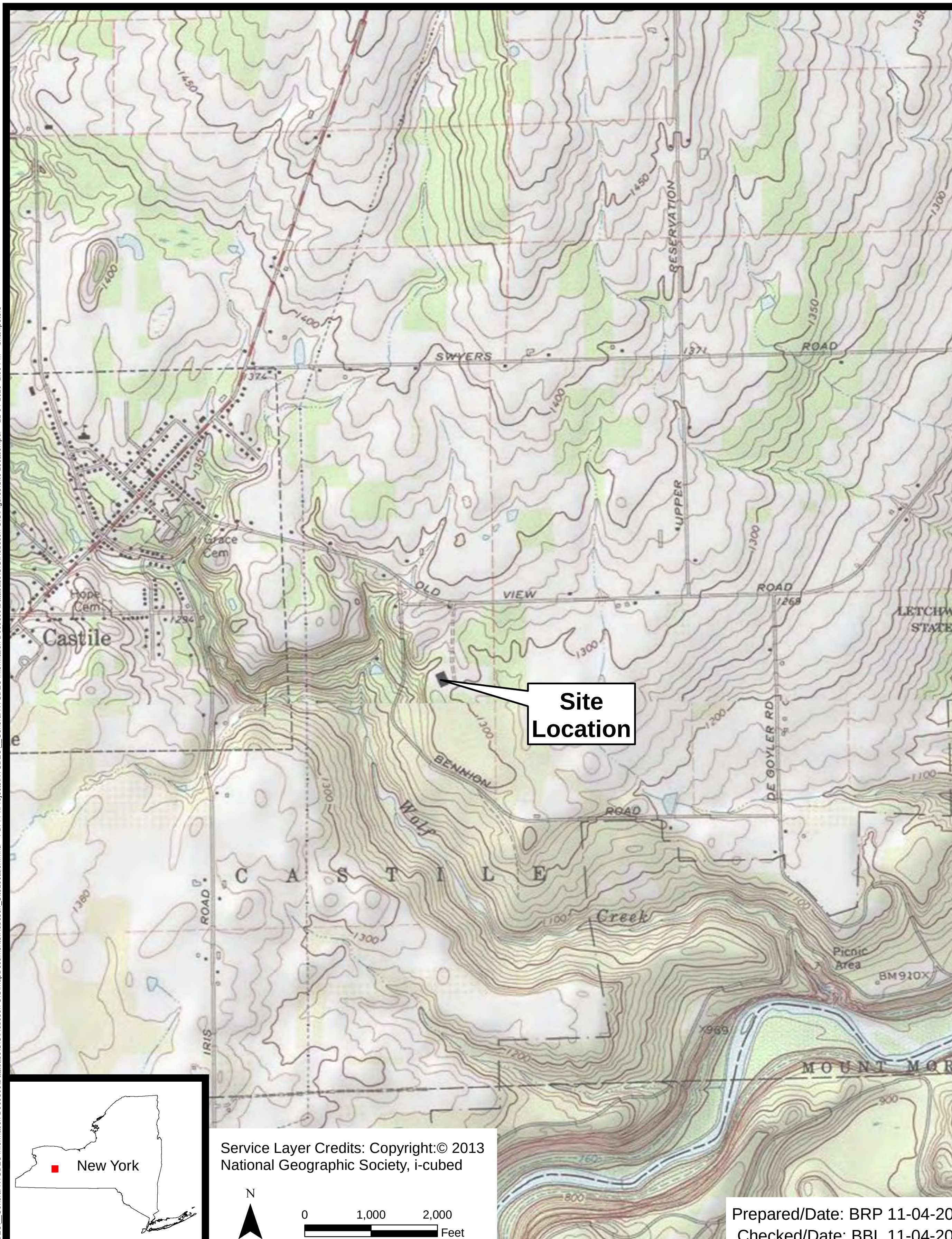
FIGURES

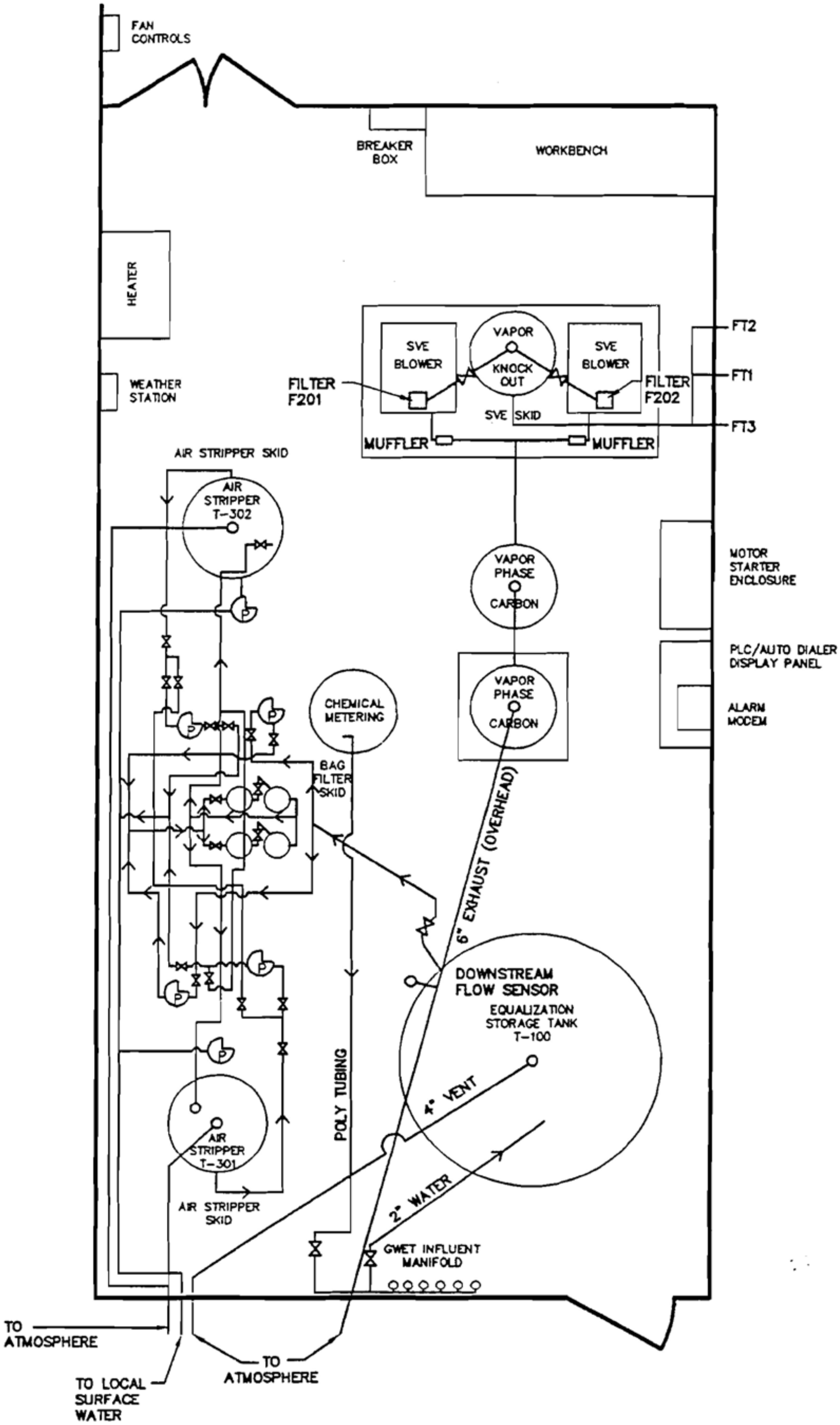


NYSDEC Site # 961008
Robeson Industries
Castile, New York

MACTEC

Site Location

Project 3616206112 Figure 1



Note: Remedial System Layout from Tyree Organization, Ltd., 1/15/99. Not to Scale

Prepared/Date: BRP 01-20-21
Checked/Date: BBL 01-20-21

NYSDEC Site # 961008 Robeson Industries Castile, New York	MACTEC	Remedial System Layout Project 3616206112 Figure 2

Document: P:\Projects\NYSDEC_General NYSDEC Information D009809\Database\GIS\Robeson GIS\MapDocuments\Robeson_11x17P.mxd PDF: P:\Projects\NYSDEC_General NYSDEC Information D009809\Database\GIS\Robeson GIS\Figures\Figure 3 - Well Locations.pdf 01-20-2021 3:39 PM brian.peters

NYSDEC Site # 961008
Robeson Industries
Castile, New York

MACTEC

Well Locations

Project 3616206112

Figure 3

APPENDIX A
PHOTO LOG

Photo 1
View of GWET system – Full View within remediation system room.

Photo 2

View of GWET system control panel Front with flow controllers and system controls apparent.

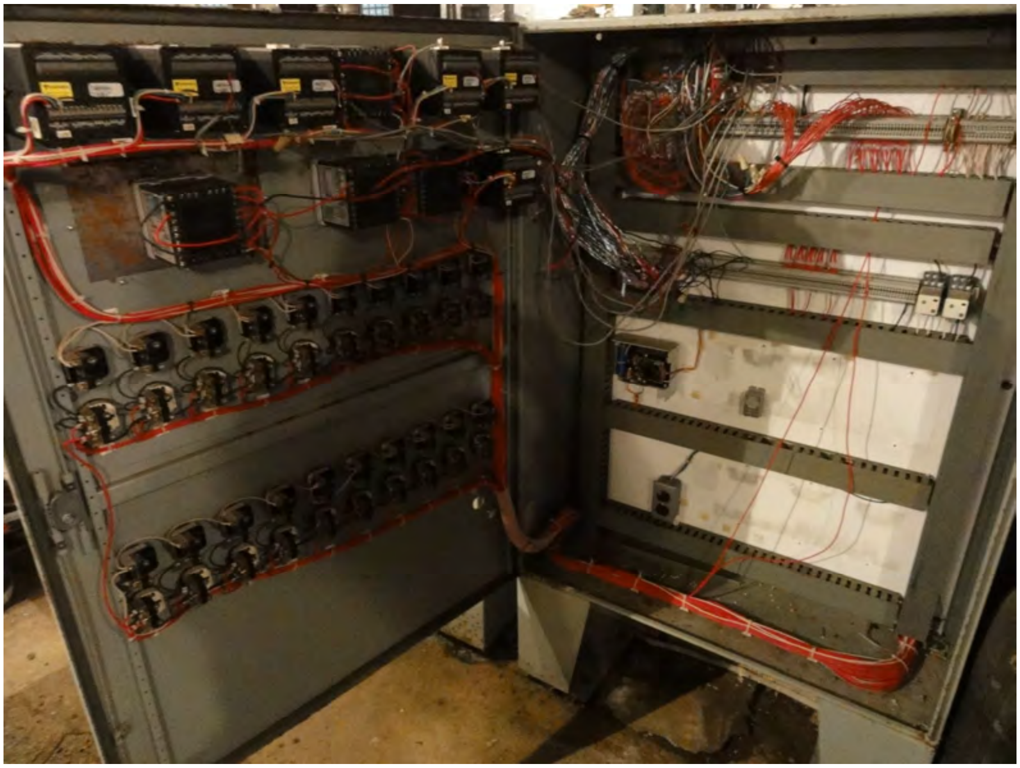


Photo 3

View of interior of GWET system control panel. Note absence of PLC within control panel.

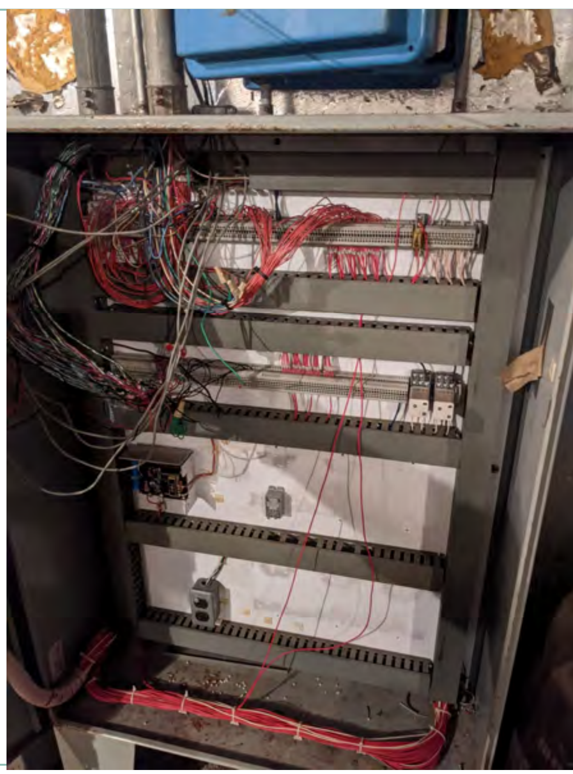


Photo 4

View of interior of GWET system control panel. Note absence of PLC within control panel

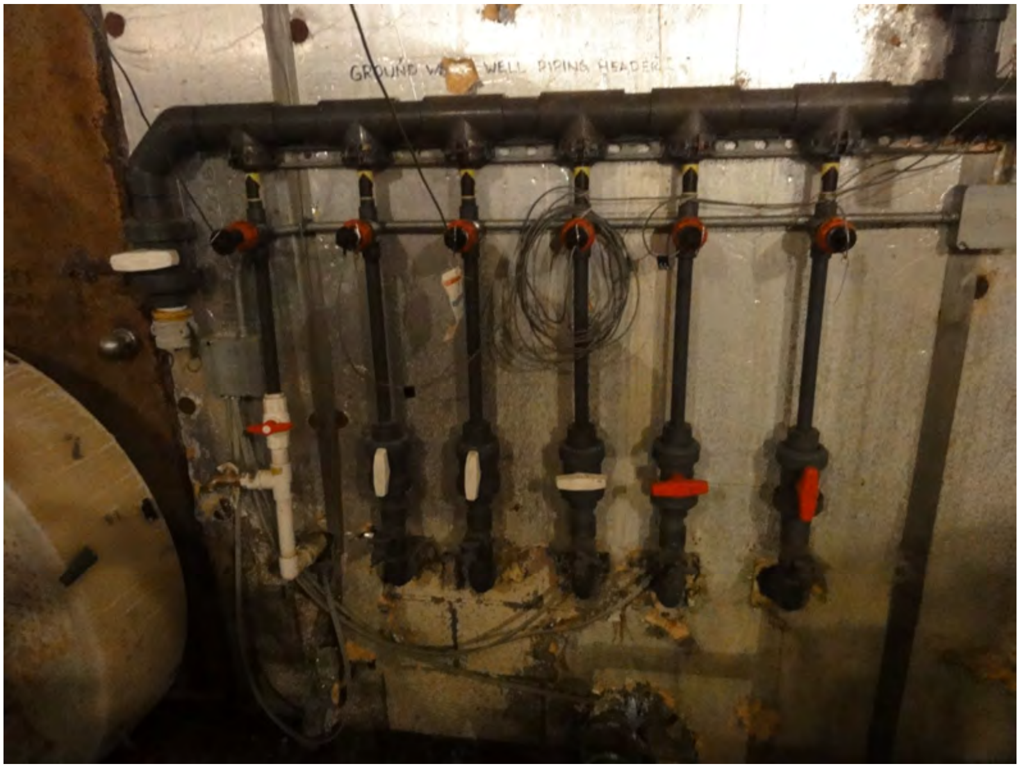


Photo 5

View of GWET system influent header.

Photo 6

View of GWET system influent header, static mixer, and air stripper effluent air line.

Photo 7

View of GWET System EQ storage tank, influent header, and air stripper.

Photo 8

Top view of GWET system EQ storage tank.

Photo 9

View of influent piping to GWET system EQ storage tank.

Photo 10

Side view of GWET system EQ storage tank with pressure transmitter and level sensor apparent.

Photo 11

View of GWET system filter skids and air stripper piping.

Photo 12

View of GWET system filter skids, air stripper, and piping.

Photo 13

View of GWET system filter piping and solenoids.

Photo 14

View of GWET system filter skids with damaged filter housing apparent.

Photo 15

View of GWET system cracked filter housing.

Photo 16

View of GWET system filter monitoring infrastructure.

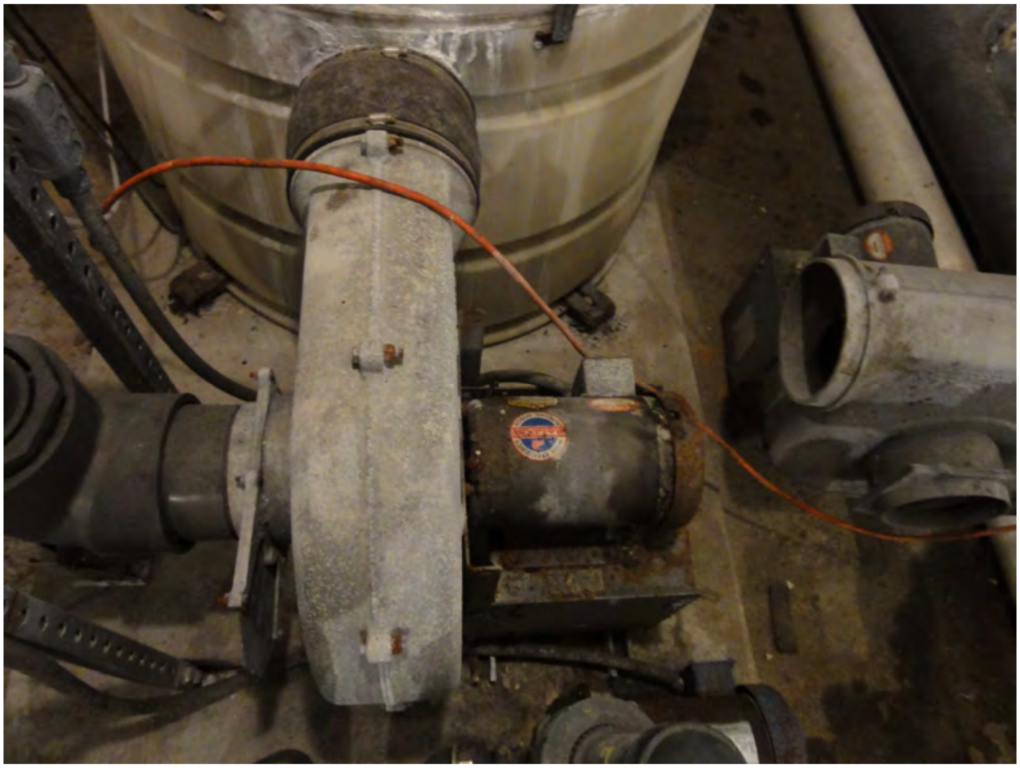


Photo 17

View of GWET system air filter blower.

Photo 18

View of GWET system air stripper piping.

Photo 19

View of GWET system air stripper, piping, magnehelic and capsuhelic gauges, and other infrastructure. Epoxy repairs are evident on the exterior of the air stripper.

Photo 20

View of GWET system air stripper damage to clips and rivets.

Photo 21

GWET system air stripper blower nameplate.

Photo 22

View of GWET system Feed Pump 101.

Photo 23

View of GWET system air stripper effluent water piping.

Photo 24

View of GWET system effluent piping.

wood. Environment & Infrastructure Solutions, Inc. 4600 J Barry Court, Suite 210 Canonsburg, Pennsylvania 15317	W.O. 3616206112 PROCESSED TJH DATE January 2021 PAGE: 12	**PHOTOGRAPHIC LOG** NYSDEC Robeson Remedial Systems Report Robeson Industries Castile, NY

Photo 25

View of GWET system filter line solenoid nameplate.

Photo 26

View of GWET system filter line solenoid nameplate.

Photo 27

View of SVET system.

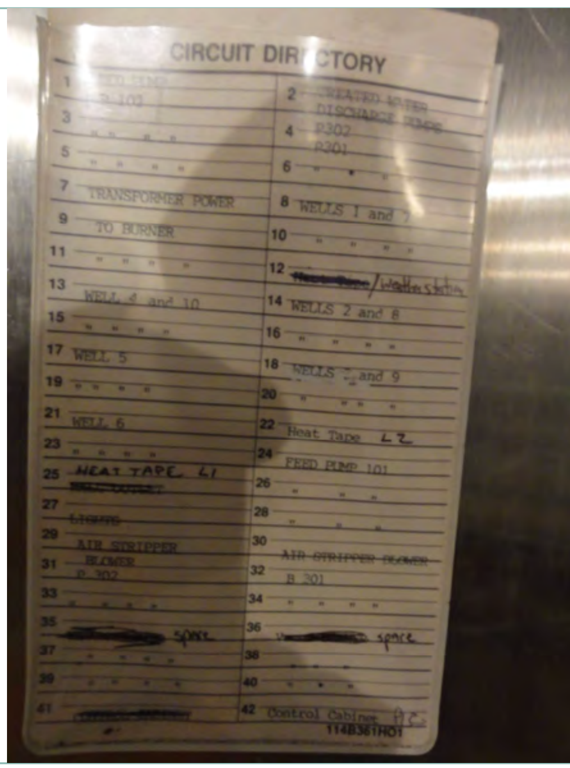


Photo 28

View of circuit directory in system power panel.

Photo 29

View of system power panel.

Photo 30

View of disconnected autodialer associated with the remediation systems on Site.

Photo 31

View of debris within remediation system room near the SVET system.

Photo 32

View of one of two SVET system vacuum blower.

Photo 33

View of repairs on effluent of SVET system blower.

Photo 34

View of second GWET system air stripper components. Scaling and damage is evident on these components.

Photo 35

View of various equipment and pumps within the remediation system room.

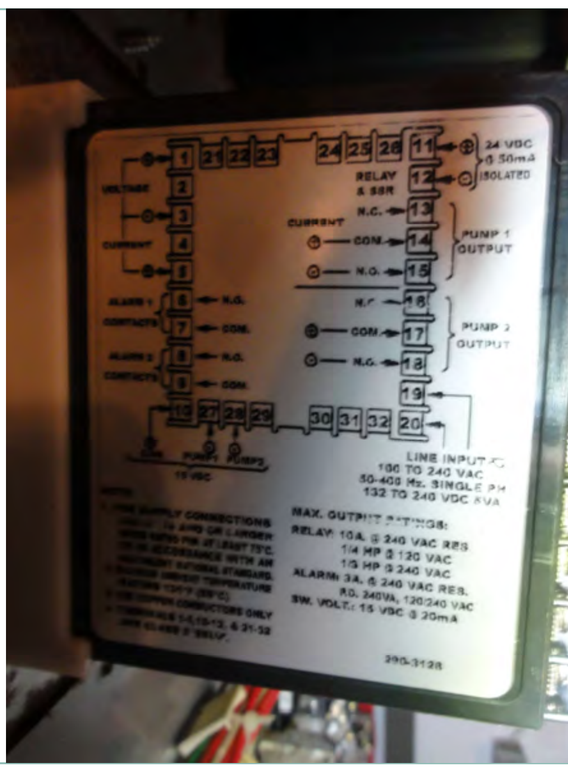


Photo 36

View of pump control wiring diagram.

Photo 37

Exterior view of GWET system influent lines and exterior discharge line.

Photo 38

View of GWEW-01. A pump is noted to be present in GWEW-01. A transducer is absent from GWEW-01. It is additionally noted that the electrical cover is missing in GWEW-01.

Photo 39

View of GWEW-02. No pump or transducer are present in GWEW-02.

Photo 40

View of abandoned GWEW-03.

Photo 41

View of GWEW-04. A pump and transducer are noted to be present in GWEW-04. It is additionally noted that the electrical cover is missing in GWEW-04.

Photo 42

View of GWEW-05. A pump and transducer are noted to be present in GWEW-05. It is additionally noted that the electrical cover is missing in GWEW-05.

Photo 43

View of GWEW-06. A pump is noted to be present, while a transducer is noted to be absent in GWEW-06. It is additionally noted that the electrical cover is missing in GWEW-06.

Photo 44

View of abandoned GWEW-07.

Photo 45

View of GWEW-08. A pump and transducer are noted to be present in GWEW-08. It is apparent that the integrity of the manhole cover has been compromised.

Photo 46

View of GWEW-09. A pump and transducer are noted be present in GWEW-09. It is additionally noted that the electrical cover is missing in GWEW-09.

Photo 47

View of GWEW-10. No pump or transducer are noted to be present in GWEW-10. Additionally, it was observed that the integrity of the manhole cover has been compromised.

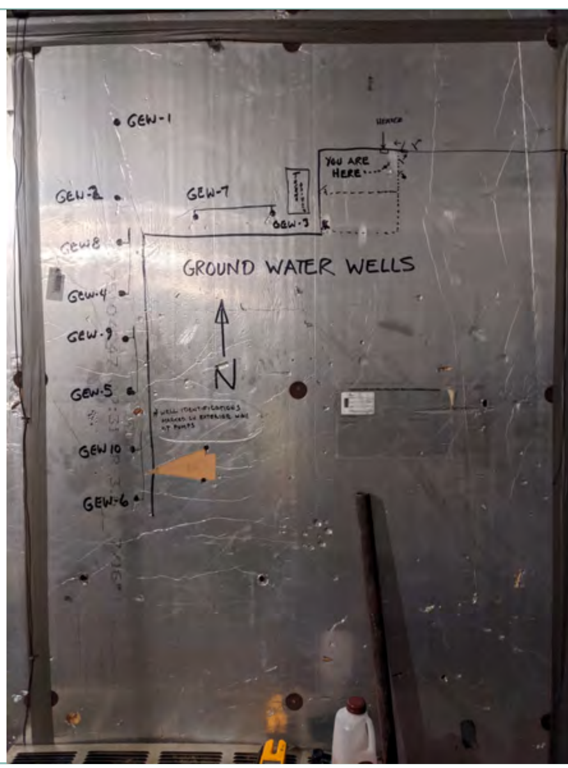


Photo 48

View of GWET system wells in the interior of the remediation system room.

ATTACHMENT 6

Site Specific Health and Safety Plan

Site-Specific Health and Safety Plan
Short Form

Site: Robeson Industries, NYSDEC Site No. 961008 Job #/Task # 3616206112.05.****
Street Address: 5540 Sutton Road, Castile, New York 14427
Proposed Date(s) of Investigation: October 2023
Prepared by: Tom Gerhard Date: 11/21/2022
*Approved by: Katie Amann, Project Manager Date: 12/09/2022
Site Description: **(attach map)** See map on page 5
Comments: NYSDEC – Site Management and Remedial System Optimization

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

Project Overview - Characterization "Color" Use the SMARTool Assessment form to determine the project classification. SMARTool Assessment summary, which is an output of the SMARTool, provides an overview of the site hazards, as entered into the SMARTool. The Assessment Form is included on Page 2.

Tasks:

WSP	Sub	Task Description	AHA Attached?
[ ]	[x]	Direct Push Drilling	[x]
[x]	[ ]	Groundwater Sampling	[x]
[x]	[ ]	Surface Water/ Sediment Sampling	[x]
[x]	[ ]	Building/Structural Evaluation	[x]

High Hazard Activities:

WSP	Sub	Activity	WSP	Sub	Activity
[ ]	[ ]	Confined space entry	[ ]	[x]	Operating drill rig
[ ]	[ ]	Entering excavations	[ ]	[ ]	Operating other heavy equipment
[ ]	[ ]	Hot work	[ ]	[ ]	Using aerial lift
[x]	[ ]	Lockout/tagout	[ ]	[ ]	Working from scaffolding
[ ]	[ ]	Operating forklift	[ ]	[ ]	Working at heights >6 feet

Life Saving Actions:

The following WSP Life Saving Actions potentially apply to the work being conducted at the site:

- [x] Plant / People / Interface – Working around heavy equipment
- [ ] Suspended Loads
- [x] Driving
- [ ] Hazardous Atmospheres / Substances -
- [ ] Working on or Near Water
- [ ] Lone or Remote Work
- [ ] Ground Stability
- [x] Energy Sources
- [ ] Working at Height

Site-Specific Health and Safety Plan
Short Form

SMARTool Assessment Summary

Robeson Industries, Inc.

E&I HSSEA SMARTool Results

Assessment Date: **Friday, November 18, 2022**
Contract Value: **$216,755 USD**
Completed By: **Katie Amann, Senior 1 Geologist**
Project Number: **3616206112**
Project Type: **Active Project**
Project Phase/Task: **05.****
Business Unit: **Consulting**
Business Group: **Resilient Environments**
Project Location: **New York, United States**
Sub Business Group: **East US**
Project Role: **Designer, Engineer, Consultant or Inspector without field subcontractors**
E&I is Engineer of Record: **No**

HSSE Risk Rank	Project Risk Category	Project Tier
Yellow	C	Tier 2

Comments
Data gap investigation including monitoring well installation and development, well assessment, repair, and decommissioning, groundwater sampling, porewater and sediments sampling.

Action Items

None

Initial Screening

1. Does the project have low-risk contract terms meeting E&I Mandatory Contracting Principles? **Yes**
2. Is project scope within technical competency of primary office managing the work? **Yes**
3. Will the project involve field work? **Yes**
4. Is E&I responsible for all aspects of engineering, design, procurement and construction/construction management? **No**
5. Does the project include elements that involve International Clients, Dam Safety Services, Disclosure Services, Nuclear Services or invoke the Technical Safety Standard (i.e. those that could result in catastrophic incidents due to design or project execution: retaining structures, or scenarios where E&I assumes a process liability)? **No**

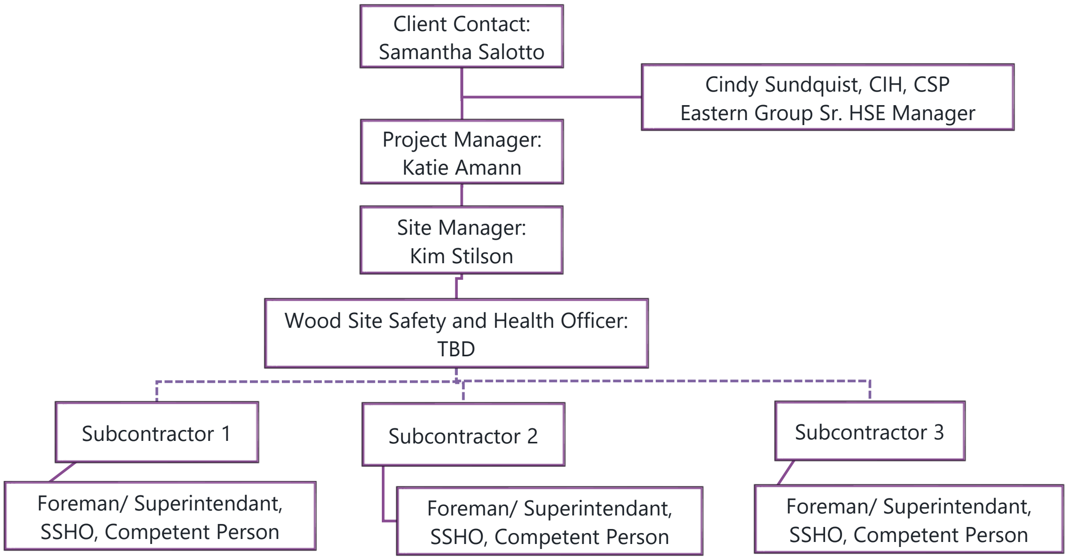
Preliminary Screening

1. Do we have Subcontractors? **No**
2. Maximum E&I and subcontractor staff expected in the field: **5-10**

Hazards

Emp	Sub		Hazard Level	Hazard
☐			Moderate	Cold stress
☐			Substantial	Compressed air use/maintenance (excluding calibration gas, small containers)
☐			Moderate	Conventional decontamination of personnel or equipment at hazardous waste sites using decon stations
☐			Substantial	Dropped objects
☐			Substantial	Fire Safety - Flammable liquids
☐			Moderate	Hand and portable power tools
☐			Moderate	Hand digging or augering
☐			Substantial	Hazardous waste site remediation projects, with heavy equipment
☐			Moderate	Heat stress
☐			Substantial	Hot work
☐			Moderate	Lightning
☐			Substantial	Lockout/Tagout - Control of Hazardous Energy (lock out)
☐			Substantial	Non-Routine driving at work (when journey management is/may be required)
☐			Moderate	Occupational noise exposure/hearing conservation
☐			Substantial	Operating in proximity to underground utilities
☐			Moderate	Particulates not otherwise specified - nuisance
☐			Moderate	Personal Protective Equipment (PPE) Modified Level D required (refer to PPE Procedure, linked in Instructions)
☐			Substantial	Poisonous plants, insects, and wildlife exposure
☐			Moderate	Poisonous plants, insects, and wildlife exposure (unless classified as substantial)
☐			Moderate	Sanitation, housekeeping, drinking water
☐			Substantial	Structural integrity of buildings, roofs, walking surfaces
☐			Moderate	Sun, UV light exposure
☐			Moderate	Toxic/Hazardous Substances (HAZCOM/WHMIS) not listed as substantial
☐			Moderate	Walking uneven terrain
☐			Substantial	Work in proximity to construction equipment

Project Organization Chart:



Dates of Required Training and Medical Surveillance:

Add additional training topics, as required. **Verify training in online training database**: **LINK**

Name:	**Katie Amann**	**Kim Stilson**	**Meril Benny**	**Eric Thompson**	
Job duties:	**Project Manager**	**Site Manager**			
	Dates	**Dates**	**Dates**	**Dates**	
Medical Surveillance	2/16/2022	01/10/22		7/20/2022	
-Exam Type (A3, B, C)	A	A		A	
40-Hour Initial	12/07/2009	01/31/2012	1/26/2019	6/28/1987	
8-Hour Supervisor [2]	12/14/2009	05/31/2012		10/01/2022	
8-Hour Refresher	3/11/2022	12/21/2021	05/06/2022	02/04/2022	
First Aid[1]	2/12/2021	10/20/2020	04/08/2022	8/19/2021	
CPR[1]	2/12/2021	12/5/2020	04/08/2022		
Hazard Communication	7/31/2020	1/14/2022		02/10/2020	
Fire Extinguisher					

[1] At least one worker must be trained in First Aid/CPR
[2] Required for Site Manager and Site Health and Safety Officer
[3] **Medical Surveillance Exam A has no respiratory clearance so can only be used for Level D PPE.** . Exam A (basic HAZWOPER), Exam B (respirator & HAZWOPER under 40 years old), Exam C (respirator & HAZWOPER over 40 years old), Exam E (DOT), Exam F (asbestos monitoring), Exam G (lead monitoring) etc. **Contact HSE Coordinator, Regional HSE Manager or Cindy Sundquist to determine type of exam employee received.**

Site-Specific Health and Safety Plan
Short Form

Goals/Targets:

The following goals/targets have been established for the project:

☑ Zero OSHA Recordable Incidents
☐ Weekly HSE Inspections (documented Project Safety Checklist)
☐ 1 Leadership (PM) HSE Inspection
☑ 1 HEART observation per week

Meetings:

The following meetings will be held at the site:

Meeting	Lead by		Frequency				
	WSP	Sub	Initial	Daily	Weekly	Monthly	As Needed
☑ Project Kick-off [1]	☑	☐	☑	☐	☐	☐	☐
☑ Tailgate [2]	☑	☐	☐	☑	☐	☐	☐
☐ Safety Committee [1]	☐	☐	☐	☐	☐	☐	☐
☑ Incident Reviews [1]	☑	☐	☐	☐	☐	☐	☑
☐ E&I Monthly Safety Topics [1]	☐	☐	☐	☐	☐	☐	☐
☐ HSE Closeout Meetings [1]	☐	☐	☐	☐	☐	☐	☐

[1] Attended by subcontractor management representative
[2] Attended by all subcontractor employees and supervisors.

Inspections:

Regular inspections will be conducted by WSP E&I and/or subcontractor personnel. Inspections will be documented, and corrective actions established for all findings. Corrective actions will be tracked to closure. HEART observations will be entered into the HEART database.

Inspection Type	Lead by		Frequency			
	WSP	Sub	Daily	Weekly	Monthly	Before Use
☑ HSE (Visual)	☑	☑	☑	☐	☐	☐
☐ HSE (Documented)	☐	☐	☐	☐	☐	☐
☐ Leadership HSE (e.g., PM)	☐	☐	☐	☐	☐	☐
☐ Scaffolding	☐	☐	☐	☐	☐	☐
☐ Excavations	☐	☐	☐	☐	☐	☐
☑ Heavy Equipment	☐	☑	☑	☐	☐	☐
☑ PPE	☑	☑	☑	☐	☐	☐
☑ Tools/Equipment	☑	☑	☑	☐	☐	☐
☑ HEART/Observations	☑	☐	☐	☑	☐	☐
☐ PoWRA	☐	☐	☐	☐	☐	☐

INSERT SITE MAP(s) HERE

Journey Management Plan:

A Journey Management Plan will be developed to address non-routine/non-commute type travel to and from the project site. Considerations will include anticipated weather, work duration prior to travel, travel route, etc. See the Vehicle Travel – Journey Management Plan AHA.

JOURNEY MANAGEMENT PLANNING		
All projects with a field component must have a journey management plan completed for each work location. Complete the below as accurately as possible with your knowledge of the project, site location, time of year, etc. If there are significant changes to the scope of the project, or the conditions of travel, the plan must be updated, or new journey management plan must be completed. ***Not required for city or urban driving***		
	Points	**List Control Measures**
1. How many total hours will the driver have been on duty at the end of the journey? Note: Maximum 14 duty hours permitted. (12+ hours = 10 pts)		
2. Will the overall journey distance exceed 120 miles/~200km? (Yes = 10 pts)		
3. Will the journey require driving in wet, flooded, icy, and/or snowy roads? (Yes = 10 pts)		
4. Will the journey require driving in conditions that limit visibility (dark, fog, snow, hail, etc.)? (Yes = 10 pts)		
5. Will the journey require driving overnight (after 9pm - 5am)? (Yes = 10 pts)765		
6. Is the driver familiar with the route for this journey? (No = 5 pts)		
7. How many hours of sleep has the driver had in the past 24 hours? (If < 8 hrs = 5 pts)		
8. Will there be a passenger in the vehicle during the journey? (No = 5 pts)		
9. Is heavy traffic congestion expected during the journey? (Yes = 5 pts)		
10. Was a pre-trip inspection performed (walk around, towing, load securement, etc.)? (No = 5 pts)		
11. Is the vehicle towing a heavy or oversized load OR permit required? (Yes = 5 pts)		
12. Will the driver encounter unpaved or mountainous road conditions? (Yes = 5 pts)		
13. In case of emergency, will the driver have suitable means of communication? (No= 5 pts)		
14. Are there elevated security risks associated with this journey? (Yes = 5 pts)		
15. Is there an elevated risk of striking an animal on the roadway during this journey? (Yes = 5 pts)		
TOTAL		**Low Risk = 0-25 pts, Medium Risk = 30-55 pts requires mitigation, High = 60 or more requires Management Approval**
Workers must also establish a check in/check out system for any project where there is significant driving and where they will not be returning to the office at the end of the day. This process should be documented.		

Known or Suspected Contaminants (include PELs/TLVs): LINK to COC Library

Contaminants of Concern (COC) (Attach Fact Sheets*)	Maximum Concentrations		PEL/TLV**
	Soil (mg/kg)	Water/Groundwater (µg/l)	
Trichloroethene (TCE)	57,000	9,400	

*Workers must be made aware of the signs, symptoms, and first aid for each COC. Information is located on the COC fact sheets.
**See (LINK) for OSHA PELs and ACGIH TLVs

Air Monitoring Action Levels:

PID/FID Reading[1]	Detector Tube[1]	Dust Meter[1]	LEL[2]/O_2[1]	Action
			>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) (**LINK to AHA Library**):

Activity Specific AHAs:

- [x] Mobilization/Demobilization and Site Preparation
- [x] Vehicle Travel – Journey Management Plan
- [x] Field Work - General
- [x] Field Work - Oversight
- [x] Decontamination
- [x] Utility Clearance Activities
- [x] Groundwater Sampling
- [x] Soil Sampling
- [x] Geoprobe
- [ ] Excavations and Backfilling
- [ ] Stream/Wetlands Work

Hazard Specific AHAs:

- [x] Insect Stings and Bites
- [x] Gasoline
- [x] Working with Preservatives (Acids)
- [x] General PPE Use
- [ ] COVID-19 related AHAs
- [x] Drilling with GeoProbe
- [x] Surface Water/Sediment Sampling
- [x] Working Over or Near Water
- [x] Working in Muddy Areas
- [x] Well Decommissioning/LOTO
- [ ]

Health and Safety Snippets

The following Safety Snippets apply to the hazards identified in the SMARTool:

Robeson Industries, Inc.

E&I HSSE SMARTool Safety Snippets

Project Number:	**3616206112**	Risk Rank:	**Yellow**
Business Unit:	**Consulting**	Project Category:	**C**
Business Group:	**Resilient Environments**	Project Tier:	**Tier 2**
Sub Business Group:	**East US**	Project Location:	**New York, United States**

Cold Stress

- Follow local weather advisories and adjust work accordingly
  - **Wind Chill Warning:** Take Action! Wind Chill Warning advisories are issued when dangerously cold wind chill values are expected or occurring. If you are in an area with a wind chill warning, avoid going outside during the coldest parts of the day. If you do go outside, dress in layers, cover exposed skin, and make sure at least one other person knows your whereabouts. Update them when you arrive safely at your destination.
  - **Wind Chill Watch:** Be Prepared: A Wind Chill Watch is issued when dangerously cold wind chill values are possible. As with a warning, adjust your plans to avoid being outside during the coldest parts of the day. Make sure your car has at least a half a tank of gas and update your winter survival kit.
  - **Wind Chill Advisory:** Be Aware: A Wind Chill Advisory is issued when seasonably cold wind chill values, but not extremely cold values are expected or occurring. Be sure to dress appropriately and cover exposed skin when venturing outdoors.
- Wear a hat or other head covering as up to 40% of heat loss can occur when the head is exposed. If wearing a hard hat, use a hard hat liner designed to work with your hard hat brand. Wear waterproof boots with two pairs of socks where the inner pair should be cotton and the outer pair wool. Keep as dry as possible and have extra clothing readily available to change into if you do get wet.
- Signs of Hypothermia - shivering - blue lips and/or fingers - disorientation, confusion, poor coordination. If your body temperature sinks below 96°F (25.6°C), you have hypothermia.
- Signs of Frostbite - sharp, prickling sensation - skin appears waxy and feels numb. Frostbite can happen in minutes, especially on the extremities such as fingers, toes, nose and ears, but can affect any area of exposed skin. If you suspect frostbite, immediately move inside to a heated location and begin warming the affected areas using warm water or body heat. Do not use hot water or radiant heat such as a fireplace since affected areas can be easily burned. Seek medical attention for severe frostbite.

Compressed Air

- Compressed air used for cleaning purposes shall be reduced to less than 30 pounds per square inch (psi) and then only with effective chip guarding and personal protective equipment. This requirement does not apply to concrete form, mill scale, and similar cleaning operations.
- Cylinders must be properly labeled, in compliance with HAZCOM/WHMIS and country Transportation regulations. Labels must be legible.
- Cylinder valves must be closed when work is finished and when cylinders are empty or are moved.
- All cylinders must have a means to immediate shut off cylinder readily available (fixed hand wheel, key, wrench or a key/handle) for each manifold.
- Valve protection caps shall be in place and secured when compressed gas cylinders are transported, moved, or stored.
- Compressed gas cylinders shall be secured in an upright position at all times, except if necessary for short periods of time when cylinders are actually being hoisted or carried.
- Cylinders shall be kept far enough away from the actual welding or cutting operations so that sparks, hot slag, or flame will not reach them.
  - When this is impractical, fire-resistant shields shall be provided.
- Cylinders must be stored away from heat producing devices.
- Cylinders stored must be stored so that they cannot accidentally become part of an electrical circuit.
- Cylinders should be protected from snow, rain, etc.
- Cylinders must be protected from any object that could produce a harmful cut or other abrasion in the cylinder.
- Cylinders must be stored away from elevators, walkways, unprotected platform edges, and locations where heavy-moving objects may strike or fall on them.
- Gas cylinder storage areas must be compartmented (toxic, reactive, flammable, pyrophoric) by adequate distance or partitioning.
- Oxygen and fuel gas pressure regulators, including their related gauges, shall be in proper working order while in use.
- Oxygen cylinders must be separated from flammable gases, flammable or combustible liquids, and easily ignitable materials (wood, paper, oil, grease) by at least 20 ft (or by a 5-foot-high non-combustible firewall

Health and Safety Snippets (continued)

with ½-hour rating).

- Flammable gas cylinders must be kept out of confined spaces (basements, cabinets [except "gas" cabinets with exhaust], etc.).
- Flammable gas cylinders must be stored away from flammable liquids, highly combustible materials, oxidizers, arcing electrical equipment open flame or other sources of ignition.
- Smoking is prohibited and must be "no smoking" signs posted in storage areas (smoking and open flames not allowed within 20 ft) of flammable gas cylinders.
- Liquefied petroleum gas (LPG) cylinders shall be:
    - Stored away from exits.
    - Limited to 300 pounds of LPG if inside industrial buildings (except in special buildings or rooms).
- Acetylene cylinders must be stored valve ends up.
- When "empty" cylinders are removed from the process:
    - Valves must be closed
    - Cylinders tagged as "EMPTY" (in appropriate language).
    - Valve caps replaced.
    - Kept segregated.
- Employees who work with fuel gas cylinders must receive training and be instructed in their safe use.

Conventional Decontamination of Personnel or Equipment at Hazardous Waste Sites using Decon Stations

- Decontamination involves the removal of contaminated materials to minimize the potential for worker contact and/or removing hazardous substances from equipment and tools in contact with hazardous substances:
    - Set up decontamination station near work zone to prevent spread of material across uncontaminated areas of the site
    - Remove loose material from equipment
    - Clean equipment using wipes, steam cleaner, pressure washer, etc....Decon fluids need to be managed appropriately for proper disposal
    - Scrub outer boots and gloves with soap and water prior to removing
    - Remove disposals PPE such as Tyvek and Gloves into waste bags for proper disposal as contaminated waste or IDW.
    - Remove respirator, clean thoroughly, allow to dry and store properly in a sealed container to prevent contamination
    - Wash hands and face thoroughly, shower as soon as possible

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Dropped Objects

- Anyone working at heights or carrying tools above others should:
    - Plan and establish a protected work zone around the perimeter of staff that are working at heights, ie Scaffolding, Manlifts, Leading edge (roof)
    - Clearly delineate the work zone with barricades, cones, caution tape or other means that are easily recognizable and understood by all, enforce compliance
    - Keep tools in a tool pouch or belt that secures the tools and prevents them from falling
    - Use an engineered rope and pulley system with adequate capacity to bring tools to elevated work zones
    - Do not drop trash or other materials from height, use an enclosed chute if required to dispose of debris during demolition or bring materials to the ground
- Instruct workers to never walk beneath a suspended load or in a protected work zone
- Watch for overhead lines, crane operations and potential for falling objects from buildings or other structures. Maintain a safe clearance of at least 10 feet from energized electrical lines
- On projects with significant risk of dropped objects consider use of nets or other engineering controls, see link: Drop safe
- Require Level D PPE, including hard hats, boots, safety glasses and gloves at construction sites and enforce compliance

---

Fire Safety - Flammable Liquids

- Before handling flammable liquids consider all potential sources of ignition. Flammable vapors are generally heavier than air and tend to settle - traveling along lab benches and the floor.
- The transfer of material to and from a container can result in an accumulation of static charge on the container. When transferring flammable liquids, this static charge could generate a spark, thereby igniting the liquid. To make these transfers safer, flammable liquid dispensing and receiving containers should be bonded together before pouring.
- Keep flammable and combustible liquids away from strong oxidizing agents, such as chromic acid, permanganates, chlorates, perchlorates, and peroxides.
- Large containers (such as drums) must also be grounded when used as dispensing or receiving vessels. All grounding and bonding connections must be on conductive surfaces.
-

Health and Safety Snippets (continued)

Never heat flammable liquids with an open flame. Use steam baths, water baths, oil baths, hot air baths, sand baths, or heating mantles.

- Use caution when handling miscible solvent/water mixtures. These mixtures can still be flammable depending on the partial pressures involved.
- Treat water contaminated with water-immiscible solvents carefully. Hydrocarbon sheens provide adequate surface area for volatilization and ignition.
- When volatile materials are present, use only non-sparking explosion-proof electrical equipment such as explosion-proof refrigerators.
- Laboratory desks and furniture should be constructed of fire-retardant materials.
- Avoid wearing clothing made of synthetic materials (e.g. Polyester) while handling highly flammable materials. In the event of a fire, synthetic materials will melt and stick to the skin.
- When transporting organic solvent bottles, use secondary containers to prevent breakage and contain spills in case a bottle is dropped or strikes a surface.
- Use only ventilated explosion proof ovens for flammable or combustible liquids, or materials that contain residual flammable or combustible liquids.
- A spill containment kit should be available in the event of an accidental release. Kits should include appropriate absorbent material.

Waste Disposal

Almost all flammable and combustible liquid waste is considered hazardous. Flammable and combustible hazardous waste must be disposed of according to local, state, and federal regulations.

- Do not use consumer goods containers (such as old milk) jugs to store waste aggregation for disposal.
- If specialized wastes cans are not utilized, it is best to return the material to the original container and clearly label as waste.

Hand and Portable Power Tools

- Portable electric equipment must be handled in a manner that will not cause damage.
- Tools shall be used only for the purpose for which they were intended, as required by manufacturer's instructions and within their design limitations.
- Employees must know the hazards associated with the work to be performed prior to using the tool.
- All hand and portable power tools shall be guarded and equipped with a safety switch as required by regulatory requirements and applicable standards.
- Guards must provide protection at the point of operation: running nip points, rotating parts, and flying chips and sparks.
- A constant pressure switch or control that shuts off the power when pressure is released is required on power tools. Tools may not be equipped with a "lock-on" control.
- Tools shall be maintained in good working order. Tools shall be kept clean and sharp (where appropriate). Employees shall not use tools that are visibly damaged or that produce smoke, smells, or sparks. Damaged tools shall be removed from service and tagged "Do Not Use" or with similar language until fully repaired or replaced.
- Employees shall not wear loose clothing, ties, or jewellery that can be caught in moving or rotating parts while operating power tools. Long hair that extends below the hardhat or ear level shall be restrained in a manner to prevent contact with moving and rotating parts.
- Appropriate personal protective equipment shall be worn when using a hand or power tool.
- Tools shall be inspected prior to each day's use. The following items shall be included in the inspection as applicable:
  - Check power cords for signs of damage or wear
  - Check for cracking or other damage
  - Ensure bits and blades are sharp
  - Check all guards to ensure that they are both attached and functioning properly
  - For impact tools, check to ensure the head is not mushroomed
  - For pneumatic tools, check hose connections
  - For wooden handled tools, check handle for splinters, cracking, and tightness.
- When passing tools to others, ensure that all power tools are unplugged or in the off position and any moving parts (e.g., saw blades) have come to a complete stop. The employees shall pass the tool handle first or place them on the floor or other surface. Equipment shall not be passed to others or lowered, raised, or carried by the power cord or pneumatic hose or when the power tool is on, idling or in motion.
- All hand and portable power tools shall be stored in a dry, secure location.
- Employees shall follow manufacturer's instructions for lubricating tools and changing accessories.
- Care shall be taken to prevent cords and hoses associated with portable power tools from causing a tripping hazard. Never carry a tool by the cord or hose.
- Iron or steel hand tools may produce sparks that can be an ignition source around flammable or combustible substances. When working in areas where flammable gases, highly volatile liquids, and other explosive substances are stored or used, spark-resistant tools made of non-ferrous materials shall be used. When combustibles are present (paper, cardboard, dry grasses and leaves, etc.), the material will be cleared away or a work area free of this material selected.
- Additional requirements for portable power tools include:

Health and Safety Snippets (continued)

- Power cords and air hoses shall be kept away from heat, oil, and sharp edges
- Tools shall be unplugged or disconnected by the plug, not by yanking the cord or hose
- Tools shall be kept unplugged/disconnected when not in use
- Employees shall not hold the safety switch while carrying portable power tools.

Hand Digging or Augering

- Identify locations of underground utilities prior to drilling or augering.
- Always inspect hand tools for wear, damage, broken handles, missing guards, or improper function prior to use. If damaged, tag it out of service.
- Use the right tool for the job. Do not use tools in a manner, other than the way they were designed.
- Wear proper personal protective equipment e.g., safety boots with non-slip soles, safety glasses, work gloves, high visibility vest, etc.
- Maintain safe distances between employees when using digging tools.
- Maintain situational awareness. Know the locations of coworkers, heavy equipment and the condition of immediate area that you are working in.
- If there is a potential for the presence of energized electrical lines, use non-conductive tools.
- Use extreme caution when uncovering buried utilities. Hand tools may come in contact with and damage utilities.
- Maintain good ergonomic positioning when digging. Avoid awkward postures. Use a steady pace to minimize injury and fatigue
- Keep work area clean to avoid slipping, tripping or falling hazards.
- Place tools in a safe position when not in use so that sharp points are not exposed.

Hazardous Waste Remediation Sites, With Heavy Equipment

- Employers must develop and implement a written safety and health program for employees involved in hazardous waste operations.
- At a minimum, the program shall include:
  - An organizational structure
  - A comprehensive workplan
  - Standard operating procedures
  - A site-specific safety and health plan (which need not repeat the standard operating procedures)
  - A training program
  - A Medical surveillance program
- A site control program also shall be developed and shall include, at a minimum:
  - A map
  - Work zones
  - Buddy systems
  - Site communications – including alerting means for emergencies
  - Standard operating procedures or safe work practices
  - Identification of the nearest medical assistance.
- Training must be provided for all site employees, their supervisors, and management who are exposed to health or safety hazards before they are permitted to engage in hazardous waste operations.

Heat Stress

- Supervisors should schedule heaviest work during the cooler morning hours whenever possible.
- Communicate heat plan to workers and discuss symptoms of heat stress during safety meetings.
- All employees who have not been working in a hot environment must adjust to the heat before expecting to be fully productive (5-7 days).
- Encourage employees to drink a cup of water every 20 to 30 minutes, even if they do not feel thirsty.
- Employees must begin drinking fluids before they feel thirsty to avoid heat related problems.
- Avoid caffeine.
- Use the buddy system - monitor each other.
- Frequent, short breaks in the shade are better than infrequent, long ones.
- Make sure shade is available.
- Employees should wear proper clothing such as loosely fitting light-colored cotton shirts and cover the head.
- Employees must remember that a lack of sleep, obesity, alcohol use and similar factors can increase the risk of heat related injuries.
- If any worker shows signs or complains of headache, dizziness, nausea, confusion - get them into a cool area immediately.

Hot Work

Health and Safety Snippets (continued)

- Hot work includes any work that creates an ignition source performed in an area that potentially contains hydrocarbons or flammable materials.
- Hot Work Procedures describe the requirements and methods to provide protection against fires or explosions resulting from ignition sources due to work activities conducted by or under our control. When client or contractor procedures are used, these must meet our minimum requirements.
- Hot Work Procedures require:
  - Assigning a competent person accountable for planning and control of the work activities, including potential impact on third parties
  - Authorization through issuance of a hot work permit before performing hot work
  - Providing readily available fire extinguisher(s)
  - Documented inspection and monitoring of conditions (e.g., gas testing)
  - Assigning Fire Watch personnel who are responsible for preparing the work area, observing the activity, inspecting for sources of ignition for 30 minutes after the hot work is complete, and sounding an alarm if fire is discovered. Assigned personnel are trained in the use of fire extinguishers and familiar with how to sound the alarm.
- Control ignition sources
  - Ignition sources including heat, sparks, open flames that could ignite materials in the work area such as smoking, internal combustion engines, batteries, torching, grinding, welding, (un)loading of hazardous materials, chemical reactions, etc.
- Remove or isolate (e.g., guard or shield) flammable materials.
  - Flammables may be a solid (e.g., packaging, vegetation, etc.), liquid (e.g., oil, paint, gasoline, methanol, solvents, etc.), or gas (e.g., methane, propane, etc.)
- Hot work in Hazardous Areas, which are defined as 'any place in which an explosive atmosphere may occur in quantities such as to require special precautions to protect the safety of workers' require continual monitoring of gases.
- Use the Hot Work Field Level Inspection Checklist

Lightning

- Weather for the day should be discussed at the morning tailgate meeting and workers advised if lightning storms are a potential.
- Watch weather and forecast throughout the day for updates or signs of worsening conditions.
- Use the 30 - 30 rule. Stop work and seek shelter if thunder is heard within 30 seconds of seeing lightning. This indicates lightning is within 10km. Lightning can travel a long distance horizontally.
- Do not sound the all clear until 30 minutes after the last lightning is observed or thunder heard.
- Disconnect computers, power tools, rock saws and extension cords etc., from their power sources.
- Move well away from drill rigs, as the mast may act as a lightning rod.
- Shelter inside a substantial building (with indoor plumbing and wiring) whenever possible. Sit in vehicles, with window up, if other shelter is unavailable.
- Avoid contact with anything metal or electrical. Electrical outlets, plug-in appliances, radiators, open doors, windows and fireplaces all offer easy paths for lightning.

Lockout/Tagout - Control of Hazardous Energy (Lock Out)

Do not attempt to work on equipment or do lock out/tag out unless trained and have all required equipment/devices on hand.

- Identify equipment, machinery or other system components to be worked on.
- Identify all the energy sources (refer to the equipment specific lockout/tagout procedures).
- Identify the parts that need to be locked out or isolated. Use devices as necessary to lock out equipment.
- Notify all personnel that may be affected.
- Shut down equipment and machinery.
- Install lockout devices. Each individual working on equipment must have their own lock and key.
- Apply tags.
- Verify that zero-energy state has been achieved.
- Perform the work.
- Verify that the work is complete, all guards and covers have been replaced and that all personnel are clear.
- Restore power.
- Return control to operating personnel.
- Record the time and date that lockout was removed and system restored to operation.

Non-Routine Driving

- Complete a Journey Management Plan. Consider postponing or breaking up the drive due to weather, long workdays, etc.
-

Health and Safety Snippets (continued)

Drive according to the present road conditions. Conditions on unpaved roads change rapidly due to weather (e.g., wind, rain, storms, floods, snowstorms and whiteouts).

- Always assume you will encounter oncoming traffic, especially when cornering on narrow roads. Slow down and keep to your half of the road so there is a better chance to avoid a collision. Large trucks will commonly cut corners.
- Be aware of your surroundings. Frequently check mirrors and continually scan 20-30 seconds ahead. Keep your eyes moving.
- Avoid aggressive drivers. Slow down, change lanes, turn or exit the highway to separate yourself from aggressive drivers.
- Always lock your doors and wear your seatbelt.
- Do not speed. Posted speed limits apply to ideal conditions. May need to slow down due to weather or road conditions.
- Avoid distractions. These include cell phone use, eating or drinking in the vehicle, etc.
- Keep an eye out for pedestrians, bicyclists, and pets along the road.
- Do not depend on other drivers to behave predictably our courteously. Expect the unexpected! Assume that drivers will run through red lights or stop signs, unexpectly change lanes, etc. Be prepared to react!
- Follow the 3- to 4-second following rule. Maintain at least a 3-4 second following distance between you and the vehicle in front of you. This gives you time to react, if need be. Increase the following distance in adverse road or weather conditions.
- Plan an escape route. Be prepared in how you can react and avoid an incident.

Occupational Noise Exposure

- Hearing protection must be worn, and workers included in a Hearing Conservation Program when exposed to noise levels of 85 dBA (decibels - A scale) or higher on an 8-hour time-weighted average.
- As a rule of thumb, hearing protection should be warn when you have to raise your voice to be heard by someone standing two feet away.
- Inclusion in a Hearing Conservation Program includes:
    - Training
    - Noise monitoring
    - Hearing tests
    - Use of hearing protection such as ear plugs or earmuffs.
    - Use of engineering or administrative controls, if possible, to reduce noise exposures.
- Contact your Regional HSSE Manager if working extensive in noisy areas or around noisy equipment to determine of inclusion in Hearing Conservation Program is required

Operating in Proximity to Underground Utilities

- No excavation work shall be initiated until public and private underground utility locates have been completed within the work area.
- Utility owner notification is conducted through local One Call services or by calling 811.
- Retain a private utility locating service to verify utility locate sheets/information, where possible.
- Any markings made during the utility investigation must be maintained throughout the project.
- A qualified person/s must evaluate the marking of all underground utilities in the work area for accuracy against the locate sheets:
    - Compare the Limits of Locate referenced in the utility locates information to the actual work area
    - Compare utility locations marked on the ground surface with the utility locate sheets/information
    - Compare available utility plans with utility locate sheets/information
    - Compare visible surface cuts and repairs with utility locate sheets/information
- No ground disturbance shall occur outside of the limits of locate.
- The location of the underground utility must be physically verified by non-aggressive means (e.g., hand digging, vacuum, air or water excavation techniques) when mechanical excavation is planned within the tolerance zone/hand exposure zone identified by the utility owner.
- Non-aggressive means shall also be used to identify utility locations if working within 5 feet of underground utilities when the actual location of the utilities are uncertain.
- Excavation with mechanical equipment shall not be used within 0.60 m (2 feet) of a known utility (5 feet if utility locations are uncertain), unless under direct supervision by an authorized representative of the owner of the utility.
- Hand digging shall be performed using wood or fiberglass handled tools, which do not have sharp points, when any adjacent construction work is expected to come within 0.60m (2 feet) of the underground system.
- If damage occurs to a buried utility, immediately stop work and notify the owner of the damaged utility.
- The colors and corresponding installation type are as follows unless otherwise specified.
    - **Red**: Electric Power Lines, Cables, Conduit, and Lighting Cables
    - **Yellow**: Gas, Oil, Stream, Petroleum, or Gaseous Materials
    - **Orange**: Communication, Alarm or Signal Lines, Cables, or Conduit
    - **Green**: Sewers and Drain Lines
    - **White**: Proposed Ground Disturbance area. Note: Orange may be used (e.g. on snow or where contrast is required), provided markings clearly depict borehole, etc. Never use Red or Yellow.

Health and Safety Snippets (continued)

- : Temporary Survey Markings
- **Purple:** Nonpotable Water

Particulates Not Otherwise Specified - Nuisance

- Particle pollution — also called particulate matter (PM) — is made up of particles (tiny pieces) of solids or liquids that are in the air. These particles may include:
  - Dust
  - Dirt
  - Soot
  - Smoke
  - Drops of liquid

Some particles are big enough (or appear dark enough) to see — for example, you can often see smoke in the air. Others are so small that you can't see them with the naked eye, can only be detected using an electron microscope.
Breathing in particle pollution can be harmful to your health. Coarse (bigger) particles, called PM10 (inhalable particles, with diameters that are generally 10 micrometers and smaller), can irritate your eyes, nose, and throat. Dust from roads, farms, dry riverbeds, construction sites, and mines are types of PM10.
Fine (smaller) particles, called PM2.5 (fine inhalable particles, with diameters that are generally 2.5 micrometers and smaller), are more dangerous because they can get into the deep parts of your lungs — or even into your blood.
What are the Harmful Effects of PM?

- Particulate matter contains microscopic solids or liquid droplets that are so small that they can be inhaled and cause serious health problems.
- Some particles less than 10 micrometers in diameter can get deep into your lungs and some may even get into your bloodstream. Of these, particles less than 2.5 micrometers in diameter, also known as fine particles or PM2.5, pose the greatest risk to health.
- Fine particles are also the main cause of reduced visibility (haze) in parts of the United States, including many of our treasured national parks and wilderness areas.

Personal Protective Equipment (PPE) - Modified Level D

- Levels of protection (A, B, C, D, and Modified D) are US Hazardous Waste site PPE terms that define the level of protection required to protect employees from chemical exposure.
- Level D is a work uniform affording minimal protection, used for nuisance contamination only or for general work on construction sites.
- Level D protection should be used when:
  - The atmosphere contains no known hazard; and,
  - Field activities preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.
- Modified Level D PPE is the same as Level C PPE without the inclusion of respiratory protection. Modified Level D PPE includes:
  - Chemical-resistant clothing (overalls; two-piece chemical-splash suit; disposable hooded chemical-resistant overalls).
  - Gloves, outer, chemical-resistant.
  - Gloves, inner, chemical-resistant.
  - Boots, chemical-resistant, safety toe or disposable chemical resistant boot-covers over safety boots
  - Supplement as needed based on the PPE Assessment.
- Supplemental PPE will be added, based on the Hazard Assessment (e.g., inclusion of hard hats, hearing protection, etc.)
- PPE shall be stored properly and inspected for tears, defects, discoloration, or worn areas before each use. Any equipment that no longer provides adequate protection shall be disposed of properly.

Poisonous Plants

- Avoid working in severely infested areas, if possible (know what to look for). Provide training on identifying the species of plants plants that could be present at the site.
- Discuss work and protective measures with field workers. If avoidance of poison ivy will not be possible, extremely sensitive individuals should avoid the work or take extreme precautions.
- If a potential exists for poisonous plants to be present in the work area, apply a barrier product (IvyX or similar) to hands, forearms, and other potentially exposed body parts, 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

Health and Safety Snippets (continued)

urushiol oil encountered. Disposable gauntlets may be worn as well over arms to keep oil from clothing.

- Have a spare set of clean clothing one can change into at the end of the day but take care not to directly contact with bare skin any contaminated surfaces, including taking off boots.
- Consider wearing a face shield if there is a potential for face to contact poison ivy / oak / sumac.
- Immediately after potential exposure to poisonous plants, wash the exposed area with water and soap or if not available, apply a ivy wash product designed to remove the urushiol oil such as Tecnu of IvyWash, or similar product directly to the hands, forearms, or other parts of the body that came in contact with the plants. Carry poison ivy cleansing wipes if water source not available. These products will help cleanse the urushiol oil from the skin before it can be absorbed.
- Wash clothing potentially contaminated with urushiol oil prior to wearing again. Wash the impacted clothing by itself in hot water and strong detergent. If possible, saturate the clothing with a removal product (e.g., Tecnu) in a bucket and allow to soak for a few minutes. Then launder.
- Handle contaminated clothing and field equipment with gloves as the oil can remain on environmental surfaces for up to 5 years.
- Decontaminate equipment by scrubbing all surfaces with a brush using soap and water. Rinse with cool water using a portable garden sprayer.

Poisonous Plants, Insects, and Wildlife Exposure

Safety snippet not yet available.
Coming soon...

Sanitation and Housekeeping

- Good housekeeping is important for maintaining a safe workplace. Every worker is responsible for maintaining a clean and sanitary workplace.
- Clear all stairs and work areas of tripping hazards (scrap, waste materials) on a regular basis. Travel ways and workspace must be kept clear of obstructions.
- Maintain all floors, decks and working surfaces in non-slippery condition by removing spills as soon as possible. Any non-slip material should be inspected on a regular basis for wear.
- Place trash in proper receptacles. Do not throw it on the floor or ground. Provide a waste receptacle that is in good condition and appropriate for the type of waste material.
- Oily waste, rags or other flammable material shall only be stored in the proper metal receptacles and should not be allowed to accumulate.
- Materials should not be stored where they block access to fixed ladders, stairways, emergency egress routes, electrical switch boxes, firefighting or other rescue equipment.
- Food or beverages should not be consumed in any area exposed to toxic materials or infectious agents.
- Keep hoses, power cords, etc. from laying in heavily travelled walkways or areas.
- Use proper storage for hazardous materials, fuels, compressed gas cylinders, flammable liquids etc.

Structural Integrity of Buildings, Roofs, Walking Surfaces

- Follow PPE requirements according to project HASP and client specific requirements. Consider head, eye, foot, hand and hearing protection, high visibility safety vest, and fall protection when required.
- Company personnel will use head protection (hard hats) in any facility areas where there is the potential for objects to fall on the employee from above. Pay attention to hard hat required areas.
- Company personnel will only walk in designated pedestrian areas and will pay close attention to any possible slip/trip and entanglement hazards.
- Avoid working at height during a facility inspection/audit/site visit.
- If working at height is absolutely necessary, including the use of ladders, contact your local HSE representative for training, competency, and other requirements.
- Each employee walking/working on a surface with an unprotected side or edge that is 4 feet or more (6 feet - construction) above the lower level shall be protected from falling by the use of guardrail systems, safety net systems, or personal fall protection systems such as personal fall arrest, travel restraint, or positioning systems.
- Work on low-sloped roofs (slope equal or less than a ratio of 4 to 12):
  - When work is performed <6 ft from the roof edge, employer must ensure each employee is protected from falling by a guardrail system, safety net system, travel restraint system, or personal fall arrest system.
  - When work is performed >6 ft but <15 ft from the roof edge, the employee may use a designated area when performing both infrequent and temporary work.
- When work is performed >15 ft from the roof edge, the employer is not required to provide any fall protection, provided the work is both infrequent and temporary and has an enforceable work rule prohibiting employees from going within 15 ft of the roof edge without using fall protection.
- Block off area at point of work and below with safety tape, free standing barricade, or other type of barrier.
  - Barricade elevated work area (tools, materials, equipment); with red "Danger" tape during elevated work; with yellow "Caution" tape during non-working times.

Health and Safety Snippets (continued)

    - Place a tag on barricade tape to identify point of contact if others need access to area.
    - If blocking/barricading elevated work area infeasible, provide monitor to keep area clear.
- Top edge of top railing or guardrail shall have a vertical height of approx. 42" plus or minus 3".
- Guardrail systems shall have strength to withstand at least 200 pounds along top edge.
- A stair railing shall be constructed similar to standing railing with a vertical height of not <36".
- All protruding reinforced steel, onto and into which employees could fall, shall be guarded.
- Safety nets, when installed as close as practicable under the waling/working surface on which employees are working, but no more than 30 feet below. Safety nets must be capable of absorbing and impact force equal to that produced by the drop test 1926.502(c)(4)

Sun, UV Light Exposure

Safety snippet not yet available.
Coming soon...

Toxic/Hazardous Chemicals (HAZCOM/WHMIS) Not Listed as Substantial

- Chemical hazards and toxic substances pose a wide range of health hazards (such as irritation, sensitization, and carcinogenicity) and physical hazards (such as flammability, corrosion, and explosibility).
- OSHA's HAZCOM standard and the Canadian WHMIS programs are designed to ensure that information about chemical and toxic substance hazards in the workplace and associated protective measures are disseminated to workers.
- Various types of Occupational Exposure Limits (OELs) have been established by a number of organizations. Wood policy is to limit workplace exposures to chemicals using the lower of the PELs, RELs and TLVs:
    - **OSHA Permissible Exposure Limits (PELs) -** OSHA sets enforceable permissible exposure limits (PELs) to protect workers against the health effects of exposure to hazardous substances, including limits on the airborne concentrations of hazardous chemicals in the air. Most OSHA PELs are 8-hour time-weighted averages (TWA), although there are also Ceiling and Peak limits, and many chemicals include a skin designation to warn against skin contact.
    - **California Division of Occupational Safety and Health (Cal/OSHA) PELs -** Cal/OSHA has established an extensive list of PELs that are enforced in workplaces under its jurisdiction.
    - **National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limits (RELs). -** NIOSH RELs are Federal agency recommendations established according to the legislative mandate for NIOSH to recommend standards to OSHA. RELs are recommended exposure limits for hazardous substances in the workplace to protect worker health. NIOSH transmits its recommendations to OSHA for use in developing legally enforceable standards.
    - **ACGIH®Threshold Limit Values (TLVs®) -** ACGIH® is a private, not-for-profit, nongovernmental corporation. It is not a standard setting body. ACGIH® is a scientific association that develops recommendations or guidelines to assist in the control of occupational health hazards. Threshold Limit Values (TLVs®) refer to airborne concentrations of chemical substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed, day after day, over a working lifetime, without adverse effects.
- OSHA has annotated the existing Z-Tables that presents side-by-side table with the Cal/OSHA PELs, the NIOSH Recommended Exposure Limits (RELs) and the ACGIH® TLVs®. See: https://www.osha.gov/annotated-pels
- Definitions:
    - **Action level** - An airborne level, typically one-half of the exposure limit (PEL, REL, TLV) calculated as an eight (8)-hour time-weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance.
    - **Ceiling Limit** - The exposure limit that a worker's exposure may never exceed.
    - **Short-Term Exposure Limit (STEL)** - The average exposure to a contaminant to which a worker may be exposed during a short time period (typically 15 – 30 minutes).
    - **Time-Weighted Average (TWA)** - The average exposure to a contaminant over a given period of time, typically 8-hours.
- It is OSHA's long-standing policy that engineering, and work practice controls must be the primary means to reduce employee exposure to toxic chemicals, where feasible.
- Respiratory protection is required to be used if engineering or work practice controls are infeasible or while engineering controls are being implemented.

Walking on Uneven Terrain

- Walking on uneven terrain can lead to injury
- Uneven terrain can include:
    - Walking surfaces with slopes, loose material, or obstructions
- Be mindful of where you place your feet before you step
- Maintain situational awareness when walking on uneven terrain
- No distractions while walking on uneven terrain including casual conversation

Health and Safety Snippets (continued)

- Do not use handheld devices while walking on uneven terrain
  - Stand still when checking phone, GPS unit or other handheld electronic device
- Walking on uneven terrain requires safety toed boots with ankle support
- Ensure boots are laced correctly and fully laced
- Never walk backwards
- Before stepping out of a vehicle, check the ground surface for uneven terrain, potholes, curbs, etc.

Work in Proximity to Construction Equipment

GENERAL REQUIREMENTS

- Always request a site-specific orientation and gain an understanding of areas where equipment operations are taking place. Locations can change frequently and possibly without warning.
- BE SEEN - always wear high visibility apparel, a garment meeting ANSI 107 Class 2 safety vest or equivalent should be the minimum requirement.
- It is always preferrable to use traffic controls or other types of work zone delineation to designate areas where construction equipment is operating.
- If possible, wait until construction equipment is out of the way or shut down. Never enter an active work zone where equipment is operating without permission.
- Make note of possible equipment travel paths and remain aware of all equipment movements.
- Ensure equipment operators are aware of your presence and location at all times. Avoid blind spots and NEVER approach any piece of equipment without first obtaining the expressed permission from the operator that it is safe to do so.
- Never assume the equipment operator sees you and never depend on horns or back-up alarms to warn you equipment is nearby.
- Do not work in close proximity to operating equipment where you could be struck by, run over, or caught between equipment and/or fixed objects.
- Be aware of any counterweights that may rotate without warning and stay clear of equipment swing radius.
- When equipment is backing up, stand clear and never cut across the travel path.

EQUIPMENT OPERATOR REQUIREMENTS

- Only authorized personnel are permitted to operate equipment with appropriate training and/or licenses.
- Operators should know and understand the limitations of the machinery. They should follow safe operating procedures, utilize safety features, and heed the manufacturer's warnings.
- Documented daily inspections shall be conducted in accordance with the manufacturer's recommendations. All safety devices shall be functional and in good working condition.

Review of AHAs and Point of Work Risk Assessments

Supervisors shall conduct a daily tailgate meeting, specifying the applicable AHAs and ensure that everyone involved in the work acknowledges the AHA or daily renewal forms applicable to their work.

The work area shall be inspected for any additional hazards prior to initiating work. Where additional hazards are present, the hazards and controls shall be identified prior to initiating the work and documented on the AHA and the Point of Work Risk Assessment (PoWRA) form.

If there is a change or deviation from the planned activity, you must stop the job and re-evaluate the risk assessment and the precautions taken. Any changes to the work described in the AHA shall require a review by a Qualified Person.

- PoWRA electronic version QR Code:
- PoWRA Form (printable): LINK
- PoWRA electronic version: LINK

PPE and Monitoring Instruments:

Revise table to include all tasks listed above. Revise list of PPE to include the specific types required for the project. Refer to the **PPE Selection Guide** and contact your HSE coordinator, Regional HSE Manager, or the US Director of HSE for help. You can delete rows or columns that don't apply.

Initial Level of PPE *

☑ Level D ☐ Modified Level D ☐ Level C * Cannot use Short Form HASP for Level B or A or Confined Space Entry work

Personal Protective Equipment	Utility Locating	Groundwater Sampling	Soil/Sub-Slab/Ambient/ Indoor Air Vapor Sampling	Soil Sampling w/ GeoProbe	Surface Water Sampling	Sediment Sampling	Well Installation/Destruction	Well Development	Land Surveying	General Site Work (inspections, maintenance,	Decontamination	Building/Structural Inspection				
Hard hat	A	A	A	X	A	A	X	A	A	X	A	X				
Safety glasses	X	X	X	X	X	X	X	X	X	X	X	X				
Safety Goggles	A	A	A	A	A	A	A	A	A	A	A	A				
Hearing protection (earmuffs, earplugs)	A	A	A	A	A	A	X	A	A	A	A	A				
Safety-toed boots	X	X	X	X	X	X	X	X	X	X	X	X				
Chemical resistant boots or boot covers	A	X	X	X	X	X	X	X	A	A	X	A				
High-visibility/ reflective vest	X	X	X	X	X	X	X	X	X	X	X	X				
Nitrile gloves – thicker (outer)	A	X	X	X	X	X	A	X	A	A	X	A				
Nitrile gloves - thin (inner)	A	X	X	X	X	X	X	A	A	A	A	A				

Personal Protective Equipment	Utility Locating	Groundwater Sampling	Soil/Sub-Slab/Ambient/ Indoor Air Vapor Sampling	Soil Sampling w/ GeoProbe	Surface Water Sampling	Sediment Sampling	Well Installation/Destruction	Well Development	Land Surveying	General Site Work (inspections, maintenance,	Decontamination	Building/Structural Inspection				
Vinyl gloves (inner)	A	A	A	A	A	A	A	A	A	A	A	A				
Other chemical resistant gloves: _____	A	A	A	A	A	A	A	A	A	A	A	A				
Work gloves (leather or cut resistant)	A	A	A	X	A	A	X	A	A	A	A	A				
Uncoated Tyvek coverall											A					
Polycoated Tyvek coverall											A					
Life Jackets / PFDs					X	X										
Waders or Hip Boots					A	A										
Half-face respirator with OV/HEPA cartridge																
Full-Face respirator with OV/HEPA cartridge																

X = required A = available

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 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.)

☑ PID: ☑ 10.0/10.6 eV Lamp ☐ 11.7 eV Lamp ☐ FID

☐ Hydrogen Sulfide meter ☐ Carbon Monoxide meter ☐ Other: ____________________

☐ LEL/O2 Meter ☐ Dräger Pump (or equivalent) List Tubes:

☐ Dust Meter: ☐ Respirable dust ☐ Total dust

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

Chemicals Brought to the Site:

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

Product Identifier: (Note: Name listed below must match name on label and SDS)	**SDS Attached?**
HYDROCHLORIC ACID (SAMPLE PRESERVATIVE)	☑
LIQUINOX (DECONTAMINANT)	☑
YSI CALIBRATION STANDARDS (PH, ORP, COND), TURBIDITY STANDARDS	☑
NITRIC ACID (SAMPLE PRESERVATIVE)	☑
SULFURIC ACID (SAMPLE PRESERVATIVE)	☑

Chemicals will be kept in their original containers. If transferred to another container, aside from day use by one individual, the new container will be clearly labeled with the name of the chemical (product identifier), signal word, hazard statement, pictogram(s), precautionary statement, and name, address and telephone number of the chemical manufacturer, importer or other responsible party.

Work Zones:

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

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

Decontamination Procedures and Equipment:

Note: See Decontamination AHA 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:

- [x] Verbal
- [ ] Two-way radio
- [x] 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:	585-786-2233 or 585-335-6001		
TriageNow (early case management)	1-877-311-0038		
Police Department:	911		
	Office	**Cell**	
Site Safety and Health Officer:	TBD	TBD	
Client Contact: Samantha Salotto	518-402-9813		
Project Manager: Katie Amann		518-612-0314	
*USA Director of HSE: Cindy Sundquist	207-650-7593 (Cell)	207-650-7593 (Cell) 207-892-4402 (Home)	
Corporate SVP of HSE: Vlad Ivensky	610-877-6144	484-919-5175 (Cell) 215-947-0393 (Home)	
EPA/DEP (if applicable):			
Other: Ambulance	911		

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

Emergency Equipment:

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

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

Emergency Procedures:

- The SSHO (or alternate) should be immediately notified via the on-site communication system. The HSO assumes control of the emergency response.
- The SSHO notifies the Project Manager and client contact of the emergency.
- If the emergency involves an injury to a WSP employee, the HSE Coordinator or Site Manager are to implement the WSP Early Injury Case Management program. See procedures and Flow Diagram below:
- If applicable, the SSHO 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 SSHO 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 but only if trained within the past year. Use the **PASS** method (**P**ull the pin, **A**im at the base of the fire, **S**queeze the trigger, use a **S**weeping motion to put out the fire) when extinguishing fires. Large fires should be handled by the local fire department.
- In an unknown situation or if responding to toxic gas emergencies, appropriate PPE (e.g., level C or B PPE - 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 AHA and SDS for spill containment and spill handling procedures.
- If chemicals are accidentally spilled or splashed into eyes or on skin, use eyewash bottle/station for the eyes and wash affected area. Site worker should shower as soon as possible after incident.
- If the emergency involves toxic gases, workers will back off and reassess. Prior to re-entering the work zone, the area must be determined to be safe, that the required PPE and air monitoring equipment is available. Entry is prohibited if PPE or air monitoring equipment is inadequate.
- An injured worker shall be decontaminated appropriately.
- Within 24 hours after any emergency response, the initial Incident Analysis Report shall be completed and submitted to the WSP E&I US Director of HSE. If the injury involves vehicles or overhead/underground utilities, also complete the Vehicle Incident Report (VIR) and Ground Disturbance Report (GDR), respectively. When the use of drugs or alcohol cannot be ruled out as a factor in the incident, contact P&O to determine if post-accident drug testing is required.

WSP E&I 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 <u>and</u> HSE Coordinator (all incidents with the apparent starting event should be reported within 1 hour of occurrence).
2. Injured employee:</td><td>1. Provide emergency first aid. Supervisor on duty must immediately call 911 or local emergency number; no employee may respond to outside queries without prior authorization. Any outside media calls concerning this incident must be referred immediately to Lauren Gallagher at 602-757-3211.
2. Once medical attention is sought and provided, the supervisor must:</td></tr>
<tr><td colspan="2">Call TriageNow 24/7 Hotline*
(877) 311-0038</td></tr>
<tr><td>TriageNow will assess the situation and determine whether the incident requires further medical attention. During this process, TriageNow 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.</td><td>TriageNow 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>
</table>

• Send an email notification to the Corporate HSE Department.	

3. IMMEDIATELY after contacting TriageNow, send a brief email notification and inform verbally (direct contact is required) one of the HSE corporate representatives. See Figure 15.1.
4. Make all other local notifications and client notifications.
5. Local Supervisor, HSE Coordinator, SHSO, and any applicable safety committees must complete the 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.

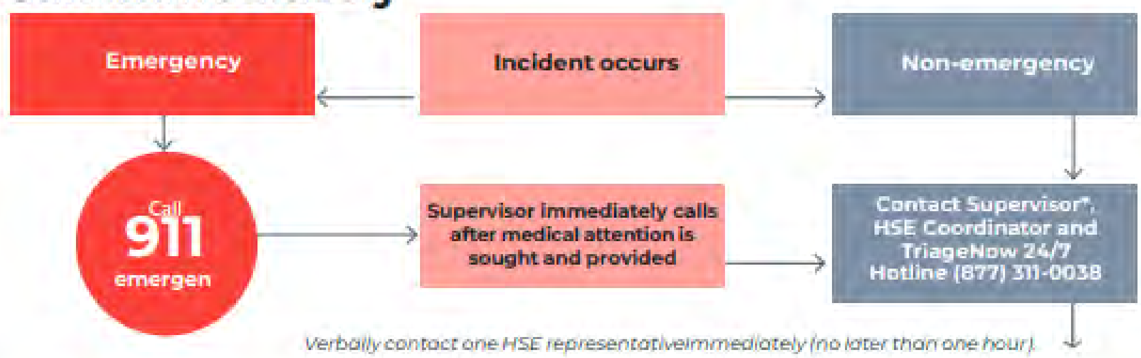
* **NOTE: Step 2 is applicable only to the North American operations and to incidents involving WSP E&I personnel. High-potential near misses, subcontractors' incidents, regulatory inspections, spills, and property damages above $1,000 should be reported immediately, following the directions in Step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

Site Specific Emergency Procedures are as follows:

INCIDENT FLOW CHART

Incident flow chart

Call immediately



Name/E-Mail	Region	Contact Information
	US	
Cindy Sundquist cynthia.sundquist@wsp.com	US	207.650.7593 (cell)
Tiana Rasmussen tiana.rasmussen@wsp.com	Mountain & Central Gulf Coast Regions, West US	480.432.6644 (cell)
Mike Larson michael.larson@wsp.com	Pacific Region, West US	719.502.7921 (cell)
Kirby Lastinger kirby.lastinger@wsp.com	Southeast Region, US East	863.272.4775 (cell)
Michele Barnhart michele.Barnhart@wsp.com	Central Region, US East	919.491.7710 (cell)
Jeff Tweeddale jeff.tweeddale@wsp.com	Northeast Region, US East	860.805.5883 (cell)
	Remediation	
Greg Ertel gregory.ertel@wsp.com	Rochester, NY	585.465.0557 (cell)
	E&I	
Karla St. John karla.stjohn@wsp.com	Minneapolis, MN	612.750.1341 (cell)
Vlad Ivensky vladimir.ivensky@wsp.com	Blue Bell, PA	267.736.0631 (cell)

High potential near misses, unsafe work refusals, workplace violence/harassment and security incidents, subcontractor incidents,regulatory inspections, spills, and property damage should be reported immediately to one of the above HSE Representatives. *Supervisor Responsible for Local/Client Notifications, completing Initial IAR within 24 hours / forwarding to Corporate HSSE and D&A Testing coordination as per client and E&I requirements.

Field Team Review:

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

Name: ______________________________ Date: ________________

Name: ______________________________ Date: ________________

Name: ______________________________ Date: ________________

Name: ______________________________ Date: ________________

Name: ______________________________ Date: ________________

Routes to Emergency Medical Facilities:

HOSPITAL (for immediate emergency treatment):

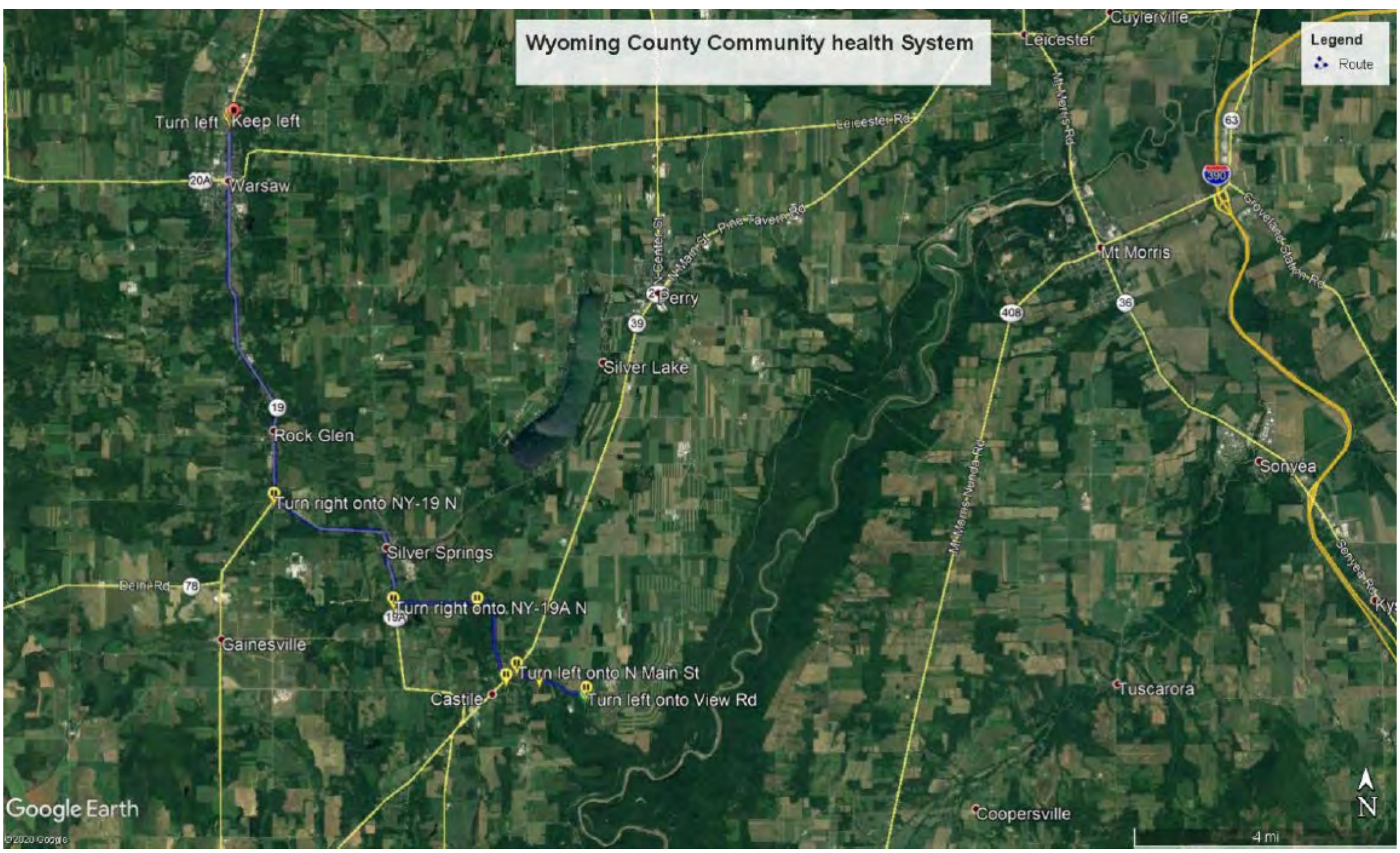
Facility Name: Wyoming County Community Health System

Address: 400 N Main Street, Warsaw NY, 14569

Telephone Number: (585) 786-2233

DIRECTIONS TO PRIMARY HOSPITAL (attach map):

- Turn left onto View Road (0.7 mi)
- Continue onto Buffalo Street (0.4 mi)
- Turn left onto N Main Street (0.2 mi)
- Turn right onto Park Road W (1.4 mi)
- Continue onto Barber Road (1.3 mi)
- Turn right onto NY-19A N (2.9 mi)
- Turn right onto NY-19 N (5.9 mi)
- Turn right (223 ft)
- Turn left (118 ft)
- Keep right (121 ft)



CLINIC (for non-emergency medical treatment)

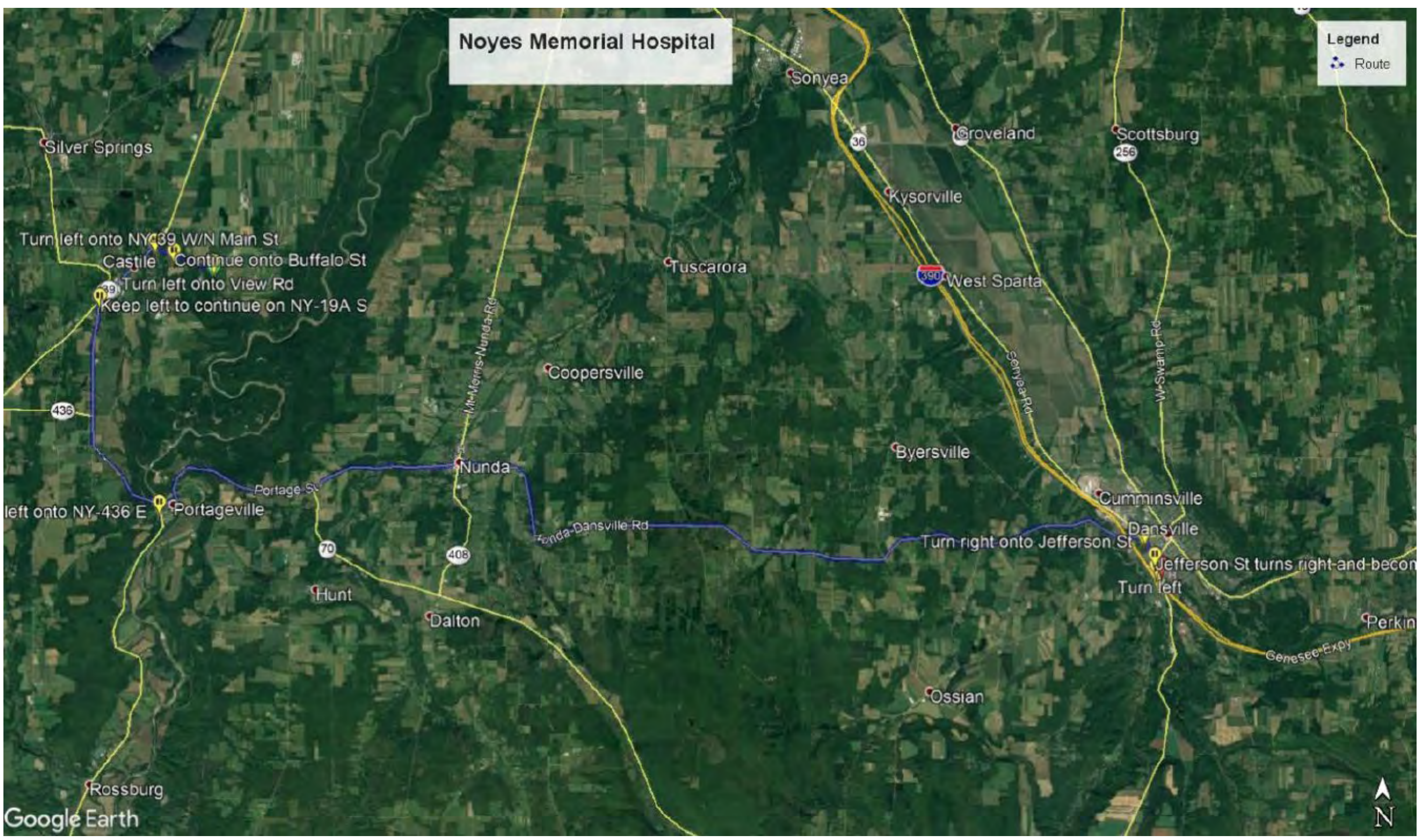
Facility Name: Noyes Memorial Hospital

Address: 111 Clara Barton Street, Dansville NY, 14437

Telephone Number: (585) 335-6001

DIRECTIONS TO CLINIC (attach map):

- Turn left onto View Road (0.7 mi)
- Continue onto Buffalo Street (0.4 mi)
- Turn left onto NY-39 W/N Main Street (1.4 mi)
- Keep left to continue on NY-19A S (4.2 mi)
- Turn left onto NY-436 E (19.7 mi)
- Continue onto Ossian Street (272 ft)
- Turn right onto Jefferson Street (0.4 mi)
- Jefferson Street turns right and becomes Clara Barton Street (0.2 mi)
- Turn left (0.1 mi)



Expectations For Health Safety and Wellbeing Management

The WSP HSW Safety Expectations includes elements that apply to the global operations, and E&I. The purpose of this document is to set out WSP's "Expectations for Health, Safety and Wellbeing Management". These Expectations are based on international best practices, including ISO 45001: Occupational Health and Safety Management System; and ISO 45003: "Occupational Health and Safety Management - Psychological Health and Safety at Work: Managing Psychological Risks – Guidelines".

WSP E&I HSE Management System Manual and California IIPP):

The WSP E&I Health, Safety and Environment (HSE) Management System Manual and California Injury and Illness Prevention Plan (IIPP) describes the HSE system and tools developed & implemented at WSP E&I. The manual addresses HSE requirements for offices, laboratories, and projects, including those of various duration, scale, location, and jurisdiction.

WSP E&I's Safety philosophy as it pertains to all work conducted whether in the office, laboratory or in the field is:

- All incidents and injuries can be prevented.
- Management and staff are responsible for preventing injuries and occupational illnesses.
- Occupational safety and health are part of every employee's total job performance.
- Working safely is a condition of employment.
- All workplace hazards can be safeguarded.
- Training employees to work safely is essential and is the responsibility of management / supervision.
- Prevention of personal injuries and incidents and protection of environment is good business.

These principles tie into the WSP - USA Health, Safety and Wellness (HSW) Policy Statement: LINK

WSP Zero Harm

Our Zero Harm Vision is a commitment shared by WSP and all employees to consider and effectively reduce or mitigate health, safety, and wellbeing risks from our activities.

Our goal is to ensure that our activities result in:

- Zero Fatalities
- Zero permanently disabling injuries
- Zero injuries to members of the public
- Zero long term harm to health

By Actively Caring for your personal safety, and for those around you, we can prevent accidents and injury. Caring together, we can attain Zero Harm.

HEART (Harm Elimination and Recognition Tracking)

HEART

HEART is the WSP E&I observation reporting system that all E&I employees are to use to report safety or environmental observations. To enter a HEART observation, use the following link: LINK

Tailgate Safety Meeting Form

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

PPE required for the tasks to be conducted: ____

____

____

Required Permits: ____

____

Site Access or other issues: ____

____

Safety Suggestions by Site Workers: ____

HEART Observation Reporting

Tailgate Safety Meeting Form

Action Taken on Previous Suggestions: ______

Injuries/Incidents/Personnel Changes since last meeting: ______

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

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

Additional Comments: ______

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

Name (Print)	Company	Signature

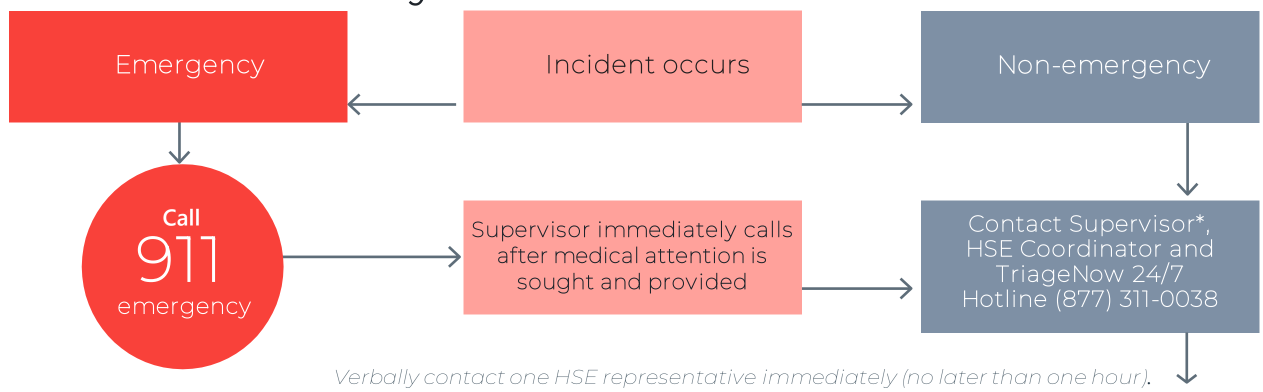
Meeting Conducted by: ______ Title: ______
Print

Signature: ______ Time: ______
Print

Incident Report Forms

Incident flow chart

Call immediately



Name/E-Mail	Region	Contact Information
	US	
Cindy Sundquist cynthia.sundquist@wsp.com	US	207.650.7593 (cell)
Tiana Rasmussen tiana.rasmussen@wsp.com	Mountain & Central Gulf Coast Regions, West US	480.432.6644 (cell)
Mike Larson michael.larson@wsp.com	Pacific Region, West US	719.502.7921 (cell)
Kirby Lastinger kirby.lastinger@wsp.com	Southeast Region, US East	863.272.4775 (cell)
Michele Barnhart michele.Barnhart@wsp.com	Central Region, US East	919.491.7710 (cell)
Jeff Tweeddale jeff.tweeddale@wsp.com	Northeast Region, US East	860.805.5883 (cell)
	Remediation	
Greg Ertel gregory.ertel@wsp.com	Rochester, NY	585.465.0557 (cell)
	E&I	
Karla St. John karla.stjohn@wsp.com	Minneapolis, MN	612.750.1341 (cell)
Vlad Ivensky vladimir.ivensky@wsp.com	Blue Bell, PA	267.736.0631 (cell)

High potential near misses, unsafe work refusals, workplace violence/harassment and security incidents, subcontractor incidents, regulatory inspections, spills, and property damage should be reported immediately to one of the above HSE Representatives. *Supervisor Responsible for Local/Client Notifications, completing Initial IAR within 24 hours / forwarding to Corporate HSSE and D&A Testing coordination as per client and E&I requirements.

Vehicle Safety Inspection Checklist

Date ______________
Vehicle ID ______________
Department / ORG ______________
Inspected By: ______________

- Scan QR code to complete on mobile device
- Print a QR code sticker to apply in the vehicle
- Completed inspections are tracked on SP List

ITEMS TO CHECK	OK	REMARKS
Oil/engine leaks (Look underneath vehicle for drips)		
Battery (look for signs of corrosion)		
Radiator (look at levels in overfill compartment)		
Parking (hand) brake (verify operational)		
Brakes (operational)		
Steering (working – turn steering wheel back and forth)		
Cabin equipment: Horn, Radio, AC, Heat		
Back up sensors/camera (working, lens/sensors clean, unobstructed)		
Tire condition/tire pressure, lugs present (tires wearing evenly, sufficient tread)		
Wiper blades/windshield/fluids (good condition, sufficient fluids)		
Mirrors (present, adjusted properly)		
Lights: Headlights, brake lights, signals, beacon, directional bar (if equipped)		
Housekeeping (inside/outside of vehicle, scratches, dents, undercarriage (debris, caked earth/vegetation)		
Tools/equipment adequately secured		
Safety Equipment: Fire Extinguisher, First aid kit, Spare tire and Jack.		
Instrument panel: Oil Pressure/Level, Battery Power, Fuel level		
Proof of insurance/registration		
Radiation safety packet (Troxler gauges), if applicable		
Hazard communication plans/SDS, if applicable		
Driver's Incident report kit		
Telematics unit properly connected, if applicable.		
On-board camera unobstructed, if applicable		
Odometer reading		
Operator Comments (if applicable)		

PROJECT SITE HSE INSPECTION FORM

DATE: ______________________ JOB NUMBER: ______________________

PROJECT LOCATION: ______________________

NAME OF PERSON CONDUCTING INSPECTION: ______________________

PROJECT MANAGER: ______________________

SUPERVISOR: ______________________

PRIME CONTRACTOR: ______________________

DESCRIPTION OF WSP E&I ROLE: ______________________

Please check (☒) the appropriate box next to the specific item.

“Y” **Indicates conformance.**
“N” **Indicates non-conformance and requires immediate correction.**
“NA” **Indicates that the item is not applicable at the project.**
“CA” **Corrective action – Initials of responsible person to complete.**

Planning and Documentation	Y	N	N/A	CA
SMARTool completed for the project? Hazard Classification (color): ______________	☐	☐	☐	
Site Specific Health and Safety Plan (HASP) completed for the project.	☐	☐	☐	
All 5 SMARTool Outputs are included in site specific Health and Safety Plan.	☐	☐	☐	
HASP and SMARTool address all current hazards and tasks.	☐	☐	☐	
HASP reviewed and approved by qualified individuals and appropriate subject matter experts? (See SMARTool HASP Approval Output document).	☐	☐	☐	
Site Health and Safety Officer, Site Manager and Project Manager meet qualifications and training as outlined in the SMARTool Role Qualifications Output Document.	☐	☐	☐	
Site Specific Activity Hazard Analysis (AHA) completed and signed.	☐	☐	☐	
Does AHA include all hazards identified in the SMARTool?	☐	☐	☐	
Is AHA renewed and signed off, daily, by all workers?	☐	☐	☐	
Project Safety Readiness Review Checklist completed by WSP and Subcontractors?	☐	☐	☐	
Competent Person identified, when required?	☐	☐	☐	
Point of Work Risk Assessments (PoWRA) conducted	☐	☐	☐	
Proof of HAZCOM/WHMIS training provided by all workers – check all workers.	☐	☐	☐	
SDS sheets available for all products on-site and current to last three years.	☐	☐	☐	
Are chemicals properly stored/identified as per WHIMIS/HAZCOM?	☐	☐	☐	
Do workers have Hazardous Materials / Transportation of Dangerous Goods (TDG) training and valid certification?	☐	☐	☐	
Tailgate/Toolbox safety meetings held, documented, and signed by all workers.	☐	☐	☐	
Kick-off meeting held, documented, and signed by all workers.	☐	☐	☐	
Weekly safety meeting held, documented, and signed (for projects exceeding 5 days)	☐	☐	☐	
Workers have all project required safety training (i.e., Hazardous Waste site, fall protection, excavation safety, etc.).	☐	☐	☐	
Appropriately sized First-aid kit with standard first aid manual on-site and inspected.	☐	☐	☐	
Is location of first aid kit clearly identified and location known by workers – check.	☐	☐	☐	
Qualified first aid person on project – check for valid certification.	☐	☐	☐	
Incident Reporting Procedure posted	☐	☐	☐	
Eye wash station on-site with current inspection tag or within expiry date.	☐	☐	☐	

PROJECT SITE HSE INSPECTION FORM

Planning and Documentation	Y	N	N/A	CA
Copy of Occupational Health and Safety Act and Regulations available on-site.	☐	☐	☐	
Copy of WSP E&I Field Safety Handbook on-site.	☐	☐	☐	
Copy of WSP Corporate HSQ policy on-site and current.	☐	☐	☐	
Emergency Response Plan and telephone numbers posted.	☐	☐	☐	
Do workers know emergency procedures for site – check one worker.	☐	☐	☐	
Have there been any near miss/incidents? Have they been documented and reported?	☐	☐	☐	
Communication system in place.	☐	☐	☐	
Workers know where safety documentation is located – check one worker.	☐	☐	☐	
Supervisor has Alcohol & Drug testing information on-site and understand requirements?	☐	☐	☐	
Are copies of previous inspection reports on-site?	☐	☐	☐	
Have deficiencies on previous inspections been addressed?	☐	☐	☐	
Signs posted where necessary	☐	☐	☐	
WSP Life Saving Actions posted.	☐	☐	☐	
WSP HSQ Policy posted?	☐	☐	☐	

General Safety	Y	N	N/A	CA
Slip, Trip & Fall hazards identified and cleared.	☐	☐	☐	
Overhead hazards identified.	☐	☐	☐	
Are pressurized systems, lines and containers identified?	☐	☐	☐	
Safety Zones established (Exclusion, Contamination Reduction, Support).	☐	☐	☐	
Decontamination procedure/area established.	☐	☐	☐	
Appropriate decontamination fluids (e.g., detergent and water) available at the site?	☐	☐	☐	
Confined space procedures followed.	☐	☐	☐	
Adequate ventilation in work areas.	☐	☐	☐	
Air monitoring equipment, as outlined in HASP, present, calibrated, appropriate for site contaminants?	☐	☐	☐	
Adequate lighting provided and maintained in work areas.	☐	☐	☐	
Sharp objects properly disposed of or protected.	☐	☐	☐	
Proper storage of tools and materials.	☐	☐	☐	
Accumulation of contaminated debris within acceptable levels.	☐	☐	☐	
Adequate trash containers provided.	☐	☐	☐	
Adequate number of toilets and washing facilities.	☐	☐	☐	
Controls to minimize heat and cold stress available at the site.	☐	☐	☐	
Eating, drinking, smoking, etc. done only in areas free from toxic materials?	☐	☐	☐	
Two people used to lift equipment or materials weighting more than 50 lbs.?	☐	☐	☐	

Personal Protective Equipment	Y	N	N/A	CA
Hardhats worn by workers.	☐	☐	☐	
Appropriate gloves being worn by workers.	☐	☐	☐	
Protective eyewear (and secondary face protection, if applicable) worn as required.	☐	☐	☐	
Appropriate respiratory protection used when required.	☐	☐	☐	
Proper work boots worn by all workers.	☐	☐	☐	
Appropriate hearing protection used when required.	☐	☐	☐	
Appropriate high visibility garments worn when required.	☐	☐	☐	
Proper protective clothing used when required – appropriate for task and weather.	☐	☐	☐	
Personal Flotation Devices (PFD) utilized when required.	☐	☐	☐	

PROJECT SITE HSE INSPECTION FORM

Fire Protection and Prevention	Y	N	N/A	CA
Fire suppression equipment available and inspected.	☐	☐	☐	
Test that supervisor knows proper procedure for inspecting fire extinguisher.	☐	☐	☐	
Have workers received recent instruction on fire extinguisher use.	☐	☐	☐	
Flammable and combustible materials stored properly.	☐	☐	☐	
Flammable liquid stored in approved containers.	☐	☐	☐	
Flammable containers properly labeled.	☐	☐	☐	
Are hot work permits available and procedures being followed?	☐	☐	☐	

Tools: Hand and Power	Y	N	N/A	CA
Proper tool used for job.	☐	☐	☐	
Hand tools in good condition and free of visible defects.	☐	☐	☐	
Guards in place.	☐	☐	☐	
Tool handles not broken.	☐	☐	☐	
Electric tools double insulated or properly grounded.	☐	☐	☐	
Power cords on electric tools in safe working condition.	☐	☐	☐	
Powder actuated tools: operators certified.	☐	☐	☐	
All belts, chains, sprockets, and pulleys properly guarded.	☐	☐	☐	
Air lines and tools inspected and in good condition.	☐	☐	☐	
Safety lanyards being used at airline connection points.	☐	☐	☐	
Power finishing machines equipped with dead man's switch.	☐	☐	☐	

Electrical	Y	N	N/A	CA
Are lock out/tag procedures followed?	☐	☐	☐	
GFIC or assured grounding in use.	☐	☐	☐	
Extension cords are three wire / construction grade.	☐	☐	☐	
Extension cords free of visible defects.	☐	☐	☐	
Extension cords not running through water.	☐	☐	☐	
Extension cords strung to avoid damage.	☐	☐	☐	
Temporary lighting properly guarded.	☐	☐	☐	
Temporary lighting properly suspended.	☐	☐	☐	
All live circuits and panels clearly posted.	☐	☐	☐	
Live panels secured to prevent unauthorized access.	☐	☐	☐	
Only qualified persons working on electrical circuits and panels.	☐	☐	☐	

Fall Protection	Y	N	N/A	CA
Workers utilizing fall protection trained and proof of certification - work above 6ft	☐	☐	☐	
Excavations properly guarded to prevent fall.	☐	☐	☐	
Rescue Plans and Equipment available.	☐	☐	☐	
Harnesses are properly worn and inspected by worker.	☐	☐	☐	
Lanyard of proper length to limit fall to less than six feet.	☐	☐	☐	
Lanyards secured to proper anchorage.	☐	☐	☐	
Lifelines secured to proper independent anchorage.	☐	☐	☐	
Controlled access zone warning lines in place.	☐	☐	☐	

Heavy Equipment (Backhoe,Excavator, Drill Rig, Loader etc.)	Y	N	N/A	CA
Permits, inspections, and licenses in order and valid	☐	☐	☐	
Valid driver's license for vehicle type.	☐	☐	☐	
Daily inspection of equipment performed i.e., kill switches operational.	☐	☐	☐	
Backup alarm operational.	☐	☐	☐	

Heavy Equipment (Backhoe,Excavator, Drill Rig, Loader etc.)	Y	N	N/A	CA
Qualified signal person provided.	☐	☐	☐	
Is hoisting equipment inspected and in good condition?	☐	☐	☐	
Clearance to power lines is adequate (20ft/6m minimum unless voltage known).	☐	☐	☐	
Backhoe outriggers fully extended and supported during operation.	☐	☐	☐	
Seatbelts worn where Roll Over Protective Systems (ROPS) provided	☐	☐	☐	
Boom down prior to drill rig movement.	☐	☐	☐	
Personnel properly positioned and wearing high visibility garments.	☐	☐	☐	

Ladders	Y	N	N/A	CA
Ladders are free of visible defects.	☐	☐	☐	
Ladders proper height for work.	☐	☐	☐	
Workers do not overextend reach of ladders.	☐	☐	☐	
Ladders erected on solid level surface.	☐	☐	☐	
Nonconductive ladder is used when necessary.	☐	☐	☐	
A-frame ladders used in open position.	☐	☐	☐	
Workers do not use top two steps of A-frame ladders.	☐	☐	☐	
Workers do not climb back of A-frame ladders.	☐	☐	☐	
Straight ladders secured.	☐	☐	☐	
Straight ladders extend 36 inches above landing.	☐	☐	☐	
Straight ladders pitched at 1 to 4 ratios.	☐	☐	☐	
No skid feet provided on straight ladders.	☐	☐	☐	

Public Liability	Y	N	N/A	CA
Delineation provided where necessary to isolate work area i.e.) fencing, cones etc.	☐	☐	☐	
Warning signs/caution tape posted where necessary.	☐	☐	☐	
Road work permits obtained and copies on-site.	☐	☐	☐	
Traffic signage of correct type for road work.	☐	☐	☐	
Traffic Management Plan developed for road work as required.	☐	☐	☐	
Flag persons used to direct pedestrian and vehicle traffic if needed.	☐	☐	☐	
Flag persons have written instructions.	☐	☐	☐	
Plans to Notify and Respond to Spills	☐	☐	☐	

Life Safety	Y	N	N/A	CA
Emergency response plan developed and known by all workers – check with one	☐	☐	☐	
Paths of emergency egress kept clear.	☐	☐	☐	

Excavation	Y	N	N/A	CA
Is Ground Disturbance authorization and copies of locates on-site and current?	☐	☐	☐	
If people are entering excavation, has it been inspected by a professional engineer?	☐	☐	☐	
Are walls of excavation sloped as required?	☐	☐	☐	
Has supervisor filled out excavation/trench entry checklist?	☐	☐	☐	
Sheeting, shoring, and bracing in place (excavation greater than 4’).	☐	☐	☐	
Sloping and bracing where necessary (excavation greater than 4’).	☐	☐	☐	
Ingress and egress provided (excavation greater than 4’).	☐	☐	☐	
Are open areas marked and secure if left unattended?	☐	☐	☐	
Spoils 1.0 m / 2 ft from excavation edge (excavation greater than 4’).	☐	☐	☐	

NOTE: Deficiencies and non-conformance issues identified during this inspection are to be corrected immediately, and if necessary, work is to be stopped until corrective actions have been taken.

Send copies of this report to: Project Manager, Office Manager, HSE Coordinator, Safety Committee

COMMENTS:

SIGN OFFs:

Inspection performed by: ______________________________

WSP E&I Site Supervisor: ______________________________

Project Manager: ______________________________

Findings	Corrected by	Corrected on
1.		
2.		
3.		
4.		
5.		
6.		

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

INCIDENT ANALYSIS REPORT (IAR)

WSP E&I

Confidential - Privileged

Incident Severity
Actual / Potential

Letter: Select One / Select One
Number: Select One / Select One
Investigation Level: Select One
Severity Matrix (LINK)
LSR Breach (LINK)
Dropped Object (LINK)

Complete Sections 1, 2, 3 and 4 for Initial Report within 24 hours.
Follow **Incident Reporting** process. Obtain **Witness Statements**. Contact **WorkCare** (888) 449-7787
Refer to **Incident Reporting Guidance** and **Client Reporting Guidance** for more information.

Section 1 – General Information

Incident Date: _____ Day of the week: _____ Time of incident: _____ ☐ am | ☐ pm

Incident Assigned to: Select One Reported by WSP personnel? ☐ Yes ☐ No

Injured / Involved Employee Name: _____ Is individual: ☐ WSP employee ☐ Subcontractor: _____ ☐ Other (Explain): _____

Age Profile: Select One Occupation: Select One Length of time in role (or date of hire): _____ Days Since Last Day Off: _____

Employee Info: Group: Select One Home office: _____ State / Province: _____ Business Line: Select One Dept. Number: _____

Employee Line Supervisor: _____ Project Manager: _____ Field Supervisor: _____

HSSE Manager: _____ HSSE Advisor: _____ HSSE Coordinator: _____

Project Name: _____ Project Number: _____ Client: _____

Location: Select One Is this a Company controlled work site: ☐ Yes ☐ No Location description: _____

Short Description (who (without names), what, where, and clarify compliance with basic controls, if known. Indicate if no injuries. 150 characters.):

_____

Immediate Action Taken _____

First Alert? (HiPo, LSR breach, Recordable (medical/restricted/lost time) injuries): ☐ Yes ☐ No Email template (link)

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

☐ **Near Miss** — **If near miss, select type.** If an observation of unsafe act / condition, complete **HEART**

☐ **Injury / Illness Incident** — If Injury / illness Select One ☐ Hospitalization ☐ Serious / Critical Injury?

☐ **Asset Damage** — If Damage: Select One ☐ 3rd Party? If underground utility, complete **GDR**

☐ **Vehicle** — If Vehicle: Select One ☐ 3rd Party? If vehicle, complete **VIR**

☐ **Environmental** — ☐ Agency Reportable

☐ **Agency Inspection** — ☐ Notice of Violation

☐ **Security** ☐ Other (describe): ___

Outcome/Result: Select One If "other", specify: ___ Source of Hazard: Select One If "other", specify: ___

Work Activity (select one of): Select One or Select One or Select One Immediate Cause: Select One

A. If **injury / illness**: If sprain /strain, complete **MSD Injury Form.**

Employee Gender: ☐ Male ☐ Female

Indicate the part of the body: Select One If "other", specify: ___ Body part location: Select One If "other", specify: ___

Injury Type: Select One If "other" specify: ___ Illness Type: Select One If "other", specify: ___

First Aid treatment provided? ☐ Yes - If yes, describe (i.e., bandage, cold/heat, etc.):

Bleeding? ☐ Yes – If yes Select One If 'First Aider', provide name: ___

Did 'First Aider' have contact with blood / infectious material? Select One

If Yes, indicate Exposure Control Precautions taken by First Aider (Check all that apply):

☐ None (If none, contact WorkCare) ☐ Gloves ☐ Previous HBV Immunization
☐ Immediate Personal Hygiene ☐ One-way CPR valve ☐ Recommended for HBV Immunization

☐ Eye protection ☐ Face mask ☐ Other (describe): ____

Blood contaminated work area / surface? ☐ Yes – If yes, describe cleanup/disposal:

Medical treatment provided? (i.e., above First Aid, prescriptions, referrals, etc.). ☐ Yes – If yes, describe:

Physical limitations received from physician? ☐ Yes – If yes, describe:

B. If **asset 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. What specific job/task or action was the employee(s) doing just prior to the incident: _____

D. Was a tool or equipment involved? ☐ Yes ☐ No What was it: _____ Last Inspection Date: _____ Defects: _____

E. Explain in **detail** what happened (Expand on Short Description without names, use Injured Person (IP)): _____

F. Explain in **detail** what object or substance directly harmed the employee: _____

G. What were the weather conditions at time of incident? _____

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

I. 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, Operations, HSSE, 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 (**Witness statements**, HASP acknowledgement forms, kickoff/daily/weekly meetings, inspections, photographs) Complete a **Physical Evidence Log**, as required: ____

Section 5 - Incident Investigation Results and Corrective Actions

A. Causal Factors: Supervisor/PM select the Immediate Cause/s and describe the Critical Factor/s that preceded the event.

B. Root Causes: Supervisor/PM selects the Root Cause/s and describe the factors that if fixed should prevent reoccurrence.

C. Life Saving Rules, Safety Essentials: Supervisor/PM selects any breaches.

D. Just and Fair Culture Process: Assess the contributing factors to recommend actions where behaviour falls below expectations.

Refer to A-Z Incident Causes and Glossary of A-Z Causes. (Why Analysis, Root Cause Analysis Guidance)

Causal Factors (Acts or Omissions / Conditions)

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

Root Cause(s) Analysis - The below items represent 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 HSSE Manager / Incident Review Panel.

	ROOT CAUSE	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 (LSR) **Select all applicable breaches of rules or** ☐ None		**Safety Essentials** **Select all applicable breaches of behavioral expectations or** ☐ None	
☐ Confined Space ☐ Driving ☐ Energy Isolations ☐ Hot Work ☐ Line of Fire	☐ Safe Mechanical Lifting ☐ Work Authorization ☐ Working At Height ☐ Bypassing Safety Controls Specify: _____	☐ Always Take Care ☐ Follow the Rules ☐ Do a Risk Assessment	☐ You Must Intervene ☐ Manage Any Change ☐ Wear the Correct PPE

Just and Fair Culture Was a LSR breached or behavior a Causal Factor? ☐ Yes ☐ No If No, this section is not required.

Has the Just and Fair culture approach (**HSE-PRO-100500**) been applied? ☐ Yes

i. If Yes, complete Just and Fair Culture Analysis Form (**HSE-FOR-101025**).

ii. If Yes, specify the recommended action/s: ☐ Disciplinary Action ☐ Management Action ☐ Training / Coaching

Corrective Actions – Identify corrective and preventative actions and recommendations to prevent a re-occurrence. Prepare Alerts (**HSE-FOR-100628**) and Lessons learned (**HSE-FOR-100627**), as required. Prepare **Incident Review Summary** for internal review of recordable injuries.

Root Cause # / Type	**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**
_____ Select One	_____	_____	_____	_____	_____
_____ Select One	_____	_____	_____	_____	_____
_____ Select One	_____	_____	_____	_____	_____
_____ Select One	_____	_____	_____	_____	_____
_____ Select One	_____	_____	_____	_____	_____

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 ☐ **HSSE Manager Notified** ☐

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

Incident Report prepared by: ___

Employee (s): ___	Date: ___	HSSE Coordinator / Advisor: ___	Date: ___
Supervisor: ___	Date: ___	HSSE Manager: ___	Date: ___
Operations Manager: ___	Date: ___	HSSE Director (if applicable): ___	Date: ___

VEHICLE INCIDENT REPORT (VIR)

WSP 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 will allow Insurers/Group Insurance 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 on 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 involving company fleet vehicles within the **United States**, please indicate on the IAR form that you have contacted our Fleet Management Vendor, Donlen, at:

Donlen Hotline: 1-800-377-3192
Select Prompt “3” for accident management
24 hours a day, 7 days a week

6. For automobile collisions involving company fleet vehicles within **Canada**, please indicate on the IAR form that you have contacted our Fleet Management Vendor, Donlen, at:

Donlen Hotline: 1-877-336-6536
Select preferred language and then select prompt “2” for accident management
24 hours a day, 7 days a week

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

- Entity Name, Address & Location/Site Code – advise that you are a WSP company, E&I
- Contact details of the person reporting the incident
- WSP vehicle details -i.e. license plate/serial number/make and model
- Injury details (if applicable)
- Driver & passenger details
- Date, location and circumstances of the accident
- Damage to your vehicle/Location of the vehicle/whether the vehicle is mobile or immobile
- Witness details
- The number of the Police Officer (if applicable) who is dealing with the incident and the name of his Police Station
- Details of the third party (if applicable) including
    a. Name, address and telephone number
    b. Vehicle details, License number, make and model
    c. Insurance company, policy number, address and telephone number.
    d. Name, address and telephone number of any passengers.
    e. Details of injuries/Hospital to which they have been taken. information (i.e., name, phone number, address, vehicle information, insurance information)

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 HSE Manager. For additional instructions on what to do, go to E&I HSE website **here**.

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

Vehicle Incident Diagram

Vehicle Crash Diagram

This or a similar diagram must be completed with all VIRs

Instructions:

1. Number each vehicle and show directions 1 2
2. Use a solid line to show path before incident and use a dotted line to show path after incient
   1 (before) 1 (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)
WSP 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: ____

AHA - Mobilization/Demobilization and Site Preparation

Activity/Work Task:	Mobilization/Demobilization and Site Preparation			Overall Risk Assessment Code (RAC) (Use highest code)					M
Project Location:	Castile, NY			**Risk Assessment Code (RAC) Matrix**					
Contract Number:	D009809-14			**Severity**	**Probability**				
Date Prepared:	11/3/20	**Date Accepted:**	11/5/20		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title):	Bradley LaForest, Project Manager			Catastrophic	E	E	H	H	M
				Critical	E	H	H	M	L
Reviewed by (Name/Title):	Katie Amann, Assistant Project Manager			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 mobilization and demobilization to/from the general site area and specific sampling locations

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

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 ▪ Complete site-specific/client-required training, if applicable ▪ Ensure all workers are fit for duty (alert, well rested, and mentally and physically fit to perform work assignment) ▪ Check weather forecast. Pack appropriate clothing and other items (e.g., sunscreen) for anticipated weather conditions. ▪ Familiarize yourself with route to the site	L

AHA - Mobilization/Demobilization and Site Preparation

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	M
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
	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.	M
	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.	L

AHA - Mobilization/Demobilization and Site Preparation

Job Steps	Hazards	Controls	RAC
	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.	M
5. Mobilization/ Demobilization of Equipment and Supplies	5a) Struck by Heavy Equipment/Vehicles	Struck by heavy equipment: ▪ Be aware of heavy equipment operations. ▪ Keep out of the swing radius of heavy equipment. ▪ Ground personnel in the vicinity of heavy equipment operations will be within the view of the operator at all times ▪ Employees shall wear a high visibility vest or T-shirt (reflective vest required if working at night). ▪ Ground personnel will be aware of the counterweight swing and maintain an adequate buffer zone. ▪ Ground personnel will not stand directly behind heavy equipment when it is in operation.	M
	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.	M
	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

AHA - Mobilization/Demobilization and Site Preparation

Job Steps	Hazards	Controls	RAC
	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.	**M**
	5f) Vehicle accident	Vehicle accident: ▪ Employees should follow Wood vehicle operation policy and be aware of all stationary and mobile vehicles.	**M**
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.	**M**
7. 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 (Safety glasses, gloves, steel toe work boots, high visibility safety vest)	**Competent / Qualified Personnel:** All Wood project field staff **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 - Vehicle Travel – Journey Management Plan

Activity/Work Task:	Vehicle Travel – Journey Management Plan		
Project Location:	Castile, NY		
Contract Number:	D009809-14		
Date Prepared:	11/3/20	**Date Accepted:**	12/9/22
Prepared by (Name/Title):	Bradley LaForest/Project Manager		
Reviewed by (Name/Title):	Katie Amann/Project Manager		

Overall Risk Assessment Code (RAC-Residual) Use highest code:	H

Risk Assessment Code (RAC) Matrix

Severity \ **Probability**	Almost certain	Likely	Possible	Unlikely	Rare
Catastrophic	**E**	**E**	**E**	**H**	**M**
Major	**E**	**H**	**H**	**M**	**L**
Serious	**H**	**H**	**M**	**L**	**VL**
Minor	**M**	**M**	**L**	**L**	**VL**
Negligible	**L**	**VL**	**VL**	**VL**	**VL**

Step 1: Review each **"Hazard"** to identify Probability and Severity (Refer to Risk Register)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Almost certain, Likely, Possible, Unlikely, Rare.	**E = Extremely High Risk**
"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Major, Serious, Minor or Negligible	**H = High Risk**
Step 2: Identify the RAC-Inherent as E, H, M, L or VL for each "Hazard" on AHA, **before controls are applied.**	**M = Moderate Risk**
Step 3: Identify the RAC-Residual as E, H, M, L or VL for each "Hazard" on AHA, **after controls are applied.**	**L = Low Risk**
Step 4: Annotate the overall highest RAC-Residual at the top of AHA.	**VL = Very Low Risk**

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

This AHA involves the following:

- Establishing site specific measures for driving a car or truck to or from the site.

This AHA is not an exhaustive summary of all hazards associated with the Site. Refer to the project HASP or client information for additional requirements, and emergency procedures.

Workers to follow general site safety controls for Hazard Signage/PPE, Housekeeping, Slips Trips and Falls, Biological hazards, Mobile equipment, Confined spaces, Fall hazards, Electrical, and any active operating equipment or construction activities.

MANAGEMENT OF CHANGE: If there is a change or deviation from the planned activity, you must stop the job and re-evaluate the risk assessment and the precautions taken. Any changes to work described in this AHA shall require review by a Qualified Person.

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
Safe Vehicle	**Competent / Qualified Personnel:** The vehicle driver is responsible for safe driving and completion of a journey management plan. **Training requirements:** Current Driver's license	Daily inspection of equipment per manufacturer's instructions.

AHA - Vehicle Travel – Journey Management Plan

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
1. Prepare for travel	Distractions - loss of focus	VL	▪ 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). ▪ Determine if trip is considered Non-Routine: o Driving on business makes up <50% of the driver's daily job; o The route is variable and not part of the driver's daily or weekly drive plan; o Trips during darkness in excess of 20 miles (32 km); o Environmental or visibility hazards require a reduction in vehicle operating speed; o The terrain could reasonably be anticipated to impact the shifting of loads and/or require the use of 4-wheel drive; and o Security concerns warrant higher level of caution. ▪ If non-routine, complete a Journey Management Plan ▪ Plan route. Adjust based on driving conditions. Consider: o Communications o Other WSP E&IS vehicles on same route ("convoy") o Emergency plans o Meeting point(s) o Fuel / food / rest points o Review rules and procedures (driving, remote work, lone worker) o Other ▪ If renting vehicle, select best vehicle type for road and travel conditions (e.g., AWD or 4WD if snow/ice, larger vehicle if wildlife encounters are a possibility, etc. ▪ Evaluate weather conditions prior to starting trip. Postpone trip if possible, If travel during bad weather required, adjust route to avoid backroads as much as possible. ▪ Ensure that a copy of the current insurance certificates and incident reporting procedures/forms are available during travel. ▪ If long trip, notify others of your estimated arrival time so they can follow up if you don't arrive on time.	VL

	Driver Fatigue	H	▪ Get pleanty of rest prior to starting trip. ▪ Consider WSP policy on driving and work (duty) hours limitations when planning trip: o Maximum driving time between breaks – 4.5 hours followed by 30 minute break o Maximum duty hours within a rolling 24-hour period – 14 duty hours o Maximum driving hours within a single rolling 24-hour period – 10 hours total, excluding communting time (11 hours including commuting time) o Off duty period in a rolling 7-day period - Minimum of a continuous 24 hour break ▪ Comply with the Jurisdictional P&O Work-Week Schedule Procedures and do not exceed the legislated maximum hours of work, rest periods, and/or Agency Approvals for excess hours of work for the specific activity/project. ▪ Comply with the E&IS HSE Fatigue Management Procedures (CAN: HSE-PRO-100387, US Fatigue Management Procedure HSE-PRO-100xxx). ▪ Consider alternatives (e.g., other modes of transportation such as by air, staying over at site location an extra day, breaking up trip by staying at hotel at halfway point, etc.). ▪ Avoid driving after dark.	M
	Vehicle defects	L	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
	Insufficient emergency equipment, unsecured loads	M	▪ Ensure vehicle has first aid kit and that all contents 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. ▪ Valuables shall be removed from the vehicle overnight if possible. ▪ Ensure parking cones are present, if applicable.	L

2. Operating vehicles	Collisions, unsafe driving conditions	H	▪ Drive defensively! ▪ Each operator shall observe all traffic laws, including established speed limits. ▪ Do not use cruise control during inclement (wet/icy) road conditions. ▪ Do not eat or use tobacco products (e.g. smoking or e-cigarettes) in the vehicle. ▪ Avoid any distracting or potentially distracting activities while operating a vehicle, including but not limited to: the use of any device that requires the use of headphones; reaching for items under the seat, in the back seat or in the glove box. ▪ Pets are prohibited to ride in a company vehicle. ▪ Non-E&IS employees are prohibited from operating Company vehicles. ▪ Non-E&IS employees are prohibited from riding in E&IS vehicles unless their presence is required for the conduct of business for E&IS or its client; nonwork riders (e.g., hitch hikers, girl friend, mother-in-law) allowed in vehicles, unless authorized on a case-by-case basis. ▪ Seat belts must be used at all times by all occupants when the vehicle is in gear. ▪ 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. ▪ Cellular telephones are prohibited from use by the operator while driving or even when stopped at stop lights, including texting, emailing, and including the use of BlueTooth devices or car microphone/speakers. ▪ Mount global positioning satellite (GPS) navigating devices within the vehicle as to not obstruct the driver's view of the roadway and attached so that it will not injure any of the vehicle's occupants in the event of a sudden stop. Window mounting of navigation devices is prohibited. ▪ The use of GPS-enabled smartphones is allowed as long as the device is mounted, directions setup prior to driving, has an audio feature, is not adjusted while driving. ▪ 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.	M
	Intersections	H	▪ 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.	M

AHA - Vehicle Travel – Journey Management Plan

	Dusty, winding, narrow roads	H	▪ Go slow around corners, occasionally clearing the windshield.	M
	Rocky or one-lane roads	H	▪ 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
	Stormy weather	H	▪ Inquire about conditions before leaving the office. ▪ Be aware of oncoming storms.	M
	When angry or irritated	H	▪ Attitude adjustment; change the subject or work out the problem before driving the vehicle. Let someone else drive.	M
	Turning around on narrow roads	H	▪ Safely turn out with as much room as possible. ▪ Know what is ahead and behind the vehicle. ▪ Use a spotter if available.	M
	Sick or medicated	H	▪ Let others on the crew know you do not feel well. ▪ Let someone else drive.	L
	On wet or slick roads	H	▪ Drive slow and safe.	M
	Animals on road	H	▪ Drive slowly, watch for other animals nearby. ▪ Be alert for animals darting out of wooded areas	H
	Vehicle accident	H	▪ Employees should follow WSP E&IS vehicle operation policy and be aware of all stationary and mobile vehicles.	H
3. Parking	Striking other vehicles, objects	H	▪ 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). ▪ The vehicle gear must be placed in park and parking brakes engaged, when required. ▪ When two or more occupants are in a Company vehicle, one occupant will act as a spotter and safely stand outside the vehicle, to guide the vehicle into and out of a parking spot to ensure it does not hit another vehicle, pedestrian, barrier or any other object.	M
4. Leaving parking spaces	Striking other vehicles, objects	H	▪ 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. ▪ 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!	M
5. Driving back from the job site	See hazards listed for “Operating vehicles” Key Work Step	H	▪ See safe work practices for “Operating vehicles” Key Work Step	M
6. Parking at office	Striking other vehicles, objects	H	▪ See safe work practices for “Striking other vehicles, objects” Hazard/Potential Hazard for “Parking at job site” Key Work Step.	M

7. End travel	Vehicle defects	**H**	▪ Inspect vehicle. ▪ Repair or initiate repair of all vehicle deficiencies that occurred due to the trip.	**M**

AHA - Vehicle Travel – Journey Management Plan

FIELD ACKNOWLEDGEMENT OF PERSON(S) CARRYING OUT WORK

NAME(S):		SIGNED:		DATE:	
SITE SUPERVISOR:		SIGNED:		DATE:	

Note: For tasks/activities that extend beyond a single day, use attached DAILY RENEWAL form or FLRA.

AHA DAILY RENEWAL

Date:	Weather:	
Changes noted:		
Site Supervisor (Print & Sign):		
Name(s):		
Date:	Weather:	
Changes noted:		
Site Supervisor (Print & Sign):		
Name(s):		
Date:	Weather:	
Changes noted:		
Site Supervisor (Print & Sign):		
Name(s):		

AHA – Field Work - General

Activity/Work Task:	Field Work General			Overall Risk Assessment Code (RAC) (Use highest code)					L
Project Location:	Castile, NY			**Risk Assessment Code (RAC) Matrix**					
Contract Number:	D009809-14			**Severity**	**Probability**				
Date Prepared:	11/3/20	**Date Accepted:**	11/5/20		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title):	Bradley LaForest, Project Manager			Catastrophic	**E**	**E**	**H**	**H**	**M**
				Critical	**E**	**H**	**H**	**M**	**L**
Reviewed by (Name/Title):	Katie Amann, Assistant Project Manager			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 field work in general

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

Job Steps	Hazards	Controls	RAC
1. Mobilization/ See Mobilization/Demobilization and Site Preparation AHA Demobilization and Site Preparation	1A) See Mobilization/Demobilization and Site Preparation AHA	See Mobilization/Demobilization and Site Preparation AHA	**Exempt**
2. Communication	2A) Safety, crew unity	Talk to each other. ▪ Let other crewmembers know when you see a hazard. ▪ Avoid working near known hazard trees (trees that are rotten, dead, damaged, etc.). ▪ Always know the wherabouts of fellow crewmembers. ▪ Carry a radio and spare batteries or cell phone. ▪ Review Emergency Evacuation Procedures (see below).	**L**

AHA – Field Work - General

Job Steps	Hazards	Controls	RAC
3. Walking and working in the field	3A) Falling down, twisted ankles and knees, poor footing	Always watch your footing. ▪ Slow down and use extra caution around logs, rocks, and animal holes. ▪ Extremely steep slopes (>50%) can be hazardous under wet or dry conditions; consider an alternate route. ▪ Wear laced boots with a minimum 8" high upper and non-skid Vibram-type soles for ankle support and traction.	L
	3B) Falling objects	Protect head agains falling objects. ▪ Wear your hardhat for protection from falling limbs and pinecones, and from tools and equipment carried by other crewmembers. ▪ Stay out of the woods during extremely high winds.	L
	3C) Damage to eyes	Protect eyes: ▪ Watch where you walk, ecpecially around trees and brush with limbs sticking out. ▪ Exercise caution when clearing limbs from tree trunks. Advise wearing eye protection. ▪ Ultraviolet light from the sun can be damaging to the eyes; look for sunglasses that specify significant protection from UV-A and UV-B radiation. If safety glasses require, use ones with tinted lenses.	L
	3D) Bee and wasp stings	See AHA for Insect Stings and Bites	L
	3E) Ticks and infected mosquitos	See AHA for Insect Stings and Bites	L
	3A) Lifting Injuries (e.g., Back Injuries)	Lifting Injuries (e.g., Back Injuries) ▪ Site personnel will be instructed on proper lifting techniques. ▪ Perform warm-up excercises before starting work. ▪ **DO NOT EXCEED THE WOOD LIFTING LIMIT OF 50 POUNDS.** ▪ Use two people to lift, lower, or carry equipment or materials heavier than 50 pounds. ▪ Mechanical devices should be used to reduce manual handling of materials. ▪ Drive the field vehicle as close to the point that the heavy equipment/material will be used as long as the area is safe to drive into and you do not create hazards to you, your co-worker, or the vehicle.	L
	3F) Slips/Trips/Falls	Slips/Trips/Falls ▪ Maintain work areas safe and orderly; unloading areas should be on even terrain; mark or repair possible tripping hazards. ▪ Site SHSO inspect the entire work area to identify and mark hazards. ▪ Be aware of work area conditions that can cause slip hazards such as ponding of water on concrete surfaces. Ponding of water on smooth surfaces, such as concrete, coupled with the warm or freezing weather conditions has the potential to cause slippery condiitons such as growth of scum or ice, as applicable. Adding a layer of clean fill to the surface may prevent the growth of scum, and/or create a non-slippery walking surface.	L

AHA – Field Work - General

Job Steps	Hazards	Controls	RAC
	3G) Vehicular Traffic	Vehicular Traffic ▪ Spotters will be used when backing up trucks and heavy equipment and when moving equipment. ▪ High visibility vests will be worn when workers are exposed to vehicular traffic at the site or on public roads.	L
	3H) Dropped Objects	Dropped Objects ▪ Steel toe boots meeting ANSI Standard Z41 will be worn.	L
	3I) Noise	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.	L
	3J) Eye Injuries	Eye Injuries ▪ Safety glasses meeting ANSI Standard Z87 will be worn.	L
	3K) Struck/cut by tools	Struck/cut by tools ▪ Cut resistant work gloves will be worn when dealing with sharp objects. ▪ All hand and power tools will be maintained in safe condition. ▪ Guards will be kept in place while using hand and power tools.	L
	3L) Caught in/on/between	Caught in/on/between ▪ Workers will not position themselves between equipment and a stationary object. ▪ Workers will not wear long hair down (place in pony-tail and tuck into shirt) or jewelry if working with tools/machinery.	L
	3M) Contact with Electricity/Lightning	Contact with Electricity/Lighting ▪ All electrical tools and equipment will be equipped with GFCI. ▪ Electrical extension cords will be of the "Hard" or "Extra Hard" service type. ▪ All extension cords shall have a three-blade grounding plug. ▪ Personnel shall not use extension cords with damaged outer covers, exposed inner wires, or splices. ▪ Electrical cords shall not be laid across roads where vehicular traffic may damage the cord without appropriate guarding. ▪ All electrical work will be conducted by a licensed electrician. ▪ All utilities will be marked prior to excavation activities. ▪ All equipment will stay a minimum of 10 feet from overhead energized electrical lines (50 kV). This distance will increase by 4 inches for each 10 kV above 50 kV. Rule of Thumb: Stay 10 feet away from all overhead powerlines known to be 50 kV or less and 35 feet from all others.) ▪ The SHSO shall halt outdoor site operations whenever lightning is visible; outdoor work will not resume until 30 minutes after the last sighting of lightning.	L

AHA – Field Work - General

Job Steps	Hazards	Controls	RAC
	3N) Equipment failure	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
	3O) Hand & power tool usage, cuts, burns, etc.	Hand & power tool usage ▪ Inspect the tool daily. ▪ Remove broken or damaged tools from service. ▪ Use the tool for its intended purpose. ▪ Use in accordance with manufacturers instructions.	L

4. Environmental health considerations	4A) Heat Stress	Take precautions to prevent heat stress
		▪ Remain constantly aware of the four basic factors that determine the degree of heat stress (air temperature, humidity, air movement, and heat radiation) relative to the surrounding work environmental heat load.
		▪ Know the signs and symptoms of heat exhaustion, heat cramps, and heat stroke. Heat stroke is a true medical emergency requiring immediate emergency response action.
		NOTE: The severity of the effects of a given environmental heat stress is decreased by reducing the work load, increasing the frequency and/or duration of rest periods, and by introducing measures which will protect employees from hot environments.
		▪ Maintain adequate water intake by drinking water periodically in small amounts throughout the day (flavoring water with citrus flavors or extracts enhances palatability).
		▪ Allow approximately 2 weeks with progressive degrees of heat exposure and physical exertion for substantial acclimatization.
		▪ Acclimatization is necessary regardless of an employee's physical condition (the better one's physical condition, the quicker the acclimatization). Tailor the work schedule to fit the climate, the physical condition of employees, and mission requirements.
		    ▪ A reduction of work load markedly decreases total heat stress.
		    ▪ Lessen work load and/or duration of physical exertion the first days of heat exposure to allow gradual acclimatization.
		▪ Alternate work and rest periods. More severe conditions may require longer rest periods and electrolyte fluid replacement.
			L

	4B) Heat Stress Index	Monitor heat index ▪ Curtail or suspend physical work when conditions are extremely severe (see attached Heat Stress Index).	L
	4C) 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.	L

AHA – Field Work - General

Job Steps	Hazards	Controls	RAC
		▪ Dress in layers with wicking garments (those that carry moisture away from the body – e.g., cotton) and a weatherproof slicker. A wool outer garment is recommended. ▪ Take layers off as you heat up; put them on as you cool down. ▪ Wear head protection that provides adequate insulation and protects the ears. ▪ Maintain your energy level. Avoid exhaustion and over-exertion which causes sweating, dampens clothing, and accelerates loss of body heat and increases the potential for hypothermia. ▪ Acclimate to the cold climate to minimize discomfort. ▪ Maintain adequate water/fluid intake to avoid dehydration.	
	4D) Wind	Effects of the wind ▪ Wind chill greatly affects heat loss (see attached Wind Chill Index). ▪ Avoid marking in old, defective timber, especially hardwoods, during periods of high winds due to snag hazards.	L
	4E) Thunderstorms	Thunderstorms ▪ Monitor weather channels to determine if electrical storms are forcasted. ▪ Plan ahead and identify safe locations to be in the event of a storm. (e.g., sturdy building, vehicle, etc.) ▪ Suspend all field work at the first sound of thunder. You should be in a safe place when the time between the lightning and thunder is less than 30 seconds. ▪ Only return to work 30 minutes after the after the last strike or sound of thunder.	L
5. Check and calibrate industrial hygiene and other field instruments and equipment as required and as recommended by the manufacturer	5A) Exposure to Calibration Gases/Chemicals due to: • Use of damaged instruments.	Verify proper operation of the instrument prior to calibration. Calibrate instruments in an area with adequate ventilation and follow the manufacturer's recommendations. ▪ Wear appropriate PPE to conduct calibrations as specified in the instrument manual.	L
	5B) Exposure to Site contaminants due to: • Improper instrument calibration; • Misinterpretation of calibration results; • Improper instrument repair; • Improper use of instrument due to lack of training.	5A) Calibrate the instrument in accordance with the manufacturer's recommendations (see instrument manual) using the applicable calibration standard and calibration procedure. ▪ Perform calibrations at a frequency recommended by the manufacturer. Be aware of the instrument's limitations (e.g., detection limit, maximum sensitivity) and the conditions (e.g., humidity) that may affect correct operation or accuracy of that equipment. Possible sources of error that may affect the correct calibration of the instrument. ▪ Use only calibration materials recommended by the manufacturer for calibration. Do not use substitutions. ▪ Confirm that the connections between the instrument and the calibration gas/material is leak-free.	L

AHA – Field Work - General

Job Steps	Hazards	Controls	RAC
		▪ Record all instrument calibrations in the field logbook. Include the instrument ID (type/manufacture/serial number/lamp eV, etc.), calibration gas used (chemical and concentration), and instrument result. ▪ Do not attempt to repair instrument. Return to the vendor for replacement. Report any damaged or malfunctioning instrument to the vendor. ▪ All personnel must be familiar with operation of the instrument and understand: - Theroy of its operation including any alarms and their setpoints - Materials the instrument can and cannot detect, - Instrument's limitations - The expected responses to calibration gases/materials - Interfering gases/chemicals and their affects on the instrument readings - When re-zeroing is appropriate.	

AHA – Field Work - General

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
PPE (Safety glasses, gloves (per HASP), steel toe work boots, high visibility safety vest)	**Competent / Qualified Personnel:** All Wood Employees on site **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

NOAA's National Weather Service

Heat Index

Temperature (°F)

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

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution   Extreme Caution   Danger   Extreme Danger

Wind Chill Chart

Temperature (°F)

Wind (mph) / 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 – Decontamination

Activity/Work Task:	Decontamination		Overall Risk Assessment Code (RAC) (Use highest code)					M
Project Location:	Castile, NY		**Risk Assessment Code (RAC) Matrix**					
Contract Number:	D009809-14		**Severity**	**Probability**				
Date Prepared:	11/3/20	**Date Accepted:** 11/5/20		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title):	Bradley LaForest/Project Manager		Catastrophic	E	E	H	H	M
			Critical	E	H	H	M	L
Reviewed by (Name/Title):	Katie Amann, Assistant Project Manager		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 decontamination

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

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

AHA – Decontamination

Job Steps	Hazards	Controls	RAC
	2B) Exposure to contaminants	2B) Exposure to contaminants ▪ Conduct air monitoring (see HASP). ▪ Wear proper PPE (see HASP). ▪ See SDSs 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 Contamination Reduction Zone (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 they are 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 SDSs 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 SDS for specific hazards associated with decon solutions. ▪ Monitor breathing zone for contaminants.	M

AHA – Decontamination

Job Steps	Hazards	Controls	RAC
		▪ Monitor breathing zone for decon solutions (e.g., methanol, hexane, etc.) if appropriate (see HASP).	
	4B) Materials Handling related injuries	4B) Materials Handling related injuries ▪ Use proper lifting techniques when lifting heavy equipment. ▪ Use two-person lift for heavy coolers.	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 Exclusion Zone.
		▪ 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 SDSs for hazards associated with the decontamination solutions used.
		▪ Decon solutions will be disposed of according to the work plan or related document.
			M

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 when needed.)	**Competent / Qualified Personnel:** All Wood field staff with hazardous materials training **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 all PPE prior to use

AHA – Hostile Public Interactions

Activity/Work Task:	Hostile Public Interations		
Project Location:	Castile, NY		
Contract Number:	D009809-14		
Date Prepared:	11/3/20	**Date Accepted:**	11/5/20
Prepared by (Name/Title):	Bradley LaForest/ Project Manager		
Reviewed by (Name/Title):	Katie Amann, Assistant Project Manager		

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

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**

This AHA involves the following:

- Establishing specific measures for managing risks in hostile or confrontational situations.
- Personnel should consider each property to be a separate site with varying risks specific to that location.

This AHA is not an exhaustive summary of all hazards associated with a Site. Refer to the site HASP for additional requirements. Hostile or confrontational situations may be very fluid and unpredictable – use good judgement and avoid putting oneself or crews at unnecessary risk.

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 – Hostile Public Interactions

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
PPE: (safety glasses, nitrile gloves, steel toe work boots) as required by HASP Note: The following PPE is recommended when interacting with the public • Branded reflective vest • Other Branded Items, e.g. hat	**Competent / Qualified Personnel:** All Wood employees **Training requirements:** Site Specific HASP Orientation Tailgate Safety Meetings	Field Level Risk Assessments – Document any and all perceived risks for each property separately.

AHA – Hostile Public Interactions

Job Steps	Hazards	Controls	RAC
1. Prepare for site visit	N/A	▪ Be aware of radical or strong political groups operating in the area. Familiarize yourself with any controversial issues or illegal activities in the area you will be working. ▪ Be able to briefly explain the necessity for the data collection you are charged with. ▪ Formulate a plan for dealing with hostile people that includes avoidance or calm, deliberate departure from their presence. ▪ Check internal project team tracking of known locations with hostile or aggressive residents or animals; consult with field lead for guidance as needed. Ensure client is aware of potentially dangerous situations. The Supervisor must make a decision if it is necessary to conduct the site visit. ▪ Program emergency numbers (auto-dial) on the cell phone. ▪ Use the buddy system when visiting private property, unless the location and resident are known to be friendly from previous interactions; however, be observant and manage any changes in conditions. ▪ See Mobilization/Demobilization for general preparation.	L
2. Driving into a potentially hostile situation	Potential physical harm to you/individual, vehicles, equipment	▪ Be alert. Watch for threatening behavior. ▪ Stay in the vehicle with doors locked. ▪ If the situation is suspicious and/or not safe, leave the scene at once. ▪ Report any threatening behavior to your supervisor and/or the local authorities depending on the severity of the situation.	L
3. Walking into a potentially hostile situation	Potential physical harm to you/individual	▪ Be alert. Watch for threatening behavior. ▪ Be courteous and respectful. ▪ Do not argue or threaten potentially hostile people. If you are at all uncomfortable, turn around and leave the scene in a calm, deliberate manner. ▪ Contact field manager, your supervisor, and/or the local authorities and report any threatening behavior.	M
4. Having a potentially hostile situation develop at working location	Potential physical harm to you/individual, vehicles, equipment	▪ Be aware of the changing environment. ▪ Be prepared to leave on short notice. ▪ Do not aggravate the situation by arguing or confronting individuals. ▪ If you become uncomfortable with the situation, leave the scene immediately; abandon your equipment if necessary. ▪ Contact field manager, your supervisor, and/or the local authorities and report the incident.	M

AHA – Hostile Public Interactions

5. Being approached by a hostile person(s)	Potential physical harm to you/individual, vehicles, equipment	▪ Leave the site if individual is behaving and/or verbally hostile and you feel unsafe. If you remain: ▪ Stay calm. ▪ Listen attentively. ▪ Be courteous, patient and respectful. ▪ Do not become angry and argue with or threaten the person. ▪ Maintain eye contact. ▪ Try to calm the person down by using a soothing voice and non-threatening body language. ▪ Keep the situation in your control. ▪ If they ask you to leave, do so. ▪ Contact field manager, your supervisor, and/or the local authorities (if needed) and report the incident.	**M**
6. Dealing with verbal abuse	Potential escalation to physical violence	▪ Leave the site if the verbal abuse is such that you feel unsafe. If you remain: ▪ Stay calm. ▪ Be courteous, patient and respectful. ▪ Do not become angry and argue with or threaten the person. ▪ Maintain eye contact. ▪ Try to calm the person down by using a soothing voice and non-threatening body language. ▪ Keep the situation in your control. ▪ If possible, signal a co-worker or supervisor that you need help. ▪ Report the incident to field manager and/or your supervisor.	**L**
7. Dealing with physical violence	Potential physical harm to you/individual, vehicles, equipment	▪ Stay calm. ▪ At the first sign of physical violence immediately back away. ▪ Protect yourself by trying to escape to a safe area. ▪ Do not challenge or try to subdue the assailant. ▪ The best defense is to get away. ▪ Report the incident to field manager, your supervisor, and the local authorities.	**M**
8. Dealing with a weapon	Potential physical harm to you/individual, vehicles, equipment	▪ Stay very calm. ▪ If possible quietly signal for help. ▪ Maintain eye contact. ▪ Stall for time. ▪ Keep talking but follow instructions from the person with the weapon. ▪ Don't risk harm to yourself or others by trying to be a hero. ▪ NEVER grab the weapon. ▪ Watch for a safe chance to escape to a safe area. ▪ Call 9-1-1 if you are able to and require emergency assistance. ▪ Report the incident to field manager, your supervisor, and the local authorities.	**H**

AHA – Hostile Public Interactions

9. Working in known hostile environments	Potential physical harm to you/individual, vehicles, equipment	▪ Coordinate with project managers, client, and/or local authorities to determine the best course of action. ▪ Document procedures and protocols and include as part of the HASP. ▪ Have client and/or local authorities coordinate and evaluate or “clear” the area before crew arrival.	**L**

AHA – TRAVEL TO / FROM OFFICE OR PROJECT SITE, DURING COVID-19 CONSIDERATIONS

Activity/Work Task:	Travel To / From Office or Project Site during Covid-19 Pandemic	HSE-GDS-110002 Trigger Level where you're coming from	2	HSE-GDS-110002 Trigger Level where you're going to	2	Overall RAC	MS

Project Location:	Castile, NY		
Project Number:	3616206112		
Date Prepared:	11/3/20	Date Reviewed:	12/9/22
Prepared by / for (Name/Title):	Bradley LaForest/Project Manager		
Reviewed by (Name/Title):	Katie Amann/Project Manager		

Risk Assessment Code (RAC) Matrix

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

Notes:

This AHA is not an exhaustive summary of all hazards associated with the field activities or project site. Refer to the site Emergency Action Plan provided by the local office or project site. This AHA is intended to provide WSP personnel a safety framework for mobilizing to the physical WSP office or field location at a WSP-controlled or client-controlled worksite. This AHA review and update should be completed in parallel with the HSSE Field Readiness Checklist.

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	**H = High Risk**
	S = Substantial 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

Equipment to be Used	Contact Information	Inspection Requirements
PPE as required by the office / job site Cellphone First Aid kit Safety Vest Sunglasses Handwashing soap and/or hand sanitizer Disinfecting wipes and EPA-recommended disinfectants	**Competent / Qualified Personnel:** North Atlantic HSE Lead: Jeff Tweeddale 860-670-5908 HSE Manager: Cindy Sundquist 207-650-7593 WorkCare: 888-449-7787 Emergency services: 911 See Emergency Contact List posted in the HASP for additional contacts if needed.	Inspection of vehicle prior to operation. Note needed repairs and schedule service as soon as feasible. Inspect all PPE prior to use. Perform an assessment to identify all areas and equipment with shared surfaces. Verify all areas and equipment identified with shared surfaces are disinfected with antimicrobial wipes prior to use. Check in regularly with yourself and other field staff to ensure hands are washed frequently and/or sanitized. Stay home if: - Feeling sick even if symptoms do not align with COVID-19; or - You have been in contact with someone believed to have the coronavirus or traveled to a foreign country or out of state.

AHA – TRAVEL TO / FROM OFFICE OR PROJECT SITE, DURING COVID-19 CONSIDERATIONS

Job Steps	Hazards	Controls	RAC
1. Prepare for travel	1A) Mental health, family concerns	▪ Ops management to limit personnel deployed to projects to individuals whose presence on the project site would be considered “essential” for work. ▪ Plan to use multiple vehicles, where possible with respect to social distancing recommendations. ▪ Communications are assessed routinely with site personnel including use of ISOS app, cellphone coverage, email, and Skype/Teams messaging. ▪ Ensure you have all materials with you necessary to conduct work effort including handwashing supplies. ▪ Determine training and medical monitoring needs and ensure all required Health and Safety training and medical monitoring has been received and is current (e.g. WorkCare, download ISOS app (Instruction), coordinate with Global Mobility, etc.). ▪ Ensure all workers are fit for duty (alert, well rested, no underlying medical conditions that would increase severity or susceptibility to infectious illness, and mentally and physically fit and willing to perform work assignment). ▪ Familiarize yourself with route to destinations (e.g. home to airport, airport to hotel, hotel to site, etc.). ▪ Ensure that a copy of the current insurance certificates and incident reporting procedures/forms are available during travel (some documents are appended to this AHA). ▪ Ensure you have reviewed latest geographic updates for COVID-19 risk within the location you are travelling to, and where you’re coming from, including airport layovers and considerations for international and intrastate entry upon return. ▪ Be prepared for possible quarantine events or shelter-in-place mandates from local officials.	L

Job Steps	Hazards	Controls	RAC
	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
	1C) Insufficient emergency equipment, unsecured loads	▪ Ensure vehicle has first aid kit (if first aid kits are not provided at the site); bring medications for allergic responses if necessary. ▪ 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. Ensure cellphone provider has coverage in location of travel prior to departure. ▪ Vehicles carrying tools must have a safety cage in place; all tools must be properly secured. ▪ Ensure parking cones are present, if applicable.	L

AHA – TRAVEL TO / FROM OFFICE OR PROJECT SITE, DURING COVID-19 CONSIDERATIONS

Job Steps	Hazards	Controls	RAC
2. Travelling to site or airport	2A) Collisions, unsafe driving conditions	▪ Drive defensively! And complete a Journey Management Plan. ▪ Cell phone us is prohibited while driving, including hands free! ▪ Do not use cruise control during inclement weather. ▪ Do not drive more than 300 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, family members, significant others) 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.	M
	2B) Taxi / Uber / Lyft / driver service - unsafe driving or personal security concerns	▪ Minimize the time that you're standing outside by yourself with your phone in your hand. Instead, wait inside until the app shows that your driver has arrived. ▪ Make sure you're getting into the right car with the right driver by matching the license plate, car make and model, and driver photo with what's provided in your app. Never get in a car where the vehicle or driver identity doesn't match what's displayed in your app. ▪ Have the driver confirm your name. To safely exchange names, you can ask, "Who are you here to pick up? ▪ Whenever possible, sit in the back seat, especially if you're riding alone. This helps ensure that you can safely exit on either side of the vehicle to avoid moving traffic, and it gives you and your driver some personal space. ▪ Always wear your seatbelt! ▪ Share your trip details with your supervisor, friends, or family members. ▪ Request to end the ride if you ever feel unsafe during the trip. ▪ If you're in an urgent situation, call 911 or emergency services phone number.	M
	2C) 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.	M
	2D) Dusty, winding, narrow roads	▪ Go slow around corners, occasionally clearing the windshield.	M

AHA – TRAVEL TO / FROM OFFICE OR PROJECT SITE, DURING COVID-19 CONSIDERATIONS

Job Steps	Hazards	Controls	RAC
	2E) 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
	2F) Stormy weather	▪ Inquire about conditions before leaving the hotel or office. ▪ Be aware of oncoming storms.	M
	2G) When angry or irritated	▪ Attitude adjustment; change the subject or work out the problem before driving the vehicle. Let someone else drive.	M
	2H) 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.	M
	2I) SARS-CoV-2 exposure NOTE: *If Trigger Level to/from is 1, then insert L for RAC. If Trigger Level to/from is 2 or 3, then insert M for RAC.* *Any work inside a healthcare facility is Substantial to High risk and prohibited*	▪ Do not travel when not feeling well. ▪ Do not travel if someone you've had close contact with in the last 14-days has experienced fever, chills, or other related symptoms. ▪ Do not travel with other individuals who are not feeling well or have been in close contact with individuals in the last 14-days who have experienced COVID-19 symptoms. ▪ Do not travel if you have been in close contact with individuals who are healthcare professionals treating confirmed or suspected COVID-19 patients. ▪ Cleanliness of vehicle assessed along with regular cleaning intervals. ▪ Travel to project sites and airport should limit the number of personnel per vehicle (i.e. no travelling invan with multiple personnel to project sites). ▪ Avoid touching high-contact surfaces within vehicles. ▪ Wash hands after exiting vehicle and avoid touching face/eyes/mouth while inside vehicle. ▪ Keep ventilation systems running when inside vehicle or crack the window open for additional fresh air.	M
	2J) On wet or slick roads	▪ Drive slow and safe.	M
	2K) Animals on road	▪ Drive slowly, watch for other animals nearby. ▪ Be alert for animals darting out of wooded areas	S
	2L) Vehicle accident	▪ Employees should follow WSP vehicle operation policy and be aware of all stationary and mobile vehicles.	S

AHA – TRAVEL TO / FROM OFFICE OR PROJECT SITE, DURING COVID-19 CONSIDERATIONS

Job Steps	Hazards	Controls	RAC
3. Parking at job site or airport parking and movement to site location or airport	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).	M
	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.) ▪ 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.	M
	3C) Slips, trips, and falls using walking surfaces, stairways, ramps, escalators, etc.	▪ Ensure that aisles are correctly established and clear, no tripping hazards are evident, floors are even, wires are not streched across aisles, entrance mats are available and used for wet weather, floors are dry-not slippery, and carpets/rugs are secure. ▪ Ensure that adequate lighting- suitable for walking and say on locations treated for potentially icy conditions. ▪ Stick to ramps, walkways, corridors with a nonslip surface. ▪ Use proper body mechanics when lifting supplies, luggage, equipment, etc. Do not attempt to carry more than 50 lbs; utility rolling wheels, hand cart, etc. for assistance.	L

Job Steps	Hazards	Controls	RAC
	3D) SARS-CoV-2 exposure in airports and on airplane, and ground transportation at airports NOTE: *If Trigger Level to/from is 1, then insert L for RAC. If Trigger Level to/from is 2 or 3, then insert M for RAC.* *Any work inside a healthcare facility is Substantial to High risk and prohibited*	▪ Travel to be booked routing outside of potential high community transmission transport hubs. ▪ Temperature monitoring taking place by security personnel. ▪ Wash your hands often or use hand sanitizer. Wash your hands for at least 20 seconds; remember to lather the backs of the hands, between the fingers, and under the nails. Use a hand sanitizer that contains at least 60 percent alcohol. Cover all surfaces of your hands and rub them together until they feel dry. Avoid touching your eyes, nose, and mouth with unwashed hands. Cover your mouth and nose if you sneeze or cough with a tissue or use the inside of your elbow and throw used tissues in the trash. Follow up with hand washing or hand sanitizer. Bring your own hand sanitizer (up to 12 ounces allowed in carry on). ▪ Pack disinfecting wipes in your carry on and use them to wipe down common areas throughout the airport from check in, to gate, to plane. Touch screens, door handles, seating and dining areas, as well as frequently-used objects that you touch with your hands should all be wiped down. Bleach-based wipes and solutions with at least 60 percent alcohol can kill the coronavirus. Once you're seated on the plane, use disinfecting wipes to clean the hard surfaces like the head and arm rest, the seatbelt buckle, the remote, screen, seat back pocket, and the tray table. ▪ When we're traveling, many of us place pens, boarding passes, parking tickets, and more into our mouths without even noticing it and then hand those items to other people like parking attendants, Transportation Security Administration (TSA) officers, or flight crew. Be conscientious about keeping your hands or other items out of your mouth. ▪ During your travel journey, look for opportunities to stay six feet, or an arm's length from others. One of the ways coronavirus is spread is between people who are in close contact with one another or through respiratory droplets with an infected person coughs or sneezes. ▪ Protect other people from infection and give yourself the time you need to recuperate by staying home if you are not feeling well. ▪ Avoid travelling in vans or buses with multiple personnel, keep distance between seats if you must.	M

AHA – TRAVEL TO / FROM OFFICE OR PROJECT SITE, DURING COVID-19 CONSIDERATIONS

Job Steps	Hazards	Controls	RAC
4. Travel back /forth to hotel, home, restaurants, recreation, airport, etc.	4A) Hazards from criminal activity / security / social unrest	▪ Always plan the trip (Journey Management Plan) prior to leaving or returning. ▪ Drive with the vehicle doors locked. ▪ Keep plenty of gas in the vehicle's tank. ▪ Observe all local traffic laws. ▪ Stay in area where there are other people. Use restroom facilities that are located near to public areas. Be aware of people around you. ▪ Pick hotels that are located in the safest part of town and when possible, have good security. ▪ Move quickly when going from the parking lots to the hotel. ▪ Park as close to lighting as possible. ▪ Look in the vehicle prior to entering to see if anyone is hiding in the vehicle. ▪ If you feel threatened, scream, yell and run. Don't be a hero. ▪ Request a room located on the 7th floor or below (fire truck ladders will reach to the 7th floor). Learn the emergency exit route from your room upon arrival. Always keep your room door locked and bolted.	L

AHA – TRAVEL TO / FROM OFFICE OR PROJECT SITE, DURING COVID-19 CONSIDERATIONS

Job Steps	Hazards	Controls	RAC
	4B) SARS-CoV-2 exposure in community NOTE: *If Trigger Level to/from is 1, then insert L for RAC. If Trigger Level to/from is 2 or 3, then insert M for RAC.* *Any work inside a healthcare facility is Substantial to High risk and prohibited*	▪ Avoid public spaces and going out to eat by bringing your own lunch to the project site. Ensure all personnel wash and/or sanitize their hands properly prior to eating. While staying in a hotel, the following is recommended: ▪ When booking confirm the hotel has an ehanced cleaning procedure for high-touch public areas (elevators, door handles, lobbies, room keys) in response to the pandemic. ▪ Confirm hand sanitizers for staff and guest are located through the facilty, including front desk. ▪ Confirm hotel has a procedure to identify if staff are Covid-19 high risk, and if so, is this procedure followed (e.g. self quarantine). ▪ Confirm if they require a guest to complete a Covid-19 questionnaire before assigning a room. ▪ Confirm that staff have taken enhanced Covid-19 awareness training. ▪ Eat all food in your hotel room after disinfecting surfaces as outlined above. Do not eat in public spaces or restaurants. ▪ Wash hands with soap and warm water for a minimum of 20 seconds or disinfect using hand sanitizer prior to eating. ▪ If the hotel has a restaurant or café, order food to be picked up or delivered to your room. Follow guidelines for minimizing time in public spaces in section 4D above. ▪ If there is no food available at the hotel, order groceries or food for delivery to the hotel. Call local restaurants to order food for delivery (call the hotel lobby for recommendations) or use food ordering applications such as Postmates, Caviar, and Doordash. Some of these applications have options for contactless delivery. Prior to leaving the site: ▪ Disinfect shared equipment you came into contact with during the work day. ▪ Wash your hands thoroughly for a minimum of 20 seconds with soap warm water or disinfect using hand sanitizer prior to leaving the site. When you arrive home: ▪ Disinfect your cell phone with an approved antimicrobial wipe. ▪ Wash hands thoroughly for a minimum of 20 seconds with soap and warm water.	**M**

AHA – TRAVEL TO / FROM OFFICE OR PROJECT SITE, DURING COVID-19 CONSIDERATIONS

Daily Field Level Readiness Review- Covid-19 Updates*	**Enter Date Below**						
Employee Name = **Name of Site and Project Location =** **Project number =**							
The work today is business essential (i.e. can't be done remotely or postponed).							
If outside your home country, travel is still allowed within this geography.							
If outside your home country, travel is still allowed back into your home country.							
State/provincial/local governments still allow travel from my home to this project destination.							
State/provincial/local governments still allow travel from this project destination back to my home.							
If visiting a client's facility, the client is still open for business and visitors/contractors are allowed.							
Work is still allowed in the area where this project is located (state / provincial / local government has not implemented a shelter in place mandate that would restrict the employee's ability to complete work tasks).							
Hotels are open and available in the area.							
Employees are able to get meals (e.g. restaurants, grocery stores, etc.).							
Adequate supplies of work required PPE (e.g. respirators, protective clothing) are available.							
Gasoline is available for purchase.							
Adequate supplies of disinfectants (e.g. wipes, sprays) are available for cleaning.							
Facilities are available for employees to frequently wash hands (or sanitizer is available).							
Work activities remain LOW to MODERATE risk for COVID-19 exposure.							

*All readiness boxes must be checked in order to continue operations for today. If any boxes are not checked, re-evaluate with Manager/Supervisor on "essential" of field work.

AHA REVIEW ACKNOWLEDGEMENT		
Reviewed by (PM):	Signature:	Date:
Plan Concurrence by (other):	Signature:	Date:
The undersigned acknowledge they have read, understood and shall comply with all components of the AHA. This AHA is a living document and should be reviewed and revised during regular meetings with the WSP team.		
Name (print):	Signature:	Date:
Name (print):	Signature:	Date:
Name (print):	Signature:	Date:
Name (print):	Signature:	Date:
Name (print):	Signature:	Date:
Name (print):	Signature:	Date:

Document Title	Activity Hazard Analysis (AHA) Site Activities During Covid-19 Pandemic	wsp

Activity/Work Task:	**Travel To / From and Work at Project Site during Covid-19 Pandemic**			HSE-GDS-110002 Trigger Level where you're coming from	2	HSE-GDS-110002 Trigger Level where you're going to	2	Overall RAC	L
Project Location:	Castile, NY			**Risk Assessment Code (RAC) Matrix**					
Project Number:	3616206112			**Severity**	**Probability**				
Date Prepared:	11/3/20	Date Reviewed:	12/9/22		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by / for (Name/Title):	Bradley LaForest/Project Manager			Catastrophic	H	H	S	S	M
Reviewed by (Name/Title):	Katie Amann/Project Manager			Critical	H	S	S	M	L
				Marginal	S	M	M	L	L
				Negligible	M	L	L	L	L

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

This AHA involves the following activity:
Precautions to be taken for prevention of Covid-19 exposure at home, travelling to and from the Project and working on the Project Site.

This AHA is not an exhaustive summary of all hazards associated with the Project or activity. Refer to the site HASP for additional requirements. Workers are to follow general site safety controls for; Slips, Trips and Falls; biological hazards; cuts lacerations and pinch points; and emergency response 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	**H = High Risk**
	S = Substantial Risk
Step 2: Identify the RAC (Probability/Severity) as H, S, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.	**M = Moderate Risk**
	L = Low Risk

MANAGEMENT OF CHANGE: If there is a change or deviation from the planned activity, you must stop the job and re-evaluate the risk assessment and the precautions taken. Any changes to work described in this AHA shall require review by a Qualified Person.

Equipment to be Used	Training Requirements / Contact Information	Inspection Requirements
PPE as required by Site HASP. Additional PPE as required by risk assessment, such as use of a respirator in non-ventilated spaces (i.e. pump houses) or when social distancing cannot be achieved. Cellphone. Handwashing soap and/or hand sanitizer. Disinfecting wipes and disinfectant cleaners.	**Competent / Qualified Personnel:** North Atlantic HSE Lead: Jeff Tweeddale 860-670-5908 HSE Manager: Cindy Sundquist 207-650-7593 WorkCare: 888-449-7787 Emergency services: 911 See Emergency Contact List posted in the HASP for additional contacts if needed. **Training requirements:** • Site-specific HASP orientation • Review of applicable AHAs • Toolbox safety meeting • Task kickoff meeting • WSP Guide to Covid-19 presentation. • Any other trainings required by the site-specific HASP	Inspection of vehicle/equipment prior to operation. Note needed repairs and schedule service as soon as feasible. Inform supervisor if issues identified that will affect safe operation. Inspect all PPE prior to use. Perform an assessment to identify all areas and equipment with shared surfaces. Verify all areas and equipment identified with shared surfaces are disinfected with antimicrobial wipes prior to use. Check in regularly with yourself and other field staff to ensure hands are washed frequently and/or sanitized. Stay home if: • Feeling sick even if symptoms do not align with COVID-19; or • You have been in contact with someone believed to have the coronavirus or traveled to a foreign country

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
1. Pre-Work Preparation • Communicate hazards and controls to all employees and subcontractors involved in the Project - Tailgate - Unscheduled meeting - Town Hall • Manage Change • Be prepared	Failure to identify a hazard and subsequent potential for injuries, illness, damage, environmental impact, economic loss or business impact. Failure to prepare. Evaluate potential high-risk issues: Shared workspaces; Work tasks involving close contact of workers; etc. Workers unfamiliar with site safety requirements.	**M**	• Ensure workers understand scope of work, emergency response procedures and location of emergency response equipment on the Project. • Workers and supervisory staff involved with the work to be involved in the AHA generation process through pre-job safety discussion. • Assign trained, competent workers. Provide mentoring/coaching as needed for supplier trained personnel and trained Site workers. • Inform Site Superintendent/Field Lead and/or SSHO if high risk situation cannot be controlled or mitigated. • Superintendents/Field Leads to have contact list for all workers (text, email, phone) to be able to quickly update workers with any significant changes outside of work hours.	**L**

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
	Unfamiliar with current global/local events and WSP/Government directives.		• Individuals to stay up to date with current directives/procedures issued by civil authority. • WSP Project Management Team to stay up to date with current WSP directives/procedures through **WSP Occupational Health website** and emailed communications. • Keep workforce briefed on situation daily through tailgates and unscheduled H&S meetings, if needed. Postings in trailers to maintain awareness. • Utilize daily go/no go decision making specific to proposed tasks through use of WSP Daily Field Level Readiness Review (attached to tailgate daily). • Use of the WSP Declaration Form daily attached to tailgate. • All should be prepared for unexpected/sudden work shutdowns/civil restrictions i.e. have a plan and emergency kits/supplies available.	
2. Habits Outside Work • Social gathering • Shopping • Other high-risk activity for exposure	**Close Contact with others** • Compliance • High risk individuals • Non-compliance to physical distance directives • Hygiene • Visiting friends/relatives • Visiting people that have recently travelled	M	• Although it is a difficult transition, all must "**Manage Change**" and adjust to the current situation and follow the directives issued by various Medical Officer of Health (local, Provincial, Federal). • Understand the implications of non-compliance – you could be responsible for the death of another person. • Stay away from those individuals and establishments that are considered high risk (underlying health issues, old age homes etc.). • Do not go out and visit friends and relatives unless necessary. Curtail social habits. • Encourage those that are not "**Following the Rules**" to do so – "**Intervene**". • Practice social distancing (2 metres/6 feet from each other). • Make use of the numerous businesses now offering non-contact and free delivery of items. No need to actually go into a store for supplies. • Practice good hygiene, such as frequent hand washing. Use "**Correct PPE"** if needed (i.e. gloves). • Be familiar with the signs and symptoms of Covid-19. If at any time they develop, know what to do: self-assessment tool online	L

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
			(https://www.ontario.ca/page/2019-novel-coronavirus), call, follow directions.	
	SARS-CoV-2 exposure in community	M	• Avoid public spaces and going out to eat by bringing your own lunch to the Project site. Ensure all personnel wash and/or sanitize their hands properly prior to eating. • While staying in a hotel, the following is recommended: - Eat all food in your hotel room after disinfecting surfaces. Do not eat in public spaces or restaurants. - Wash hands with soap and warm water for a minimum of 20 seconds or disinfect using hand sanitizer prior to eating. - If the hotel has a restaurant or café, order food to be picked up or delivered to your room. Minimizing time in public spaces. - If there is no food available at the hotel, order groceries or food for delivery to the hotel. Call local restaurants to order food for delivery (call the hotel lobby for recommendations) or use food ordering applications. Some of these applications have options for contactless delivery. • Prior to leaving the site: - Disinfect work areas (hard surfaces) and shared equipment you came into contact with during the work day. - Wash your hands thoroughly for a minimum of 20 seconds with soap warm water or disinfect using hand sanitizer prior to leaving the site.	L

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
			• When you arrive home: - Disinfect your cell phone with an approved antimicrobial wipe.	
3. Mental Health • Stress • Fear • Anxiety	**Unexpected Reactions** • Anger • Violence • Breakdown	**M**	• Understand that all people are individuals and we all react differently to situations of high stress and change to normal routine in our lives. • Watch out for each other's wellbeing. • Don't be a downer affecting morale - keep a good attitude and stay positive. A good attitude will help maintain a positive atmosphere at home and work. • Think before you say – don't spread false news or gossip. • If you are feeling stress/anxiety that overwhelms you, seek out assistance. • Be prepared for an unexpected reaction to a comment or interaction.	**L**
Travel To/From Site • Staffing level. • Arrival protocols.	**Work Assignment** • Priority of task • Staffing	**M**	• Evaluate if it is necessary to go to Project or if you can effectively work remotely from home and be on call. • Superintendents/Field Leads to minimize to the extent possible the number of people on the Project based on the work to be performed and other considerations such as site conditions, weather. If staff will not be needed have them stay home on call. Subcontractors to be managed in the same way.	**L**

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
	Arrival at Site • Security protocols • Interactions with others	M	• Security attendant will sign you in to avoid needless sharing of pen etc. • Change procedure from subs obtaining dosimetry badge from security and handing in at end of day. Have a centralized location for them where workers can get their own. • Security attendant to screen all workers/visitors etc. attempting to enter the site based on the WSP Visitor Declaration Form. • Anyone with an issue identified through use of screening to be prevented from entering and the Superintendent to be notified to provide instruction. • Do not arrive for work too early unless justified. • When parking on-site, stay in vehicle until time for tailgate meeting. If getting out practice social/physical separation from others. • Do not gather with others in close groups.	L
	SARS-CoV-2 exposure • Illness. • Exposure to others.	M	• Do not travel if you are not feeling well. • Do not travel if someone you've had close contact with in the last 14-days has experienced fever, chills, or other virus related symptoms. • Do not travel with other individuals who are not feeling well or have been in close contact with individuals in the last 14-days who have experienced COVID-19 symptoms. • Do not travel if you have been in close contact with individuals who are healthcare professionals treating confirmed or suspected COVID-19 patients. • Travel to project site should limit the number of personnel per vehicle. Do not carpool is preferred. • Avoid touching high-contact surfaces within vehicles if operated by others. • Wash hands after exiting vehicle and avoid touching face/eyes/mouth while inside vehicle if its not yours. • Keep ventilation systems running (i.e. drawing in outside air) when inside vehicle or crack the window open for additional fresh air.	L

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
Work at Site • Performing assigned work tasks with others. • Breaks. • Equipment use. • Shared facilities. • Tailgate meetings. • Business continuity.	**Shared Facilities/Equipment** • Lunch/Meeting Trailers • Admin Trailers • Washrooms • Equipment (dozer, excavator etc.) • Workspaces.	M	• Minimize to the extent possible the number of people in trailers at any one time. Tailgates and meetings to be limited such that social distancing can be accomplished. • If necessary, have multiple tailgate meetings, possibly by employer. For example, Drain Bros, WSP, others on-site in any particular day. • Investigate possibility/feasibility of phone in/Skype meetings and maximize use of alternative communications to mitigate face to face interactions and proximity of people. • Increase frequency of cleaning of facilities. Ensure good supply of cleaning supplies are on-hand/available. Assign workers to clean frequently used surfaces twice daily and if necessary, retain a contractor to supply this service. • Encourage all to understand that everyone needs to chip in and assist in keeping work areas clean. If in doubt, grab a cleaning cloth and wipe down surfaces. • Plan meals (i.e. lunch) so that microwave is not used to minimize contact between workers using a common piece of equipment. • To the extent possible limit equipment use to one operator. If required to share equipment, equipment to be wiped down between workers. • At the end of day, operators are to clean/wipe down control surfaces in the unit so it is ready for the next days work in case another operator is assigned. • If a second operator is assigned to a specific unit in a day, first operator performs a wipe down, opens window and leaves unit running for ventilation. New operator to wait 5 minutes before getting in and operating. • Where two people work in the same office, one to move out to another space or evaluate if remote work from Project is possible. • Shared offices need to be cleaned after use before another person uses that space. • Stagger breaks so that not everyone is using facilities at the same time depending on the number of staff on-site. Social distancing needs to be maintained. •	L

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
	Personal Hygiene • Washing. • Personal habits.	M	• Avoid touching face, especially nose, eyes. • Wash hands frequently. Before and after eating; after you have been in a public place; after using the washroom; after coughing and sneezing; after touching surfaces that other people also touch. • Use a tissue if experiencing runny nose and dispose. Alternatively cough and/or sneeze into the crook of arm. • Where there is common, frequent contact of rails, door knobs etc., consider use of nitrile gloves for work outside of the controlled zones to control direct contact with common surfaces. • Increase frequency of glove change out in all Zones.	L
	Performance of Work Tasks • Work involving close contact between workers. • UTV use.	M	• Perform risk assessment prior to task to mitigate hazard of close contact. Consider type of work, duration involving close contact (incidental or long term). For long term work (hours) it should be postponed, or another way found to complete the task. • If necessary, use half or full-face respirator as a mitigation if workers cannot practice physical distancing requirements (i.e. labour work). If the task requires long term (hours) continuous work in close proximity to a coworker consider postponing such tasks. • If unsure how to mitigate, involve supervisor and/or PHSO. • Avoid operation of UTVs with a full load if possible (i.e. make multiple trips). Run with windows open for ventilation if necessary. • Ventilation systems to be always operated in the cabs of heavy equipment to ensure good fresh air exchange.	L
	Communication • Lack of awareness.	M	• Promote awareness by posting WSP HSSEA supplied materials. • Hand washing posters. • Hold unscheduled H&S meetings to communicate new information.	L
	Business Continuity	M	• Those workers with a laptop should be taking it home at night. • Test internet connections at home to identify issues to be rectified. • All with the ability should be prepared to work from home if the situation arises where the civil authority issues shut down controls.	L

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
Emergency Response • Illness at work • Performing first aid. • CPR.	**Becoming ill at work** • Experiencing any symptoms of illness. • Observing someone ill.	**M**	• Immediately notify supervisor and isolate yourself from all others. Wait for instruction. • If you become aware of an individual who does not appear to feel well and has not indicated so, **"Intervene".**	**L**
	Providing First Response in advance of responding agency • Close contact	**M**	• As with all first aid situations, any individual has a choice as to provide first aid or not. • If you are asked to be a Site first aider for the day as noted on tailgate say no if you are not comfortable doing so. • If CPR is required only do chest compressions. If AR is required in addition to CPR use a rescue breather mask. • Use a face shield if risk assessment determines one is needed.	**L**

AHA REVIEW ACKNOWLEDGEMENT		
Reviewed by (PM):	Signature:	Date:
Plan Concurrence by (other):	Signature:	Date:
The undersigned acknowledge they have read, understood and shall comply with all components of the AHA. This AHA is a living document and should be reviewed and revised during regular meetings with the WSP team.		
Name (print):	Signature:	Date:
Name (print):	Signature:	Date:
Name (print):	Signature:	Date:
Name (print):	Signature:	Date:
Name (print):	Signature:	Date:
Name (print):	Signature:	Date:
Name (print):	Signature:	Date:
Name (print):	Signature:	Date:
Name (print):	Signature:	Date:
Name (print):	Signature:	Date:
Name (print):	Signature:	Date:
Name (print):	Signature:	Date:

AHA – Groundwater Monitoring and Well Development

Activity/Work Task:	Groundwater Monitoring and Well Development	Substantial / High Risks:	Exposure to Site Contaminants via Groundwater	Highest RAC: (residual)	M
Project Location:	**Robeson Industries, Castile, NY**				
Project Number:	3616206112				
Date Prepared:	4/7/21	Date Accepted:	12/9/22		
Prepared by (Name/Title):	Madeline Bruno Technical Professional II - Geology				
Reviewed by (Name/Title):	Katie Amann Senior Project Manager				

Risk Assessment Code (RAC) Matrix

Severity \ Probability	Almost certain	Likely	Possible	Unlikely	Rare
Catastrophic	H	H	S	S	M
Critical	H	S	S	M	L
Marginal	S	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 the specified activity
- **BOLD hazards corresponding to Substantial or High Risk**.

This AHA is not an exhaustive summary of all hazards associated with the Site. Refer to the project HASP or client information for additional requirements, and emergency procedures.

Workers to follow general site safety controls for Hazard Signage/PPE, Housekeeping, Slips Trips and Falls, Biological hazards, Mobile equipment, Confined spaces, Fall hazards, Electrical, and any active operating equipment or construction activities.

Step 1: Review each **"Hazard"** to identify Probability and Severity (Refer to Project HSE Risk Characterization Form)

- **"Probability"** is the likelihood to cause an incident, near miss, or accident and identified as: Almost certain, Likely, Possible, Unlikely, Rare.
- **"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-Inherent as H, S, M, or L for each "Hazard" on AHA, ***before* controls are applied.**

Step 3: Identify the RAC-Residual as H, S, M, or L for each "Hazard" on AHA, ***after* controls are applied.**

Step 4: Annotate the overall highest RAC-Residual at the top of AHA.

Risk Categories

- **H = High Risk**
- **S = Substantial Risk**
- **M = Moderate Risk**
- **L = Low Risk**

MANAGEMENT OF CHANGE: If there is a change or deviation from the planned activity, you must stop the job and re-evaluate the risk assessment and the precautions taken. Any changes to work described in this AHA shall require review by a Qualified Person.

Check all Life Saving Rules that apply:

☐ Bypassing Safety Controls	☐ Confined Space	☐ Driving	☐ Energy Isolation
☐ Hot Work	☐ Line of Fire	☑ Work Authorization	☐ Safe Mechanical Lifting
☐ Working at Height			

AHA – Groundwater Monitoring and Well Development

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
PPE: • Work uniform or work clothes • Hard hat • Safety glasses • Steel-toed boots • Gloves (per HASP) • High-visibility reflective vests • Hearing protection	**Competent / Qualified Personnel:** See HASP – All WSP employees trained in this activity **Training Requirements:** • HAZWOPER (40-hour, 8-hour Refresher, Supervisory, if 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.

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
1. Mobilization	See Mobilization/Demobilization and Site Preparation AHA	M	See Mobilization/Demobilization and Site Preparation AHA	Exempt
2. General Site Hazards	See Field Work General AHA	M	See Field Work General AHA	Exempt
	2A) Exposure to Site Contaminants	M	Read HASP to determine level of protection (PPE) and to become familiar with Site contaminants and symptoms of exposure.	L
	2B) Head Injuries and Slips, Trips, Falls from Walking in Wooded Areas of the Site	M	▪ Protect head against falling objects. ▪ Wear your hardhat for protection from falling limbs and pinecones, and from tools and equipment carried by other crewmembers. ▪ Stay out of the woods during high winds. ▪ Watch your footing as stepping over rocks, roots, uneven terrain, etc.	L
3. Check and Calibrate Monitoring Instruments/ Equipment	3A) Muscle Strain – lifting, twisting, tugging	M	▪ Get assistance from a co-worker or use mechanical means to move heavy sampling equipment (dolly, cart, etc.).	L
	3B) Exposure to Calibration Gases and Chemicals	M	▪ Review equipment manuals and follow manufacture's requirements for calibrating monitoring instruments. ▪ Read the safety data sheet (SDS) for the chemical and follow the recommended handling and use requirements including PPE. ▪ Calibrate instruments in a clean, well ventilated area.	L
4. Load/Carry Sampling Equipment to Site	4A) Muscle Strain – lifting, twisting, tugging	M	▪ Use proper lifting techniques. Do not lift and twist. ▪ Use mechanical aids when possible.	L

AHA – Groundwater Monitoring and Well Development

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
			▪ Use 2 person lift for heavy items.	
5. Opening the Well Cap, Gauging (total depth, water level), PID Monitoring for Site Contaminants	5A) Contact with Poisonous Plants and Biting Insects	S	See Poisonous Plants AHA See Insect Stings and Bites AHA	**Exempt**
	5B) **Inhalation and Contact with Hazardous Substances (contaminated groundwater); Liquid Splash**	S	▪ 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
	5C) Foot Injuries from Dropped Equipment	M	▪ 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
6. Removal of Extraction Well Pump (if necessary)	6A) **Hazardous Electricity**	S	▪ Ensure well pump and equipment is deenergized and LOTO of pump and equipment has been completed by WSP competant person and subcontractor. ▪ Confirm zero energy state using a clamp meter before cutting wires.	M
	6B) Safe Lifting		▪ Ensure subcontractor equipment is rated for lifting well pump and piping from well (assume piping is full of water). ▪ Confirm equipment can either lift entire pump/pipe/pitless adapter from well without disconnection, or that additional safety measures are in place to secure well pump/piping during winch relocation. ▪ Keep away from the well riser during pump removal activities.	M
7. Surge and/or Bail Well (Well Development using bailer or portable pump) and Collect Well Development Water	6A) Lifting/ Twisting/ Tugging/ Straining due to lifting bailers, pumps, 5-gallon carboys and from moving equipment to well locations	M	See 4A) above.	L

AHA – Groundwater Monitoring and Well Development

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
	6B) Slips, Trips, Falls	M	▪ Ground can become wet/muddy, created by spilled water. ▪ Place all purged water into drums or carboys for removal. ▪ Wear good slip resistant footwear. ▪ Be aware of the placement of cords, tubing, rope, etc. and do not place in an area to create a trip hazard.	L
	6C) Repetitive Motion and other Ergonomic Issues	M	▪ 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
	6D) **Exposure to Contaminated Groundwater**	S	▪ Wear appropriate PPE as identified in HASP. ▪ Decontaminate outside of bottles. ▪ Prevent water from contacting skin. ▪ Work in well ventilated area – upwind of samples. ▪ Be aware when sampling water through a filter, if it becomes plugged with sediment it may unexpectedly “blow off” the hose and splash. Change filter prior to sedimentation back pressure. ▪ Work upwind of the sample location. ▪ Review and understand SDS for all chemicals being handled. ▪ Be careful when handling acids and caustic substances. Wear PPE including gloves and wash hands after completion of task.	M
8. Conducting Field Measurements and Collecting Groundwater Samples	7A) **Exposure to Contaminated Groundwater and Sample Preservative**	S	See 6D) above. ▪ Wear appropriate safety glasses. Use tinted lenses that provides UV protection during sun exposure. ▪ Be aware when sampling water through a filter, if it becomes plugged with sediment it may unexpectedly “blow off” the hose and splash. Change filter prior to sedimentation back pressure. ▪ Wear PPE including protective gloves, coveralls, safety glasses as appropriate. ▪ Work upwind of the sample location. ▪ Minimize exposure using a shovel/spoon or tool to collect the sample. ▪ Review and understand SDS for all chemicals being handled. ▪ Be careful when handling acids and caustic substances. Wear PPE including gloves and wash hands after completion of task.	M

AHA – Groundwater Monitoring and Well Development

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
	7B) Cuts to Hands	M	▪ Be alert for sharp edges on equipment and monitoring wells. ▪ Wear cut resistant gloves as appropriate.	L
	7C) Using Generator/Electrical Equipment – Electrocution/ Fire Hazards	M	▪ Read and follow the manufacturer's requirements for inspection, operation and fueling the generator. ▪ 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 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. ▪ Do not fuel a hot generator. Turn the generator off and let it cool down before refueling. Following the manufacturer's requirements. ▪ Transport fuels in approved safety containers. The use of containers other than those specifically designed to carry fuel is prohibited. ▪ Read the Safety Data Sheet for hazards associated with gasoline use.	L
	7D) Bending, pulling, twisting and lifting	M	See 4A) above.	L
	7E) Chemical Exposure/Splash	M	▪ Wear appropriate safety glasses. Use tinted lenses that provides UV protection during sun exposure. ▪ Be aware when sampling water through a filter, if it becomes plugged with sediment it may unexpectedly "blow off" the hose and splash. Change filter prior to sedimentation back pressure. ▪ Wear PPE including protective gloves, coveralls, safety glasses as appropriate. ▪ Work upwind of the sample location.	L

AHA – Groundwater Monitoring and Well Development

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
			▪ Minimize exposure using a shovel/spoon or tool to collect the sample. ▪ Review and understand SDS for all chemicals being handled. ▪ Be careful when handling acids and caustic substances. Wear PPE including gloves and wash hands after completion of task.	
	7F) Water Borne Diseases	**M**	▪ 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. ▪ If site water is suspected or know to contain bacteria that could cause water borne diseases, ensure that all equipment is adequately decontaminated using a 10% bleach solution.	**L**
	7G) Vegetation, sticks, reeds, - cuts and punctures	**M**	▪ Clear access to each sampling site. ▪ Be familiar with types of plants that could cause cuts and punctures. Plants with rigid stalks, branches, etc. and avoid.	**L**
	7H) Sharps and knives	**M**	▪ Use care when handling tape dispensers, knives and other sharp objects. Make sure your hands / fingers are out of the path of the blade. ▪ Do not use straight utility knives.	**L**
9. Pack samples for shipment to laboratory	8A) Contact with contamination	**M**	▪ Handle samples with gloved hands. ▪ Contaminated PPE (gloves) should be disposed on-site. ▪ Remove gloves and wash hands as soon as possible.	**L**
	8B) Freeze Burns, Back Strain, Hazardous Chemical Exposure	**M**	▪ Wear appropriate chemical resistant gloves as identified in HASP when handling samples. ▪ 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.	**L**

AHA – Groundwater Monitoring and Well Development

FIELD ACKNOWLEDGEMENT OF PERSON(S) CARRYING OUT WORK

NAME(S):	SIGNED:	DATE:
______________________	______________	__________
______________________	______________	__________
______________________	______________	__________
______________________	______________	__________
______________________	______________	__________
______________________	______________	__________
______________________	______________	__________
______________________	______________	__________

SITE SUPERVISOR: ______________________ SIGNED: ______________ DATE: __________

BY SIGNING – You Acknowledge that:

- I have read and understand all job steps, hazards and controls associated with today's work.
- Further, I WILL stop any job I think is unsafe.
- I have completed a site-specific HASP Orientation
- I have participated in a daily tailgate safety meeting

For tasks/activities that extend beyond a single day, use DAILY RENEWAL form or Point of Work Risk Assessment (PoWRa).

AHA – Groundwater Monitoring and Well Development

AHA DAILY RENEWAL		
Date:	Weather:	
Changes noted:		
Site Supervisor (Print & Sign):		
Name(s):		
Date:	Weather:	
Changes noted:		
Site Supervisor (Print & Sign):		
Name(s):		
Date:	Weather:	
Changes noted:		
Site Supervisor (Print & Sign):		
Name(s):		

AHA – Working with Sample Preservatives

Activity/Work Task:	Working with Sample Preservatives		Substantial / High Risks:	Exposure to Chemicals	Highest RAC: (residual)	L
Project Location:	**Robeson Industries, Castile, NY**					
Project Number:	3616206112					
Date Prepared:	4/7/21	Date Accepted:	12/9/22			
Prepared by (Name/Title):	Madeline Bruno – Technical Professional II					
Reviewed by (Name/Title):	Katie Amann Senior Project Manager					

Risk Assessment Code (RAC) Matrix

Severity \ **Probability**	Almost certain	Likely	Possible	Unlikely	Rare
Catastrophic	**H**	**H**	**S**	**S**	**M**
Critical	**H**	**S**	**S**	**M**	**L**
Marginal	**S**	**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 the specified activity
- **BOLD hazards corresponding to Substantial or High Risk**.

This AHA is not an exhaustive summary of all hazards associated with the Site. Refer to the project HASP or client information for additional requirements, and emergency procedures.

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Step 1: Review each **"Hazard"** to identify Probability and Severity (Refer to Project HSE Risk Characterization Form)

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Risk Categories
H = High Risk
S = Substantial Risk
M = Moderate Risk
L = Low Risk

MANAGEMENT OF CHANGE: If there is a change or deviation from the planned activity, you must stop the job and re-evaluate the risk assessment and the precautions taken. Any changes to work described in this AHA shall require review by a Qualified Person.

Check all Life Saving Rules that apply:	☐ Bypassing Safety Controls	☐ Confined Space	☐ Driving	☐ Energy Isolation
☐ Hot Work	☐ Line of Fire	☐ Work Authorization	☐ Safe Mechanical Lifting	☐ Working at Height

AHA – Working with Sample Preservatives

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
PPE: • Work uniform or work clothes • Hard hat • Safety glasses • Steel-toed boots • Gloves (per HASP) • High-visibility reflective vests • Hearing protection Safety Equipment: • Eyewash	**Competent / Qualified Personnel:** See HASP **Training Requirements:** Site-Specific HASP Orientation Toolbox safety meeting Task kick-off meeting • HAZWOPER (40-hour, 8-hour refresher, supervisor if applicable)	• 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.

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
1. Opening the Box of Ampoules Containing the Preservative	1A) Cuts or Punctures with a Knife	M	▪ Use appropriate techniques when handling a knife and always cut away from your body/hands. ▪ Use of an xacto-type or other fixed blade is prohibited.	L
	1B) Cuts or Punctures from Broken Ampoules / Glass	M	▪ Wear safety glasses and protective gloves. ▪ Do not put your hand into the box, use mechanical means to clean up the glass. ▪ When disposing of the broken glass, place it in a cardboard box, label it "broken glass", and tape it shut so that anyone handling the trash will not be injured by it.	L
	1C) Contact with Preservative – Skin/Eye Burns, Skin Irritation and Breathing Fumes	M	▪ Do not work alone with working with acids and bases. Acids and bases used in preservation of samples are dangerous and must be handled with care. ▪ Nitric acid and hydrochloric acid have high vapor pressures. Always work in a well-ventilated area. ▪ Make sure you are in close proximity to a working eyewash station. ▪ Always wear gloves and safety goggles when handling preservatives. ▪ When opening a preservative bottle, particularly a glass ampoule, break open the ampoule away from yourself and others.	L

AHA – Working with Sample Preservatives

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
			▪ Fumes may come into contact with the perspiration on your skin and rehydrate to form an acid. ▪ Have acid/base neutralization supplies (baking soda) on hand in the event of a spill. ▪ If your skin itches, flush affected area for 15 minutes with water. ▪ If acid spills on your skin or clothing, immediately remove the contaminated clothing and rinse the area with water. **Do not** apply baking soda (the heat of reaction can cause burns).	
2. Adding Acid to Water Sample	2A) Chemical Reaction – Breathing Fumes and Skin/Eye Contact	**M**	▪ Wear safety goggles and protective gloves. Acid may react with high alkaline sample and “fizz” (release carbon dioxide). ▪ If acid splashes in the eyes, flush eyes for 15 minutes with water and seek medical help immediately.	**L**
3. Ampoule Disposal	3A) Cuts from Broken Glass	**M**	See 1B) above. Dispose of the	**L**
	3B) Contact with Preservative – Skin/Eye Burns, Skin Irritation and Breathing Fumes	**M**	See 1C) above. ▪ Dispose of ampoules and any residual chemical in accordance with environmental and hazardous waste regulations.	**L**

AHA – Working with Sample Preservatives

FIELD ACKNOWLEDGEMENT OF PERSON(S) CARRYING OUT WORK

		SIGNED:	DATE:
NAME(S):	______________________	______________________	______________
	______________________	______________________	______________
	______________________	______________________	______________
	______________________	______________________	______________
	______________________	______________________	______________
	______________________	______________________	______________
	______________________	______________________	______________
	______________________	______________________	______________
SITE SUPERVISOR:	______________________	SIGNED: ______________________	DATE: ______________

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AHA – Working with Sample Preservatives

AHA DAILY RENEWAL		
Date:	Weather:	
Changes noted:		
Site Supervisor (Print & Sign):		
Name(s):		
Date:	Weather:	
Changes noted:		
Site Supervisor (Print & Sign):		
Name(s):		
Date:	Weather:	
Changes noted:		
Site Supervisor (Print & Sign):		
Name(s):		

AHA – Insect Stings and Bites

Activity/Work Task:	**Insect Bites & Stings**	Substantial / High Risks:	Lyme Disease, Rocky Mountain Spotted Fever, other tick-borne diseases; Allergic reactions, painful stings
Highest RAC: (residual)	**M**		
Project Location:	**Robeson Industries, Castile, NY**		
Project Number:	3616206112		
Date Prepared:	4/7/21	Date Accepted:	12/9/22
Prepared by (Name/Title):	Madeline Bruno Technical Professional II - Geology		
Reviewed by (Name/Title):	Katie Amann Project Manager		

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Critical	H	S	S	M	L
Marginal	S	M	M	L	L
Negligible	M	L	L	L	L

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

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- **BOLD hazards corresponding to Substantial or High Risk**.

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Risk Categories
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S = Substantial Risk
M = Moderate Risk
L = Low Risk

manage any change

MANAGEMENT OF CHANGE: If there is a change or deviation from the planned activity, you must stop the job and re-evaluate the risk assessment and the precautions taken. Any changes to work described in this AHA shall require review by a Qualified Person.

Check all Life Saving Rules that apply:				
☐ Hot Work	☐ Bypassing Safety Controls	☐ Confined Space	☐ Driving	☐ Energy Isolation
	☐ Line of Fire	☐ Work Authorization	☐ Safe Mechanical Lifting	☐ Working at Height

AHA – Insect Stings and Bites

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
PPE: • Work uniform or work clothes • Hard hat • Safety glasses • Steel-toed boots • Gloves (per HASP) • High-visibility reflective vests • Hearing protection	**Competent / Qualified Personnel:** See HASP – All WSP Employees **Training Requirements:** • HAZWOPER (40-hour, 8-hour Refresher, Supervisory, if applicable) • Site-Specific HASP Orientation • Toolbox safety meeting • Task kick-off meeting	• Daily inspection of equipment per manufacturer's instructions. • Inspect all PPE prior to use.

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
1. Traveling/working in areas with potential tick bites (ex. outdoor wooded areas or fields). See species summary below.	1A) **Lyme Disease, Rocky Mountain Spotted Fever, etc.**	S	• Treat outer layer of field clothing and boots by spraying with tick repellent product that contains permethrin or equivalent and allowing the treated clothing/boots to dry before wearing. Read the safety data sheet for the specific tick repellent and follow the manufacturer's instructions and precautions for use. • Spray exposed areas of your skin with an insect repellant that contains at least 30% DEET, picaridin, or IR3535. • Wear light colored clothing that fits tightly at the wrists, ankles, and waist. • Each outer garment should overlap the one above it. Tuck in shirt tails. • Cover trouser legs with high socks or boots. • Conduct tick checks throughout the day. Visually check co-workers clothing also. Search the body on a regular basis, especially hair and clothing; ticks generally do not attach for the first couple of hours. • Upon returning from the field and as soon as possible, conduct a full-body tick check using a hand-held or full-length mirror to view all parts of your body especially in and around the ears, inside belly button, back of the knees, in and around the hair, between the legs, and around the waist. • Examine field gear. Ticks can ride into the home on clothing, boots, bags, then attach to a person later. Tumble clothes in a dryer on high heat for an hour to kill remaining ticks. • Bathe or shower as soon as possible after coming indoors	M

AHA – Insect Stings and Bites

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
			(preferably within two hours) to wash off and more easily find ticks that are crawling on you. • If a tick becomes attached, pull it by grasping it (use fine point tweezers or tick removal device if available) 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. Record dates of exposure and removal. **Notify WorkCare and your supervisor and HSE Coordinator.** • Do not try to remove the tick by burning with a match or covering it with chemical agents or petroleum jelly. • If you cannot remove the tick, or the head detaches, seek prompt medical help. **Notify WorkCare**. • 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. Other tick-borne diseases have been identified including Anaplasmosis, Babesiosis, Borrelia, Powassan, etc.	
2. Working/traveling in areas with potential bee and wasp stings (ex. wooded areas and fields)	2A) **Allergic reactions, painful stings**	S	• Be alert to hives in brush or in hollow logs. Watch for insects travelling in and out of one location. • If you or anyone you are working with is known to have allergic reactions to bee stings, tell the rest of the crew and your supervisor. Make sure you carry emergency medication (epinephrine autoinjector, Epi Pen) with you at all times. • Wear light-colored clothing. Wear clothing that covers the body including long sleeve shirts and trousers; tuck in shirt. Bright colors and metal objects may attract bees. • Wear clean clothing and bathe daily. • Avoid using perfumed soaps, shampoos, and deodorants and do not wear perfume or cologne. • Avoid flowering plants when possible. • Keep work area clean; some insects are attracted to discarded food. • Remain calm and still if a single stinging insect is flying	L

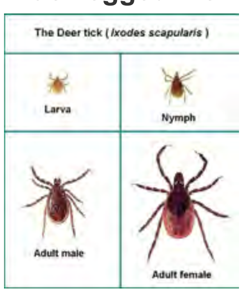
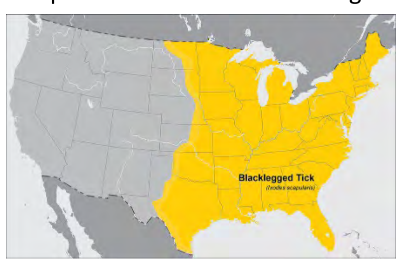
AHA – Insect Stings and Bites

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
			around you. Swatting may cause it sting. • If an insect is inside your vehicle, stop slowly, and open all the windows. • If attacked by several stinging insects, run to get away. Bees release a chemical when they sting, which attracts other bees. • Get indoors (bldg. vehicle). • Shaded areas are better than open areas. • Do not jump into water. Some insects (Africanized honey bees) are known to hover above the water. • If you are stung, have someone stay with you to be sure you do not have an allergic reaction. • Wash the sting site with soap and water. • If a stinger is left behind, scrape it off the skin with a fingernail or gauze. Do not use a tweezers as this squeezes the venom sack, worsening the injury. • A cold compress may bring relief. Do not scratch the sting as this may increase swelling, itching, and risk of infection. • If the victim develops hives, asthmatic breathing, tissue swelling, or a drop in blood pressure, seek medical help immediately. **CALL 9-1-1 immediately.** If available, give victim antihistime, (Benadryl, chlo-amine tabs).	
3. Traveling/working in areas of potential mosquito bites (ex. woods, fields, near bodies of water, etc.)	3A) Skin irritation, encephalitis such as Eastern Equine Encephalitis. West Nile Virus	M	• Wear long sleeves and trousers. • Avoid heavy scents. • Follow clothing recommendations outlined for bee/wasp contact above. • Wear clean clothing and bathe daily. • Avoid using perfumed soaps, shampoos, and deodorants and do not wear perfume or cologne • Use insect repellents. Note that the CDC and EPA recommend using an EPA-registered insect repellent to guard against diseases spread by mosquitoes. • Carry after-bite medication to reduce skin irritation.	L
4. Traveling/Working in areas of potential Spider	4A) Symptoms can vary from minor to severe: Itching, rash, pain, blisters, difficulty	M	• Inspect or shake out any clothing, shoes, towels, or field equipment/gear before use. • Wear protective clothing such as a long-sleeved shirt and	

AHA – Insect Stings and Bites

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
Bites. See species summary below.	breathing, muscle pain/cramping, headache, increased sweating, nausea/vomiting, fever, chills, high blood pressures, anxiety or restlessness.		long pants, hat, gloves, and boots when handling stacked or undisturbed piles of materials. • Minimize the empty spaces between stacked materials. • Remove and reduce debris and rubble from around the work areas. • If possible, trim or eliminate tall grasses from around long-term work areas. Avoid these areas whenever possible. • Store clothing/gear and field equipment in tightly closed/sealed plastic bags. • Keep your tetanus boosters up-to-date (every 10 years). Spider bites can become infected with tetanus spores. • If you are bitten, stay calm. Identify the type of spider if it is possible to do so safely. Identification will aid in medical treatment. • Wash the bite area with soap and water. • Apply a cloth dampened with cold water or filled with ice to the bite area to reduce swelling. • Elevate bite area if possible. • Do not attempt to remove venom. • **Call WorkCare immediately and seek medical attention. Notify your Supervisor and the HSE Coordinator.**	

AHA – Insect Stings and Bites

Species (photos from CDC and EPA websites)	Range of Detection and Species Information	RAC Inherent
 **American Dog Tick**	American dog tick (Dermacentor variabilis, also known as the wood tick) is the most commonly identified species responsible for transmitting *Rickettsia rickettsii*, which causes Rocky Mountain spotted fever and Tularemia in humans. This tick is widely distributed east of the Rocky Mountains, and also occurs in limited areas on the Pacific Coast. Larvae and nymphs feed on small rodents, rabbits. Dogs and medium-sized mammals are the preferred hosts of adult *D. variabilis*, although it feeds readily on other large mammals, including humans. Distribution areas are shown in yellow (Center for Disease Control). Highest risk of tick bites are spring and summer.  **American Dog Tick Distribution**	S
 **Blacklegged Tick (a/k/a Deer Tick)**  	The blacklegged tick (*Ixodes scapularis*), commonly known as the **"deer tick",** can transmit the organisms responsible for Borrelia burgdorferi and B. mayonii (which cause Lyme disease), Anaplasma phagocytophilum (anaplasmosis), B. miyamotoi disease (a form of relapsing fever), Ehrlichia muris eauclairensis (ehrlichiosis), Babesia microti (babesiosis), and Powassan virus (Powassan virus disease). This tick is widely distributed across eastern United States. Larvae and nymphs feed on small mammals and birds, while adults feed on larger mammals and will bite humans on occasion. Distribution areas are shown in yellow (CDC). The greatest risk of being bitten is in the spring, summer and fall. However, adult ticks may search for a host any time winter temperatures are above freezing. Stages most likely to bit humnas are nymphs and adult females.  **Deer Tick Distribution** Note: Ticks in photo on the left are shown larger than actual size for easier identification.	S

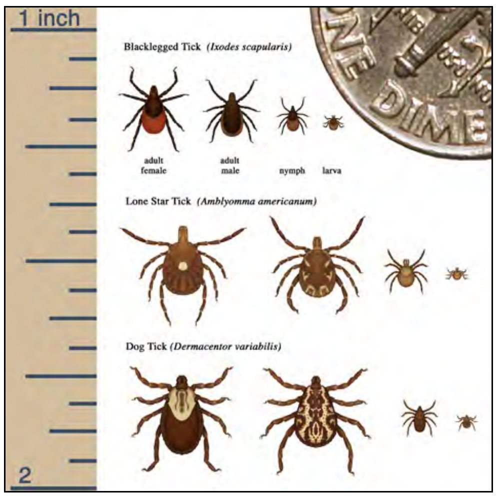
AHA – Insect Stings and Bites

Species (photos from CDC and EPA websites)	Range of Detection and Species Information	RAC Inherent
		
 **Lone star tick**	The lone star tick (*Amblyomma americanum*) transmits Ehrlichia chaffeensis and Ehrlichia ewingii, causing human ehrlichiosis, Heartland virus, tularemia, and STARI. The lone star tick is primarily found in the southeastern and eastern United States. As recent as 2017, the lone star tick continues to expand from its original territory into the northern and mid-western states. White-tailed deer are a major host of lone star ticks and appear to represent one natural reservoir for E. chaffeensis. Larvae and nymphs feed on birds and deer. Both nymphal and adult female ticks most frequently bite humans and transmit disease. Distribution areas are shown in yellow (CDC). 	M
 **Brown Dog Tick**	The brown dog tick (*Rhipicephalus sanguineus*) transmits *Rickettsia rickettsii* bacteria that causes Rocky Mountain spotted fever (in the southwestern United States and along the US-Mexico border). Dogs are the primary host for the brown dog tick in each of its life stages, but the tick may also bite humans or other mammals. 	M

AHA – Insect Stings and Bites

Species (photos from CDC and EPA websites)	Range of Detection and Species Information	RAC Inherent
 Woodchuck Tick (a/k/a Groundhog tick)	Woodchuck ticks (Ixodes cookei) are mostly found on woodchucks and rarely bites humans. Can be found throughout the eastern half of the U.S. and Canada throughout the summer months with peak activity during July. Very similar in size and appearance to deer ticks. This is the primary vector for Powassan virus. Also known as groundhog tick. All life stages feed on a variety of warm-blooded animals, including groundhogs, skunks, squirrels, raccoons, foxes, weasels, and occasionally people and domestic animals.	L
 Gulf Coast Tick	The Gulf Coast Tick (Amblyomma maculatum) is present along coastal areas of the United States, along the Atlantic coast and the Gulf of Mexico. This tick transmits Rickettsia parkeri rickettsiosis, a form of spotted fever. Larvae and nymphs feed on birds and small rodents, while adult ticks feed on deer and other wildlife. Adult ticks have been associated with transmission of R. parkeri to humans. 	L
 **Asian Longhorned Tick nymph and adult female top view (above) and underside view (below** 	A new tick species, *Haemaphysalis longicornis* (the **Asian longhorned tick**) has been identified for the first time in the United States. In other countries, bites from longhorned ticks can make people and animals seriously ill. **As of April 9, 2019**, no harmful germs have been found in the ticks of this species that have been collected in the United States. Research is ongoing. **As of February 7, 2020, longhorned ticks have been found in Arkansas, Connecticut, Delaware, Kentucky, Maryland, North Carolina, New Jersey, New York, Pennsylvania, Tennessee, Virginia, and West Virginia**. Compared with well-known native ticks (such as the blacklegged tick, lone star tick and American dog tick), the Asian longhorned tick appears to be less attracted to human skin. Information on this new species is available from the CDC and US Department of Agriculture: https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/animal-disease-information/cattle-disease-information/cattle-vector-borne-diseases . Based on the current (3/2020) avaiable information, the Asian longhorned tick was found in the following areas:	L

AHA – Insect Stings and Bites

Species (photos from CDC and EPA websites)	Range of Detection and Species Information	RAC Inherent
		
Note: Most ticks go through four life stages: egg, six-legged larva, eight-legged nymph, and adult. After hatching from the eggs, ticks must eat blood at every stage to survive. Ticks that require this many hosts can take up to 3 years to complete their full life cycle, and most will die because they don't find a host for their next feeding. The picture below shows the life stages of the Blacklegged Tick (Deer Tick), Lone Star Tick, and the American Dog Tick**.** Ticks are shown larger than actual size for easier identification. 		S
Brown Recluse Spider	Found in spaces with secluded, dry, sheltered areas such as underneath structures logs, or in piles of rocks or leaves, or indoors in dark closets, shoes, or attics. This spider is most commonly found in the Midwestern and southern states of the United States, but has been found in areas to the north and west of that range. It is brown in color with a characteristic dark violin-shaped (or fiddle-shaped) marking on its head and has six equal-sized eyes (most spiders have eight eyes). Brown recluse spiders are usually found in workplaces with secluded, dry, sheltered areas such as underneath structures logs, or in piles of rocks or leaves. If a brown recluse spider wanders indoors, they may be found in dark closets, shoes, or attics.	L

AHA – Insect Stings and Bites

Species (photos from CDC and EPA websites)	Range of Detection and Species Information	RAC Inherent
	The brown recluse spider cannot bite humans without some form of counter pressure, for example, through unintentional contact that traps the spider against the skin. Bites may cause a stinging sensation with localized pain. A small white blister usually develops at the site of the bite. The venom of a brown recluse can cause a severe lesion by destroying skin tissue. **This skin lesion will require professional medical attention.**	
Black Widow Spider  	Found throughout North America, but are most common in the southern and western areas of the United States, and are usually found in workplaces containing undisturbed areas such as woodpiles, under eaves, fences, and other areas where debris has accumulated. They may also be found living in outdoor toilets where flies are plentiful. Black widow spiders build webs between objects, and bites usually occur when humans come into direct contact with these webs. These spiders have a pattern of red coloration on the underside of their abdomen. The black widow's venom is a neurotoxin that produces pain at the bite area and then spreads to the chest, abdomen, or the entire body. The spider's bite can be distinguished from other insect bites by the two puncture marks it makes in the skin. The bite of the black widow may be painful or it may go unnoticed. The skin may display one or two bite marks with local swelling. Pain usually progresses from the bite site and eventually to the abdomen and back. Severe cramping or rigidity may occur in the abdominal muscles.	L

AHA – Insect Stings and Bites

Insect Repellents

TREAT SKIN

DEET (repels mosquitoes, ticks, some flies). Used on the skin. Maximum protection is provided at formulations with 30% DEET.

Picaridin (repels mosquitoes, ticks, flies): A synthetic version of a repellent found in pepper plants. This repellent is effective against the greatest range of insects. Maximum protection is provided at formulations with 20% picaridin. Used on the skin.

Synthesized Plant Oils (repels mosquitoes, some ticks): These include lemon eucalyptus oil and IR3535. Used on the skin.

Other natural plant oils are available (soybean, lemongrass, citronella, cedar, etc.) but they are not regulated for safety or effectiveness.

TREAT CLOTHING AND GEAR/SHOES/BOOTS

PERMETHRIN (kills or repels mosquitoes, ticks). Do not use on the skin. Use to treat exterior side (not the side that touches your skin) clothing and gear (boots, pants, socks, jackets, hats). Is also available as permethrin-treated clothing and gear. Permethrin-treated clothing provides protection after multiple washings. Note that there are many "natural" insect repellents that are not registered with the EPA and therefore the effectiveness is not known/proven. The CDC and EPA recommend using an EPA-registered insect repellent to guard against diseases spread by mosquitoes, tick, etc. The EPA has an established a website for identifying the right repellent for the conditions: https://www.epa.gov/insect-repellents

Graphics obtained from CDC website.

FIELD ACKNOWLEDGEMENT OF PERSON(S) CARRYING OUT WORK

NAME(S): ____________________ SIGNED: ____________________ DATE: ____________

____________________ ____________________ ____________

____________________ ____________________ ____________

____________________ ____________________ ____________

SITE SUPERVISOR: ____________________ SIGNED: ____________________ DATE: ____________

BY SIGNING – You Acknowledge that:

- I have read and understand all job steps, hazards and controls associated with today's work.
- Further, I WILL stop any job I think is unsafe.
- I have completed a site-specific HASP Orientation
- I have participated in a daily tailgate safety meeting

For tasks/activities that extend beyond a single day, use DAILY RENEWAL form below or Point of Work Risk Assessment (PoWRa).

AHA – Insect Stings and Bites

AHA DAILY RENEWAL		
Date:	Weather:	
Changes noted:		
Site Supervisor (Print & Sign):		
Name(s):		
Date:	Weather:	
Changes noted:		
Site Supervisor (Print & Sign):		
Name(s):		
Date:	Weather:	
Changes noted:		
Site Supervisor (Print & Sign):		
Name(s):		

AHA – Dog and Wildlife Safety

Activity/Work Task:	Dog and Wildlife Safety		Overall Risk Assessment Code (RAC) (Use highest code)					L
Project Location:	Castile, NY		**Risk Assessment Code (RAC) Matrix**					
Project Number:	D009809-14		**Severity**	**Probability**				
Date Modified:	11/3/20	**Date Accepted:** 11/5/20		Frequent	Likely	Occasional	Seldom	Unlikely
Modified by (Name/Title):	Bradley LaForest/Project Manager		Catastrophic	**E**	**E**	**H**	**H**	**M**
			Critical	**E**	**H**	**H**	**M**	**L**
Reviewed by (Name/Title):	Katie Amann, Assistant Project Manager		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 dealing with animals if accidently encountered onsite.
- This AHA assumes it is unlikely to encounter wild animals but gives information on what to do if it does occur, therefore PPE is described as what is relevant to what should be worn while inspecting the site

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 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 – Dog and Wildlife Safety

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
PPE: (safety glasses, nitrile gloves, steel toe work boots) as required by HASP	**Competent / Qualified Personnel:** All Amec Foster Wheeler employees **Training requirements:** Site Specific HASP Orientation Tailgate Meetings	Look for dogs before exiting your vehicle.

AHA – Dog and Wildlife Safety

Job Steps	Hazards	Controls	RAC
1. Working in areas with potential wild animals or dogs exist, example, outdoor wooded areas, fields, or residential areas	1A) Preparation for Site Visit	1A) Preparation for Site Visit ▪ Call land owner prior to site visit. ▪ Arrange for appointment time so animals can be restrained during the visit. ▪ Wear field clothes such as long pants, long sleeves, and boots to provide protection if attacked.	L
	1B) Preventing Bites or Attacks	1B) Preventing Bites or Attacks ▪ Be aware of surroundings. Locate and work at safe distance from dens, nests, warrens, cages, leashed animals, or “homes” of animals. ▪ Learn body language and warning signs of animals posturing to attack. ▪ See attached drawings and explainations of animal behavior. ▪ Do not approach strange dogs especially one who's tied, tethered or confined behind a fence or in a car. They often feel vulnerable and will fight to protect their territory. ▪ Never hang over fences or put your hands through fence openings to touch a dog, even one you know. ▪ Never approach a dog that is acting afraid, growling, showing teeth or who has puppies - even if the owner is there. ▪ Don't disturb a dog while sleeping, eating, chewing on a toy, or caring for puppies. ▪ Always let the dog sniff you first before petting. Pat on the back or side, reaching over a dog’s head may scare it. ▪ Never run past a dog. Joggers and children on bicycles can trigger their instinct to chase and attack. ▪ Never tease a dog by pulling ears, tail or feet or play too rough. Avoid games such as tug-of-war, jumping up for toys/food, wrestling and chase, all could lead to injury if the game gets out of hand. ▪ Be careful around older dogs. They may be blind, sensitive to touch or hearing-impaired . ▪ Never try to break up a dog fight with your hands. Use a water hose, stick or throw a blanket over the dogs to disorient them. ▪ Alert animal control to stray or roaming dogs.	L
	1C) Attacking Animal	1C) Attacking Animal ▪ If an animal shows aggressive behavior, slowly walk away from it. ▪ If the animal approaches you, remain calm and quiet. Do not run away from the dog, panic, or make loud noises. Avoid sudden movements. ▪ If you say anything, speak calmly and firmly. ▪ If the animal still follows you, remain motionless with hands at your sides. Avoid eye contact. Stand with the side of your body facing the dog. Facing a dog directly can appear aggressive to the dog. Instead, keep your body turned partially or completely to the side. If you are boring or not a threat, there is a good chance the animal will lose interest and move on. Once the dog loses interest in you, slowly back away until it is out of sight. ▪ If the animal does attack, put anything that you can between yourself and the animal like a tree or car. ▪ If lunged at, don't try to overpower the animal. ▪ If you're holding something (jacket, bag, clipboard), put it into its mouth. If you don't have anything in your hand, put your arm up to protect your face. ▪ If the animal jumps on you or knocks you down, don't move or scream or roll around. Pretend that you are a turtle: curl into a ball, face down, cover your head with your arms and use your hands to protect the back of your neck. Stay in this position until the animal leaves.	L

AHA – Dog and Wildlife Safety

Job Steps	Hazards	Controls	RAC
2. If bitten or wounded	2A) Allergic reactions, excessive bleeding, broken bones	2A) Allergic reactions, excessive bleeding, broken bones ▪ Field crews must maintain a stocked first aid kit. ▪ Work using the buddy system or maintain communicaitons by radio or cell phone. ▪ If you or anyone you are working with is allergic, make sure you carry emergency medication with you at all times. ▪ If the victim develops hives, asthmatic breathing, tissue swelling, or a drop in blood pressure, seek medical help immediately. ▪ If the person is bitten, apply pressure to stop bleeding. - Immediately wash the area thoroughly with soap and water. - Cover lightly with an antiseptic ointment. - Cover with a sterile bandage. - Seek medical attention for additional care and advice as appropriate. ▪ If you cannot stop the bleeding or you feel faint or weak, call 911 or your local emergency medical services immediately ▪ If bitten, contact authorities (the local animal care and control agency) and tell them everything you can about the dog: the owner's name and address, if you know it; color of the dog; size; where you saw it; if you've seen it before, if you know it is a stray, and in which direction the dog went. These details may help animal-control officers locate the dog.	L
	2B) Rabid Animal	3A) Rabid Animal ▪ If the animal is a vaccinated pet, follow the steps for basic bite care above. ▪ If you can identify or safely capture the animal, this may help your doctor determine if you need anti-rabies therapy. The dog may need to be quarantined. ▪ If it is a wild animal, only try to capture it if you can do so without getting bitten again. If the animal cannot be contained and must be killed to prevent its escape, do so without damaging the head. The brain will be needed to test for rabies.	L

U.S. Humane Society at (202) 452-1100

How to interpret dogs' body language, facial expressions and vocalizations.

Domestic dogs use body language, facial expressions, and vocalizations to communicate, and all of these signals are easily understood by other dogs. If you can learn to interpret how your dog is feeling by observing its posture and expression and listening to it, you'll be well on the way to successful communication with your pet and better equipped to solve any behavior problems that arise.

AGGRESSIVE

Ears	Forward or back, close to head.
Eyes	Narrow or staring challengingly.
Mouth/ Teeth	Lips open, drawn back to expose teeth bared in a snarl. Possible jaw snapping.
Body	Tense. Upright. Hackles on neck up. Completely Dominant position.
Tail	Straight out from body. Fluffed up.
Vocali-zation	Snarl. Growl. Loud bark.

AHA – Dog and Wildlife Safety

ALERT		
	Ears	Perked-up. Turning to catch sounds.
	Eyes	Open normally or wide.
	Mouth/ Teeth	Mouth closed or slightly open with teeth covered.
	Body	Normal. Possibly standing on tiptoe. Slightly Dominant position.
	Tail	Up. Possibly wagging.
	Vocali-zation	None. Low whine or alarm bark.

AHA – Dog and Wildlife Safety

ANXIOUS		
	Ears	Partially back.
	Eyes	Slightly narrowed.
	Mouth/ Teeth	Mouth closed, or slightly open in a "grin."
	Body	Tense. Slightly lowered in a Submissive position.
	Tail	Partially lowered.
	Vocali-zation	Low whine or moaning-type bark.

CHASE, BEGINNING STAGE		
	Ears	Perked-up, forward-pointing.
	Eyes	Wide open. Very alert.
	Mouth/ Teeth	Mouth slightly open. Excited panting.
	Body	Tense. Crouched low in a predatory position. Legs bent, poised to run.
	Tail	Extended straight out from body.
	Vocali-zation	None.

CURIOUS/EAGER/EXCITED

Ears	Perked-up, forward-pointing.
Eyes	Wide open.
Mouth/ Teeth	Mouth open, teeth covered. Possible panting.
Body	Normal stance. Possible wiggling, standing on tiptoe, or pacing.
Tail	Up. Wagging.
Vocali-zation	Excited short barking, whining.

DOMINANT

Ears	Up straight or forward.
Eyes	Wide open, staring.
Mouth/ Teeth	Mouth closed or slightly open.
Body	Very tall posture. Hackles may be up.
Tail	Stiffened and fluffed. Up or straight out from body.
Vocali-zation	Low, assertive growl or grunt.

AHA – Dog and Wildlife Safety

FEARFUL

Ears	Laid back flat and low on head.
Eyes	Narrowed, averted. Possibly rolled back in head, whites showing.
Mouth/ Teeth	Lips drawn back to expose teeth.
Body	Tense. Crouched low in submissive position. Shivering, trembling. Possible secretion from anal scent glands.
Tail	Down between legs.
Vocali-zation	Low, worried yelp, whine, or growl.

FLIGHT, BEGINNING STAGE

Ears	Back.
Eyes	Wide open. Possibly rolled back with whites showing.
Mouth/ Teeth	Slightly opened mouth. Possible drooling.
Body	Tense. Shivering. Low, poised to run.
Tail	Low or between legs.
Vocali-zation	None. Possible yelp or whine.

FRIENDLY

Ears	Perked-up.
Eyes	Wide open. Alert look.
Mouth/ Teeth	Relaxed, possibly slightly open, "smiling" mouth.
Body	Normal posture. Still, or possible wiggling of whole rear end.
Tail	Up or out from body. Wagging.
Vocali-zation	Whimpering, yapping, or short, high bark.

GUARDING

Ears	Perked-up. Forward.
Eyes	Wide open, alert.
Mouth/ Teeth	Mouth slightly open, teeth bared. Snapping or gnashing of teeth.
Body	Tense. Rigid. Hackles up. Standing very tall in an aggressive or dominant stance.
Tail	Rigid. Held straight out from body. Sometimes fluffed.
Vocali-zation	Loud alert bark. Growl. Snarl.

PLAYFUL/HAPPY

Ears	Perked-up and forward, or relaxed.

Eyes	Wide open. Sparkly/merry-looking.
Mouth/ Teeth	Mouth relaxed and slightly open, teeth covered. Excited panting.
Body	Relaxed, or front end lowered, rear end up in the air, wiggling in a play-bow. Excited bouncing and jumping up and down. Circling around and running forward and back in an invitation to play.
Tail	Wagging vigorously.
Vocali-zation	Excited barking. Soft play-growling.

PREDATORY

Ears	Alert. Held forward or backward to catch sounds.
Eyes	Wide open. Staring, focusing.
Mouth/ Teeth	Mouth closed.
Body	Rigid. Low to ground, ready to spring forward. Quietly sniffing the air.
Tail	Straight and low.
Vocali-zation	None (so the prey won't be alerted).

SUBORDINATE (SUBMISSIVE)

Ears	Down, flattened against head.

AHA – Dog and Wildlife Safety

Eyes	Narrowed to slits or wide open, whites showing.
Mouth/ Teeth	Lips pulled way back from teeth in a "grin". Nuzzling or licking other animal or person on face.
Body	Lowered to ground, front paw raised. Lying on back, belly up. Possible urine leaking/dribbling. Possible emptying of anal scent glands.
Tail	Down, between legs.
Vocali-zation	None, or low, worried whining. Possible yelping/whimpering in fear.

http://www.pawsacrossamerica.com/interpret.html

AHA – Poisonous Plants

Activity/Work Task:	Poisonous Plants		Substantial / High Risks:	Allergic Reaction, Contact Dermatitis in Eyes		Highest RAC: (residual)	M
Project Location:	Robeson Industrial, Castile, NY						
Project Number:	3616206112						
Date Prepared:	4/7/21	Date Accepted:	12/9/22				
Prepared by (Name/Title):	Madeline Bruno Tech Professional II - Geology						
Reviewed by (Name/Title):	Katie Amann Project Manager						

Risk Assessment Code (RAC) Matrix

Severity \ Probability	Almost certain	Likely	Possible	Unlikely	Rare
Catastrophic	H	H	S	S	M
Critical	H	S	S	M	L
Marginal	S	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 the specified activity
- **BOLD hazards corresponding to Substantial or High Risk**.

This AHA is not an exhaustive summary of all hazards associated with the Site. Refer to the project HASP or client information for additional requirements, and emergency procedures.

Step 1: Review each **"Hazard"** to identify Probability and Severity (Refer to Project HSE Risk Characterization Form)

- **"Probability"** is the likelihood to cause an incident, near miss, or accident and identified as: Almost certain, Likely, Possible, Unlikely, Rare.
- **"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-Inherent as H, S, M, or L for each "Hazard" on AHA, ***before* controls are applied.**

Step 3: Identify the RAC-Residual as H, S, M, or L for each "Hazard" on AHA, ***after* controls are applied.**

Step 4: Annotate the overall highest RAC-Residual at the top of AHA.

Risk Categories

- **H = High Risk**
- **S = Substantial Risk**
- **M = Moderate Risk**
- **L = Low Risk**

manage any change

MANAGEMENT OF CHANGE: If there is a change or deviation from the planned activity, you must stop the job and re-evaluate the risk assessment and the precautions taken. Any changes to work described in this AHA shall require review by a Qualified Person.

Check all Life Saving Rules that apply:

	☐ Bypassing Safety Controls	☐ Confined Space	☐ Driving	☐ Energy Isolation
☐ Hot Work	☐ Line of Fire	☐ Work Authorization	☐ Safe Mechanical Lifting	☐ Working at Height

AHA – Poisonous Plants

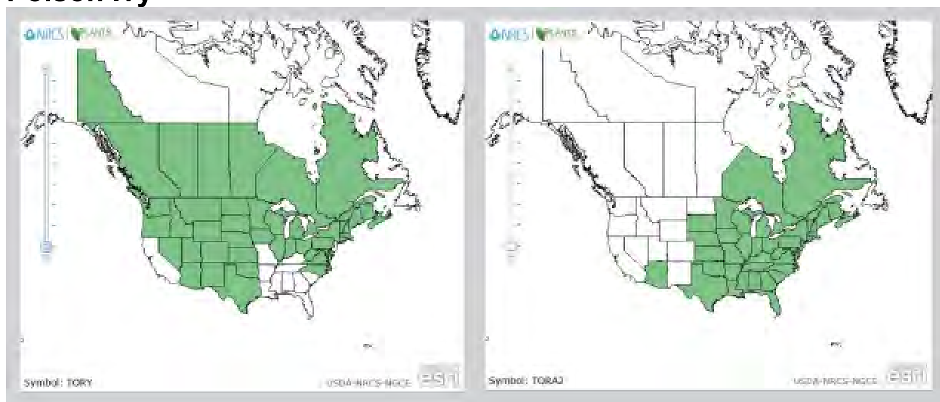
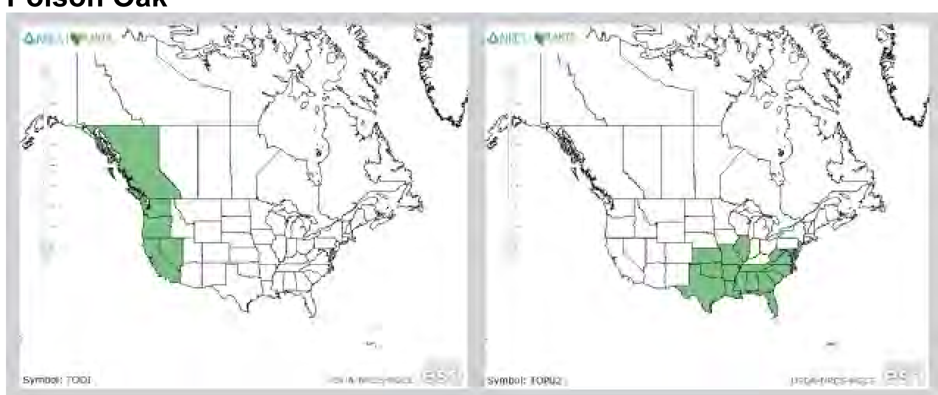
Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
PPE: • Work uniform or work clothes • Hard hat • Safety glasses • Steel-toed boots • Gloves (per HASP) • High-visibility reflective vests • Hearing protection	**Competent / Qualified Personnel:** See HASP **Training Requirements:** • HAZWOPER (40-hour, 8-hour Refresher, Supervisory, if applicable) • Site-Specific HASP Orientation • Toolbox safety meeting • Task kick-off meeting	• Daily inspection of equipment per manufacturer's instructions. • Inspect all PPE prior to use.

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
1. Preparation	1A) Training – Identifying Poisonous Plants	S	• Provide training on identifying the species of plants plants that could be present at the site. • Employees should also be trained on how to prevent exposure and what to do if they are exposed to poisonous plants.	M
2. Traveling/working in areas with poisonous plants. See plant information below.	2A) **Allergic Reaction, Contact Dermatitis, Blisters, Rash, Eye Irritation from Skin/Eye Contact**	S	• Avoidance is the most important precaution for all poisonous plants. • Inspect the work area including around any monitoring well, walking path, etc. to identify and mark areas of poisonous plants. Communicate the presence to all site workers during the daily briefing and avoid these areas when at all possible. • If a potential exists for poisonous plants to be present in the work area, apply a barrier product (IvyX or similar) to hands, forearms, and other potentially exposed body parts, 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 be worn as well over arms to keep oil from clothing. • Have the sleeves pulled down to the base of the hand, covering the forearm and wrist (all exposed skin). • Immediately after potential exposure to poisonous plants, wash the exposed area with water and soap or if not available, apply a ivy wash product designed to remove the urushiol oil such as Tecnu of IvyWash, or similar product directly to the hands, forearms, or other parts of the body that came in contact with the	M

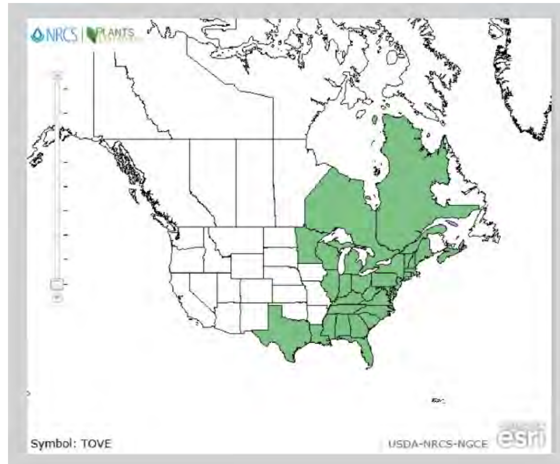
AHA – Poisonous Plants

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
			plants. These products will help cleanse the urushiol oil from the skin before it can be absorbed. Do not put this wash product in your eyes, nose, mouth, etc. Its meant for extermal use only. • Sensitive individuals can also apply the wash product prior to showering in the evening.	
	2B) Exposure from handling contaminated boots or equipment	S	• Avoid contact with handling contaminated clothing, boots, or equipment. • Wash clothing potentially contaminated with urushiol oil prior to wearing again. Wash the impacted clothing by itself in hot water and strong detergent. If possible, saturate the clothing with a removal product (e.g., Tecnu) in a bucket and allow to soak for a few minutes. Then launder. • Handle contaminated clothing with gloves as the oil can remain on environmental surfaces for up to 5 years. • Do not handle any field equipment that may have come in contact with poison ivy/oak/sumac without gloves. • Scrub all surfaces with a brush. • **Rinse with cool water using a portable garden sprayer.**	L

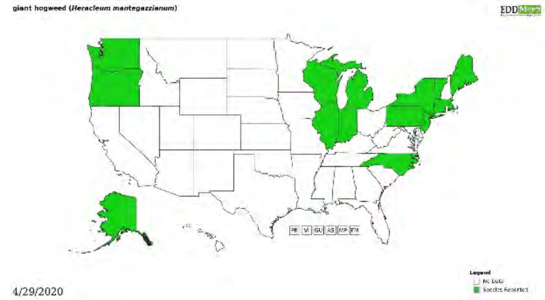
AHA – Poisonous Plants

Plant (photos from CDC, USDA, and www.poisonivy.org)	Range of Detection and Species Information	RAC Inherent
Poison Ivy (Eastern) 	**Poison Ivy**  **Range: Western (left) and Eastern (right) Poison Ivy** ▪ Poison ivy grows everywhere in United States except Hawaii and Alaska. ▪ In the East, Midwest, and the South, it grows as a vine. ▪ In the Northern and Western United States, it grows as a shrub. ▪ Each leaf has three leaflets. ▪ Leaves are green in the summer and red in the fall. ▪ In the late summer and fall, white berries may grow from the stems.	S
Poison Oak (Atlantic) 	**Poison Oak**  **Range: Pacific Poison Oak (left) and Atlantic Poison Oak (right)** ▪ Oak-like fuzzy leaves in clusters of three. Poisonous oak has two distinct kinds:	S

AHA – Poisonous Plants

Plant (photos from CDC, USDA, and www.poisonivy.org)	Range of Detection and Species Information	RAC Inherent
	▪ 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.	
Poison Sumac   	**Poison Sumac**  **Range: 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
Giant Hogweed	**Giant Hogweed**	L

AHA – Poisonous Plants

Plant (photos from CDC, USDA, and www.poisonivy.org)	Range of Detection and Species Information	RAC Inherent
    **Giant Hogweed leaves and flowers. Flower clusters may reach up to 2 feet across.**   **Giant Hogweed Stems.**	 **Range: Giant Hogweed** ▪ A biennial or perennial herb growing 8 to 15 feet tall, giant hogweed usually has a taproot or occasionally fibrous root. ▪ Grows in standing water in peat bogs in the Northeast and Midwest and in swampy areas in parts of the Southeast. Since its introduction into North America, this plant has become established in rich moist soils along roadsides, stream banks and waste ground. It is present in eastern US. ▪ Each leaf has clusters of seven to 13 smooth-edged leaflets. ▪ 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. Leaves grow in a rosette around the bottom of the stem and can grow up to 5ft wide. Mature leaves are deeply lobed, with each lobe deeply cut into pointed teeth. Smaller leaves are also found along the stem. Green stems are splotched with purple and covered with stubbly hairs. ▪ Flower heads are clusters of tiny, white flowers attached to the top of the stem in an umbrella-like shape (umbels), similar to Queen Anne's Lace but significantly larger (up to 2 feet across). Plants flower from June through July. ▪ The plant'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.	
Note:		S

AHA – Poisonous Plants

FIELD ACKNOWLEDGEMENT OF PERSON(S) CARRYING OUT WORK

NAME(S): ______________________ SIGNED: ______________ DATE: __________

______________________ ______________ __________

______________________ ______________ __________

______________________ ______________ __________

SITE SUPERVISOR: ______________________ SIGNED: ______________ DATE: __________

BY SIGNING – You Acknowledge that:

- I have read and understand all job steps, hazards and controls associated with today's work.
- Further, I WILL stop any job I think is unsafe.
- I have completed a site-specific HASP Orientation
- I have participated in a daily tailgate safety meeting

For tasks/activities that extend beyond a single day, use DAILY RENEWAL form below or Point of Work Risk Assessment (PoWRa).

AHA DAILY RENEWAL		
Date:	Weather:	
Changes noted:		
Site Supervisor (Print & Sign):		
Name(s):		
Date:	Weather:	
Changes noted:		
Site Supervisor (Print & Sign):		
Name(s):		

AHA – Drilling Operations and Utility Clearance

Activity/Work Task:	Drilling Operations and Utility Clearance	Substantial / High Risks:	Noise, overhead and underground utilities	Highest RAC: (residual)	**M**

Project Location:	Castile, NY		
Project Number:	3616206112		
Date Prepared:	11/21/22	Date Accepted:	12/9/22
Prepared by (Name/Title):	Tom Gerhard/Tech. Professional		
Reviewed by (Name/Title):	Katie Amann/Project Manager		

Risk Assessment Code (RAC) Matrix

Severity \ **Probability**	Almost certain	Likely	Possible	Unlikely	Rare
Catastrophic	**H**	**H**	**S**	**S**	**M**
Critical	**H**	**S**	**S**	**M**	**L**
Marginal	**S**	**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 the specified activity
- **BOLD hazards corresponding to Substantial or High Risk**.

This AHA is not an exhaustive summary of all hazards associated with the Site. Refer to the project HASP or client information for additional requirements, and emergency procedures.

Note: WSP personnel will not be operating any drilling rig or support equipment and will only be observing the activity. However, WSP personnel will be collecting soil samples during the drilling activities and may be in close proximity to the drilling equipment.

Step 1: Review each **"Hazard"** to identify Probability and Severity (Refer to Project HSE Risk Characterization Form)

• **"Probability"** is the likelihood to cause an incident, near miss, or accident and identified as: Almost certain, Likely, Possible, Unlikely, Rare.	**Risk Categories**
• **"Severity"** is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal or Negligible	**H = High Risk**
Step 2: Identify the RAC-Inherent as H, S, M, or L for each "Hazard" on AHA, ***before*** **controls are applied.**	**S = Substantial Risk**
Step 3: Identify the RAC-Residual as H, S, M, or L for each "Hazard" on AHA, ***after*** **controls are applied.**	**M = Moderate Risk**
Step 4: Annotate the overall highest RAC-Residual at the top of AHA.	**L = Low Risk**

MANAGEMENT OF CHANGE: If there is a change or deviation from the planned activity, you must stop the job and re-evaluate the risk assessment and the precautions taken. Any changes to work described in this AHA shall require review by a Qualified Person.

Check all Life Saving Rules that apply:

☐ Bypassing Safety Controls	☐ Confined Space	☐ Driving	☐ Energy Isolation	
☐ Hot Work	☑ Line of Fire	☑ Work Authorization	☑ Safe Mechanical Lifting	☐ Working at Height

AHA – Drilling Operations and Utility Clearance

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
PPE: • Work uniform or work clothes • Hard hat • Safety glasses • Steel-toed boots • Gloves (per HASP) • High-visibility, Class 2 reflective vests • Hearing protection	**Competent / Qualified Personnel:** Competent Person to be identified by drilling sub-contractor **Training Requirements:** • HAZWOPER (40-hour, 8-hour Refresher, Supervisory, if 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.

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
1. Clearing Utilities Prior to Site Work	1A) **Unexpected Utilities Present or Utilities Not Cleared (damage to utilities, worker injury)**	S	▪ Provide sufficient time and budget to ensure that utilities have been adequately located, prior to the start of up of work. Use WSP utility clearance checklist and procedure. ▪ Subcontractor to contact Dig Safe / One Call Utility identifier organization at least 6 days prior to the project start date. ▪ Cite or have subcontractor cite a start date of at least 3 working days prior to actual planned start date (provides window to inspect locations prior to job start-up. ▪ Verify via emails or phone that all utilities have visited the site and marked their respective utilities. ▪ If subcontractor calls One Call organization, require them to forward all e-mail responses from member utilities as they receive them. ▪ If verification cannot be done remotely, send worker to site to inspect ground for markings prior to mobilization to the site. ▪ Document all phone communications with driller about utility clearance issues and requests on the Utility Clearance Form. ▪ Call any member utilities that have not responded indicating they have cleared or marked-out utilities. Place the call morning of ticket start date (e.g., 3 days prior to actual start date). Document the phone conversations on the Utility Clearance Form. ▪ If town services (e.g., sanitary sewer, storm sewer, water) aren't listed as a One Call member, contact the town office to schedule mark-out, obtain copies of utility networks, and identify the appropriate town contacts. Document the findings on the Utility Clearance Form.	M

AHA – Drilling Operations and Utility Clearance

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
			▪ If town maps have lateral connections to private lots marked and /or if we are drilling along road right-of way opposite developed properties, identify the locations of the lateral connections. This may mean contacting abutters and asking to look in basements for location of pipes. If possible, do this during a site visit prior to field start. If not, it should occur during the first day of work so any issues can be identified and decisions made on the risk of proceeding. ▪ Walk all planned locations with the subcontractor, prior to start of excavation/drilling to identify marked utilities and note any uncertainties. Field Lead should call PM and relay any issues. Document this inspection in the field book and on the Utility Clearance Form. Note the subcontractor's responses to any WSP concerns.	
	1B) **Unknown Utilities on Private Property and/or Lack of Reliable Data on Utilities**	S	Locating Utilities on Private Property: ▪ Hire private utility locater company. ▪ Locate underground utilities by ground penetrating radar, electromagnetic, deep metal detector, pipe transmitter, vibracator, etc. ▪ Review locations with property owner, member of operations and maintenance. ▪ Check as built drawings when available. Be aware possible drawing error or construction drawings may not be representative of actual locations. ▪ Use field clues such as manhole covers, repaved areas, depressions, disturbed areas, signs and postings, etc. as indications of access to utilities or recently installed/moved ▪ If the surveys are not providing reliable data, plan to use non-destructive means to drill/excavate e.g., soil vacuum, water jet, air knife and/or hand tools. ▪ Use caution and proper PPE when using hand tools (hand augers, posthole diggers, shovels, steel rods, etc.). ▪ Involve the Project Manager, Technical Lead and/or Office Manager to make a decision to proceed. Document findings on the on the Utility Clearance Form.	M
	1C) **Working Near Live Utilities**	S	▪ If live utilities are known to be present near drilling location, if possible, move drilling to another location. ▪ Lockout/Tagout utilities, if possible. ▪ Use non-destructive means to drill until safe to proceed.	M

AHA – Drilling Operations and Utility Clearance

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
2. Subcontractor Drive Drill Rig / Geoprobe onto site	2A) Malfunction of vehicle/equipment	M	The subcontractor must: ▪ Select a drill rig suitable for the expected site terrain (i.e., rig with low center of gravity for heavy uneven terrain). ▪ WSP personnel in coordination with subcontractor personnel will confirm that a thorough inspection has been completed of the access routes to each sample location prior to moving the drill rig to those areas. The inspection will consider the terrain, environmental conditions (e.g., frozen or wet ground), predicted weather conditions, and the type of rig to be used. ▪ Drivers shall perform a pre-operational check of equipment, read and be familiar with any operator's manual and report all needed repairs promptly. ▪ Operators shall not use defective/unsafe equipment.	L
	2B) Wreck of Geoprobe while being driven	M	▪ All drivers shall be properly licensed. Supervisors shall verify that drivers are capable and qualified on each type of equipment before allowing the equipment to be used unsupervised. ▪ Subcontractor must provide manufacturer's operating limits of equipment prior to mobilization. ▪ Complete a visual inspection of the equipment prior to operation. Replace or repair equipment if necessary. Complete a checklist to document inspections and corrective actions required. ▪ Subcontractor must also check the loading materials stored on the rig to verify that they do not cause instability of the rig (e.g., uneven sand bag placement) during movement over the expected terrain. ▪ Keep wind shields, windshield wipers, side mirrors and side windows clean. ▪ Drivers shall conduct a pre-operation vehicle safety check. ▪ Drivers shall plan ahead to minimize or eliminate the need for backing. Always check to the rear before backing and use an observer when available. If an observer is not available, the driver shall walk around the vehicle to make sure rear is clear prior to backing. ▪ WSP personnel will communicate with subcontractor on appropriate equipment and contingency planning. ▪ The subcontractor will provide a second support vehicle and balance the load for stability. ▪ Seat belts shall be worn when driving by driver and passengers.	L

AHA – Drilling Operations and Utility Clearance

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
			▪ Choose the safest location possible to park equipment. Avoid parking in blind spots of other equipment. ▪ Adjust vehicle speed for load and weather. Tire chains should be utilized as dictated by weather conditions. ▪ When operating a vehicle off the roadway, be aware of possible hidden objects in the grass and unstable terrain. ▪ When operating the unit on sloped surfaces, always position the unit parallel with the slope. This provides the greatest degree of stability and will limit shifting during probing or augering operations. Position a track-mounted machine with the control panel upslope whenever possible so the machine will roll away from the operator if it becomes unstable and moves unexpectedly. ▪ Never allow anyone between truck and trailer when backing to hook trailer. ▪ Make sure tilt beds or ramps are secured before putting trailer in use. ▪ Perform periodic checks of equipment on long trips to assure the load is secure. ▪ Do not leave equipment unattended with the engine running. Shut off engine and set the parking brake when equipment is not in use. ▪ The mast shall always be in a lowered position when moving the drill rig. ▪ Do not leave equipment unattended with the engine running. Shut off engine and set the parking brake when equipment is not in use.	
3. Loading/unloading of equipment	3A) Crush and pinch points created when loading/unloading equipment	M	▪ Be aware of crushing and pinching hazards when loading, unloading and fastening down equipment. ▪ Make sure cargo is properly loaded and secured. ▪ Wear protective equipment consistent with the hazard (hard hats, safety glasses, leather gloves, safety shoes, etc.) ▪ Get assistance from a co-worker or use mechanical means to move heavy sampling equipment (dolly, cart, etc.).	L
	3B) Heavy lifting, twisting, bending, strains	M	▪ Size up the load, utilize help for heavy items, split loads as necessary. Use proper body mechanics and ergonomic techniques.	L
	3C) Slip, trips and falls	M	▪ Keep walking areas clear. ▪ Maintain plroper housekeeping.	L

AHA – Drilling Operations and Utility Clearance

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
4. Rig Operation by Subcontractor	4A) Vehicle Movement/Unstable, Crushing Injuries, Pinch Points, Entanglement and Flying Particles	M	• Subcontractor read owner's manual. • See applicable items in 1B) above. • Keep body parts clear of probe foot. • Be familiar with Emergency kill switch and controls. Test prior to probing. • Use caution on soft or loose surface. Be aware of the weight of loaded vehicle. • Be aware of weather and windy conditions. Do not operate during lighting storm or high winds. • Heed all Caution, Warning or Danger decals on machine. • Ensure everyone is clear of moving parts. • Designate only one experienced operator to avoid unexpected engagement. • Operate only from the control side. Do not reach across operating probe. • Avoid placing your hands on top of the tool string when raising/lowering the hammer or swinging/ folding probe assembly. • DO not wear loose clothing. Tie back hair when operating equipment. • Wear PPE including safety glasses, gloves, hearing protection, and steel-toe boots as listed in the HASP. • Before use, inspect cable, chain or wire for wear and replace if necessary. • Observe OSHA guidelines for use of cable clamps, safety latches, chains and slings. • Know rated capacity of chain, cable or wire rope being used and never exceed the rating. • Avoid overloading and sudden jerks. • Wear appropriate personal protective equipment with the hazard, including hard hats, safety glasses, leather gloves and safety shoes. • Check loads to be lifted for balance and have the rigging inspected to ensure a safe and balanced condition exists. • Do not allow employees to stand or work under suspended loads. • Awkward loads shall have taglines attached to control the load. • Review signals and operator communications with crew. Only one person shall direct the operator.	L

AHA – Drilling Operations and Utility Clearance

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
			• Review the area for utility lines, tree limbs and other overhead hazards. Work no closer than 10 feet to active overhead power lines. • Follow OSHA guidelines. • Personnel working tag lines shall review the area for slipping, tripping and falling hazards.	
	4B) **Noise**	S	Wear hearing protection when operating and when working near / in the vicinity of a drill rig or other heavy equipment.	M
	4C) Slips, Trips and Falls	M	• Maintain an orderly and clean site. • Barricade or establish work zones to minimize unauthorized entry. • Provide adequate lighting.	L
	4D) Material Under Stress, Equipment Limitations, Rope or Cable Blocks, Hydraulic Leaks	M	• Know the capacities, equipment limitations and acceptable operating loads. Follow the equipment operator's manual and proper maintenance requirements. • Stand clear of potential release of energy. Keep body part clear of moving parts. • Use the correct tool for the job. • Limit the rate of the hammer lowering while advancing the tool string to avoid raising the probe foot more than 6 inches off the ground surface. • In the event problem or binding, the operator should release all control levers to neutral. • Inspect hydraulic lines. Repair or replace damaged hoses.	L
	4E) **Utility Lines**	S	• Contact Dig Safe or "one call" system to mark underground utilities. • Be aware of surroundings. Establish safe "dig" zones based on utility markings and maintain throughout the field effort. • Before moving onto a site, evaluate overhead height restrictions including utilities and vegetation. • All drilling to be located a minimum of 10 feet from overhead lines. • Do not drive the machine with the mast extended.	M
	4F) Overhead Loads	M	• Remain alert. Establish work zone to minimize workers under overhead loads. • Avoid sudden jerks or overloading. • Check load for balance and appropriate support prior to hoisting.	L
	4G) Lifting	M	• Use mechanical means to lift heavy loads and removing rod.	L

AHA – Drilling Operations and Utility Clearance

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
	4H) Chemical Exposure	M	• Don appropriate PPE for chemicals of concern. Work from upwind. • Be aware or combustion fumes if equipment has auxiliary power. • Practice good hygiene by washing hands, and no eating/smoking within the exclusion zone.	L
5. Rig Operation/ Operational Area and Stablizing Rig with Hydraulic Jacks/Pads	5A) Adverse weather conditions	M	• Keep an eye on the weather. Monitor the weather forecast and actual conditions. • Be aware of muddy conditions or puddles.	L
	5B) Uneven terrain	M	• Be aware of drop-offs, uneven ground (e.g., holes, frozen earth mounds) and potential hidden objects which may cause loss of control when manoeuvring rigs or create unstable drill set-ups. • In heavily wooded area, scout to locate hidden objects. Watch your footing and use care when walking.	L
	5C) Poisonous plants and Insect Stings/Bites	S	See Insect Stings and Bites AHA.	**Exempt**
	5D) Heat/Cold Stress and Severe Weather	S	See AHA Field Work General	**Exempt**
	5E) Fall While Mounting and Dismounting Rig Equipment	M	• When mounting and dismounting equipment, use steps and handhold. Do not jump from vehicle.	L
	5F) Contaminated soils, **buried power or gas lines,** landfills and containment of spills	M	• Contaminated soils, buried power or gas lines, landfills and containment of spills. • During drilling operations, always be aware of the possibility of encountering potentially hazardous materials, such as petroleum hydrocarbons, herbicides, pesticides, chemical manufacturing by-products or solid waste materials. • In the event that any unknown or questionable materials are encountered, suspend drilling operations immediately and contact the Project Manager. • Do not handle any suspected contaminated materials unless trained to do so and proper protective methods are followed. • During drilling operations, always be aware of the possibility of striking an un-located or improperly located gas or power line. • In the event a buried utility line is struck, drilling operations are to be suspended immediately. • If the utility line is electric, keep personnel at least 10 feet from all metal surfaces connected with the drill rig.	L

AHA – Drilling Operations and Utility Clearance

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
			• If the utility is gas, then the area is to be evacuated and secured. Immediate notification to the utility company is MANDATORY. • In the event of a gas or oil spill, the proper authorities are to be contacted immediately so that containment operations can be implemented. • Wear PPE including protective gloves, coveralls, safety glasses as appropriate. • Work upwind of the sample location. • Minimize exposure using a shovel/spoon or tool to collect the sample. • Review and understand SDS for all chemicals being handled. • Be careful when handling acids and caustic substances. Wear PPE including gloves and wash hands after completion of task.	
	5G) Crushing injuries, slip, trip, fall hazards and potential back injuries.	M	• Use proper lifting techniques. • Ensure jack is rated for weight/operation with safe limits • Assure that area is clear of personnel and obstacles. • Place pads under jacks to prevent them from sinking into the ground. • Wear appropriate personal protective equipment consistent with the • hazard (hard hat, safety glasses, leather gloves, safety shoes, etc.) • Avoid contact with rotating equipment • When cathead is in use, assure a safe travel path for the rope by using proper techniques. Avoid standing on the rope. • Observe and stay clear (minimum of 10 feet for nominal system voltage, utility lines, rated 50kV and an additional 0.4 inch for each kV over 50kV or twice the length of the line insulator, but never less than 10 feet) of overhead utility lines. • In transit with no load and boom lowered, the equipment clearance shall be a minimum of 4 feet for voltage less than 50kV and 10 feet for voltages over 50kV up to and including 345kV and 16 feet for voltages up to and including 750kV. • A person shall be designated to observe clearance of the equipment and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means. • Have underground utility lines properly located and marked prior to drilling.	L

AHA – Drilling Operations and Utility Clearance

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
			• Employees on foot must use extreme caution to stay clear of operating equipment. Always establish eye contact with the operator before approaching the equipment. • Be aware of drop-offs, uneven ground and potential hidden objects which may cause loss of control when maneuvering drill rigs or create unstable drill set-ups. In heavily wooded area, scout to locate hidden objects. • Drill rod stacking must not exceed a length of 1.5 times the height of the tower. • Be aware of poisonous plants, insects, snakes, animals and animal waste products and carcasses. Wear long sleeve shirts, gloves, and high-top boots when hazards cannot be avoided. Proper first aid supplies, insect repellents shall accompany field crews. • Be alert to conditions that can lead to slippery surfaces. Examples: high groundwater resulting in muddy soils brought to the surface by augers and the utilization of bentonite drilling fluid. • Inspect all cables and clamps prior to winching operation. Stand clear of winching operations. • Use proper lifting techniques. Get help or use lifting equipment. • Suspend drilling operations during electrical storms. • Be aware of overhead hazards which may come in contact with the • drill rig, when moving or setting up equipment. • Complete a daily operations checklist to ensure that equipment is	
6. Attach Auger to Drill	6A) Auger coming loose from drill	M	• Auger coming loose from drill Insert a holding pin in auger • Insert a holding pin in auger • Use personal protective equipment such as leather gloves, safety glasses, hard hat and safety shoes. • Be aware of hand and finger positions when inserting holding pin	L
7. Subcontractor Mixing grout on site and filling/placing in hole between the well pipe and bore hole wall	7A) Chemical Exposure	M	• Stand upwind of the operation. • Wear safety glasses.	L
8. Subcontractor cutting soil acetate sleeve open to sample soil	8A) Cutting Hand with Razor Blade/ Utility Knife	M	• WSP personnel must allow the subcontractor cut the sample liners as they have the appropriate tools and have been trained in the methods to cut the liner. • Subcontractor must be aware of where hands are placed prior and during cutting with a knife or sharp hand tool.	L

AHA – Drilling Operations and Utility Clearance

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
9. Start drill by lever operations	9A) Operation of wrong lever	M	• Label levers as to their operation and review equipment manual.	L
10. Maintain proper auger drill speed with down hole pressure speed.	10A) Unstable rig from improper speed of auger	M	• Use of trained drill rig personnel and follow equipment manual specification	L
11. When auger has dug into ground unhook pin and insert another auger on top of the previous auger	11A) Auger coming loose	M	See 6A) above.	L
12. Insert PVC pipe into hollow stem auger in 10-foot sections	See 4A) above.	M	See 4A) above.	L
13. Install filter pack (50-pound bags of sand) into hole (by pouring) to filter water into screen	13A) Back injuries, slips and falls	M	• Proper lifting procedures, team lifting and use of mechanical devices. • Wear proper foot wear and maintain area in good housekeeping condition.	L
14. Reverse auger after each five-foot section of sand is installed	See 4A) above.	M	See 4A) above.	L
15. Install Bentonite on top of sand (3 foot) to seal up area above sand.	See 4A) above.	M	See 4A) above.	L
16. Remove auger	Auger falling	M	• Insert auger- maintain auger at ground surface to prevent auger from • falling into hole.	L
17. Release auger tension and remove pins. Remove auger from hole.	See 4A) above.	M	See 4A) above.	L
18. Lower drill head attached to auger remaining in bore hole attach with a pin.	See 4A) above.	M	See 4A) above.	L
19. Decontamination of drill equipment using pressure washer	19A) Contamination of personnel and environment	M	• Follow the HASP for PPE and level of protection. • Containerize material washed from contaminated equipment with proper containment materials.	L

AHA – Drilling Operations and Utility Clearance

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
			• Trained/authorized personnel to use pressure washer and assure area is clean of personnel prior to operation of pressure water device.	
20. Mix grout on site and fill/place in hole between the well pipe and bore hole wall	See 7A) above.	M	See 7A) above.	L
21. Cut PVC pipe off at determined height with a hand saw.	21A) Cutting hand	M	• Be aware of where hands are placed prior and during cutting with any knife/hand saw.	L
22. Install a protective cover and fill with grout.	See 4A) above.	M	See 4A) above.	L
23. Driving drilling rig offsite.	See relevant items in 2 and 3 above.	M	See relevant items in 2 and 3 above.	L

AHA – Drilling Operations and Utility Clearance

FIELD ACKNOWLEDGEMENT OF PERSON(S) CARRYING OUT WORK

NAME(S):	SIGNED:	DATE:
____________________	____________________	____________________
____________________	____________________	____________________
____________________	____________________	____________________
____________________	____________________	____________________
____________________	____________________	____________________
____________________	____________________	____________________
____________________	____________________	____________________
____________________	____________________	____________________

SITE SUPERVISOR: ____________________ SIGNED: ____________________ DATE: ____________________

BY SIGNING – You Acknowledge that:

- I have read and understand all job steps, hazards and controls associated with today's work.
- Further, I WILL stop any job I think is unsafe.
- I have completed a site-specific HASP Orientation
- I have participated in a daily tailgate safety meeting

For tasks/activities that extend beyond a single day, use DAILY RENEWAL form or Point of Work Risk Assessment (PoWRa).

AHA – Drilling Operations and Utility Clearance

AHA DAILY RENEWAL		
Date:	Weather:	
Changes noted:		
Site Supervisor (Print & Sign):		
Name(s):		
Date:	Weather:	
Changes noted:		
Site Supervisor (Print & Sign):		
Name(s):		
Date:	Weather:	
Changes noted:		
Site Supervisor (Print & Sign):		
Name(s):		

AHA – Drilling Operations and Utility Clearance

Section 1: Pre-Job Locate Accuracy Evaluation

Site / Project No.			
One-Call Ticket No.		Site Plan Provided?	☐ Yes ☐ No
Work Area			
Excavation Methods			
Date(s) of Work			

Utility Type	Utility Owner / Locator	Date Located	All Clear	Period Valid For	Expiry Date	Special Permits or Protocols	Limit of Locate Covers Work Area?	Described LOL matches sketch?	Tolerance Zone Distance	Other Site Plan(s)	Pre-Job Check Completed By Qualified Person? By Name:
(Name)		DD-MMM-YR	(Y/NA)	No. Days	DD-MMM-YR	Attach	(Y/N)	(Y/N)	(0.0 m)	Attach	Initial
Natural Gas											
Electric #1											
Electric #2											
Telcom/Cable #1											
Telcom/Cable #2											
Telcom/Cable #3											
Telcom/Cable #4											
Water Service											
Sanitary Sewer											
Storm Sewer											
Pipeline within 30 m (100 ft)											
Traffic Signal											
Street Lights											
Other:											
Owners Plans											
Private Locator	Name and Methods:										

Section 2: On-Site Locate and Accuracy Evaluation

Utility Type	All Permit/Protocols followed?	Positive Response (either All Clear or Utility Identified): *All Clear* in Writing?	Positive Response: Marks on site and Locate Sheet is required – Marks (Paint/ Flag/ Stake)	Positive Response: Marks on site and Locate Sheet is required – Locate Sheets	Do Marks and Locate Sheet match?	Observable locate accurate? N – If inaccurate, Incomplete, Unmarked or miss-marked	Public Marks match Private Locator findings?	Machine work clear of tolerance zone(s)?	On-Site Check Completed By Qualified Person? By Name:
(Name)	(Y/N/NA)	(Y/NA)	(Y/N)	(Y/N)	(Y/N)	(Y/N)	(Y/N)	(Y/N)	Initial
Natural Gas									
Electric #1									
Electric #2									
Telcom/Cable #1									
Telcom/Cable #2									
Telcom/Cable #3									
Telcom/Cable #4									
Water Service									
Sanitary Sewer									
Storm Sewer									
Pipeline within 30 m (100 ft)									
Traffic Signal									
Street Lights									
Other:									
Owners Plans									
Private Locator									

EMERGENCY PROCEDURES
- Stop Work and follow the project Emergency Response Plan.
- Notify the owner of the damaged utility.
- Take measures to protect the health and safety of others.
- Do not resume work until authorized by authorities and WSP.
- Complete the Ground Disturbance Incident Report (GDR) and Incident Analysis Report (IAR).

If any responses "N" STOP and correct. Add footnote/reference and document in Sec 3.
If any utilities are mismarked or abandoned, STOP and relocate.
Locates shall be valid for work date/s. Refresh at expiry.
Attach ALL locate sheets, permits, protocols, and site plans. Maintain locate marks and hard copy of locate sheets on-site during work.
Acknowledgment based on available information and provided 'AS IS.'

Acknowledgement:	On-Site Review Acknowledgement Signature	
	Owner/Customer	Subcontractor
WSP	Other:	Other

AHA – Drilling Operations and Utility Clearance

Section 3: Management of Change and Deficiencies						
Ref. No.	Utility	Deficiency	Corrective Action	Action Closed (describe follow up)	Date	QP Initial

AHA - Soil Sampling
Activity Description

Activity/Work Task:	Soil Sampling			Overall Risk Assessment Code (RAC) (Use highest code)					L
Project Location:	Castile, NY			**Risk Assessment Code (RAC) Matrix**					
Project Number:	3616206112			**Severity**	**Probability**				
Date Prepared:	11/21/2022	**Date Accepted:**	12/9/2022		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title):	Tom Gerhard/Tech. Professional			Catastrophic	E	E	H	H	M
				Critical	E	H	H	M	L
Reviewed by (Name/Title):	Katie Amann/Project Manager			Marginal	H	M	M	L	L
				Negligible	M	L	L	L	L

This AHA involves the following:

- Establishing site specific measures soil sampling by hand (direct push or hand auger). For safety measures associated with drilling for soil sampling, also look at the drilling AHA

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.	**E = Extremely High Risk**
"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible	**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

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	**Competent / Qualified Personnel:** The field operations lead is the competent person identified for soil sampling activities. **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 all PPE prior to use

AHA - Soil Sampling
Activity Description

Job Steps	Hazards	Controls	RAC
1. Prepare for sampling event	1A) Chemical exposure	1A) Chemical Exposure ▪ Read HASP and determine air monitoring and PPE needs.	L
2. Carrying equipment to site location	2A) Back or muscle strain	2A) Back or muscle strain ▪ Use proper lifting techniques when lifting pumps or generators ▪ Use mechanical aids if available ▪ Use 2 person lift for heavy items	L
3. Calibrate monitoring equipment	1A) Exposure to calibration gases	3A) Exposure to calibration gases ▪ Review equipment manuals ▪ Calibrate in a clean, well ventilated area	L
4. Preparing sampling location	4A) Contact with poisonous plants or the oil from poisonous plants	4A) Contact with poisonous plants or the oil from those plants: ▪ Look for signs of poisonous plants and avoid. ▪ Wear PPE as described in the HASP. ▪ Do not touch anything part of your body/clothing. ▪ Always wash gloves before removing them. ▪ Discard PPE in accordance with the HASP.	L
	4B) Contact with biting insects (i.e., spiders, bees, etc.)	4B) Contact with stinging/biting insects ▪ Discuss the types of insects expected at the Site and be able to identify them. ▪ Look for signs of insects in and around the well. ▪ Wear Level of PPE as described in the HASP. At a minimum, follow guidelines in the AHA "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
	4C) Exposure to hazardous Inhalation and contact with hazardous substances (VOC contaminated soil); flammable atmospheres.	4C) Exposure to hazardous substances ▪ Wear PPE as identified in HASP. ▪ Review hazardous properties of site contaminants with workers before sampling operations begin ▪ Monitor breathing zone air in accordance with HASP to determine levels of contaminants present. ▪ When decontaminating equipment wear additional eye/face protection over the safety glasses such as a face shield.	M
	4D) Back strain due to lifting or moving equipment to sampling locations	4D) Back strain ▪ Use mechanical aids when possible, if mechanical aids are not available, use two person lifts for heavy items. ▪ Use proper lifting techniques	L

AHA - Soil Sampling
Activity Description

Job Steps	Hazards	Controls	RAC
	4E) Foot injuries from dropped equipment	4E) Foot Injuries ▪ Be aware when moving objects, ensure you have a good grip when lifting and carrying objects. ▪ Do not carry more than you can handle safely ▪ Wear steel toed boots	L
5. Collecting soil samples	5A) Working around drill rigs	5A) See AHA - Drilling	L
	5B) Encountering underground or overhead utilities	5B) Have all utilities located.	L
	5C) Fire/Explosion/Contamination hazard from refueling generators	5C) 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
	5D) Electrocution	5D) 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
	5E) Exposure to contaminants	5E) 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
	5F) Exposure to preservatives	5F) Exposure to preservatives ▪ Work in a well ventilated area, upwind of samples ▪ Wear chemical resistant PPE as identified in HASP ▪ Review MSDSs	M
	5G) Slips/trips/falls	5G) Slips/trips/falls ▪ Ground can become wet/muddy ▪ Wear good slip resistant footwear	L

AHA - Soil Sampling
Activity Description

Job Steps	Hazards	Controls	RAC
	5H) Lifting Injury	5H) Lifting injury ▪ Use proper lifting techniques when carrying quantities of samples ▪ Use proper ergonomics when hand digging for samples	L
	5I) Eye injury	5I) Eye Injury ▪ Wear eye protection when using picks or similar devices to loosen soil	L
	5J) Fire	5J) Fire ▪ When using gas powered auger, maintain fire watch whenever fueling or otherwise handling gasoline ▪ See AHA - Gasoline	L
6. Soil sampling using floor corer	6A) Back injury	6A) Back Injury ▪ Use proper lifting techniques when moving floor corer and generator ▪ Use mechanical aids if available ▪ Use two person lift for heavy items.	L
	6B) Electric Shock	6B) Electric Shock ▪ Use electric cords free from defects ▪ Keep cords out of water ▪ Ensure all electrical equipment is properly grounded ▪ Use GFCI	L
	6C) Hearing	6C) Hearing ▪ Wear hearing protection	L
	6D) Fire	6D) Fire ▪ When using generator, maintain fire watch whenever refueling or otherwise handling gasoline ▪ See AHA - Gasoline	L
	6E) Contamination	6E) Contamination ▪ Use appropriate PPE for the contaminants of concern (see HASP). ▪ Minimize sample contact ▪ Label sample in accordance with procedures ▪ Monitor breathing zone levels.	L

AHA – Soil Vapor Sampling Activity Description

Activity/Work Task:	Soil Vapor Sampling	Substantial / High Risks:	Drilling hole through concrete slab	Highest RAC: (residual)	M

Project Location:	Castile, NY		
Contract Number:	3616206112		
Date Prepared:	01/11/22	Date Accepted:	12/9/22
Prepared by (Name/Title):	Tom Gerhard, Tech. Professional		
Reviewed by (Name/Title):	Katie Amann/Project Manager		

Risk Assessment Code (RAC) Matrix

Severity \ Probability	Almost certain	Likely	Possible	Unlikely	Rare
Catastrophic	H	H	S	S	M
Critical	H	S	S	M	L
Marginal	S	M	M	L	L
Negligible	M	L	L	L	L

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

This AHA involves the following:

- Establishing site specific safety measures for the specified activity.
- **BOLD hazards correspond to Substantial or High Risk**.

This AHA is not an exhaustive summary of all hazards associated with the Site. Refer to the project HASP or client information for additional requirements, and emergency procedures.

Workers to follow general site safety controls for Hazard Signage/PPE, Housekeeping, Slips Trips and Falls, Biological hazards, Mobile equipment, Confined spaces, Fall hazards, Electrical, and any active operating equipment or construction activities.

Step 1: Review each **"Hazard"** to identify Probability and Severity (Refer to Project HSE Risk Characterization Form)

• **"Probability"** is the likelihood to cause an incident, near miss, or accident and identified as: Almost certain, Likely, Possible, Unlikely, Rare.	**Risk Categories**
• **"Severity"** is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal or Negligible	**H = High Risk**
Step 2: Identify the RAC-Inherent as H, S, M, or L for each "Hazard" on AHA, ***before* controls are applied.**	**S = Substantial Risk**
Step 3: Identify the RAC-Residual as H, S, M, or L for each "Hazard" on AHA, ***after* controls are applied.**	**M = Moderate Risk**
Step 4: Annotate the overall highest RAC-Residual at the top of AHA.	**L = Low Risk**

MANAGEMENT OF CHANGE: If there is a change or deviation from the planned activity, you must stop the job and re-evaluate the risk assessment and the precautions taken. Any changes to work described in this AHA shall require review by a Qualified Person.

Check all Life Saving Rules that apply:	☐ Bypassing Safety Controls	☐ Confined Space	☐ Driving	☐ Energy Isolation
☐ Hot Work	☐ Line of Fire	☐ Work Authorization	☐ Safe Mechanical Lifting	☐ Working at Height

AHA – Soil Vapor Sampling Activity Description

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
When initially entering the Site, the following PPE must be donned: • Hard hat* • Safety glasses or goggles* • Steel-toed boots* • Gloves (see HASP for type) * • Reflective vests* • Hand Tools • Dust Mask Decon equipment (e.g., plastic sheeting, wading pools, brushes, tables, chairs, drums, plastic bags, duct tape, stream cleaner and/or water spray)	**Competent / Qualified Personnel:** See HASP **Training Requirements:** List specific certification (as applicable) Site-Specific HASP Orientation Toolbox safety meeting Task kick-off meeting Safe Tool Operation	• 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.

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
1. Mobilization	1A) See JHA Mobilization/Demobilization /Site Preparation	M	1A) See JHA Mobilization/Demobilization/Site Preparation	M
2. General Site Hazards	2A) See JHA Field Work - General	M	2A) See JHA Field Work - General	M
	2B) Chemical exposure	L	2C) Chemical Exposure ▪ Read HASP and determine air monitoring and PPE needs.	L
3. Calibrate monitoring equipment	3A) Exposure to calibration gases	L	3A) Exposure to calibration gases ▪ Review equipment manuals ▪ Calibrate in a clean, well ventilated area	L
4. Access soil vapor sampling location	4A) Tripping hazards	L	4A) Observe floors/stairs for potential tripping hazards	L
	4B) Back strain	M	4B) Use proper lifting techniques when carrying equipment. Use 2-man lifts when handling large, heavy, or awkward items	M

AHA – Soil Vapor Sampling Activity Description

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
	4C) Chemical Hazard	L	4C) Be aware of what chemicals are present in the work area ▪ Wear PPE as described in the HASP.	L
5. Drill or core hole in concrete floor or exterior location	5A) Electrocution	M	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 ▪ Do not stand/walk on power cords ▪ 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.	M
	5B) Exposure to hazardous Inhalation and contact with hazardous substances (VOC contaminated Soil Vapor, Silica Dust).	L	5B) Exposure to hazardous substances ▪ Apply water spray during hammer drill operation to prevent visible dust generation. ▪ 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	L
	5C) Rotating equipment	S	5C) Rotating equipment • Do not have any loose clothing, jewellery, hair, PPE while operating or working near hammer drill or core drill • Use anchor bolts or vacuum system to anchor core drill to floor • Maintain safe distance from rotating equipment. Be aware that drill bit may jam in hole, causing drill to rotate violently and strike operator/helper with great force • Helpers use long handle sprayer to assist in water application. Keep all body parts out of spin radius of drill	M

AHA – Soil Vapor Sampling Activity Description

Job Steps	Hazards	RAC Inherent	Controls	RAC Residual
	5D) Back strain due to lifting and/or moving equipment	M	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	M
	5E) Foot injuries from dropped equipment/drill bit	M	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 ▪ Watch feet when drilling and hold drill firmly ▪ Wear Steel toed boots	M
	5F) Muscle fatigue while using hammer drill for extended periods	S	5F) Muscle fatigue ▪ Switch equipment operator/helper positions to allow for rest periods ▪ Take frequent breaks to rest muscles	M
6. Collecting sample	6A) Burn Hazard/fire Hazard	M	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.	M
	6B) Cutting Hazard	M	Use caution when using sharp knives when cutting materials. Cut away from your body or any other personnel	M
	6C) Exposure to contaminants	L	6B) 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	L
7. Collecting sample	7A) Pinching Hazard	L	7A) Pinching Hazard from attaching regulators/tubing ▪ Be careful when using wrenches to attach regulator and or tubing to cans to not pinch fingers	L

AHA – Soil Vapor Sampling Activity Description

FIELD ACKNOWLEDGEMENT OF PERSON(S) CARRYING OUT WORK

NAME(S):	SIGNED:	DATE:

SITE SUPERVISOR: ______________________ SIGNED: ______________________ DATE: ______________

Note: For tasks/activities that extend beyond a single day, use attached DAILY RENEWAL form or FLRA.

AHA – Soil Vapor Sampling Activity Description

AHA DAILY RENEWAL

Date:	Weather:	
Changes noted:		
Site Supervisor (Print & Sign):		
Name(s):		
Date:	Weather:	
Changes noted:		
Site Supervisor (Print & Sign):		
Name(s):		
Date:	Weather:	
Changes noted:		
Site Supervisor (Print & Sign):		
Name(s):		

AHA - Geoprobe Investigation – Oversight and Sample Collection ONLY

Activity/Work Task:	Geoprobe Investigation – Oversight and Sample Collection ONLY			Overall Risk Assessment Code (RAC) (Use highest code)					M
Project Location:	Castile, NY			**Risk Assessment Code (RAC) Matrix**					
Contract Number:	3616206112			**Severity**	**Probability**				
Date Prepared:	11/21/2022	**Date Accepted:**	12/9/2022		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title):	Tom Gerhard – Tech. Professional			Catastrophic	E	E	H	H	M
				Critical	E	H	H	M	L
Reviewed by (Name/Title):	Katie Amann/Project Manager			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

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

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

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

AHA - Geoprobe Investigation – Oversight and Sample Collection ONLY

		3G) Remain alert. Establish work zone to minimize workers under overhead loads. Avoid sudden jerks or overloading. Check load for balance and appropriate support prior to hoisting. 3H) Use mechanical means to lift heavy loads and removing rod. Don appropriate PPE for chemicals of concern. Work from upwind. Be aware or combustion fumes if equipment has auxiliary power. Practice good hygiene by washing hands, and no eating/smoking within the exclusion zone.	**L**
4. Operational area	4A) adverse weather conditions (temperature extremes), 4B) uneven terrain, 4C) poisonous plants/snakes/insects hazards	4A) Keep a weather eye. Monitor the weather forecast and actual conditions. • Wear appropriate clothing that does not restrict, cause over heat or is too loose. • Be aware of muddy conditions or puddles. 4B) Be aware of drop-offs, uneven ground and potential hidden objects which may cause loss of control when maneuvering rigs or create unstable drill set-ups. In heavily wooded area, scout to locate hidden objects. Use care when walking. 4C) Be aware of poisonous plants, insects, snakes, animals and animal waste products and carcasses. Wear long sleeve shirts, gloves, and high top boots when hazards cannot be avoided. Proper first aid supplies, insect repellents shall accompany field crews.	**M**
	4D) Contaminated soils, buried power or gas lines, landfills and containment of spills	4D) Contaminated soils, buried power or gas lines, landfills and containment of spills ▪ During drilling operations, always be aware of the possibility of encountering potentially hazardous materials, such as petroleum hydrocarbons, herbicides, pesticides, chemical manufacturing by-products or solid waste materials. ▪ In the event that any unknown or questionable materials are encountered, then the drilling operations are to be suspended immediately until further instructions are received from supervision. ▪ Do not handle any suspected contaminated materials unless trained to do so and proper protective methods are followed. ▪ During drilling operations, always be aware of the possibility of striking an un-located or improperly located gas or power line. ▪ In the event a buried utility line is struck, drilling operations are to be suspended **immediately**. - If the utility line is electric, keep personnel at least 10 feet from all metal surfaces connected with the drill rig. - If the utility is gas, then the area is to be evacuated and secured. Immediate notification to the utility company is MANDATORY. ▪ In the event of a gas or oil spill, the proper authorities are to be contacted immediately so that containment operations can be implemented.	**M**
5. Subcontractor Mixing grout on site and filling/placing in hole between the well pipe and bore hole wall	5A) Lifting 5B) Chemical exposure	5A) Size the load of materials to be moved and utilize appropriate help for lifting and moving. Use proper ergonomic and body mechanics to move materials (bags of grout, etc.). Use mechanical mixer for large quantities of grout. 5B) PPE – Safety glasses, safety shoes, gloves, optional tyvek/coveralls.	**M**
6. Subcontractor cutting soil acetate sleeve open to sample soil	6A) cutting of hand with a razor blade	6A) MACTEC personnel must let the subcontractor cut the sample liners as they have the appropriate tools to do so. 6B) Subcontractor must be aware of where hands are placed prior and during cutting with hand saw	**M**
7. Subcontractor driving drilling rig offsite.	7A) Reference item # 1	7A) Reference item #1.	

AHA - Geoprobe Investigation – Oversight and Sample Collection ONLY

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
PPE (Hard Hat, safety glasses, gloves, steel toe work boots, high visibility safety vest, hearing protection)	**Competent / Qualified Personnel:** Drilling subcontractor **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

FIELD ACKNOWLEDGEMENT OF PERSON(S) CARRYING OUT WORK

NAME(S): ______________________ SIGNED: ______________________ DATE: ______________

SITE SUPERVISOR: ______________________ SIGNED: ______________________ DATE: ______________

Note: For tasks/activities that extend beyond a single day, use attached DAILY RENEWAL form or FLRA.

AHA DAILY RENEWAL		
Date:	Weather:	
Changes noted:		
Site Supervisor (Print & Sign):		
Name(s):		
Date:	Weather:	
Changes noted:		
Site Supervisor (Print & Sign):		
Name(s):		
Date:	Weather:	
Changes noted:		
Site Supervisor (Print & Sign):		
Name(s):		

AHA – Working in a Muddy Area
Activity Description

Activity/Work Task:	Working in a Muddy Area		Overall Risk Assessment Code (RAC) (Use highest code)					L
Project Location:	Castile, NY		**Risk Assessment Code (RAC) Matrix**					
Project Number:	3616206112		**Severity**	**Probability**				
Date Prepared:	11/21/2022	**Date Accepted:** 12/9/2022		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title):	Tom Gerhard, Tech. Professional		Catastrophic	E	E	H	H	M
			Critical	E	H	H	M	L
Reviewed by (Name/Title):	Katie Amann/Project Manager		Marginal	H	M	M	L	L
			Negligible	M	L	L	L	L

This AHA involves the following:

- Establishing site specific measures for working in a muddy area and extracting oneself from mud

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

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
Walking stick, appropriate boots, and over-boots or waders if necessary, snow shoes and geotextile geocomposite for weight distribution	**Competent / Qualified Personnel:** Any WSP employee **Training requirements:** Site Specific HASP Orientation Toolbox safety meeting Task kick-off meeting ow shoes	None

Job Steps	Hazards	Controls	RAC
1. Prepare for site visit	1A) See AHA Mobilization/ demobilization/site preparation	1A) See AHA Mobilization/ demobilization/site preparation	L

AHA – Working in a Muddy Area
Activity Description

Job Steps	Hazards	Controls	RAC
2. Traveling/working in areas with potential muddy locations –Example outdoor surface water areas, wetlands, mud flats.	2A) Poor footing - slip, suction, entrapment or fall.	2A) Poor footing - slip, suction, entrapment or fall. ▪ Use a walking stick or probe to check footing and potietial deep holes prior to entering area. ▪ Wear appropriate foot wear such as boots. Over shoe boots provide protection to foot wear as well as a layer to remove if foot gets stuck. ▪ Be aware of surroundings. Avoid muddy areas if possible. ▪ Use the buddy system. Keep a safe distance between workers to avoid both workers getting stuck. ▪ Be prepared with rope, plywood, shovel, pole to assist “rescue” from being stuck in the mud. ▪ If walking in mud is required to reach sample area, several techniques may be employeed to limit foot suction and sinking in mud or quicksand. - Provide a walkway or elevated surface. - Use of snow fencing on the surface or snow shoes to disperse your weight. - Use a skating motion and keep moving until on location. Use a platform to stand on for sampling.	**L**
3.	3A) Allergic reactions, painful stings	3A) Allergic reactions, painful stings ▪ Be alert to hives in brush or in hollow logs. Watch for insects travelling in and out of one location. ▪ See AHA – Insect bites and stings.	**L**
4. .	4A) Skin irritation, encephalitis	4A) Skin irritation, encephalitis ▪ Wear long sleeves and trousers.	**L**

AHA – Working Over or Near Water

Activity/Work Task:	Working Over/ Near Water			Overall Risk Assessment Code (RAC) (Use highest code)					M
Project Location:	Castile, NY			**Risk Assessment Code (RAC) Matrix**					
Project Number:	3616206112			**Severity**	**Probability**				
Date Prepared:	11/21/2022	**Date Accepted:**	12/9/2022		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title):	Tom Gerhard/Technical Professional			Catastrophic	E	E	H	H	M
				Critical	E	H	H	M	L
Reviewed by (Name/Title):	Katie Amann/Project Manager			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

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, PFD)	**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 tools that are defective and remove from service. Inspect all PPE, rescue, and fall protection equipment prior to use

AHA – Working Over or Near Water

Job Steps	Hazards	Controls	RAC
1. Field Work Over/ Near Water	1A) Slips, trips, falls	1A) Familiarize self with site prior to visit. ▪ Complete appropriate training before going on site. ▪ Provide appropriate person in district office your itinerary. ▪ Prepare listing of emergency phone numbers, both on and offsite. ▪ Identify site/activity PPE needs. ▪ Ensure that First Aid training is current, and that tetanus booster is current. ▪ Be aware of your surroundings including weather conditions. ▪ Familiar and trained in use and inspection of personal floatation device (PFD), lifesaving equipment and fall protection equipment. ▪ Fall protection installed (warning lines, barriers, nets, etc.)	L
	1B) Falling into water	1B) Falling into water ▪ Use equipment that facilitates reaching the location from a safe distance (extensions, etc.). ▪ Ladders and throwing ring buoys will lines attached readily available. ▪ Work using the buddy system. ▪ Wear PFD when working on or near the water. ▪ Lifesaving skiff immediately available and not intended for use other than rescue. ▪ Avoid leaning over edge of land to water. **Anchor or secure yourself to a permanent and secure structure when working near water.**	M
	1C) Vermin, leaches, Insect/animal born disease	1C) Vermin, leaches, Insect/animal born disease ▪ Survey the area for dens, nests, etc. ▪ Identify areas where biological hazards may be present. ▪ Be aware of your surroundings. ▪ Wear insect netting clothing or apply insect repellant on all exposed skin surfaces as appropriate – consider sample contamination. ▪ Wear appropriate footwear (snake boots, etc.) ▪ Avoid high grass areas along shoreline if possible. ▪ Tuck pants leg into boot. ▪ Do not put hand/arm into/under an area that you can not see into/under clearly. ▪ Do not touch any suspected contaminant without appropriate hand PPE. ▪ Wash hands as soon as possible upon completion of task. ▪ Perform routine inspections for ticks, leaches, etc. of yourself and co-workers. ▪ Contract vermin relocation, if applicable. ▪ Remain vigilant and respectful of wildlife. (See AHA for Insects, Stings and Bites, and AHA for Dog – Wildlife Safety. ▪ Wear wind impervious outerwear ▪ During warm months – wear a long sleeve cotton/breathable fabric shirt and pants.	L

AHA – Working Over or Near Water

	1D) Bending, pulling, twisting	1D) Bending, pulling, twisting ▪ Balance weight in the boat with other personnel and equipment. ▪ Use a vibrating or wiggling motion on the sample device to break the sediment suction. ▪ Attach recovery line to sample equipment prior to deploying equipment. ▪ Proper lifting technique. ▪ Do not lean outside the boat or over water	L

AHA – Working Over or Near Water

FIELD ACKNOWLEDGEMENT OF PERSON(S) CARRYING OUT WORK

NAME(S): ______________________ SIGNED: ______________________ DATE: ______________

SITE SUPERVISOR: ______________________ SIGNED: ______________________ DATE: ______________

NOTE: FOR TASKS/ACTIVITIES THAT EXTEND BEYOND A SINGLE DAY, USE ATTACHED DAILY RENEWAL FORM OR FLRA.

AHA – Working Over or Near Water

AHA DAILY RENEWAL		
DATE:	WEATHER:	
CHANGES NOTED:		
SITE SUPERVISOR (PRINT & SIGN):		
NAME(S):		
DATE:	WEATHER:	
CHANGES NOTED:		
SITE SUPERVISOR (PRINT & SIGN):		
NAME(S):		
DATE:	WEATHER:	
CHANGES NOTED:		
SITE SUPERVISOR (PRINT & SIGN):		
NAME(S):		

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 05/17/2017 **Revision** : 05/17/2017

Trade Name: Liquinox

1 Identification of the substance/mixture and of the supplier

1.1 Product identifier

Trade Name: Liquinox

Synonyms:

Product number: 1232-1, 1232, 1201-1, 1201, 1205, 1215, 1255

1.2 Application of the substance / the mixture : Cleaning material/Detergent

1.3 Details of the supplier of the Safety Data Sheet

Manufacturer

Alconox, Inc.
30 Glenn Street
White Plains, NY 10603
1-914-948-4040

Supplier

Emergency telephone number:

ChemTel Inc

North America: 1-800-255-3924

International: 01-813-248-0585

2 Hazards identification

2.1 Classification of the substance or mixture:

In compliance with EC regulation No. 1272/2008, 29CFR1910/1200 and GHS Rev. 3 and amendments.

Hazard-determining components of labeling:

Alcohol ethoxylate
Sodium alkylbenzene sulfonate
Sodium xylenesulphonate
Lauramine oxide

2.2 Label elements:

Eye irritation, category 2A.
Skin irritation, category 2.

Hazard pictograms:

Signal word: Warning

Hazard statements:

H315 Causes skin irritation.
H319 Causes serious eye irritation.

Precautionary statements:

P264 Wash skin thoroughly after handling.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P302+P352 If on skin: Wash with soap and water.
P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P332+P313 If skin irritation occurs: Get medical advice/attention.
P501 Dispose of contents and container as instructed in Section 13.

Additional information: None.

Hazard description

Trade Name: Liquinox

Hazards Not Otherwise Classified (HNOC): None

Information concerning particular hazards for humans and environment:

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

Classification system:

The classification is according to EC regulation No. 1272/2008, 29CFR1910/1200 and GHS Rev. 3 and amendments, and extended by company and literature data. The classification is in accordance with the latest editions of international substances lists, and is supplemented by information from technical literature and by information provided by the company.

3 Composition/information on ingredients

3.1 Chemical characterization : None

3.2 Description : None

3.3 Hazardous components (percentages by weight)

Identification	Chemical Name	Classification	Wt. %
CAS number: 68081-81-2	Sodium Alkylbenzene Sulfonate	Acute Tox. 4; H303 Skin Irrit. 2 ; H315 Eye Irrit. 2; H319	10-25
CAS number: 1300-72-7	Sodium Xylenesulphonate	Eye Irrit. 2; H319	2.5-10
CAS number: 84133-50-6	Alcohol Ethoxylate	Skin Irrit. 2 ; H315 Eye Dam. 1; H318	2.5-10
CAS number: 1643-20-5	Lauramine oxide	Skin Irrit. 2 ; H315 Eye Dam. 1; H318	1-2

3.4 Additional Information: None.

4 First aid measures

4.1 Description of first aid measures

General information: None.

After inhalation:

Maintain an unobstructed airway.
Loosen clothing as necessary and position individual in a comfortable position.

After skin contact:

Wash affected area with soap and water.
Seek medical attention if symptoms develop or persist.

After eye contact:

Rinse/flush exposed eye(s) gently using water for 15-20 minutes.

Remove contact lens(es) if able to do so during rinsing.
Seek medical attention if irritation persists or if concerned.

After swallowing:

Rinse mouth thoroughly.
Seek medical attention if irritation, discomfort, or vomiting persists.

4.2 Most important symptoms and effects, both acute and delayed

None

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 05/17/2017 **Revision** : 05/17/2017

Trade Name: Liquinox

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

No additional information.

5 Firefighting measures

5.1 Extinguishing media

Suitable extinguishing agents:

Use appropriate fire suppression agents for adjacent combustible materials or sources of ignition.

For safety reasons unsuitable extinguishing agents : None

5.2 Special hazards arising from the substance or mixture :

Thermal decomposition can lead to release of irritating gases and vapors.

5.3 Advice for firefighters

Protective equipment:

Wear protective eye wear, gloves and clothing.
Refer to Section 8.

5.4 Additional information :

Avoid inhaling gases, fumes, dust, mist, vapor and aerosols.
Avoid contact with skin, eyes and clothing.

6 Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures :

Ensure adequate ventilation.
Ensure air handling systems are operational.

6.2 Environmental precautions :

Should not be released into the environment.
Prevent from reaching drains, sewer or waterway.

6.3 Methods and material for containment and cleaning up :

Wear protective eye wear, gloves and clothing.

6.4 Reference to other sections : None

7 Handling and storage

7.1 Precautions for safe handling :

Avoid breathing mist or vapor.
Do not eat, drink, smoke or use personal products when handling chemical substances.

Conditions for safe storage, including any incompatibilities:

Store closed upright and in a cool dry place, should be 15 - 30 deg C or 60 - 90 deg F.

7.2 Specific end use(s):

No additional information.

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 05/17/2017 **Revision** : 05/17/2017

Trade Name: Liquinox

8 Exposure controls/personal protection

8.1 Control parameters :

No applicable occupational exposure limits

8.2 Exposure controls

Appropriate engineering controls:

Emergency eye wash fountains and safety showers should be available in the immediate vicinity of use or handling.

Respiratory protection:

Not needed under normal conditions.

Protection of skin:

Select glove material impermeable and resistant to the substance.

Eye protection:

Safety goggles or glasses, or appropriate eye protection.

General hygienic measures:

Wash hands before breaks and at the end of work.
Avoid contact with skin, eyes and clothing.

9 Physical and chemical properties

Appearance (physical state, color):	Pale yellow liquid	**Explosion limit lower**: **Explosion limit upper**:	Not determined or not available. Not determined or not available.
Odor:	Not determined or not available.	**Vapor pressure at 20°C**:	Not determined or not available.
Odor threshold:	Not determined or not available.	**Vapor density**:	Not determined or not available.
pH-value:	8.5 as is	**Relative density**:	Not determined or not available.
Melting/Freezing point:	Not determined or not available.	**Solubilities**:	Not determined or not available.
Boiling point/Boiling range:	Not determined or not available.	**Partition coefficient (n-octanol/water)**:	Not determined or not available.
Flash point (closed cup):	Not determined or not available.	**Auto/Self-ignition temperature**:	Not determined or not available.
Evaporation rate:	Not determined or not available.	**Decomposition temperature**:	Not determined or not available.
Flammability (solid, gaseous):	Not determined or not available.	**Viscosity**:	a. Kinematic: Not determined or not available. b. Dynamic: Not determined or not available.

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 05/17/2017 **Revision** : 05/17/2017

Trade Name: Liquinox	
Density at 20°C:	Not determined or not available.

10 Stability and reactivity

10.1 Reactivity : None

10.2 Chemical stability : None

10.3 Possibility hazardous reactions : None

10.4 Conditions to avoid : None

10.5 Incompatible materials : None

10.6 Hazardous decomposition products : None

11 Toxicological information

11.1 Information on toxicological effects :

Acute Toxicity:

Oral:

: LD50 >5000 mg per kg Rat, Oral) - product .

Chronic Toxicity: No additional information.

Skin corrosion/irritation:

Alcohol Ethoxylate: May cause mild to moderate skin irritation.

Sodium Alkylbenzene Sulfonate: Causes skin irritation.

Lauramine oxide: Causes skin irritation.

Serious eye damage/irritation:

Sodium Alkylbenzene Sulfonate: Causes serious eye irritation.

Alcohol Ethoxylate: Causes moderate to severe eye irritation and conjunctivitis.

Sodium xylenesulphonate: Rabbit: irritating to eyes.

Lauramine oxide: Causes serious eye damage.

Respiratory or skin sensitization: No additional information.

Carcinogenicity: No additional information.

IARC (International Agency for Research on Cancer): None of the ingredients are listed.

NTP (National Toxicology Program): None of the ingredients are listed.

Germ cell mutagenicity: No additional information.

Reproductive toxicity: No additional information.

STOT-single and repeated exposure: No additional information.

Additional toxicological information: No additional information.

12 Ecological information

12.1 Toxicity:

Sodium Alkylbenzene Sulfonate: Fish, LC50 1.67 mg/l, 96 hours.

Sodium Alkylbenzene Sulfonate: Aquatic invertebrates, EC50 Daphnia 2.4 mg/l, 48 hours.
Sodium Alkylbenzene Sulfonate: Aquatic Plants, EC50 Algae 29 mg/l, 96 hours.
Lauramine oxide: Fish, LC0 24.3 mg/l, 96h [Killifish (Cyprinodontidae)]
Lauramine oxide: Aquatic invertebrates, (LC50): 3.6 mg/l 96 hours [Daphnia (Daphnia)].
Lauramine oxide: Aquatic plants, EC50 Algae 0.31 mg/l 72 hours [Algae]
Alcohol Ethoxylate: Aquatic invertebrates, (LC50): 4.01 mg/l 48 hours [Daphnia (daphnia)].

12.2 Persistence and degradability: No additional information.

12.3 Bioaccumulative potential: No additional information.

12.4 Mobility in soil: No additional information.

General notes: No additional information.

12.5 Results of PBT and vPvB assessment:

PBT: No additional information.

vPvB: No additional information.

12.6 Other adverse effects: No additional information.

13 Disposal considerations

13.1 Waste treatment methods (consult local, regional and national authorities for proper disposal)

Relevant Information:

It is the responsibility of the waste generator to properly characterize all waste materials according to applicable regulatory entities. (US 40CFR262.11).

14 Transport information

14.1 UN Number: ADR, ADN, DOT, IMDG, IATA	None
14.2 UN Proper shipping name: ADR, ADN, DOT, IMDG, IATA	None
14.3 Transport hazard classes: ADR, ADN, DOT, IMDG, IATA	**Class:** None **Label:** None **LTD. QTY:** None

US DOT

Limited Quantity Exception: None

Bulk:
RQ (if applicable): None
Proper shipping Name: None
Hazard Class: None
Packing Group: None
Marine Pollutant (if applicable): No additional information.
Comments: None

Non Bulk:
RQ (if applicable): None
Proper shipping Name: None
Hazard Class: None
Packing Group: None
Marine Pollutant (if applicable): No additional information.
Comments: None

Trade Name: Liquinox	
14.4 Packing group: ADR, ADN, DOT, IMDG, IATA	None
14.5 Environmental hazards :	None
14.6 Special precautions for user:	None
Danger code (Kemler):	None
EMS number:	None
Segregation groups:	None
14.7 Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code: Not applicable.	
14.8 Transport/Additional information:	
Transport category:	None
Tunnel restriction code:	None
UN "Model Regulation":	None

15 Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture.

North American

SARA

Section 313 (specific toxic chemical listings): None of the ingredients are listed.
Section 302 (extremely hazardous substances): None of the ingredients are listed.

CERCLA (Comprehensive Environmental Response, Clean up and Liability Act) Reportable Spill Quantity: None of the ingredients are listed.

TSCA (Toxic Substances Control Act):

Inventory: All ingredients are listed.
Rules and Orders: Not applicable.

Proposition 65 (California):

Chemicals known to cause cancer: None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for females: None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for males: None of the ingredients are listed.

Chemicals known to cause developmental toxicity: None of the ingredients are listed.

Canadian

Canadian Domestic Substances List (DSL):
All ingredients are listed.

EU

REACH Article 57 (SVHC): None of the ingredients are listed.

Germany MAK: Not classified.

Safety Data Sheet

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Effective date: 05/17/2017 **Revision** : 05/17/2017

Trade Name: Liquinox

Asia Pacific

Australia

Australian Inventory of Chemical Substances (AICS): All ingredients are listed.

China

Inventory of Existing Chemical Substances in China (IECSC): All ingredients are listed.

Japan

Inventory of Existing and New Chemical Substances (ENCS): All ingredients are listed.

Korea

Existing Chemicals List (ECL): All ingredients are listed.

New Zealand

New Zealand Inventory of Chemicals (NZOIC): All ingredients are listed.

Philippines

Philippine Inventory of Chemicals and Chemical Substances (PICCS): All ingredients are listed.

Taiwan

Taiwan Chemical Substance Inventory (TSCI): All ingredients are listed.

16 Other information

Abbreviations and Acronyms: None

Summary of Phrases

Hazard statements:

H315 Causes skin irritation.
H319 Causes serious eye irritation.

Precautionary statements:

P264 Wash skin thoroughly after handling.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P302+P352 If on skin: Wash with soap and water.
P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P332+P313 If skin irritation occurs: Get medical advice/attention.
P501 Dispose of contents and container as instructed in Section 13.

Manufacturer Statement:

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as guidance for safe handling,

use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

NFPA: 1-0-0

HMIS: 1-0-0

SAFETY DATA SHEET

According to US Regulation 29 CFR 1910.1200 (HazCom 2012)

1. Identification

Product identifier: Hydrochloric Acid, 32-38%

Other means of identification

Synonyms:	Muriatic Acid, Hydrogen Chloride, Aqueous
CAS No.:	7647-01-0

Recommended restrictions

Recommended use: For Laboratory, Research or Manufacturing Use.
Restrictions on use: Not determined.

Details of the supplier of the safety data sheet

Company Name:	Quality Environmental Containers, Inc.
Address:	607 Industrial Park Road Beaver, WV 25813
Telephone:	Customer Service: 304-255-3900
E-mail:	info@qecusa.com

Emergency telephone number:
CHEMTREC: 1-800-424-9300 within US and Canada (24 hrs/day, 7 days/week)

2. Hazard(s) identification

Hazard Classification

Physical Hazards

Corrosive to metal	Category 1

Health Hazards

Acute toxicity (Oral)	Category 4
Skin Corrosion/Irritation	Category 1A
Serious Eye Damage/Eye Irritation	Category 1
Specific Target Organ Toxicity - Single Exposure	Category 3[1.]

Target Organs

1. Respiratory tract irritation.

Unknown toxicity - Health

Acute toxicity, oral	0 %
Acute toxicity, dermal	0 %
Acute toxicity, inhalation, vapor	30 %
Acute toxicity, inhalation, dust or mist	30 %

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 Statements

Prevention: Keep only in original packaging. 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: IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. Call a POISON CENTER/doctor if you feel unwell. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water [or 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. Immediately call a POISON CENTER/doctor. Absorb spillage to prevent material damage.

Storage: Store locked up. Store in a well-ventilated place. Keep container tightly closed. Store in a corrosion-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.

Hazard(s) not otherwise classified (HNOC): None.

3. Composition/information on ingredients

Mixtures

Chemical Identity	CAS number	Content in percent (%)*
Hydrochloric acid	7647-01-0	30.00 - 38.00%

* 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.

Hazards: None known.

Indication of immediate medical attention and special treatment needed

Treatment: Treat symptomatically. Symptoms may be delayed.

5. Fire-fighting measures

General Fire Hazards: No unusual fire or explosion hazards noted.

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. Store below 25°C. 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)
	Ceiling	5 ppm	7 mg/m3	US. Tennessee. OELs. Occupational Exposure Limits, Table Z1A (06 2008)
	TWA PEL	0.3 ppm	0.45 mg/m3	US. California Code of Regulations, Title 8, Section 5155. Airborne Contaminants (01 2015)
	Ceiling	2 ppm		US. California Code of Regulations, Title 8, Section 5155. Airborne Contaminants (01 2015)
	AN ESL	Health	7.9 µg/m3	US. Texas. Effects Screening Levels (Texas Commission on Environmental Quality) (06 2018)
	ST ESL	Health	130 ppb	US. Texas. Effects Screening Levels (Texas Commission on Environmental Quality) (06 2018)
	ST ESL	Health	190 µg/m3	US. Texas. Effects Screening Levels (Texas Commission on Environmental Quality) (06 2018)
	AN ESL	Health	5.3 ppb	US. Texas. Effects Screening Levels (Texas Commission on Environmental Quality) (06 2018)

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.

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 (20 °C) (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.
Density:	1.17 - 1.19 g/ml (20 °C)
Relative density:	1.18 (20 °C)
Solubility(ies)	
Solubility in water:	Soluble
Solubility (other):	alcohol: Soluble
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: 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

Inhalation: Severely irritating to respiratory system.

Skin Contact: Causes severe skin burns.

Eye contact: Causes serious eye damage.

Ingestion: Harmful if swallowed. May cause burns of the gastrointestinal tract if swallowed.

Information on toxicological effects

Acute toxicity (list all possible routes of exposure)

Oral
Product: ATEmix (Rat): 2,368.42 mg/kg

Dermal
Product: ATEmix (Rabbit) 3,813.16 mg/kg

Inhalation
Product: Not classified for acute toxicity based on available data.

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: Respiratory tract irritation.

Specific Target Organ Toxicity - Repeated Exposure
Product: None known.

Target Organs
Specific Target Organ Toxicity - Single Exposure: Respiratory tract irritation.

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

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
LC 50 (Common shrimp, sand shrimp (Crangon crangon), 48 h): 260 mg/l

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

14. Transport information

DOT

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

Special precautions for user:	Keep away from alkalis.

IMDG

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

IATA

UN Number:	UN 1789
Proper Shipping Name:	Hydrochloric acid
Transport Hazard Class(es):	
Class:	8
Label(s):	8
Packing Group:	II
Marine Pollutant:	No
Special precautions for user:	Keep away from alkalis.

15. Regulatory information

US Federal Regulations

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

None present or none present in regulated quantities.

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):

Chemical Identity	Reportable quantity
Hydrochloric acid	5000 lbs.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories

Corrosive to metal
Acute toxicity (any route of exposure)
Skin Corrosion or Irritation
Serious eye damage or eye irritation
Specific target organ toxicity (single or repeated exposure)

SARA 302 Extremely Hazardous Substance

Chemical Identity	Reportable quantity	Threshold Planning Quantity
Hydrochloric acid	5000 lbs.	500 lbs.

SARA 304 Emergency Release Notification

Chemical Identity	Reportable quantity
Hydrochloric acid	5000 lbs.

SARA 311/312 Hazardous Chemical

Chemical Identity	Threshold Planning Quantity
Hydrochloric acid	500 lbs.

SARA 313 (TRI Reporting)

Chemical Identity	Reporting threshold for other users	Reporting threshold for manufacturing and processing
Hydrochloric acid	10000 lbs.	25000 lbs.

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

Chemical Identity	Reportable quantity
Hydrochloric acid	5000 lbs.

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

Chemical Identity	Reportable quantity
Hydrochloric acid	Reportable quantity: 5000 lbs.

US State Regulations

US. California Proposition 65

No ingredient requiring a warning under CA Prop 65.

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

Chemical Identity
Hydrochloric acid

US. Massachusetts RTK - Substance List

Chemical Identity
Hydrochloric acid

US. Pennsylvania RTK - Hazardous Substances

Chemical Identity
Hydrochloric acid

US. Rhode Island RTK

Chemical Identity
Hydrochloric acid

International regulations

Montreal protocol

Not applicable

Stockholm convention

Not applicable

Rotterdam convention

Not applicable

Kyoto protocol

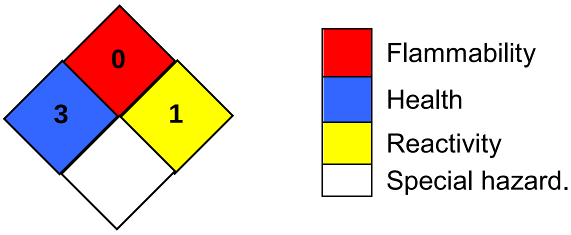
Not applicable

Inventory Status:

Australia AICS:	On or in compliance with the inventory
Canada DSL Inventory List:	On or in compliance with the inventory
China Inv. Existing Chemical Substances:	On or in compliance with the inventory
Japan (ENCS) List:	On or in compliance with the inventory
Japan ISHL Listing:	Not in compliance with the inventory.
Korea Existing Chemicals Inv. (KECI):	On or in compliance with the inventory
Mexico INSQ:	On or in compliance with the inventory
New Zealand Inventory of Chemicals:	On or in compliance with the inventory
Philippines PICCS:	On or in compliance with the inventory
Taiwan Chemical Substance Inventory:	On or in compliance with the inventory
US TSCA Inventory:	On or in compliance with the inventory
EINECS, ELINCS or NLP:	On or 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; RNP - Rating not possible

Issue Date:	06-26-2020
Revision Information:	Not relevant.
Version #:	4.6
Source of information:	Sources of information used in preparing this SDS included one or more of the following: results from in house or supplier toxicology studies, information from the Toxicology Data Network (TOXNET), European Chemical Agency (ECHA) substance dossiers, IARC Monographs, US National Toxicology Program data, the Agency for Toxic Substances and Disease Registry, other manufacturer’s SDSs and other sources, as appropriate.
Further Information:	No data available.

Disclaimer:

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SAFETY DATA SHEET

Creation Date 12-Nov-2010 **Revision Date** 10-Jan-2017 **Revision Number** 4

1. Identification

Product Name	**Sulfuric Acid (Gerber)**
Cat No. :	**SA176-4**
Synonyms	Hydrogen sulfate; Vitriol brown oil; Oil of vitriol
Recommended Use	Laboratory chemicals.
Uses advised against	No Information available

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 001-703-527-3887

2. Hazard(s) identification

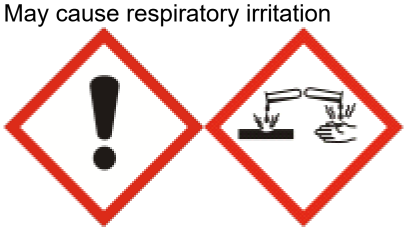
Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin Corrosion/irritation	Category 1 A
Serious Eye Damage/Eye Irritation	Category 1
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Respiratory system.	

Label Elements

Signal Word
Danger

Hazard Statements
Causes severe skin burns and eye damage
May cause respiratory irritation



Precautionary Statements

Prevention
Do not breathe dust/fume/gas/mist/vapors/spray
Wear protective gloves/protective clothing/eye protection/face protection
Wash face, hands and any exposed skin thoroughly after handling
Use only outdoors or in a well-ventilated area
Response
Immediately call a POISON CENTER or doctor/physician
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Skin
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
Wash contaminated clothing before reuse
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
Ingestion
IF SWALLOWED: Rinse mouth. DO NOT induce vomiting
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)

WARNING! This product contains a chemical known in the State of California to cause cancer.
Unknown Acute Toxicity

3. Composition / information on ingredients

Component	CAS-No	Weight %
Sulfuric acid	7664-93-9	90 - 98
Water	7732-18-5	2 - 10

4. First-aid measures

General Advice Show this safety data sheet to the doctor in attendance. Immediate medical attention is required.

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Immediate medical attention is required.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Remove and wash contaminated clothing before re-use. Call a physician immediately.

Inhalation If not breathing, give artificial respiration. Remove from exposure, lie down. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Call a physician immediately.

Ingestion Do not induce vomiting. Clean mouth with water. Never give anything by mouth to an unconscious person. Call a physician immediately.

Most important symptoms/effects Causes burns by all exposure routes. Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated: Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation

Notes to Physician Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media CO_2, dry chemical, dry sand, alcohol-resistant foam.

Unsuitable Extinguishing Media DO NOT USE WATER

Flash Point Not applicable
Method - No information available

Autoignition Temperature No information available
Explosion Limits
Upper No data available
Lower No data available
Sensitivity to Mechanical Impact No information available
Sensitivity to Static Discharge No information available

Specific Hazards Arising from the Chemical
Thermal decomposition can lead to release of irritating gases and vapors. The product causes burns of eyes, skin and mucous membranes.

Hazardous Combustion Products
Sulfur oxides Hydrogen
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA

Health	Flammability	Instability	Physical hazards
3	0	2	W

6. Accidental release measures

Personal Precautions Ensure adequate ventilation. Use personal protective equipment. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak.
Environmental Precautions Should not be released into the environment.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Use only under a chemical fume hood. Do not breathe vapors or spray mist. Do not ingest.

Storage Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from water. Corrosives area.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH
Sulfuric acid	TWA: 0.2 mg/m^3	(Vacated) TWA: 1 mg/m^3 TWA: 1 mg/m^3	IDLH: 15 mg/m^3 TWA: 1 mg/m^3

Component	Quebec	Mexico OEL (TWA)	Ontario TWAEV
Sulfuric acid	TWA: 1 mg/m^3 STEL: 3 mg/m^3	TWA: 1 mg/m^3	TWA: 0.2 mg/m^3

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures	Use only under a chemical fume hood. Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection	Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin and body protection	Long sleeved clothing.
Respiratory Protection	Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Clear, Colorless to brown
Odor	Odorless
Odor Threshold	No information available
pH	0.3 (1N)
Melting Point/Range	10 °C / 50 °F
Boiling Point/Range	290 - 338 °C / 554 - 640.4 °F
Flash Point	Not applicable
Evaporation Rate	Slower than ether
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	< 0.001 mmHg @ 20 °C
Vapor Density	3.38 (Air = 1.0)
Specific Gravity	1.84
Solubility	Soluble in water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	340°C
Viscosity	No information available
Molecular Formula	H_2SO_4
Molecular Weight	98.08

10. Stability and reactivity

Reactive Hazard	Yes
Stability	Reacts violently with water. Hygroscopic.
Conditions to Avoid	Incompatible products. Excess heat. Exposure to moist air or water.
Incompatible Materials	Water, Organic materials, Strong acids, Strong bases, Metals, Alcohols, Cyanides, Sulfides
Hazardous Decomposition Products	Sulfur oxides, Hydrogen
Hazardous Polymerization	Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Oral LD50	Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.
Dermal LD50	Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.
Vapor LC50	Based on ATE data, the classification criteria are not met. ATE > 20 mg/l.

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Sulfuric acid	2140 mg/kg (Rat)	Not listed	LC50 = 510 mg/m³ (Rat) 2 h
Water	-	Not listed	Not listed

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Causes severe burns by all exposure routes

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen. Exposure to strong inorganic mists containing sulfuric acid may cause cancer by inhalation.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Sulfuric acid	7664-93-9	Group 1	Known	A2	X	A2
Water	7732-18-5	Not listed	Not listed	Not listed	Not listed	Not listed

IARC: (International Agency for Research on Cancer)

IARC: (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans

NTP: (National Toxicity Program)

NTP: (National Toxicity Program)
Known - Known Carcinogen
Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen

ACGIH: (American Conference of Governmental Industrial Hygienists)

A1 - Known Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Animal Carcinogen
ACGIH: (American Conference of Governmental Industrial Hygienists)

Mexico - Occupational Exposure Limits - Carcinogens

Mexico - Occupational Exposure Limits - Carcinogens
A1 - Confirmed Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Confirmed Animal Carcinogen
A4 - Not Classifiable as a Human Carcinogen
A5 - Not Suspected as a Human Carcinogen

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Respiratory system
STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated: Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity
This product contains the following substance(s) which are hazardous for the environment. .

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Sulfuric acid	-	LC50: > 500 mg/L, 96h static (Brachydanio rerio)	-	EC50: 29 mg/L/24h

Persistence and Degradability No information available
Bioaccumulation/ Accumulation No information available.

Mobility No information available.

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT
UN-No UN1830
Proper Shipping Name Sulfuric acid
Hazard Class 8
Packing Group II

TDG
UN-No UN1830
Proper Shipping Name SULFURIC ACID
Hazard Class 8
Packing Group II

IATA
UN-No UN1830
Proper Shipping Name SULFURIC ACID
Hazard Class 8
Packing Group II

IMDG/IMO
UN-No UN1830
Proper Shipping Name SULFURIC ACID
Hazard Class 8
Packing Group II

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Sulfuric acid	X	X	-	231-639-5	-		X	X	X	X	X
Water	X	X	-	231-791-2	-		X	-	X	X	X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Sulfuric acid	7664-93-9	90 - 98	1.0

SARA 311/312 Hazard Categories

Acute Health Hazard	Yes
Chronic Health Hazard	Yes
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	Yes

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Sulfuric acid	X	1000 lb	-	-

Clean Air Act Not applicable

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Sulfuric acid	1000 lb	1000 lb

California Proposition 65 This product contains the following proposition 65 chemicals

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Sulfuric acid	7664-93-9	Carcinogen	-	Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Sulfuric acid	X	X	X	X	X
Water	-	-	X	-	-

U.S. Department of Transportation

Reportable Quantity (RQ):	Y
DOT Marine Pollutant	N
DOT Severe Marine Pollutant	N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

Canada
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class
D1A Very toxic materials
E Corrosive material
D2A Very toxic materials

16. Other information

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 12-Nov-2010
Revision Date 10-Jan-2017
Print Date 10-Jan-2017
Revision Summary SDS sections updated; 2
Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

SAFETY DATA SHEET

Creation Date 12-Mar-2009 **Revision Date** 24-Dec-2021 **Revision Number** 9

1. Identification

Product Name	**Nitric acid (67 - 70%)**
Cat No. :	**A467-1, A467-2, A467-250, A467-500**
CAS No	7697-37-2
Synonyms	Azotic acid; Engraver's acid; Aqua fortis
Recommended Use	Laboratory chemicals.
Uses advised against	Food, drug, pesticide or biocidal product use.

Details of the supplier of the safety data sheet

Company
Fisher Scientific Company
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number Chemtrec US: (800) 424-9300
Chemtrec EU: 001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Oxidizing liquids	Category 3
Corrosive to metals	Category 1
Acute Inhalation Toxicity - Vapors	Category 3
Skin Corrosion/Irritation	Category 1 A
Serious Eye Damage/Eye Irritation	Category 1

Label Elements

Signal Word
Danger

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

Toxic if inhaled
Corrosive to the respiratory tract

Precautionary Statements
Prevention
Do not breathe dust/fume/gas/mist/vapors/spray
Wash face, hands and any exposed skin thoroughly after handling
Wear protective gloves/protective clothing/eye protection/face protection
Use only outdoors or in a well-ventilated area
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Keep/Store away from clothing/ other combustible materials
Take any precaution to avoid mixing with combustibles
Keep only in original container
Wear respiratory protection
Response
Immediately call a POISON CENTER or doctor/physician
Inhalation
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
Skin
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
Wash contaminated clothing before reuse
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
Ingestion
IF SWALLOWED: Rinse mouth. DO NOT induce vomiting
Fire
In case of fire: Use CO2, dry chemical, or foam for extinction
Spills
Absorb spillage to prevent material damage
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Store in a dry place
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
Corrosive to the respiratory tract

3. Composition/Information on Ingredients

Component	CAS No	Weight %
Nitric acid …% [C ≤ 70 %]	7697-37-2	65 - 70
Water	7732-18-5	30 - 35

4. First-aid measures

General Advice Immediate medical attention is required. Show this safety data sheet to the doctor in

	attendance.
Eye Contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Immediate medical attention is required.
Skin Contact	Wash off immediately with plenty of water for at least 15 minutes. Remove and wash contaminated clothing and gloves, including the inside, before re-use. Call a physician immediately.
Inhalation	If breathing is difficult, give oxygen. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Remove from exposure, lie down. Call a physician immediately.
Ingestion	Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Clean mouth with water. Call a physician immediately.
Most important symptoms and effects	Causes burns by all exposure routes. Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation: Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	CO_2, dry chemical, dry sand, alcohol-resistant foam.
Unsuitable Extinguishing Media	No information available
Flash Point	Not applicable
Method -	No information available
Autoignition Temperature	No information available
Explosion Limits	
Upper	No data available
Lower	No data available
Oxidizing Properties	Oxidizer
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Thermal decomposition can lead to release of irritating gases and vapors. The product causes burns of eyes, skin and mucous membranes. Oxidizer: Contact with combustible/organic material may cause fire. May ignite combustibles (wood paper, oil, clothing, etc.).

Hazardous Combustion Products
Nitrogen oxides (NOx). Thermal decomposition can lead to release of irritating gases and vapors.
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA

Health	Flammability	Instability	Physical hazards
4	0	0	OX

6. Accidental release measures

Personal Precautions	Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak. Ensure adequate ventilation. Use personal protective equipment as required.

Environmental Precautions Should not be released into the environment. Do not flush into surface water or sanitary sewer system. See Section 12 for additional Ecological Information.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable, closed containers for disposal. Sweep up and shovel into suitable containers for disposal. Wear self-contained breathing apparatus and protective suit.

7. Handling and storage

Handling Use only under a chemical fume hood. Wear personal protective equipment/face protection. Do not get in eyes, on skin, or on clothing. Do not ingest. If swallowed then seek immediate medical assistance. Do not breathe mist/vapors/spray. Keep away from clothing and other combustible materials.

Storage. Keep containers tightly closed in a dry, cool and well-ventilated place. Do not store near combustible materials. Do not store in metal containers. Keep in properly labeled containers. Corrosives area. Incompatible Materials. Combustible material. Strong bases. Reducing Agent. Metals. Finely powdered metals. Organic materials. Aldehydes. Alcohols. Cyanides. Ammonia. Strong reducing agents.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Nitric acid …% [C ≤ 70 %]	TWA: 2 ppm STEL: 4 ppm	(Vacated) TWA: 2 ppm (Vacated) TWA: 5 mg/m³ (Vacated) STEL: 4 ppm (Vacated) STEL: 10 mg/m³ TWA: 2 ppm TWA: 5 mg/m³	IDLH: 25 ppm TWA: 2 ppm TWA: 5 mg/m³ STEL: 4 ppm STEL: 10 mg/m³	TWA: 2 ppm STEL: 4 ppm

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH IDLH: NIOSH - National Institute for Occupational Safety and Health

Engineering Measures Use only under a chemical fume hood. Ensure that eyewash stations and safety showers are close to the workstation location. Ensure adequate ventilation, especially in confined areas.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166. Tight sealing safety goggles. Face protection shield.

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures Keep away from food, drink and animal feeding stuffs. When using do not eat, drink or smoke. Contaminated work clothing should not be allowed out of the workplace. Provide regular cleaning of equipment, work area and clothing. Avoid contact with skin, eyes or clothing. Remove and wash contaminated clothing and gloves, including the inside, before re-use. Wear suitable gloves and eye/face protection.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Clear Colorless, Light yellow
Odor	Strong Acrid
Odor Threshold	No information available
pH	< 1.0 (0.1M)
Melting Point/Range	-41 °C / -41.8 °F
Boiling Point/Range	Not applicable
Flash Point	Not applicable
Evaporation Rate	No information available
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	0.94 kPa (20°C)
Vapor Density	No information available
Specific Gravity	1.40
Solubility	miscible
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	No information available
Viscosity	No information available
Molecular Formula	HNO_3
Molecular Weight	63.01

10. Stability and reactivity

Reactive Hazard Yes

Stability Oxidizer: Contact with combustible/organic material may cause fire.

Conditions to Avoid Incompatible products. Combustible material. Excess heat. Exposure to air or moisture over prolonged periods.

Incompatible Materials Combustible material, Strong bases, Reducing Agent, Metals, Finely powdered metals, Organic materials, Aldehydes, Alcohols, Cyanides, Ammonia, Strong reducing agents

Hazardous Decomposition Products Nitrogen oxides (NOx), Thermal decomposition can lead to release of irritating gases and vapors

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Oral LD50	Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.
Dermal LD50	Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.
Mist LC50	Category 3. ATE = 1 - 5 mg/l. Category 4.
Vapor LC50	Based on ATE data, the classification criteria are not met. ATE > 20 mg/l.

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Nitric acid …% [C ≤ 70 %]	Not listed	Not listed	LC50 = 2500 ppm. (Rat) 1h
Water	-	-	-

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Causes severe burns by all exposure routes

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS No	IARC	NTP	ACGIH	OSHA	Mexico
Nitric acid ...% [C ≤ 70 %]	7697-37-2	Not listed	Not listed	Not listed	Not listed	Not listed
Water	7732-18-5	Not listed	Not listed	Not listed	Not listed	Not listed

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure None known
STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation: Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity
Do not empty into drains. Large amounts will affect pH and harm aquatic organisms.

Persistence and Degradability Miscible with water Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its water solubility.

Component	log Pow
Nitric acid ...% [C ≤ 70 %]	-2.3

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT

- **UN-No** UN2031
- **Proper Shipping Name** NITRIC ACID
- **Hazard Class** 8
- **Subsidiary Hazard Class** 5.1
- **Packing Group** II

TDG

- **UN-No** UN2031

Proper Shipping Name	NITRIC ACID
Hazard Class	8
Subsidiary Hazard Class	5.1
Packing Group	II

IATA

UN-No	UN2031
Proper Shipping Name	NITRIC ACID
Hazard Class	8
Subsidiary Hazard Class	5.1
Packing Group	II

IMDG/IMO

UN-No	UN2031
Proper Shipping Name	NITRIC ACID
Hazard Class	8
Subsidiary Hazard Class	5.1
Packing Group	II

15. Regulatory information

United States of America Inventory

Component	CAS No	TSCA	TSCA Inventory notification - Active-Inactive	TSCA - EPA Regulatory Flags
Nitric acid …% [C ≤ 70 %]	7697-37-2	X	ACTIVE	-
Water	7732-18-5	X	ACTIVE	-

Legend:
TSCA US EPA (TSCA) - Toxic Substances Control Act, (40 CFR Part 710)
X - Listed
'-' - Not Listed

TSCA 12(b) - Notices of Export Not applicable

International Inventories
Canada (DSL/NDSL), Europe (EINECS/ELINCS/NLP), Philippines (PICCS), Japan (ENCS), Japan (ISHL), Australia (AICS), China (IECSC), Korea (KECL).

Component	CAS No	DSL	NDSL	EINECS	PICCS	ENCS	ISHL	AICS	IECSC	KECL
Nitric acid …% [C ≤ 70 %]	7697-37-2	X	-	231-714-2	X	X	X	X	X	KE-25911
Water	7732-18-5	X	-	231-791-2	X	X		X	X	KE-35400

KECL - NIER number or KE number (http://ncis.nier.go.kr/en/main.do)

U.S. Federal Regulations

SARA 313

Component	CAS No	Weight %	SARA 313 - Threshold Values %
Nitric acid …% [C ≤ 70 %]	7697-37-2	65 - 70	1.0

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Nitric acid …% [C ≤ 70 %]	X	1000 lb	-	-

Clean Air Act Not applicable

OSHA - Occupational Safety and Health Administration

Component	Specifically Regulated Chemicals	Highly Hazardous Chemicals
Nitric acid …% [C ≤ 70 %]	-	TQ: 500 lb

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Nitric acid …% [C ≤ 70 %]	1000 lb	1000 lb

California Proposition 65 This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Nitric acid …% [C ≤ 70 %]	X	X	X	X	X
Water	-	-	X	-	-

U.S. Department of Transportation
Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security This product contains the following DHS chemicals:
Legend - STQs = Screening Threshold Quantities, APA = A placarded amount

Component	DHS Chemical Facility Anti-Terrorism Standard
Nitric acid …% [C ≤ 70 %]	Release STQs - 15000lb Theft STQs - 400lb

Other International Regulations

Mexico - Grade No information available

Authorisation/Restrictions according to EU REACH

Component	REACH (1907/2006) - Annex XIV - Substances Subject to Authorization	REACH (1907/2006) - Annex XVII - Restrictions on Certain Dangerous Substances	REACH Regulation (EC 1907/2006) article 59 - Candidate List of Substances of Very High Concern (SVHC)
Nitric acid …% [C ≤ 70 %]	-	Use restricted. See item 75. (see link for restriction details)	-

https://echa.europa.eu/substances-restricted-under-reach

Safety, health and environmental regulations/legislation specific for the substance or mixture

Component	CAS No	OECD HPV	Persistent Organic Pollutant	Ozone Depletion Potential	Restriction of Hazardous Substances (RoHS)
Nitric acid …% [C ≤ 70 %]	7697-37-2	Listed	Not applicable	Not applicable	Not applicable
Water	7732-18-5	Listed	Not applicable	Not applicable	Not applicable

Component	CAS No	Seveso III Directive (2012/18/EC) - Qualifying Quantities for Major Accident Notification	Seveso III Directive (2012/18/EC) - Qualifying Quantities for Safety Report Requirements	Rotterdam Convention (PIC)	Basel Convention (Hazardous Waste)
Nitric acid …% [C ≤ 70 %]	7697-37-2	Not applicable	Not applicable	Not applicable	Annex I - Y34
Water	7732-18-5	Not applicable	Not applicable	Not applicable	Not applicable

16. Other information

Prepared By	Regulatory Affairs Thermo Fisher Scientific Email: EMSDS.RA@thermofisher.com
Creation Date	12-Mar-2009
Revision Date	24-Dec-2021
Print Date	24-Dec-2021
Revision Summary	SDS sections updated. 2. 11.

Disclaimer

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End of SDS

Safety Data Sheet
According to the (US) Hazard Communication Standard (29 CFR 1910.1200)

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

Product Name Buffer Solution pH 4.00

Catalog Number **YSI 3821**

Product Description Laboratory chemical, for use in calibrating pH probes.

Supplier

YSI, a Xylem brand
Telephone: 937-767-7241
Emergency: CHEMTREC
US/Can: 800-424-9300
International: 001 703-572-3997

1725 Brannum Lane
Yellow Springs, OH 45387
MSDSinfo@ysi.com
YSI.com
Collect calls accepted

Manufacturer

NCL of Wisconsin, Inc.
Telephone: 1-800-648-7836
Email: nclabs@nclabs.com

PO Box 8, Birnamwood, WI 54414
Fax: 715-449-2454
Emergency Contact: 1-800-424-9300 (Chemtrec)

SECTION 2: HAZARDS IDENTIFICATION

GHS Classification Not classified

Signal Word Not applicable

Pictograms None

Hazard Statements Not applicable

Precautionary Statements Not applicable

Other Hazards Not Contributing to the Classification None under normal conditions.

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Identity Not applicable

Common Name Not applicable

Mixture

Name	CAS #	Approximate %
Water	7732-18-5	>98.8
Potassium Hydrogen Phthalate	877-24-7	1.1
Red Food Coloring	Not found	<0.001

SECTION 4: FIRST AID MEASURES

Description of First Aid Measures

General First Aid Measures Never give anything by mouth to an unconscious person. Seek medical advice if you feel unwell.

If Inhaled Remove person to fresh air and keep comfortable for breathing. Allow victim to rest.

In Case of Skin Contact Remove contaminated clothing and wash exposed skin with mild soap and water. Rinse with warm water.

In Case of Eye Contact Immediately flush eyes with plenty of water. Remove contact lenses, if present and easy to do. Get medical attention if irritation develops.

If Swallowed Rinse mouth. Do NOT induce vomiting. Get medical attention if you feel unwell.

Most Important Symptoms/Effects Acute and Delayed

Not expected to present a significant hazard under normal use.

Indication of Immediate Medical Attention and Special Treatment Needed

No additional information available.

SECTION 5: FIRE-FIGHTING MEASURES

Extinguishing Media

Suitable Extinguishing Media	Foam. Dry powder. Sand. Carbon dioxide. Water spray.
Unsuitable Extinguishing Media	Do not use high pressure water stream.
Special Hazards Arising from the Chemical	No additional information available.
Special Protective Actions for Fire-Fighters	Wear self-contained breathing apparatus and protective clothing. Keep exposed containers cool with water spray.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures

Personal Precautions	Use personal protective equipment (see section 8). Evacuate area of non-essential personnel. Eliminate ignition sources.
Environmental Precautions	Prevent entry to surface and ground waters.
Methods and Materials for Containment and Cleaning Up	Clean up spills with inert solids. Collect spillage. Store away from other materials. Ensure compliance with federal, state, and local regulations.

SECTION 7: HANDLING AND STORAGE

Precautions for Safe Handling	Avoid contact with eyes and skin. Avoid breathing vapors. Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Provide good ventilation in process area to prevent formation of vapor.
Conditions for Safe Storage Including any Incompatibilities	Keep in a tightly closed container, stored in a cool, dry, ventilated area. Store away from strong oxidizers.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Control Parameters	Not applicable
Appropriate Engineering Controls	Provide adequate general ventilation. Maintain eye-wash fountain and quick-drench facilities in work area.
Individual Protection Measures	Avoid all unnecessary exposure.
Eye/Face Protection	Use chemical safety goggles and /or a full face shield where splashing is possible. Contact lenses should not be worn when working with this material. Maintain eye-wash fountain and quick-drench facilities in work area.
Skin Protection	Rubber or neoprene gloves and additional protection including impervious boots, apron, or coveralls, as needed in areas of unusual exposure to prevent skin contact.
Respiratory Protection	Wear appropriate mask.
Other Information	Do not eat, drink, or smoke when using this product.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid
Color	Red to pink
Odor	Odorless
Odor Threshold	Not determined
pH	4
Melting Point/Freezing Point	Not determined
Initial Boiling Point and Boiling Range	Not determined
Flash Point	Not determined
Evaporation Rate	Not determined
Flammability (Solid, Gas)	Not determined
Upper/Lower Flammability/Explosive Limits	Not determined
Vapor Pressure	Not determined
Vapor Density	Not determined

Relative Density	1.00
Solubility	Soluble in water.
Partition Coefficient: n-octanol/water	Not determined
Auto-Ignition Temperature	Not determined
Decomposition Temperature	Not determined
Viscosity	Not determined

SECTION 10: STABILITY AND REACTIVITY

Reactivity	No data available
Chemical Stability	Stable under ordinary conditions of use and storage.
Possibility of Hazardous Reactions	No data available
Conditions to Avoid	Extremely high or low temperatures.
Incompatible Materials	Strong oxidizers.
Hazardous Decomposition Products	When heated to decomposition, can emit toxic gases, carbon dioxide, and carbon monoxide.

SECTION 11: TOXICOLOGICAL INFORMATION

Acute Toxicity Not classified

Potassium Hydrogen Phthalate (877-24-7)	
LD50 oral rat	≥3200 mg/kg
Water (7732-18-5)	
LD50 oral rat	≥90000 mg/kg

Skin Corrosion/Irritation	Not classified
Serious Eye Damage/Irritation	Not classified
Respiratory or Skin Sensitization	Not classified
Germ Cell Mutagenicity	Not classified
Carcinogenicity	Not classified
Reproductive Toxicity	Not classified
Specific Target Organ Toxicity (Single Exposure)	Not classified
Specific Target Organ Toxicity (Repeated Exposure)	Not classified
Aspiration Hazard	Not classified
Potential Adverse Human Health Effects and Symptoms	No data available
Other Information	Not available

SECTION 12: ECOLOGICAL INFORMATION

Toxicity	Not applicable
Persistence and Degradability	Not applicable
Bioaccumulative Potential	Not applicable
Mobility in Soil	Not applicable
Other Adverse Effects	Not applicable

SECTION 13: DISPOSAL CONSIDERATIONS

Methods of Disposal

Disposal Recommendations	Dispose of contents/containers in accordance with federal, state, and local regulations.
Other Information	Avoid release to the surrounding environment.

SECTION 14: TRANSPORT INFORMATION

UN Number	Not applicable
UN Shipping Name	Not applicable
Transport Hazard Class(es)	Not applicable
Packing Group	Not applicable
Environmental Hazards	Not applicable
Transport in Bulk	Not applicable
Other Precautions	Not applicable

SECTION 15: REGULATORY INFORMATION

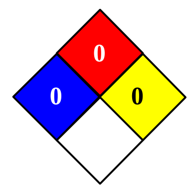
Potassium Hydrogen Phthalate (877-24-7)
Listed on the United States TSCA (Toxic Substances Control Act) inventory
Water (7732-18-5)
Listed on the United States TSCA (Toxic Substances Control Act) inventory

SECTION 16: OTHER INFORMATION

Revision Date: 12/10/2014

NFPA Hazards

Health Hazard	0: Exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials.
Fire Hazard	0: Materials that will not burn.
Instability/Reactivity	0: Normally stable, even under fire exposure conditions, and are not reactive with water.



HMIS III Rating

Health	0: No significant risk to health.
Flammability	0: Materials that will not burn.
Physical Hazard	0: Materials that are normally stable.
Personal Protection	A

YSI 3821	
Health	**0**
Flammability	**0**
Physical Hazard	**0**
Personal Protection	**A**

The information contained herein is provided in good faith and is believed to be correct as of the date hereof. However, NCL of Wisconsin, Inc. makes no representation as to the comprehensiveness or accuracy of the information. It is expected that individuals receiving the information will exercise their independent judgment in determining its appropriateness for their conditions of use. Accordingly, NCL of Wisconsin, Inc. will not be responsible for damages of any kind resulting from the use of or reliance upon such information.

END OF SAFETY DATA SHEET

a xylem brand

Safety Data Sheet
According to the (US) Hazard Communication Standard (29 CFR 1910.1200)

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

Product Name	Buffer Solution pH 7.00
Catalog Number	**YSI 3822**
Product Description	Laboratory chemical, for use in calibrating pH probes

Supplier

YSI, a Xylem brand
Telephone: 937-767-7241
Emergency: CHEMTREC
US/Can: 800-424-9300
International: 001 703-572-3997

1725 Brannum Lane
Yellow Springs, OH 45387
MSDSinfo@ysi.com
YSI.com
Collect calls accepted

Manufacturer

NCL of Wisconsin, Inc.
Telephone: 1-800-648-7836
Email: nclabs@nclabs.com

PO Box 8, Birnamwood, WI 54414
Fax: 715-449-2454
Emergency Contact: 1-800-424-9300 (Chemtrec)

SECTION 2: HAZARDS IDENTIFICATION

GHS Classification	Not classified
Signal Word	Not applicable
Pictograms	None
Hazard Statements	Not applicable
Precautionary Statements	Not applicable
Other Hazards Not Contributing to the Classification	None under normal conditions

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Identity	Not applicable
Common Name	Not applicable

Mixture

Name	CAS #	Approximate %
Water	7732-18-5	>98
Potassium Phosphate Monobasic	7778-77-0	<1
Yellow Food Coloring	Not found	<0.001

SECTION 4: FIRST AID MEASURES

Description of First Aid Measures

General First Aid Measures	Never give anything by mouth to an unconscious person. Seek medical advice if you feel unwell.
If Inhaled	Remove person to fresh air and keep comfortable for breathing. Allow victim to rest.
In Case of Skin Contact	Remove contaminated clothing and wash exposed skin with mild soap and water. Rinse with warm water.
In Case of Eye Contact	Immediately flush eyes with plenty of water. Remove contact lenses, if present and easy to do. Get medical attention if irritation develops.
If Swallowed	Rinse mouth. Do NOT induce vomiting. Get medical attention if you feel unwell.

Most Important Symptoms/Effects Acute and Delayed

Not expected to present a significant hazard under normal use.

Indication of Immediate Medical Attention and Special Treatment Needed

No additional information available.

SECTION 5: FIRE-FIGHTING MEASURES

Extinguishing Media

Suitable Extinguishing Media	Foam. Dry powder. Sand. Carbon dioxide. Water spray.
Unsuitable Extinguishing Media	Do not use high pressure water stream.
Special Hazards Arising from the Chemical	No additional information available.
Special Protective Actions for Fire-Fighters	Wear self-contained breathing apparatus and protective clothing. Keep exposed containers cool with water spray.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures

Personal Precautions	Use personal protective equipment (see section 8). Evacuate area of non-essential personnel. Eliminate ignition sources.
Environmental Precautions	Prevent entry to surface and ground waters.
Methods and Materials for Containment and Cleaning Up	Clean up spills with inert solids. Collect spillage. Store away from other materials. Ensure compliance with federal, state, and local regulations.

SECTION 7: HANDLING AND STORAGE

Precautions for Safe Handling	Avoid contact with eyes and skin. Avoid breathing vapors. Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Provide good ventilation in process area to prevent formation of vapor.
Conditions for Safe Storage Including any Incompatibilities	Keep in a tightly closed container, stored in a cool, dry, ventilated area. Store away from strong oxidizers.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Control Parameters	Not applicable
Appropriate Engineering Controls	Provide adequate general ventilation. Maintain eye-wash fountain and quick-drench facilities in work area.
Individual Protection Measures	Avoid all unnecessary exposure.
Eye/Face Protection	Use chemical safety goggles and /or a full face shield where splashing is possible. Contact lenses should not be worn when working with this material. Maintain eye-wash fountain and quick-drench facilities in work area.
Skin Protection	Rubber or neoprene gloves and additional protection including impervious boots, apron, or coveralls, as needed in areas of unusual exposure to prevent skin contact.
Respiratory Protection	Wear appropriate mask.
Other Information	Do not eat, drink, or smoke when using this product.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid
Color	Yellow
Odor	Odorless
Odor Threshold	Not determined
pH	7
Melting Point/Freezing Point	Not determined
Initial Boiling Point and Boiling Range	Not determined
Flash Point	Not determined
Evaporation Rate	Not determined
Flammability (Solid, Gas)	Not determined
Upper/Lower Flammability/Explosive Limits	Not determined
Vapor Pressure	Not determined
Vapor Density	Not determined

Relative Density	1.00
Solubility	Soluble in water
Partition Coefficient: n-octanol/water	Not determined
Auto-Ignition Temperature	Not determined
Decomposition Temperature	Not determined
Viscosity	Not determined

SECTION 10: STABILITY AND REACTIVITY

Reactivity	No data available
Chemical Stability	Stable under ordinary conditions of use and storage
Possibility of Hazardous Reactions	No data available
Conditions to Avoid	Extremely high or low temperatures
Incompatible Materials	Strong oxidizers
Hazardous Decomposition Products	When heated to decomposition, can emit toxic gases, carbon dioxide, carbon monoxide, phosphorus oxides, and sodium oxide

SECTION 11: TOXICOLOGICAL INFORMATION

Acute Toxicity Not classified

Potassium Hydrogen Phthalate (877-24-7)	
LD50 dermal rabbit	4640 mg/kg
Water (7732-18-5)	
LD50 oral rat	≥90000 mg/kg

Skin Corrosion/Irritation	Not classified
Serious Eye Damage/Irritation	Not classified
Respiratory or Skin Sensitization	Not classified
Germ Cell Mutagenicity	Not classified
Carcinogenicity	Not classified
Reproductive Toxicity	Not classified
Specific Target Organ Toxicity (Single Exposure)	Not classified
Specific Target Organ Toxicity (Repeated Exposure)	Not classified
Aspiration Hazard	Not classified
Potential Adverse Human Health Effects and Symptoms	No data available
Other Information	Not available

SECTION 12: ECOLOGICAL INFORMATION

Toxicity	Not applicable
Persistence and Degradability	Not applicable
Bioaccumulative Potential	Not applicable
Mobility in Soil	Not applicable
Other Adverse Effects	Not applicable

SECTION 13: DISPOSAL CONSIDERATIONS

Methods of Disposal

Disposal Recommendations	Dispose of contents/containers in accordance with federal, state, and local regulations
Other Information	Avoid release to the surrounding environment

SECTION 14: TRANSPORT INFORMATION

UN Number	Not applicable
UN Shipping Name	Not applicable
Transport Hazard Class(es)	Not applicable
Packing Group	Not applicable
Environmental Hazards	Not applicable
Transport in Bulk	Not applicable
Other Precautions	Not applicable

SECTION 15: REGULATORY INFORMATION

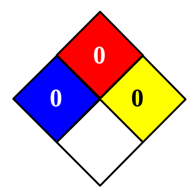
Potassium Hydrogen Phthalate (7778-77-0)
Listed on the United States TSCA (Toxic Substances Control Act) inventory
Water (7732-18-5)
Listed on the United States TSCA (Toxic Substances Control Act) inventory

SECTION 16: OTHER INFORMATION

Revision Date: 12/10/2014

NFPA Hazards

Health Hazard	0: Exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials.
Fire Hazard	0: Materials that will not burn.
Instability/Reactivity	0: Normally stable, even under fire exposure conditions, and are not reactive with water.



HMIS III Rating

Health	0: No significant risk to health.
Flammability	0: Materials that will not burn.
Physical Hazard	0: Materials that are normally stable.
Personal Protection	A

YSI 3821	
Health	0
Flammability	0
Physical Hazard	0
Personal Protection	A

The information contained herein is provided in good faith and is believed to be correct as of the date hereof. However, NCL of Wisconsin, Inc. makes no representation as to the comprehensiveness or accuracy of the information. It is expected that individuals receiving the information will exercise their independent judgment in determining its appropriateness for their conditions of use. Accordingly, NCL of Wisconsin, Inc. will not be responsible for damages of any kind resulting from the use of or reliance upon such information.

END OF SAFETY DATA SHEET

a xylem brand

www.ysi.com
Revision Date: 12/10/2014

Safety Data Sheet
According to the (US) Hazard Communication Standard (29 CFR 1910.1200)

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

Product Name Buffer Solution pH 10.00

Catalog Number **YSI 3823**

Product Description Laboratory chemical, for use in calibrating pH probes

Supplier

YSI, a Xylem brand
Telephone: 937-767-7241
Emergency: CHEMTREC
US/Can: 800-424-9300
International: 001 703-572-3997

1725 Brannum Lane
Yellow Springs, OH 45387
MSDSinfo@ysi.com
YSI.com
Collect calls accepted

Manufacturer

NCL of Wisconsin, Inc.
Telephone: 1-800-648-7836
Email: nclabs@nclabs.com

PO Box 8, Birnamwood, WI 54414
Fax: 715-449-2454
Emergency Contact: 1-800-424-9300 (Chemtrec)

SECTION 2: HAZARDS IDENTIFICATION

GHS Classification
Reproductive Toxicity — Category 1B

Signal Word Danger

Hazard Statements
H360 May damage fertility or the unborn child

Precautionary Statements
P201 Obtain special instructions before use
P202 Do not handle until all safety precautions have been read and understood
P280 Wear protective gloves and eye protection
P308+P313 IF exposed or concerned: Get medical advice/attention
P405 Store locked up
P501 Dispose of contents/container to comply with local, state, and federal regulations

Other Hazards Not Contributing to the Classification None under normal conditions

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Identity Not applicable

Common Name Not applicable

Mixture

Name	CAS #	Approximate %
Water	7732-18-5	>96
Potassium Hydroxide	1310-58-3	<1
Disodium EDTA dihydrate	6381-92-6	<1
Potassium Carbonate	584-08-7	<1
Potassium Borate	1332-77-0	<1
Bromphenol Blue, Sodium Salt	62625-28-9	<0.01
Bromcresol Green, Sodium Salt	62625-32-5	<0.01

SECTION 4: FIRST AID MEASURES

Description of First Aid Measures

General First Aid Measures Never give anything by mouth to an unconscious person. Seek medical advice if you feel unwell.

If Inhaled Remove person to fresh air and keep comfortable for breathing. Allow victim to rest.

In Case of Skin Contact Remove contaminated clothing and wash exposed skin with mild soap and water. Rinse with warm water.

In Case of Eye Contact Immediately flush eyes with plenty of water. Remove contact lenses, if present and easy to do. Get medical attention if irritation develops.

If Swallowed — Rinse mouth. Do NOT induce vomiting. Get medical attention if you feel unwell.

Most Important Symptoms/Effects Acute and Delayed

May damage fertility or the unborn child

Indication of Immediate Medical Attention and Special Treatment Needed

No additional information available.

SECTION 5: FIRE-FIGHTING MEASURES

Extinguishing Media

Suitable Extinguishing Media — Foam. Dry powder. Sand. Carbon dioxide. Water spray.

Unsuitable Extinguishing Media — Do not use high pressure water stream.

Special Hazards Arising from the Chemical — No additional information available.

Special Protective Actions for Fire-Fighters — Wear self-contained breathing apparatus and protective clothing. Keep exposed containers cool with water spray.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures

Personal Precautions — Use personal protective equipment (see section 8). Evacuate area of non-essential personnel. Eliminate ignition sources.

Environmental Precautions — Prevent entry to surface and ground waters.

Methods and Materials for Containment and Cleaning Up — Clean up spills with inert solids. Collect spillage. Store away from other materials. Ensure compliance with federal, state, and local regulations.

SECTION 7: HANDLING AND STORAGE

Precautions for Safe Handling — Avoid contact with eyes and skin. Avoid breathing vapors. Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Provide good ventilation in process area to prevent formation of vapor. Do not handle until all safety precautions have been read and understood. Obtain special instructions before use.

Conditions for Safe Storage Including any Incompatibilities — Keep in a tightly closed container, stored in a cool, dry, ventilated area. Store away from heat sources, strong oxidizers and strong acids

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Control Parameters

Potassium Hydroxide (1310-58-3)		
USA ACGIH	ACGIH Ceiling (mg/m^3)	2 mg/m^3

Appropriate Engineering Controls — Provide adequate general ventilation. Maintain eye-wash fountain and quick-drench facilities in work area.

Individual Protection Measures — Avoid all unnecessary exposure.

Eye/Face Protection — Use chemical safety goggles and /or a full face shield where splashing is possible. Contact lenses should not be worn when working with this material. Maintain eye-wash fountain and quick-drench facilities in work area.

Skin Protection — Rubber or neoprene gloves and additional protection including impervious boots, apron, or coveralls, as needed in areas of unusual exposure to prevent skin contact.

Respiratory Protection — Wear appropriate mask.

Other Information — Do not eat, drink, or smoke when using this product.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid
Color	Blue
Odor	Odorless
Odor Threshold	Not determined
pH	10
Melting Point/Freezing Point	Not determined

Initial Boiling Point and Boiling Range	Not determined
Flash Point	Not determined
Evaporation Rate	Not determined
Flammability (Solid, Gas)	Not determined
Upper/Lower Flammability/Explosive Limits	Not determined
Vapor Pressure	Not determined
Vapor Density	Not determined
Relative Density	1.00
Solubility	Soluble in water
Partition Coefficient: n-octanol/water	Not determined
Auto-Ignition Temperature	Not determined
Decomposition Temperature	Not determined
Viscosity	Not determined

SECTION 10: STABILITY AND REACTIVITY

Reactivity	No data available
Chemical Stability	Stable under ordinary conditions of use and storage.
Possibility of Hazardous Reactions	No data available
Conditions to Avoid	Extremely high or low temperatures.
Incompatible Materials	Strong oxidizers and strong acids
Hazardous Decomposition Products	When heated to decomposition, can emit toxic gases, carbon dioxide, and carbon monoxide.

SECTION 11: TOXICOLOGICAL INFORMATION

Acute Toxicity Not classified

Potassium Hydroxide (1310-58-3)	
LD50 oral rat	333 mg/kg, Rat; experimental value
Water (7732-18-5)	
LD50 oral rat	≥90000 mg/kg

Skin Corrosion/Irritation	Not classified
Serious Eye Damage/Irritation	Not classified
Respiratory or Skin Sensitization	Not classified
Germ Cell Mutagenicity	Not classified
Carcinogenicity	Not classified
Reproductive Toxicity	May damage fertility or the unborn child
Specific Target Organ Toxicity (Single Exposure)	Not classified
Specific Target Organ Toxicity (Repeated Exposure)	Not classified
Aspiration Hazard	Not classified
Potential Adverse Human Health Effects and Symptoms	No data available
Other Information	Not available

SECTION 12: ECOLOGICAL INFORMATION

Toxicity	Not applicable
Persistence and Degradability	Not applicable
Bioaccumulative Potential	Not applicable
Mobility in Soil	Not applicable
Other Adverse Effects	Not applicable

SECTION 13: DISPOSAL CONSIDERATIONS

Methods of Disposal

Disposal Recommendations	Dispose of contents/containers in accordance with federal, state, and local regulations.
Other Information	Avoid release to the surrounding environment.

UN Number	Not applicable
UN Shipping Name	Not applicable
Transport Hazard Class(es)	Not applicable
Packing Group	Not applicable
Environmental Hazards	Not applicable
Transport in Bulk	Not applicable
Other Precautions	Not applicable

SECTION 15: REGULATORY INFORMATION

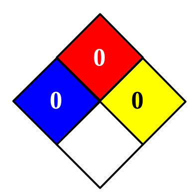
Potassium Hydroxide (1310-58-3)
Listed on the United States TSCA (Toxic Substances Control Act) inventory
Disodium EDTA Dihydrate (6381-92-6)
Listed on the United States TSCA (Toxic Substances Control Act) inventory
Water (7732-18-5)
Listed on the United States TSCA (Toxic Substances Control Act) inventory
Potassium Carbonate (584-08-7)
Listed on the United States TSCA (Toxic Substances Control Act) inventory
Potassium Borate (1332-77-0)
Listed on the United States TSCA (Toxic Substances Control Act) inventory
Bromphenol Blue, Sodium Salt (62625-28-9)
Listed on the United States TSCA (Toxic Substances Control Act) inventory
Bromcresol Green, Sodium Salt (62625-32-5)
Listed on the United States TSCA (Toxic Substances Control Act) inventory

SECTION 16: OTHER INFORMATION

Revision Date: 12/10/2014

NFPA Hazards

Health Hazard	0: Exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials.
Fire Hazard	0: Materials that will not burn.
Instability/Reactivity	0: Normally stable, even under fire exposure conditions, and are not reactive with water.



HMIS III Rating

Health	0: No significant risk to health.
Flammability	0: Materials that will not burn.
Physical Hazard	0: Materials that are normally stable.
Personal Protection	A

YSI 3821	
Health	0
Flammability	0
Physical Hazard	0
Personal Protection	A

END OF SAFETY DATA SHEET

ISO9001:2000 Certified

Material Safety Data Sheet
Light's Solution and ORP Standards, 400 – 475 mV

Section 1 - Chemical Product and Company Identification

MSDS Name:
Light's Solution and ORP Standard, 400 - 475 mV
Catalog Numbers:
LC16140, LC18015, LC18020
Synonyms:
Redox Buffers, 400 – 475 mV
Company Identification:
LabChem, Inc.
200 William Pitt Way
Pittsburgh, PA 15238
Company Phone Number:
(412) 826-5230
Emergency Phone Number:
(800) 424-9300
CHEMTREC Phone Number:
(800) 424-9300

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name:	Percent
7783-83-7	Ferric ammonium sulfate, dodecahydrate	<10
7783-85-9	Ferrous ammonium sulfate, hexahydrate	<10
7664-93-9	Sulfuric acid	1.5
7732-18-5	Water	Balance

Section 3 - Hazards Identification

Emergency Overview

Appearance*: Yellow solution*

Caution! May cause eye and skin irritation. May cause respiratory and digestive tract irritation. May cause liver damage. May cause cardiac disturbances. Air and light sensitive.

Target Organs: *Eyes, skin, respiratory tract, teeth, liver, cardiovascular system.*

Potential Health Effects

Eye:
May cause moderate eye irritation. May cause chemical conjunctivitis.
Skin:
May cause moderate skin irritation. May be harmful if absorbed through the skin.
Ingestion:
May cause gastrointestinal irritation with nausea, vomiting, and diarrhea. May cause liver damage. May cause cardiac disturbances, cardiovascular abnormalities, and cerebral swelling.

Inhalation:
May cause respiratory tract irritation. Can produce delayed pulmonary edema.

Chronic:
Chronic exposure may cause liver damage. Prolonged or repeated skin contact may cause dermatitis. Chronic exposure to sulfuric acid mists may cause chronic tracheobronchitis, erosion and discoloration of teeth. May cause conjunctivitis and lacrimation. Sulfuric acid mists are carcinogenic to humans.

Section 4 - First Aid Measures

Eyes:
Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids until no evidence of chemical remains. Get medical aid at once. Cover burns with loose sterile non-medicated bandages.

Skin:
Get medical aid. Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Remove contaminated clothing and shoes. Cover burns with a dry sterile bandage (secure, not tight).

Ingestion:
Do NOT induce vomiting. Get medical aid at once. Give conscious victim large quantities of water to dilute acid. Give oxygen if respiration is depressed.

Inhalation:
Give artificial respiration if necessary. Get medical aid. Keep victim warm, at rest. Move victim to fresh air.

Notes to Physician:
The use of Deferoxamine as a chelating agent should be determined only by qualified medical personnel. Monitor arterial blood gases, chest x-ray, and pulmonary function tests. Treat dermal irritation or burns with standard topical therapy. Effects may be delayed. Do not use sodium bicarbonate in an attempt to neutralize the acid.

Section 5 - Fire Fighting Measures

General Information:
Negligible fire and explosion hazard when exposed to heat or flame. Move container if possible, cool with fog or spray. Do not scatter contents with excess water. Contact with metals may evolve flammable hydrogen gas. Combustion may produce toxic vapors.

Extinguishing Media:
For small fires, use dry chemical, carbon dioxide, or alcohol-resistant foam.

Autoignition Temperature:
No information found.

Flash Point:
No information found.

NFPA Rating:
CAS# 7783-83-7: H-1, F-0, R-0.
CAS# 7783-85-9: H-2, F-0, R-0.
CAS# 7664-93-9: H-3, F-0, R-2.
CAS# 7732-18-5: Not published.

Material Safety Data Sheet
Light's Solution and ORP Standards, 400 – 475 mV

Explosion Limits:
Lower: N/A Upper: N/A

Section 6 - Accidental Release Measures

General Information:
Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:
Absorb spills with absorbent (vermiculite, sand, fuller's earth) and place in plastic bags for later disposal.

Section 7 - Handling and Storage

Handling:
Wash thoroughly after handling. Avoid contact with skin, eyes, and clothing. Keep tightly closed. Avoid ingestion or inhalation.

Storage:
Store capped at room temperature, protected from light and air. Do not store near combustible materials.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls:
Facilities using this material should be equipped with an eyewash facility and safety shower. Local exhaust ventilation may be necessary to control any air contaminants to within their TLVs during the use of this product. Use a corrosion-resistant ventilation system.

Exposure Limits:

Chemical Name	ACGIH	NIOSH	OSHA
Ferric ammonium sulfate dodecahydrate	1 mg/m3 TWA (as Fe) (listed under Iron salts (soluble))	1 mg/m3 TWA (as Fe) (listed under Iron salts (soluble))	none listed
Ferrous ammonium sulfate hexahydrate	1 mg/m3 TWA (as Fe) (listed under Iron salts (soluble))	1 mg/m3 TWA (as Fe) (listed under Iron salts (soluble))	none listed
Sulfuric acid	0.2 mg/m3 TWA (thoracic fraction)	1 mg/m3 TWA 15 mg/m3 IDLH	1 mg/m3 TWA
Water	none listed	none listed	none listed

OSHA Vacated PELs:
Sulfuric acid: 1 mg/m3 TWA
No OSHA Vacated PELs are listed for the other components.

Personal Protective Equipment

Eyes:
Do not wear contact lenses when working with chemicals. An eye wash fountain should be available in the immediate work area. Wear splash-proof safety goggles.

Material Safety Data Sheet
Light's Solution and ORP Standards, 400 – 475 mV

Skin:
Wear acid protective clothing and gloves.
Clothing:
Wear acid protective clothing and gloves.
Respirators:
Use the following when exposure limits are exceeded: Sulfuric acid-- 50 mg/M3 - gas mask with acid gas canister and high efficiency particulate filter. Self contained breathing apparatus with full facepiece. 100 mg/M3 - Type C supplied-air respirator with full facepiece, helmet or hood operated in continuous-flow mode.

Section 9 - Physical and Chemical Properties

Physical State:	Clear liquid
Color:	Dull yellow
Odor:	Very slight sulfurous odor
pH:	Acidic
Vapor Pressure:	No information found.
Vapor Density:	No information found.
Evaporation Rate:	>1 (ether=1)
Viscosity:	No information found.
Boiling Point:	> 100°C (> 212.00°F)
Freezing/Melting Point:	< 0°C (< 32.00°F)
Decomposition Temperature:	No information found.
Solubility in water:	Soluble.
Specific Gravity/Density:	No information found.
Molecular Formula:	No information found.
Molecular Weight:	No information found.

Section 10 - Stability and Reactivity

Chemical Stability:
Stable in closed containers under normal temperatures and pressures.
Conditions to Avoid:
Incompatible materials, light exposure to air, excess heat.
Incompatibilities with Other Materials:
Metals, strong oxidizing agents, alkalies, permanganates, reducing agents, oxidizing agents, acrylonitrile, chlorates, finely powdered metals, nitrate, perchlorates, aniline, carbides, epichlorohydrin, fulminates, picrates, organic materials, flammable liquids.
Hazardous Decomposition Products:
Oxides of nitrogen, oxides of sulfur, ammonia.
Hazardous Polymerization:
Has not been reported

Section 11 - Toxicological Information

RTECS:
CAS# 7783-83-7: WS5900000.

CAS# 7783-85-9: BR6500000.
CAS# 7664-93-9: WS5600000.

LD50/LC50:

CAS# 7783-83-7: Not available.
CAS# 7783-85-9:
Oral, rat: LD50 = 3250 mg/kg.
CAS# 7664-93-9:
Draize test, rabbit, eye: 250ug severe,
Inhalation, mouse: LC50 =320 mg/m3/2H
Inhalation, rat: LC50 =510 mg/m3/2H
Oral, rat: LD50 = 2140 mg/kg.
CAS# 7732-18-5- Not available.

Carcinogenicity:

CAS# 7732-18-5: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.
CAS# 7783-85-9: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.
CAS# 7664-93-9
ACGIH: A2 - Suspected Human Carcinogen (contained in strong inorganic acid mists)
California: Carcinogen, initial date 3/14/03 (listed as Strong inorganic acid mists containing sulfuric acid).
NIOSH: Not listed.
NTP: Known carcinogen (listed as Strong inorganic acid mists containing sulfuric acid).
OSHA: Select carcinogen
IARC: Group 1 carcinogen

Epidemiology:

Workers exposed to industrial sulfuric acid mist showed a statistical increase in laryngeal cancer. This suggests a possible relationship between carcinogenesis and inhalation of sulfuric acid mist.

Teratogenicity:

Sulfuric acid was not teratogenic in mice and rabbits, but was slightly embryotoxic in rabbits (a minor, rare skeletal variation). The animals were exposed to 5 and 20 mg/m3 for 7 hr/day throughout pregnancy. Slight maternal toxicity was present at the highest dose in both species.

Reproductive:

No information found.

Mutagenicity:

There are no mutagenicity studies specifically of sulfuric acid. However, there are established effects of reduced pH in mutagenicity testing, as would be caused by sulfuric acid. These effects are an artifact of low pH and are not necessarily due to biological effects of sulfuric acid.

Neurotoxicity:

No information found.

Section 12 - Ecological Information

Ecotoxicity:

Fish: Bluegill/Sunfish: 49 mg/L; 48 Hr; TLm (tap water @ 20 C)
Fish: Bluegill/Sunfish: 24.5 ppm; 48 Hr; TLm (fresh water)

Material Safety Data Sheet
Light's Solution and ORP Standards, 400 – 475 mV

Section 13 - Disposal Considerations

Dispose of in accordance with Federal, State, and local regulations.

Section 14 - Transport Information

US DOT

Shipping Name: Corrosive liquid, acidic, inorganic, nos. (Sulfuric acid)
Hazard Class: 8
UN Number: UN3264
Packing Group: PG II

Section 15 - Regulatory Information

US Federal

TSCA:

CAS# 7783-83-7 is not listed on the TSCA inventory. It is for research and development use only.
CAS# 7783-85-9 is not on the TSCA Inventory. However, its anhydrous form is on the inventory, and so this hydrate is exempt from TSCA Inventory requirements (40CFR270.3(u)(2)).
CAS# 7664-93-9 is listed on the TSCA Inventory.
CAS# 7732-18-5 is listed on the TSCA Inventory.

SARA Reportable Quantities (RQ):

CAS# 7664-93-9: final RQ = 1000 pounds (454 kg)

CERCLA/SARA Section 313:

This material contains Sulfuric acid (CAS# 7664-93-9, 1.5%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

OSHA - Highly Hazardous:

None of the components are on this list.

US State

State Right to Know:

CAS# 7783-83-7 can be found on the following state Right-to-Know lists: California (listed as Iron salts (soluble), Pennsylvania (listed as Iron salts (soluble), Minnesota (listed as Iron salts (soluble).
CAS# 7783-85-9 can be found on the following state Right-to-Know lists: California (listed as Iron salts (soluble), Pennsylvania (listed as Iron salts (soluble), Minnesota (listed as Iron salts (soluble).
CAS# 7664-93-9 can be found on the following state Right-to-Know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.

California Regulations:

WARNING: This product contains Sulfuric acid, listed as 'Strong inorganic mists containing sulfuric acid,' a chemical known to the state of California to cause cancer.

European/International Regulations

Canadian DSL/NDSL:

CAS# 7783-83-7 is not listed on Canada's DSL List.
CAS# 7783-85-9 is not listed on Canada's DSL List.

CAS# 7664-93-9 is listed on Canada's DSL List.
CAS# 7732-18-5 is listed on Canada's DSL List.

Canada Ingredient Disclosure List:

CAS# 7783-83-7 (listed as Iron salts (soluble)) is listed on Canada's Ingredient Disclosure List.
CAS# 7783-85-9 (listed as Iron salts (soluble)) is listed on Canada's Ingredient Disclosure List.
CAS# 7664-93-9 is listed on Canada's Ingredient Disclosure List.
CAS# 7732-18-5 is not listed on Canada's Ingredient Disclosure List.

Section 16 - Other Information

MSDS Creation Date: July 28, 2006
Revision Date: August 20, 2008

Information in this MSDS is from available published sources and is believed to be accurate. No warranty, express or implied, is made and LabChem Inc. assumes no liability resulting from the use of this MSDS. The user must determine suitability of this information for his application.

SAFETY DATA SHEET

1. Identification

Product identifier	**CONDUCTIVITY STANDARD 1413 uS/cm**
Other means of identification	
Product code	2174
Recommended use	professional, scientific and technical activities: other professional, scientific and technical activities
Recommended restrictions	None known.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer

Company name	GFS Chemicals, Inc.	
Address	800 Kaderly Drive Columbus, OH 43228 United States	
Telephone	Phone	740-881-5501
	Toll Free	800-858-9682
	Fax	740-881-5989
Website	www.gfschemicals.com	
E-mail	service@gfschemicals.com	
Emergency phone number	Emergency Assistance	Chemtrec 800-424-9300

2. Hazard(s) identification

Physical hazards	Not classified.
Health hazards	Not classified.
Environmental hazards	Not classified.
OSHA defined hazards	Not classified.

No hazards resulting from the material as supplied.

Label elements

Hazard symbol	None.
Signal word	None.
Hazard statement	The mixture does not meet the criteria for classification.
Precautionary statement	
Prevention	Observe good industrial hygiene practices.
Response	Wash hands after handling.
Storage	Store away from incompatible materials.
Disposal	Dispose of waste and residues in accordance with local authority requirements.
Hazard(s) not otherwise classified (HNOC)	None known.
Supplemental information	None.

3. Composition/information on ingredients

Mixtures

Chemical name	Common name and synonyms	CAS number	%
WATER		7732-18-5	>99.9%
POTASSIUM CHLORIDE		7447-40-7	<0.1%

*Designates that a specific chemical identity and/or percentage of composition has been withheld as a trade secret.

4. First-aid measures

Inhalation	Unlikely route of exposure as the product does not contain volatile substances.
Skin contact	Rinse with water.
Eye contact	Rinse with water. Get medical attention if irritation develops and persists.
Ingestion	Drink water as a precaution.

Most important symptoms/effects, acute and delayed	Direct contact with eyes may cause temporary irritation.
Indication of immediate medical attention and special treatment needed	Treat symptomatically.
General information	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media	Use extinguishing agent suitable for type of surrounding fire.
Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.
Specific hazards arising from the chemical	During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire fighting equipment/instructions	Move containers from fire area if you can do so without risk.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.
General fire hazards	No unusual fire or explosion hazards noted.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	This product is miscible in water. Large Spills: Dike the spilled material, where this is possible. Flush into sewer with plenty of water. Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination. Never return spills to original containers for re-use. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling	Observe good industrial hygiene practices.
Conditions for safe storage, including any incompatibilities	Store in original tightly closed container. Store away from incompatible materials (see Section 10 of the SDS). Keep containers tightly closed.

8. Exposure controls/personal protection

Occupational exposure limits	This mixture has no ingredients that have PEL, TLV, or other recommended exposure limit.
Biological limit values	No biological exposure limits noted for the ingredient(s).
Appropriate engineering controls	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.

Individual protection measures, such as personal protective equipment

Eye/face protection	Wear safety glasses with side shields (or goggles).
Skin protection	
Hand protection	Wear appropriate chemical resistant gloves.
Other	Wear suitable protective clothing.
Respiratory protection	In case of insufficient ventilation, wear suitable respiratory equipment.
Thermal hazards	Wear appropriate thermal protective clothing, when necessary.
General hygiene considerations	Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance	Clear.

Physical state	Liquid.
Form	Liquid.
Color	Colorless.
Odor	Odorless.
Odor threshold	Not available.
pH	6 - 8
Melting point/freezing point	32 °F (0 °C) estimated
Initial boiling point and boiling range	212 °F (100 °C) estimated
Flash point	Not available.
Evaporation rate	Not available.
Flammability (solid, gas)	Not applicable.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	Not available.
Vapor density	Not available.
Relative density	Not available.
Solubility(ies)	
Solubility (water)	Miscible.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.
Other information	
Density	1.00 g/cm3 estimated
Explosive properties	Not explosive.
Oxidizing properties	Not oxidizing.
Percent volatile	> 99.9 %
Specific gravity	1.00 estimated

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	Hazardous polymerization does not occur.
Conditions to avoid	Contact with incompatible materials.
Incompatible materials	None known.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure	
Inhalation	No adverse effects due to inhalation are expected.
Skin contact	No adverse effects due to skin contact are expected.
Eye contact	Direct contact with eyes may cause temporary irritation.
Ingestion	Expected to be a low ingestion hazard.
Symptoms related to the physical, chemical and toxicological characteristics	Direct contact with eyes may cause temporary irritation.

Information on toxicological effects

Acute toxicity

Product		Species	Test Results
CONDUCTIVITY STANDARD 1413 uS/cm			
	Acute		
	Oral		
	LD50	Guinea pig	99999 mg/kg
		Mouse	99999 mg/kg
		Rat	99999 mg/kg
	Other		
	LD50	Mouse	55714 mg/kg

Components		Species	Test Results
POTASSIUM CHLORIDE (CAS 7447-40-7)			
	Acute		
	Oral		
	LD50	Guinea pig	2500 mg/kg
		Mouse	383 mg/kg
		Rat	2600 mg/kg
	Other		
	LD50	Mouse	117 mg/kg
		Rat	39 mg/kg

* Estimates for product may be based on additional component data not shown.

Skin corrosion/irritation Prolonged skin contact may cause temporary irritation.

Serious eye damage/eye irritation May irritate eyes.

Respiratory or skin sensitization

Respiratory sensitization Not a respiratory sensitizer.

Skin sensitization This product is not expected to cause skin sensitization.

Germ cell mutagenicity No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.

Carcinogenicity Not classifiable as to carcinogenicity to humans.

IARC Monographs. Overall Evaluation of Carcinogenicity

Not listed.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

US. National Toxicology Program (NTP) Report on Carcinogens

Not listed.

Reproductive toxicity This product is not expected to cause reproductive or developmental effects.

Specific target organ toxicity - single exposure Not classified.

Specific target organ toxicity - repeated exposure Not classified.

Aspiration hazard Not an aspiration hazard.

12. Ecological information

Ecotoxicity The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

Product		Species	Test Results
CONDUCTIVITY STANDARD 1413 uS/cm			
Aquatic			
Crustacea	EC50	Daphnia	99999 mg/l, 48 hours
	LC50	Daphnia	99999 mg/l, 6 days
Fish	LC50	Fish	99999 mg/l, 96 hours

Components		Species	Test Results
POTASSIUM CHLORIDE (CAS 7447-40-7)			
Aquatic			
Crustacea	EC50	Water flea (Daphnia magna)	83 mg/l, 48 hours
Fish	LC50	Western mosquitofish (Gambusia affinis)	435 mg/l, 96 hours

* Estimates for product may be based on additional component data not shown.

Persistence and degradability No data is available on the degradability of any ingredients in the mixture.

Bioaccumulative potential No data available.

Mobility in soil No data available.

Other adverse effects No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal instructions Wash to drains with lots of water.

Local disposal regulations Dispose in accordance with all applicable regulations.

Hazardous waste code The waste code should be assigned in discussion between the user, the producer and the waste disposal company.

Waste from residues / unused products Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).

Contaminated packaging Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code Not established.

15. Regulatory information

US federal regulations This product is not known to be a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

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

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Not listed.

SARA 304 Emergency release notification

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories Immediate Hazard - No
Delayed Hazard - No
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical No

SARA 313 (TRI reporting)

Not regulated.

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

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

Not regulated.

Safe Drinking Water Act (SDWA) Not regulated.

US state regulations California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins.

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
Taiwan	Taiwan Toxic Chemical Substances (TCS)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

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

Issue date October-04-2013

Revision date May-08-2018

Version # 02

Disclaimer The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text. GFS Chemicals, Inc. cannot anticipate all conditions under which this information and its product, or the products of other manufacturers in combination with its product, may be used. It is the user’s responsibility to ensure safe conditions for handling, storage and disposal of the product, and to assume liability for loss, injury, damage or expense due to improper use. The information in the sheet was written based on the best knowledge and experience currently available.

Revision information This document has undergone significant changes and should be reviewed in its entirety.

Safety Data Sheet

OSHA format

Issuing Date May-04-2015 **Revision Date** Jun-30-2020 **Revision Number** 0

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product identifier

Product name **Turbidity Standard 1.0 NTU (2020we/TC3000we/LTC3000we)**

Other means of identification

Product Code(s) **1450**

Recommended use of the chemical and restrictions on use

Recommended Use Laboratory chemicals. Industrial (not for food or food contact use). Use as a laboratory reagent.

Uses advised against This product should not be used in applications other than those listed

Details of the supplier of the safety data sheet

LaMotte Company, Inc.
802 Washington Avenue
P.O. Box 329
Chestertown, MD 21620 USA
T 410-778-3100
F 410-778-9748

Emergency telephone numbers

24 Hour Emergency Number (CHEM-TEL):USA, Canada, Puerto Rico 1-800-255-3924 Outside North American Continent (Call collect) 813-248-0585

2. HAZARDS IDENTIFICATION

OSHA Regulatory Status

This product is not considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200).

Not a dangerous substance or mixture according to the Globally Harmonized System (GHS)

EMERGENCY OVERVIEW

Appearance Clear, colorless liquid	**Physical state** liquid	**Odor** Odorless

Precautionary Statements - Prevention

Do not handle until all safety precautions have been read and understood. Keep container tightly closed. Keep out of reach of children.

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. IF ON SKIN: Wash with plenty of soap and water. Take off contaminated clothing and wash before reuse. IF SWALLOWED:. Drink 1 or 2 glasses of water. Call a physician immediately.

Storage:

Store in a well-ventilated place. Keep cool.

3. COMPOSITION/INFORMATION ON INGREDIENTS*

Chemical name	CAS No	Weight-%

AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water	9003-70-7	<1
Water, distilled	7732-18-5	>99

4. FIRST AID MEASURES

First Aid Measures

General advice No hazards which require special first aid measures.

Eye contact Rinse thoroughly with plenty of water, also under the eyelids. If symptoms persist, call a physician.

Skin contact Wash off immediately with soap and plenty of water. If skin irritation persists, call a physician.

Inhalation Not expected. Remove to fresh air.

Ingestion Drink 1 or 2 glasses of water.

5. FIREFIGHTING MEASURES

Suitable extinguishing media
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Protective equipment and precautions for firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions Use personal protection recommended in Section 8.

Environmental precautions See Section 12 for additional Ecological Information. Beware of vapors accumulating to form explosive concentrations. Vapors can accumulate in low areas.

Methods and material for containment and cleaning up

Methods for containment Contain and collect spillage with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations (see Section 13).

Methods for cleaning up Soak up with inert absorbent material. After cleaning, flush away traces with water.

7. HANDLING AND STORAGE

Precautions for safe handling

Handling Handle in accordance with good industrial hygiene and safety practice. Do not taste or swallow. Do not eat, drink or smoke when using this product.

Conditions for safe storage, including any incompatibilities

Storage: Keep containers tightly closed in a dry, cool and well-ventilated place. Keep from freezing. Keep out of the reach of children.

Incompatible Products None known based on information supplied.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Chemical name	ACGIH TLV	OSHA PEL	NIOSH IDLH
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	*-	*-	Not Established
Water, distilled 7732-18-5	*-	*-	Not Established

Appropriate engineering controls

Engineering Measures
Showers
Eyewash stations
Ventilation systems.

Individual protection measures, such as personal protective equipment

Eye/Face Protection No special protective equipment required.

Skin and body protection Gloves & Lab Coat. Impervious clothing. Protective gloves. Nitrile rubber.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state liquid
Appearance Clear, colorless liquid **Odor** Odorless
Color Clear, colorless

Property	Values	Remarks • Method
pH		Neutral
Melting point / freezing point	No information available	
Boiling point / boiling range	100 °C / 212 °F	
Flash point	Not Applicable	
Evaporation rate		
Flammability (solid, gas)	No information available	
Flammability Limit in Air		
Upper flammability limit:	No information available	
Lower flammability limit:	No information available	
Vapor pressure	No information available	
Vapor density	No information available	
Specific gravity	No information available	
Water solubility	No information available	
Solubility in other solvents	No information available	
Partition coefficient	No information available	
Autoignition temperature	No information available	
Decomposition temperature	No information available	
Kinematic viscosity	No information available	
Dynamic viscosity	No information available	
Explosive properties	No information available	
Oxidizing properties	No information available	

Other Information

Softening point No information available
Molecular weight No information available

VOC Content (%) No information available
Density No information available
Bulk density No information available

10. STABILITY AND REACTIVITY

Stability Stable under recommended storage conditions.
Hazardous polymerization Hazardous polymerization does not occur.

Conditions to avoid Do not freeze. (Once frozen, polymer will not remain completely suspended).

Incompatible materials None known based on information supplied.

Hazardous decomposition products

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Component identification

Chemical name	ATEmix (oral)	ATEmix (dermal)	Inhalation LC50
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established	Not Established	Not Established
Water, distilled 7732-18-5	> 90 mL/kg (Rat)	Not Established	Not Established

Information on toxicological effects

Chemical name	ACGIH	IARC	NTP	OSHA
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established	Not Established	Not Established	Not Established
Water, distilled 7732-18-5	Not Established	Not Established	Not Established	Not Established

Chronic toxicity No known effect based on information supplied.

12. ECOLOGICAL INFORMATION

Ecotoxicity
Unknown Aquatic Toxicity 0.1 % of the mixture consists of components(s) of unknown hazards to the aquatic environment

Chemical name	Toxicity to Algae	Toxicity to Fish	Daphnia Magna (Water Flea)
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established	Not Established	Not Established
Water, distilled 7732-18-5	Not Established	Not Established	Not Established

Persistence and degradability
No information available.

Bioaccumulation/Accumulation
No information available.

Chemical name	Log Pow
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established

Water, distilled 7732-18-5	Not Established

13. DISPOSAL CONSIDERATIONS

Disposal Methods Can be disposed as waste water, when in compliance with local regulations. Dispose of contents/containers in accordance with local regulations.

Contaminated packaging Do not reuse empty containers.

Chemical name	RCRA	RCRA - Basis for Listing	RCRA - D Series Wastes	RCRA - U Series Wastes
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established	-	Not Established	Not Established
Water, distilled 7732-18-5	Not Established	-	Not Established	Not Established

Chemical name	RCRA - Halogenated Organic Compounds	RCRA - P Series Wastes	RCRA - F Series Wastes	RCRA - K Series Wastes
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established	Not Established	Not Established	Not Established
Water, distilled 7732-18-5	Not Established	Not Established	Not Established	Not Established

Chemical name	California Hazardous Waste Status
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	*-
Water, distilled 7732-18-5	*-

14. TRANSPORT INFORMATION

DOT Not regulated

TDG Not regulated

MEX Not regulated

ICAO Not regulated

IATA Not regulated

IMDG/IMO Not regulated

RID Not regulated

ADR Not regulated

ADN Not regulated

15. REGULATORY INFORMATION

International Inventories

TSCA Complies
DSL/NDSL Complies
EINECS/ELINCS Does not comply

ENCS	Does not comply
IECSC	Complies
KECL	Complies
PICCS	Complies
AICS	Complies

Legend:

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances
AICS - Australian Inventory of Chemical Substances

US Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

Chemical name	SARA 313 - Threshold Values %
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established
Water, distilled 7732-18-5	Not Established

SARA 311/312 Hazard Categories

Acute health hazard	No
Chronic Health Hazard	No
Fire hazard	No
Sudden release of pressure hazard	No
Reactive Hazard	No

CWA (Clean Water Act)

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

Chemical name	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants	CWA - Hazardous Substances
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established	Not Established	Not Established	Not Established
Water, distilled 7732-18-5	Not Established	Not Established	Not Established	Not Established

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

Chemical name	Hazardous Substances RQs	CERCLA/SARA RQ	RQ
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	*-	Not Established	-
Water, distilled 7732-18-5	*-	Not Established	-

US State Regulations

California Proposition 65

Chemical name	California Proposition 65
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established
Water, distilled 7732-18-5	Not Established

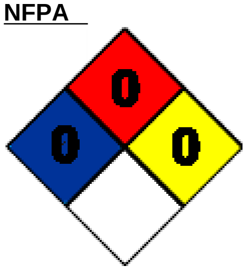
U.S. State Right-to-Know Regulations

Chemical name	New Jersey	Massachusetts	Pennsylvania
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established	Not Established	Not Established
Water, distilled 7732-18-5	Not Established	Not Established	X

CPSC (Consumer Product Safety Commission) - Specially Regulated Substances

16. OTHER INFORMATION

NFPA



Health Hazard	0
Fire Hazard	0
Reactivity	0

Prepared by Regulatory Affairs Department
Issuing Date May-04-2015
Revision Date Jun-30-2020
Reason for revision Five year review

Disclaimer

The information provided on this SDS is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of Safety Data Sheet

Safety Data Sheet

OSHA format

Issuing Date Jun-01-2015

Revision Number 0

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product identifier

Product name **Turbidity Standard 10.0 NTU (2020wi/TC3000wi/LTC3000wi)**

Other means of identification

Product Code(s) **1454**

Recommended use of the chemical and restrictions on use

Recommended Use Laboratory chemicals. Industrial (not for food or food contact use).

Details of the supplier of the safety data sheet

LaMotte Company, Inc.
802 Washington Avenue
P.O. Box 329
Chestertown, MD 21620 USA
T 410-778-3100
F 410-778-9748

Emergency telephone number

24 Hour Emergency Number (CHEM-TEL):USA, Canada, Puerto Rico 1-800-255-3924 Outside North American Continent (Call collect) 813-248-0585

2. HAZARDS IDENTIFICATION

OSHA Regulatory Status

This chemical is not considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Not a dangerous substance or mixture according to the Globally Harmonized System (GHS)

EMERGENCY OVERVIEW

Appearance Clear, colorless **Physical state** liquid **Odor** Odorless

Precautionary Statements - Prevention

Keep out of the reach of children.

Precautionary Statements - Response

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
IF ON SKIN: Wash with plenty of soap and water. Take off contaminated clothing and wash before reuse.
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
IF SWALLOWED. Drink 1 or 2 glasses of water. Call a physician immediately.

Precautionary Statements - Storage

Store in a well-ventilated place. Keep cool.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical name	CAS No	Weight-%
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water	9003-70-7	<1
Water, distilled	7732-18-5	>99

4. FIRST AID MEASURES

First Aid Measures

General advice No hazards which require special first aid measures.

Eye contact Rinse thoroughly with water as necessary. If irritation persists or develops, contact a physician.

Skin contact Wash off with warm water and soap. If skin irritation persists, call a physician.

Inhalation Not expected.

Ingestion Drink 1 or 2 glasses of water.

Notes to Physician Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media

Water spray, dry chemical, carbon dioxide (CO_2), or foam.

Protective equipment and precautions for firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions See section 8.

Environmental precautions See Section 12 for additional Ecological Information.

Methods and material for containment and cleaning up

Methods for containment Contain and collect spillage with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations (see Section 13).

Methods for cleaning up Soak up with inert absorbent material. After cleaning, flush away traces with water.

7. HANDLING AND STORAGE

Precautions for safe handling

Handling Handle in accordance with good industrial hygiene and safety practice. Do not taste or swallow. Do not eat, drink, or smoke when using this product.

Conditions for safe storage, including any incompatibilities

Storage Keep containers tightly closed in a dry, cool and well-ventilated place. Keep from freezing. Keep out of the reach of children.

Incompatible Products Organic material. (No hazardous reaction).

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Chemical name	ACGIH TLV	OSHA PEL	NIOSH IDLH
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	-	-	Not Established
Water, distilled 7732-18-5	-	-	Not Established

Appropriate engineering controls

Engineering Measures Showers
Eyewash stations
Ventilation systems.

Individual protection measures, such as personal protective equipment

Eye/Face Protection No special protective equipment required.

Skin and body protection Gloves & Lab Coat. Impervious clothing. Protective gloves. Nitrile rubber.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	liquid		
Appearance	Clear, colorless	**Odor**	Odorless

Property	Values	Remarks • Method
pH		No information available
Melting point / freezing point	No information available	
Boiling point / boiling range	100 °C No information available	
Flash point	No information available	
Evaporation rate		
Flammability (solid, gas)	No information available	
Flammability Limit in Air		
Upper flammability limit:	No information available	
Lower flammability limit:	No information available	
Vapor pressure	No information available	
Vapor density	No information available	
Specific gravity	No information available	
Water solubility	No information available	
Solubility in other solvents	No information available	
Partition coefficient	No information available	
Autoignition temperature	No information available	
Decomposition temperature	No information available	
Kinematic viscosity	No information available	
Dynamic viscosity	No information available	
Explosive properties	No information available	
Oxidizing properties	No information available	

Other Information

Softening point	No information available
Molecular weight	No information available
VOC Content (%)	No information available

Density No information available
Bulk density No information available

10. STABILITY AND REACTIVITY

Stability Stable.
Hazardous polymerization Hazardous polymerization does not occur.

Conditions to avoid Do not freeze. (Once frozen, polymer will not remain completely suspended).
Incompatible materials Organic material. (No hazardous reaction).
Hazardous decomposition products

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Component Information

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established	Not Established	Not Established
Water, distilled 7732-18-5	> 90 mL/kg (Rat)	Not Established	Not Established

Information on toxicological effects

Chemical name	ACGIH	IARC	NTP	OSHA
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established	Not Established	Not Established	Not Established
Water, distilled 7732-18-5	Not Established	Not Established	Not Established	Not Established

Chronic toxicity No known effect based on information supplied.

12. ECOLOGICAL INFORMATION

Ecotoxicity

Chemical name	Toxicity to Algae	Toxicity to Fish	Daphnia Magna (Water Flea)
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established	Not Established	Not Established
Water, distilled 7732-18-5	Not Established	Not Established	Not Established

Persistence and degradability
No information available.

Bioaccumulation/Accumulation
No information available.

Chemical name	Log Pow
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established
Water, distilled 7732-18-5	Not Established

13. DISPOSAL CONSIDERATIONS

Disposal Methods Can be disposed as waste water, when in compliance with local regulations.

Contaminated packaging Do not reuse empty containers.

Chemical name	RCRA	RCRA - Basis for Listing	RCRA - D Series Wastes	RCRA - U Series Wastes
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established	-	Not Established	Not Established
Water, distilled 7732-18-5	Not Established	-	Not Established	Not Established

Chemical name	RCRA - Halogenated Organic Compounds	RCRA - P Series Wastes	RCRA - F Series Wastes	RCRA - K Series Wastes
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established	Not Established	Not Established	Not Established
Water, distilled 7732-18-5	Not Established	Not Established	Not Established	Not Established

Chemical name	California Hazardous Waste Status
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	-
Water, distilled 7732-18-5	-

14. TRANSPORT INFORMATION

DOT Not regulated

IATA Not regulated

IMDG/IMO Not regulated

15. REGULATORY INFORMATION

International Inventories

TSCA Complies
DSL/NDSL Complies
EINECS/ELINCS Does not comply
ENCS Does not comply
IECSC Complies
KECL Complies
PICCS Complies
AICS Complies

Legend:

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances

PICCS - Philippines Inventory of Chemicals and Chemical Substances
AICS - Australian Inventory of Chemical Substances

US Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

Chemical name	SARA 313 - Threshold Values %
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established
Water, distilled 7732-18-5	Not Established

SARA 311/312 Hazard Categories

Acute health hazard	No
Chronic Health Hazard	No
Fire hazard	No
Sudden release of pressure hazard	No
Reactive Hazard	No

CWA (Clean Water Act)

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

Chemical name	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants	CWA - Hazardous Substances
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established	Not Established	Not Established	Not Established
Water, distilled 7732-18-5	Not Established	Not Established	Not Established	Not Established

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

Chemical name	Hazardous Substances RQs	CERCLA/SARA RQ	RQ
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	-	Not Established	-
Water, distilled 7732-18-5	-	Not Established	-

US State Regulations

California Proposition 65

Chemical name	California Proposition 65
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established
Water, distilled 7732-18-5	Not Established

U.S. State Right-to-Know Regulations

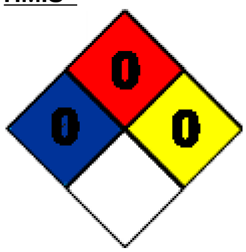
Chemical name	New Jersey	Massachusetts	Pennsylvania
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established	Not Established	Not Established

Water, distilled 7732-18-5	Not Established	Not Established	X

CPSC (Consumer Product Safety Commission) - Specially Regulated Substances

16. OTHER INFORMATION

NFPA	**Health hazard** 0	**Flammability** 0	**Instability** 0	**Physical and Chemical Hazards** N/A
HMIS	**Health hazard** 0	**Flammability** 0	**Stability** 0	



Health Hazard	0
Fire Hazard	0
Reactivity	0

Prepared by Regulatory Affairs Department
Issuing Date Jun-01-2015
Disclaimer
The information provided on this SDS is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of Safety Data Sheet

LaMotte

Safety Data Sheet

OSHA format

Issuing Date Jun-01-2015 **Revision Date** Jun-30-2020 **Revision Number** 0

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product identifier

Product name **Turbidity Standard 100 NTU (2020we/TC3000we/LTC3000we)**

Other means of identification

Product Code(s) **1452**

Recommended use of the chemical and restrictions on use

Recommended Use Laboratory chemicals. Industrial (not for food or food contact use). Use as a laboratory reagent.

Uses advised against This product should not be used in applications other than those listed

Details of the supplier of the safety data sheet

LaMotte Company, Inc.
802 Washington Avenue
P.O. Box 329
Chestertown, MD 21620 USA
T 410-778-3100
F 410-778-9748

Emergency telephone numbers

24 Hour Emergency Number (CHEM-TEL):USA, Canada, Puerto Rico 1-800-255-3924 Outside North American Continent (Call collect) 813-248-0585

2. HAZARDS IDENTIFICATION

OSHA Regulatory Status

This product is not considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200).

Not a dangerous substance or mixture according to the Globally Harmonized System (GHS)

EMERGENCY OVERVIEW

Appearance Clear, colorless liquid **Physical state** liquid **Odor** Odorless

Precautionary Statements - Prevention

Keep out of the reach of children.

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. IF ON SKIN: Wash with plenty of soap and water. Take off contaminated clothing and wash before reuse. IF SWALLOWED:. Drink 1 or 2 glasses of water. Call a physician immediately.

Storage:

Store in a well-ventilated place. Keep cool.

3. COMPOSITION/INFORMATION ON INGREDIENTS*

Chemical name	CAS No	Weight-%
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water	9003-70-7	<0.1

Water, distilled	7732-18-5	>99

4. FIRST AID MEASURES

First Aid Measures

General advice No hazards which require special first aid measures.

Eye contact Rinse thoroughly with water as necessary. If irritation persists or develops, contact a physician.

Skin contact Wash off with warm water and soap. If skin irritation persists, call a physician.

Inhalation Not expected.

Ingestion Drink 1 or 2 glasses of water.

Notes to Physician Treat symptomatically.

5. FIREFIGHTING MEASURES

Suitable extinguishing media
Water spray, dry chemical, carbon dioxide (CO_2), or foam.

Protective equipment and precautions for firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions See section 8.

Environmental precautions See Section 12 for additional Ecological Information. Beware of vapors accumulating to form explosive concentrations. Vapors can accumulate in low areas.

Methods and material for containment and cleaning up

Methods for containment Contain and collect spillage with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations (see Section 13).

Methods for cleaning up Soak up with inert absorbent material. After cleaning, flush away traces with water.

7. HANDLING AND STORAGE

Precautions for safe handling

Handling Handle in accordance with good industrial hygiene and safety practice. Do not taste or swallow. Do not eat, drink, or smoke when using this product.

Conditions for safe storage, including any incompatibilities

Storage: Keep containers tightly closed in a dry, cool and well-ventilated place. Keep from freezing. Keep out of the reach of children.

Incompatible Products Organic material. (No hazardous reaction).

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Chemical name	ACGIH TLV	OSHA PEL	NIOSH IDLH
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	*-	*-	Not Established
Water, distilled 7732-18-5	*-	*-	Not Established

Appropriate engineering controls

Engineering Measures
Showers
Eyewash stations
Ventilation systems.

Individual protection measures, such as personal protective equipment

Eye/Face Protection No special protective equipment required.

Skin and body protection Gloves & Lab Coat. Impervious clothing. Protective gloves. Nitrile rubber.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state liquid
Appearance Clear, colorless liquid
Color Clear, colorless
Odor Odorless

Property	Values	Remarks • Method
pH	6.0 - 7.0	pH range 6.0-7.0
Melting point / freezing point	No information available	
Boiling point / boiling range	100 °C / 212 °F	
Flash point	Not Applicable	
Evaporation rate		
Flammability (solid, gas)	No information available	
Flammability Limit in Air		
Upper flammability limit:	No information available	
Lower flammability limit:	No information available	
Vapor pressure	No information available	
Vapor density	No information available	
Specific gravity	No information available	
Water solubility	No information available	
Solubility in other solvents	No information available	
Partition coefficient	No information available	
Autoignition temperature	No information available	
Decomposition temperature	No information available	
Kinematic viscosity	No information available	
Dynamic viscosity	No information available	
Explosive properties	No information available	
Oxidizing properties	No information available	

Other Information

Softening point	No information available
Molecular weight	No information available
VOC Content (%)	No information available

Density No information available
Bulk density No information available

10. STABILITY AND REACTIVITY

Stability Stable.
Hazardous polymerization Hazardous polymerization does not occur.

Conditions to avoid Do not freeze. (Once frozen, polymer will not remain completely suspended).

Incompatible materials Organic material. (No hazardous reaction).

Hazardous decomposition products

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Component identification

Chemical name	ATEmix (oral)	ATEmix (dermal)	Inhalation LC50
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established	Not Established	Not Established
Water, distilled 7732-18-5	> 90 mL/kg (Rat)	Not Established	Not Established

Information on toxicological effects

Chemical name	ACGIH	IARC	NTP	OSHA
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established	Not Established	Not Established	Not Established
Water, distilled 7732-18-5	Not Established	Not Established	Not Established	Not Established

Chronic toxicity No known effect based on information supplied.

12. ECOLOGICAL INFORMATION

Ecotoxicity

Chemical name	Toxicity to Algae	Toxicity to Fish	Daphnia Magna (Water Flea)
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established	Not Established	Not Established
Water, distilled 7732-18-5	Not Established	Not Established	Not Established

Persistence and degradability
No information available.

Bioaccumulation/Accumulation
No information available.

Chemical name	Log Pow
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established
Water, distilled 7732-18-5	Not Established

13. DISPOSAL CONSIDERATIONS

Disposal Methods Can be disposed as waste water, when in compliance with local regulations.

Contaminated packaging Do not reuse empty containers.

Chemical name	RCRA	RCRA - Basis for Listing	RCRA - D Series Wastes	RCRA - U Series Wastes
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established	-	Not Established	Not Established
Water, distilled 7732-18-5	Not Established	-	Not Established	Not Established

Chemical name	RCRA - Halogenated Organic Compounds	RCRA - P Series Wastes	RCRA - F Series Wastes	RCRA - K Series Wastes
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established	Not Established	Not Established	Not Established
Water, distilled 7732-18-5	Not Established	Not Established	Not Established	Not Established

Chemical name	California Hazardous Waste Status
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	*-
Water, distilled 7732-18-5	*-

14. TRANSPORT INFORMATION

DOT Not regulated

TDG Not regulated

MEX Not regulated

ICAO Not regulated

IATA Not regulated

IMDG/IMO Not regulated

RID Not regulated

ADR Not regulated

ADN Not regulated

15. REGULATORY INFORMATION

International Inventories

TSCA Complies
DSL/NDSL Complies
EINECS/ELINCS Does not comply
ENCS Does not comply
IECSC Complies
KECL Complies

PICCS Complies
AICS Complies

Legend:

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances
AICS - Australian Inventory of Chemical Substances

US Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

Chemical name	SARA 313 - Threshold Values %
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established
Water, distilled 7732-18-5	Not Established

SARA 311/312 Hazard Categories

Acute health hazard No
Chronic Health Hazard No
Fire hazard No
Sudden release of pressure hazard No
Reactive Hazard No

CWA (Clean Water Act)

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

Chemical name	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants	CWA - Hazardous Substances
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established	Not Established	Not Established	Not Established
Water, distilled 7732-18-5	Not Established	Not Established	Not Established	Not Established

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

Chemical name	Hazardous Substances RQs	CERCLA/SARA RQ	RQ
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	*-	Not Established	-
Water, distilled 7732-18-5	*-	Not Established	-

US State Regulations

California Proposition 65

Chemical name	California Proposition 65
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established
Water, distilled 7732-18-5	Not Established

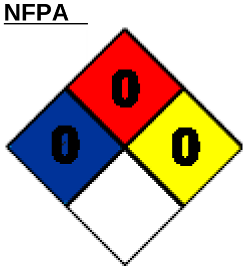
U.S. State Right-to-Know Regulations

Chemical name	New Jersey	Massachusetts	Pennsylvania
AMCO polymer spheres (Styrene Divinyl Benzene Copolymer Beads) suspended in water 9003-70-7	Not Established	Not Established	Not Established
Water, distilled 7732-18-5	Not Established	Not Established	X

CPSC (Consumer Product Safety Commission) - Specially Regulated Substances

16. OTHER INFORMATION

NFPA **Health hazard** 0 **Flammability** 0 **Stability** 0



Health Hazard	0
Fire Hazard	0
Reactivity	0

Prepared by Regulatory Affairs Department
Issuing Date Jun-01-2015
Revision Date Jun-30-2020
Reason for revision Five year review

Disclaimer

The information provided on this SDS is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of Safety Data Sheet

ATTACHMENT 7

Community Air Monitoring Plan

COMMUNITY AIR MONITORING PLAN

A Community Air Monitoring Plan (CAMP) will be implemented during intrusive activities. The purpose of the CAMP is to provide a measure of protection for the downwind community from potential airborne contaminant releases, including fugitive dust and volatile organic compounds (VOCs), resulting from the proposed site investigation activities. Site-specific procedures described below for fugitive dust monitoring are consistent with the New York State Department of Health generic CAMP as outlined in New York State Department of Environmental Conservation (NYSDEC) *Technical Guidance for Site Investigation and Remediation* (DER-10).

Particulate Air Monitoring

Particulate monitoring will be conducted continuously during ground intrusive activities (e.g., installation of soil borings and/or monitoring wells). Dust/particulate monitoring will be conducted near upwind and downwind perimeters of the work area or where dust generating operations are obvious. Dust monitoring may be suspended during periods of heavy precipitation and snow cover.

Particulate air monitoring will be conducted with a DataRAM-4 or similar device. This instrument is equipped with an audible alarm (indication of action level exceedance) and is capable of measuring particulate matter less than 10 micrometers in size (PM-10). It will continually record emissions (calculating 15-minute running average concentration levels) generated during field activities. The upwind and downwind dust monitoring devices will be checked periodically throughout each day of intrusive activities to assess emissions and the need for corrective action.

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

<u>Particulate monitoring response and action levels</u>

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter ($\mu g/m^3$) greater than background (upwind perimeter) for the 15-minute period, or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 µg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

- If after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 µg/m^3 above the upwind level, work will be stopped, and a re-evaluation of activities initiated. Work can resume if dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration levels to within 150 µg/m^3 of the upwind level and in preventing visible dust migration.
- Readings will be provided to the NYSDEC and the New York State Department of Health (NYSDOH) on a weekly basis. Any exceedances will be reported the same day of occurrence or the next business day, if after hours, including effectiveness of corrective measures implemented.

VOC Air Monitoring

VOC air monitoring will be conducted in conjunction with dust monitoring. The VOC air monitoring will be conducted using a photo-ionization detector (PID) (e.g., RAE Systems MiniRAE 2000) which provides real-time recordable air monitoring data.

VOCs will be continuously monitored in the immediate work zone only. Upwind concentration levels will be measured before field activities commence and periodically throughout the day to establish background conditions. Equipment will be calibrated daily and capable of calculating 15-minute running average concentrations.

VOC monitoring response and action levels

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

- If total organic vapor levels at the downwind perimeter of the work area persist above 5 ppm over background but below 25 ppm, work activities will be halted, the vapor source identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume if the total organic vapor level 200 feet downwind of the work area or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but not less than 20 feet, is below 5 ppm over background for the 15-minute average.
- If the organic vapor level is above 25 ppm at the work area perimeter, activities will be shut down.
- Readings will be provided to the NYSDEC and the NYSDOH on a weekly basis. Any exceedances will be reported the same day of occurrence or the next business day, if after hours, including effectiveness of corrective measures implemented.