FIELD ACTIVITIES PLAN
REMEDIAL INVESTIGATION PHASE I
WF LAKE CORPORATION
SITE # 558042
GLENS FALLS, NEW YORK

WORK ASSIGNMENT NO. D009809-30

Prepared for:

New York State Department of Environmental Conservation
Albany, New York

Prepared by:

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

MACTEC: 3616216155

APRIL 2022

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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

DPT	Direct Push Technology
FAP	Field Activities Plan
FDR	Field Data Record
FWIA	Fish and Wildlife Impact Analysis
GPS	Global Positioning System
HASP	Health and Safety Plan
IDW	Investigation Derived Waste
LC/MS/MS	Liquid Chromatography Tandem Mass spectrometry
MACTEC	MACTEC Engineering and Geology, P.C.
MW	Monitoring Well
NPL	National Priorities List
NTU	Nephelometric Turbidity Units
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PFAS	Per- and Polyfluoroalkyl Substances
PFOA	Perfluorooctanoic Acid
PPE	Personal Protective Equipment
PTFE	Polytetrafluoroethylene
QAPP	Quality Assurance Program Plan
QA/QC	Quality Assurance/Quality Control
RI	Remedial Investigation
RIWP	Remedial Investigation Work Plan
SC	Site Characterization
Site	WF Lake Corporation Site
SPLP	Synthetic Precipitation Leaching Procedures
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

MACTEC Engineering and Geology, P.C. (MACTEC), under contract to the New York State Department of Environmental Conservation (NYSDEC), is submitting this Field Activities Plan (FAP) to perform a Remedial Investigation (RI) at the W.F. Lake Corporation facility (Site) located in Glens Falls, Washington County, New York (**Figure 1**). This FAP, herein referred to as the RI Work Plan (RIWP), has been prepared in general accordance with the NYSDEC requirements in Work Assignment (WA) No. D009809-30, dated August 20, 2021, and with the January 30, 2020 Superfund Standby Contract between MACTEC and NYSDEC.

The Site (NYSDEC Site No. 558042) is currently listed as a Class 2 site (i.e., poses a significant threat to the public health or environment) by NYSDEC. This classification is based on the results of the Site Characterization (SC) performed by Camp Dresser McKee & Smith (CDM Smith) from December 31, 2019 to January 23, 2020 (CDM Smith, 2020) and private drinking water supply sampling completed by the New York State Department of Health (NYSDOH). These investigations identified the presence of per- and polyfluoroalkyl substances (PFAS), specifically perfluorooctanoic acid (PFOA), in media sampled at concentrations that met or exceeded established standards, criteria and guidance values (SCGs). Work Assignment D009809-30 was issued by NYSDEC to conduct a Remedial Investigation (RI) and Feasibility Study (FS) for the Site.

This RIWP describes the investigation activities planned at the Site. The investigation will be performed in accordance with MACTEC's pre-approved Health and Safety Plan [HASP] (MACTEC, 2020a) and Quality Assurance Program Plan [QAPP] (MACTEC, 2020b). A Site-Specific HASP is included as Appendix A.

This RIWP is organized into five sections as follows:

- Section 1.0 – Introduction
- Section 2.0 – Site Background and Site Physical Setting
- Section 3.0 – Conceptual Site Model
- Section 4.0 – Scope of Work
- Section 5.0 – References

1.1 WORK ASSIGNMENT OBJECTIVES

Based on the WA issuance and discussions with the NYSDEC Project Manager, the objectives of the RI/FS are to:

- evaluate the extent of PFAS in overburden soil in at and in the vicinity of the Site specifically in areas located offsite in the prevalent downwind direction (east) from the Site;
- evaluate the potential presence of additional on-Site source area(s);
- evaluate the extent of PFAS in overburden groundwater on and off Site;
- evaluate the presence/absence of PFAS in bedrock groundwater as a result of Site operations;
- evaluate if and where shallow groundwater is discharging to the unnamed nearby stream;
- evaluate the presence/absence of PFAS in surface water and sediment in the surface water flow pathway;
- evaluate the presence/absence of PFAS in yarn and fabric materials found at the Site;
- assist with private water supply well sampling on an "as needed" basis; and,
- prepare and submit RI and FS Reports for the Site.

It should be noted that additional site investigation activities are planned for subsequent phases of the project (e.g., Phase II). These activities will be defined following an evaluation of Phase I/Task 2 results and the additional scope will be provided in an amendment to this RIWP.

1.2 SITE BACKGROUND

1.2.1 SITE LOCATION

The Site is an active manufacturing facility located at 65 Park Road in the Town of Kingsbury, Washington County, New York. The Site is approximately 4.1 acres in size located in a mixed commercial and industrial area and identified as Washington County tax parcel 137-2-32. It is bounded by Midway Industrial Supply to the north, Park Road to the east, Sterile Technologies, Inc. to the south, and undeveloped property to the west.

1.2.2 SITE HISTORY

Based on available information for the Site, W.F. Lake Corporation has operated solely as a manufacturer of high performance coated industrial fibers and woven fabrics since 1995. Historical topographic maps and aerial imagery indicate the area immediately surrounding was comprised of wetlands and agricultural fields until the construction of County Airport (Floyd Bennett Memorial Airport) was completed in the 1940s and the Site remained largely undeveloped until the 1990s. The Site was improved with a building circa 1995 with subsequent production and warehousing expansions completed in 1996, 1998, and 2015.

1.2.3 PREVIOUS INVESTIGATIONS

CDM Smith completed a SC in 2020 to evaluate the presence/absence of contamination that may be associated with the manufacturing processes at the Site. Samples of soil, shallow overburden groundwater, surface water, stormwater, and sediment from the Site were analyzed for target compound list (TCL) volatile organic compounds (VOCs), TCL semivolatile organic compounds (SVOCs), TCL pesticides, target analyte list (TAL) metals, mercury, cyanide, 1,4-dioxane, and per- and polyfluoroalkyl substances (PFAS). Few samples had exceedances of VOCs, SVOCs, pesticides, metals, mercury, cyanide, and 1,4-dioxane in sampled media. However, PFAS were detected in each media sampled with exceedances of one or more regulated compounds reported (CDM Smith, 2020). As such, due to concentrations detected, the primary focus of the RI will be to further define the nature and extent of PFAS contamination and address data gaps identified during the SC.

2.0 SITE PHYSICAL SETTING

The following sections describe the Site location, history, and previous investigations performed at the Site.

2.1 TOPOGRAPHY

The Site is located within the Town of Glens Falls, New York (Figure 1), at approximately 430 ft above mean sea level (msl). Regional topography grades towards the Hudson River, located about 3 miles to the south, at an elevation of approximately 210 ft above msl. The topography rises slightly to the north of the Site, reaching an elevation of approximately 360 ft msl with topography exhibiting minimal relief to the east and west. Local Site topography is minimal; however, slopes gently to the west and south.

2.2 CLIMATE

The project area is characterized by moderately warm summers and cold winters with mean monthly temperatures ranging from 28.5 degrees Fahrenheit (°F) in January to 81°F in July. Average annual precipitation is 39 inches.

2.2 SURFACE WATER/STORMWATER HYDROLOGY

Based on surface topography, surface and subsurface stormwater conveyance systems, and impermeable surface (e.g., asphalt paving) present at the Site, most surface water flows towards and into the retention pond located in the northwest portion of the Site. Rooftop runoff and surface sheet flow from paved areas are diverted into either a catch basin near the loading dock or surface swales and conveyed into the retention pond (Figure 1). Water from the catch basin is carried via a 24-inch diameter subsurface pipe. Remaining stormwater and surface runoff is captured by a small basin located east of the facility and flows north towards a swale where flow is managed via surface flow to the retention pond. Water from the retention pond drains through one or more surface features or down through unconsolidated overburden materials.

2.3 GROUNDWATER HYDROLOGY

Based on information provided in the Final Site Characterization Report (CDM Smith, 2020), overburden groundwater flows west across the Site with the greatest gradient located in an area southwest of the property. The gauging of existing and proposed overburden groundwater wells will be performed during Phase I to further evaluate overburden groundwater hydrology.

2.4 SITE LITHOLOGY

Overburden lithology, based on results obtained during the SC (CDM Smith, 2020), consists primarily of clay with intermittent lenses of sand and gravel typical of glacial till. Based on Site development activities likely to have occurred, fill material of variable thickness is believed to be present throughout the Site.

3.0 CONCEPTUAL SITE MODEL

The conceptual site model (CSM) is based on the review of historical data, data collected during the SC, and observations made during a Site visit completed in October 2021. This CSM is considered a dynamic model and the model presented below will be used to focus, explain and modify data gathering activities as well as subsequent report writing activities. This CSM should be modified as more data become available and to be referenced while collecting and/or analyzing data. The CSM will be modified when information gleaned from field and/or laboratory demonstrates the need for its modification with changes made through collaboration and concurrence with NYSDEC.

3.1 SITE BACKGROUND

The W.F. Lake facility has operated as a manufacturer of high-performance PTFE-coated industrial fibers and woven fabrics. These coatings and the process used in the application and curing of these coatings is the source of PFAS contamination at the Site.

3.2 CONTAMINANTS OF CONCERN (COC)

The principal contaminants of concern (COCs) identified at during the SC are PFAS compounds, primarily PFOA, that exceeded applicable SCGs in the groundwater and soil samples collected. Other PFAS were also detected at varying concentrations both above and below their SCGs. Acetone, chromium, and nickel also exceeded Unrestricted Use Soil Cleanup Objectives (SCOs); however, reported concentrations of chromium and nickel were largely consistent across the Site and may be more representative of elevated background concentrations than impacts related to Site operations.

3.3 SOURCE AREAS

The SC identified the highest concentrations of PFAS near the Site building, adjacent to sintering furnace exhausts. The currently understood primary source area is being defined as the soil located east of the building with secondary sources identified as surface/stormwater and shallow groundwater. Analytical results indicate these media have elevated concentrations on Site but will require further delineation to further define the nature and extent offsite.

3.4 COC POINTS OF ENTRY

Points of entry into the environment for PFAS at the Site are primarily related to air deposition of PFAS from sintering furnace exhausts as a result of the fiber and fabric coating and drying process. Another potential point of entry may be related to housekeeping (e.g., storage, disposal of coatings). The liquid coating material is currently stored inside the building in an area near the sintering furnace. Spills in this area could have been swept out of the building or rinse water disposed to the ground surface; however, this point of entry has not been evaluated.

3.5 HYDROGEOLOGY AND CONTAMINANT DISTRIBUTION

PFAS detected in surface soil, surface/stormwater, and overburden groundwater at the Site appears to be highest in the area to the east of the building, near the sintering furnace exhausts and immediately outside the coating storage area. The primary means of contaminant distribution appears to be a from aerial distribution, resulting in a potential widespread distribution of PFAS in surface soils and surface water. PFAS tends to be recalcitrant (i.e., persistent) in the environment and it is not unusual to find PFAS persisting in the environment following its discontinued use. The concentration of PFAS detected in Site soil during the SC may continue to act as an on-going source to groundwater contamination.

Investigations to date have focused on the overburden source area, which consists of sand, silt, and clay layers. Although historic groundwater elevations measured at the Site indicate a primary westward flow direction, flow at the Site may vary seasonally. The presence of organic carbon in the soil matrix (i.e., overburden aquifer) can increase the sequestration of the PFAS in soil; however, further investigative activities will be required and addressed further during the FS.

It should be noted that bedrock hydrogeology has not been investigated at the Site. Data from the Phase I investigation will be used to update the CSM and identify data gaps. The need for a bedrock investigation will be evaluated at that time.

3.6 MIGRATION PATHWAYS

Potential migration pathways from the Site include groundwater, surface water, surface soil and aerial deposition from the sintering furnace. The sintering furnace has not been evaluated thus aerial dispersion may be an ongoing source of contaminant migration. Contaminants have migrated from the soil source on the east of the Site building to overburden groundwater that flows west and may discharge to surface water. Concentrations of PFAS in overburden groundwater has not been fully delineated either on or off-Site. Surface/stormwater originating at the Site impacted from direct contact with source material or soils leaves the Site and is considered a migration pathway.

3.7 EXPOSURE ROUTES

Based on sampling completed by the NYSDOH, contaminants have been detected in private water supplies in areas located downwind (east) of the Site. Although public water services the W.F. Lake facility and surrounding commercial properties, groundwater is still a primary source of drinking water in the area and is considered an exposure route. Contamination is present in surficial soil and could pose a direct contact risk to people accessing the Site; however, this may be limited in frequency and duration. If construction work is conducted to the east of the Site building, a direct contact exposure to the contaminated soil or groundwater could exist.

Contaminants present in the unnamed stream to the west of the Site could result in direct contact with humans or wildlife. Humans could also potentially consume wildlife that are in direct contact or consume water or vegetation from these water bodies.

3.8 DATA GAPS

Based on the results of the SC and preliminary CSM, data gaps have been identified and include:

- The extent of the soil contamination in excess of the SCGs has not been defined;
- The extent of impacts to overburden groundwater has not been defined;
- The potential presence of contamination in bedrock groundwater has not been evaluated;
- Impacts to sediment have not been evaluated;
- Groundwater flow direction and rate (both bedrock and overburden) have not been clearly evaluated; and,
- Discharge locations of contaminants to the unnamed stream have not been fully evaluated;

4.0 SCOPE OF WORK

This RIWP has been developed for the purpose of addressing WA objectives (Section 1.1) and current data gaps (Section 3.8). Collected data will be used to prepare an RI Report and subsequent FS Report. Based on the number of activities proposed during the RI, two individual Phases will be conducted. Phase I data will be used to define the Phase II scope of work which will be submitted as an addendum to this RIWP. The components of the Phase I scope of work include:

- Development of a Site-specific HASP;
- Perform utility clearance and evaluate the location of utilities at the Site;
- Perform surface geophysical surveying to identify top of bedrock and locate bedrock fractures, if any;
- Redevelop of five existing on-Site overburden groundwater monitoring wells;
- Evaluate the presence or absence of PFAS compounds in manufacturing materials (e.g., fibers) observed onsite during preliminary Site visits.
- Preparation of a Community Air Monitoring Program (CAMP) in advance of well installation in accordance with Appendix 1A of the *Technical Guidance for Site Investigation and Remediation, DEC Program Policy*. May 2010 (DER-10);
- Install and develop four additional on-Site overburden groundwater monitoring wells;
- Survey elevations of existing and new groundwater monitoring wells;
- Collect up to six surface water samples (plus QC) from the Site stormwater pond and upgradient and downgradient locations (Figure 1) from the Site for analysis of PFAS;
- Collect up to four samples of surface soil and/or shallow groundwater for TAL and TCL analysis;
- Collect up to 18 surface soil samples (two samples per each of nine locations plus QC) from the surface (0-2 inches) and shallow (2-12 inches) for PFAS analysis;
- Synoptic groundwater sampling of five existing and four newly installed overburden groundwater monitoring wells for PFAS analysis;
- Survey elevations of established surface water, sediment, and surface soil locations;
- Perform boundary line survey of Site and provide metes and bounds property description;
- Data validation and EQuIS database deliverable;
- Fish and Wildlife Impact Analysis (FWIA) field inspection;
- IDW management and disposal; and,
- Prepare and submit RI and FS Reports for the Site.

4.1 GENERAL FIELD OPERATIONS

This investigation is designed to address data gaps identified during the Site Characterization and to inform the development of a FS for the Site. Field operations will consist of multiple mobilizations to the Site with some activities completed concurrently during a single mobilization.

Companion documents to this RIWP that will govern the execution of the field exploration activities include MACTEC's Program HASP (MACTEC, 2020a) and QAPP (MACTEC, 2020b). In addition to these program documents, the Site-specific HASP (Appendix A) provides details related to health and safety for on-Site activities. Field data records (FDRs) will be completed to document sample collection. FDR forms are included in Appendix B.

MACTEC has selected the following sub-contractors to assist in Phase I and Phase II investigations. It should be noted that current placeholders will be removed, and subcontractors finalized prior to the initiation of work.

- Hager-Richter Geoscience, to perform geophysical analysis of the site to identify potential bedrock fractures/joint sets.
- Lawson Surveying, to perform horizontal and vertical surveying of existing and newly installed monitoring wells, as well as soil and sediment sampling locations and geophysical transects,
- Drilex Environmental, to perform overburden soil borings and well installation via direct push technology,
- Northeast Geophysical, to perform underground utility clearance of proposed boring locations,
- Placeholder, to perform bedrock soil borings and well installation via sonic method.
- Placeholder, to perform transportation and disposal of soil cuttings and PPE associated with the investigations.

4.1.1 Health and Safety

The Site-specific HASP is provided as Appendix A to this document. Based on available Site information, fieldwork will be conducted in modified Level D personal protective equipment (PPE). Specific investigation activities and required level of personal protection are set forth in the Site-specific HASP. Criteria for upgrading or downgrading the specified level of protection are also provided in the Site-specific HASP. Additional health and safety requirements are set forth in the Program HASP (MACTEC, 2020a). Should Site conditions pose a threat to those present on-Site, and/or should Site conditions warrant an upgrade from modified Level D, as defined by the HASP, work will stop and the situation will be reevaluated by NYSDEC and MACTEC.

4.1.2 Mobilization

MACTEC will begin field efforts upon receipt of approval for the RIWP by the NYSDEC project manager. Due to the quantity of proposed field activities, multiple mobilizations will be required. MACTEC will coordinate mobilizations to accomplish the maximum amount of work in the most efficient means possible. Based on current understanding, the fieldwork is scheduled to begin on or around April 4, 2022. Mobilization will include obtaining utility clearances and acquisition of the following:

- transportation to and from the Site;
- health and safety equipment;
- sampling equipment and field supplies; and
- decontamination supplies and equipment.

Prior to the commencement of any field activities, a kick-off meeting will be held on-Site with MACTEC and subcontractor personnel to familiarize on-Site workers with the Site’s history, health and safety requirements, sampling procedures, decontamination efforts, and investigation derived waste (IDW) handling.

4.1.3 Laboratory Analysis

Samples submitted to the laboratory during Phase I will be analyzed using the methods outlined below. The laboratory will be Environmental Laboratory Approval Program (ELAP) certified and will provide NYSDEC Category B deliverables.

For soil and water (surface water and groundwater) samples, the following methods will be used:

- PFAS by United States Environmental Protection Agency (USEPA) Method 537.1
- Synthetic Precipitation Leaching Procedure (SPLP) Method 1312
- Target Compound List/Target Analyte List (TCL/TAL)

For manufacturing waste (e.g., waste fabric and yarn) samples, the following methods will be used:

- PFAS by United States Environmental Protection Agency (USEPA) Method 537.1
- Synthetic Precipitation Leaching Procedure (SPLP) Method 1312

Sample nomenclature will generally follow that used during the SC. Individual media will be identified as follows:

- Groundwater: Well ID (MW-##) – Matrix (GW) – Date (MMDDYY)
- Surface Soil: Location ID (SB-##) – Depth Interval (##-##) - Date (MMDDYY)
- Surface Water: Location ID (RP-##) - Matrix (SW) – Date (MMDDYY)
- Sediment: Location ID (RP-##) - Matrix (SED) – Date (MMDDYY)
- QA/QC: Blank Type (FB) - Date (MMDDYY)

It should be noted that surface water and sediment location IDs will be based on location where sample was collected. For example, samples from unnamed ditches or creeks will be UD whereas RP will be used for retention pond.

4.1.4 Utility Clearance

Prior to the start of any ground intrusive activity, including surface geophysics, direct push, and sonic drilling, a utility clearing company will be subcontracted to clear proposed areas. If a proposed drilling location is affected by a suspected underground utility, the location will be moved to a nearby location that is cleared by the third-party utility clearance subcontractor.

4.1.5 Property Access

To delineate the extent of contaminants, installation of monitoring wells and collection of water or soil samples at offsite locations is planned. Prior to the start of work at offsite locations, the NYSDEC Project Manager will coordinate property access with landowners and will have approval of property access in writing before field activities begin.

4.2 PHASE I INVESTIGATION (TASK 2)

Due to the quantity of proposed field activities and the reliance of results from one or more investigative efforts defining subsequent steps (e.g., well placement), the RI field activities will be executed in multiple phases. Work will be conducted efficiently to reduce travel costs with several efforts completed during single mobilizations (e.g., well redevelopment and surface geophysics).

The following sections summarize activities that will be completed during the Phase I investigation. Following completion of Phase I field work and review of collected information, MACTEC will refine this RIWP and resubmit for NYSDEC review and approval prior to mobilization for Phase II field activities.

4.2.1 Surface Geophysics

Field activities will begin with surface geophysics. The goal of surface geophysical analysis is to evaluate the top of bedrock surface and identify potential bedrock fractures/joint sets that could create preferential pathways for contaminants to migrate from the overburden to the bedrock. The subcontractor provided data in a field report. MACTEC will use the field report provided to assist in locating overburden monitoring wells and will review results with NYSDEC to evaluate final locations.

A total of four proposed geophysical transects are shown on Figure 1 and are aligned to encompass the site boundary in all directions. Due to the potential for multiple fracture/joint set trends in bedrock, transects are oriented such that these bedrock features, if present, are traversed by one or more profile. It should be noted that electrical resistivity tomography (ERT) is proposed along the north, west, and south sides of the site with seismic refraction proposed to the east. The ERT method is subject to interference from overhead power utilities and subsurface water lines located along the east side of the Site (Park Avenue) and requires the use of the seismic refraction method to reduce the potential for anomalous features or reduced data quality that may result. Based on available information for the Site, it is anticipated that the areas located north, west, and south of the Site are free of utility infrastructure that may result in geophysical interference to the ERT method.

4.2.2 Monitoring Well Development

Five existing overburden groundwater monitoring wells (MW-01 through MW-05) will be redeveloped using a surge and pump method where the well screen is surged and a pump is used to remove fines and particulates released during the surging process. Water and solids removed from the well will be containerized in 55-gallon drums and allowed to settle. Water will be decanted from the drum and pumped through a portable granular activated carbon unit onto the ground surface in the vicinity of the well. Investigation derived waste (IDW) is further discussed in Section 3.7.

The four newly installed overburden monitoring wells will also be developed following installation. Wells will be installed via sonic drilling to approximately 40-feet deep with the bottom 10-feet of the well screened. Protective well covers will be installed over the well and secured in place with concrete. Proposed locations for new overburden monitoring wells are shown on Figure 1; however, locations will subject to change following results of the surface geophysical surveying and utility clearance activities.

The goal of development is to clean the well screen and filter pack, allowing groundwater to flow more freely through the well screen, the removal of water that may have been introduced during well installation, and introduction of fresh formation water into the well. Development is considered complete when the turbidity of water being pumped from the well is below 5 nephelometric turbidity units (NTUs). Redevelopment will be recorded on a field data record, as shown in Appendix B.

4.2.3 Surface Water Sampling

Up to six surface water samples will be collected from the onsite stormwater retention pond and upstream and downstream surface water locations receiving discharge from these onsite stormwater management structures. Proposed surface water sample locations have been identified on Figure 1 but are subject to change based on field conditions and property access. Surface water sample locations will be surveyed, and stakes will be placed such that future sampling events can target the same locations. Water will be collected as grab samples in laboratory provided containers and will be analyzed for PFAS by USEPA Method 537.1 using liquid chromatography tandem mass spectrometry (LC/MS/MS) with isotope dilution. Surface water samples will be collected no less than 24 hours after a recordable rain event to reduce dilution caused by precipitation.

4.2.4 Solid Material Testing

The W.F. Lake Corporation manufactures high performance polytetrafluoroethylene (PTFE) coated yarn, thread, fabric, tapes, and belts and small pieces of these materials have been observed in Site soils and stormwater catch basins. At the request of NYSDEC, up to three samples of waste material from these sources will be collected for analysis of PFAS using SPLP Method 1312. These samples will be collected and analyzed concurrent with initial surface soil and surface water sampling.

4.2.5 Offsite Surface Soil Sampling

Up to 20 surface soil samples (18 samples and 2 QA/QC samples) will be collected from areas located downgradient from prevailing historical wind direction (east of Site). This will include two samples from each of nine locations, one sample collected from the surface (0-2 inches below ground surface) and one sample collected from the subsurface (2-12 inches below ground surface). Samples will be analyzed for PFAS by USEPA Method 537.1 using LC/MS/MS with isotope dilution.

Approximate sampling locations are shown on Figure 1 with final locations determined based on off-site property access. Sampling will target native surface soils that have not been disturbed by development or agricultural activities.

4.2.6 Synoptic Groundwater Gauging and Sampling

Following redevelopment of the five existing ground water monitoring wells and the installation/development of the four new overburden groundwater monitoring wells, a synoptic round of groundwater levels and groundwater sampling will be completed at each of the nine wells. Groundwater samples will be collected via the low-flow groundwater sampling method and containerized in properly labeled, laboratory supplied containers. samples will be analyzed for PFAS by USEPA Method 537.1 using LC/MS/MS with isotope dilution.

During groundwater sampling, extreme caution will be taken to avoid cross contamination of groundwater samples. Many everyday items contain PFAS compounds, including, but not limited to, water repellant clothing, bug sprays, sunscreens, lotions, hair products, etc. Technicians performing the sampling activities will avoid use of these products during the 24-hours leading up to the sampling event and will use extreme caution when collecting groundwater samples.

4.2.7 Site Surveying

Sample locations will be surveyed by a New York State-licensed surveyor who will provide the horizontal and vertical coordinates to an accuracy of 0.1 ft and 0.01 ft, respectively. The surveyor will work with the MACTEC technicians who performed the well installation and sampling to identifying and label locations. Surface soil and sediment sampling locations will also be surveyed by field technicians using a handheld global positioning system (GPS) with an accuracy of +/- 3 feet as samples are collected.

4.2.8 Fish and Wildlife Impact Analysis (FWIA) Field Inspection

A Part 1 Fish and Wildlife Impact Analysis (FWIA) will be performed in accordance with the DER10 (NYSDEC, 2010) report. The purpose of this assessment was to identify fish and wildlife resources in the vicinity of the Site and evaluate the impacts of Site-related contaminants on fish and wildlife resources.

4.3 INVESTIGATION DERIVED WASTE (IDW)

IDW generated during Phase I and Phase II investigations is expected to include groundwater, soil, and PPE, and will be handled as follows:

- During well development and groundwater sampling activities, groundwater will be containerized in totes and 55-gallon steel drums. Turbid groundwater produced during redevelopment will be segregated from less turbid water to allow solids to settle to the bottom of the drum. Low turbidity groundwater will be pumped through an onsite granular activated carbon unit and discharged to the ground surface in the vicinity of the sampling location. Turbid groundwater will be allowed to settle, and clear water will be pumped from the top. Water deemed too turbid for the GAC unit will be containerized or mix with soil cuttings from drilling activities.
- Soil cuttings generated during drilling 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 sub-contractor.
- Used PPE will be bagged and disposed as solid waste.

5.0 REPORTING

Following completion of the Phase I field investigation and receipt of analytical data, MACTEC will review analytical data, update the Site CSM, and identify data gaps. An addendum to this RIWP will be prepared which will outline additional field activities which will be conducted in a Phase II. This RIWP redistributed to the NYSDEC for review and approval prior to mobilization for Phase 2 of the investigation.

Upon completion of both Phase I and Phase II field investigations and receipt of analytical data, MACTEC will prepare a Draft RI Report in accordance with DER-10 (NYSDEC, 2010). The Draft RI Report will include a summary of the Site background and history including results of investigations conducted prior to the RI. The Draft RI Report will summarize data generated during the RI field investigation and a comparison of laboratory analytical results to applicable NYS groundwater standards (NYSDEC, 1999). The conceptual site model will be updated based on the investigation findings. FDRs and environmental sampling data will be included as appendices to the RI Draft Report.

Upon receipt of NYSDEC comments, MACTEC will address the comments and submit a Draft Final RI Report to the NYSDEC for final review. An electronic copy of the Final RI Report will be sent to the NYSDEC Project Manager. Laboratory and location information will also be submitted in the NYSDEC EQuIS electronic data deliverable format.

6.0 REFERENCES

Camp Dresser McKee & Smith (CDM Smith), Final Site Characterization Report, WF Lake Site No. 5-58-042. July 2020.

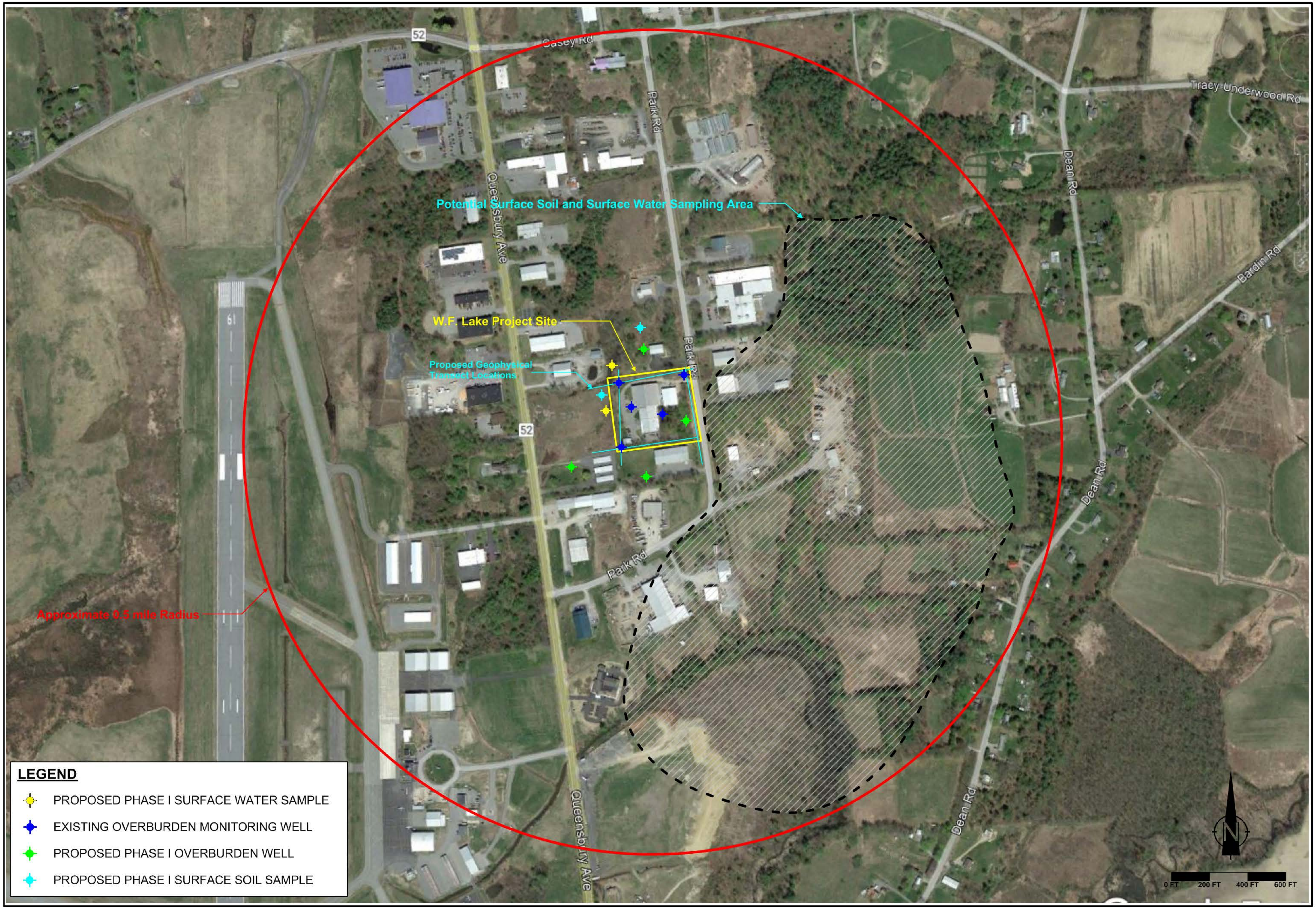
MACTEC, 2020a. *Program Health and Safety Plan*. Prepared for New York State Department of Environmental Conservation, Albany, New York. March 2020.

MACTEC, 2020b. *Program Quality Assurance Program Plan*. Prepared for the New York State Department of Environmental Conservation, Albany, New York. April 2020.

New York State Department of Environmental Conservation. *Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs*. January 17, 2020

New York State Department of Environmental Conservation. DER-10 *Technical Guidance for Site Investigation and Remediation*, *DEC Program Policy*. May 2010.

FIGURES



NOTES:

MACTEC

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Portland, Maine 04101
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Fax: 207.772.4762
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Proposed Investigation Locations
W.F. Lake Corporation
NYSDEC Site No.: 558042
Kingsbury, New York

SCALE:	DATE:	PROJECT NUMBER:
AS SHOWN	04/06/2022	3616216155.01

DRAWING NUMBER:

FIGURE 1

SHEET NUMBER:

1 OF 1

APPENDIX A-

SITE SPECIFIC HEALTH & SAFETY PLAN

Site-Specific Health and Safety Plan
Short Form

MACTEC

Site: W.F. Lake Corporation
Job #/Task # 3616216155
Street Address: 65 Park Road, Glens Falls, New York
Proposed Date(s) of Investigation: October 2021 - Ongoing
Prepared by: Christopher Buckman
Date: 02/28/2022

*Approved by:
Date:

Site Description: **(attach map)** The property is approximately two acres in size and has two primary buildings and one storage building. The facility has been in operation since the 1990s and manufactures PTFE-coated fibers and fabric. PFAS have been found in groundwater on site. The Site is currently active (See Figure 1 – Site Map).

Comments: Scope of work includes monitoring well installation via Sonic drilling, surface soil sampling, groundwater sampling, and surface water sampling.

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

Overall Project Characterization "Color" (See SMARTool Form):

☐ Green ☐ Yellow ☑ Orange 1 ☐ Orange 2 ☐ Orange 3 ☐ Red

Tasks:

MACTEC	Sub	Task Description	AHA Attached?
☑	☐	Mobilization/Demobilization	☑
☑	☐	Drilling Operations	☑
☑	☐	Soil Sampling	☑
☑	☐	Field Work -General	☑
☑	☐	Field Work Oversight	☑
☑	☐	Covid19 Risk – Travel	☐
☑	☐	Covid19 Risk – Field Work	☐
☑	☐	Porewater Sampling	☐

High Hazard Activities:

MACTEC	Sub	Activity	MACTEC	Sub	Activity
☐	☐	Confined Space Entry	☐	☑	Operating Drill Rig
☐	☐	Entering excavations	☐	☑	Operating Skid Steer
☐	☐	Hot Work	☐	☐	Using Aerial Lift
☐	☐	Lockout/Tagout			
☐	☐	Operating Forklift	☐	☐	Working at Heights >6 feet

Stand up for Safety:

The above tasks could expose MACTEC E&IS employees and subcontractors to hazards associated with the following Stand up for Safety Initiatives:

☑ Driving
☐ Dropped Objects
☐ Energy Isolation (Lockout/Tagout)
☐ Working at Height

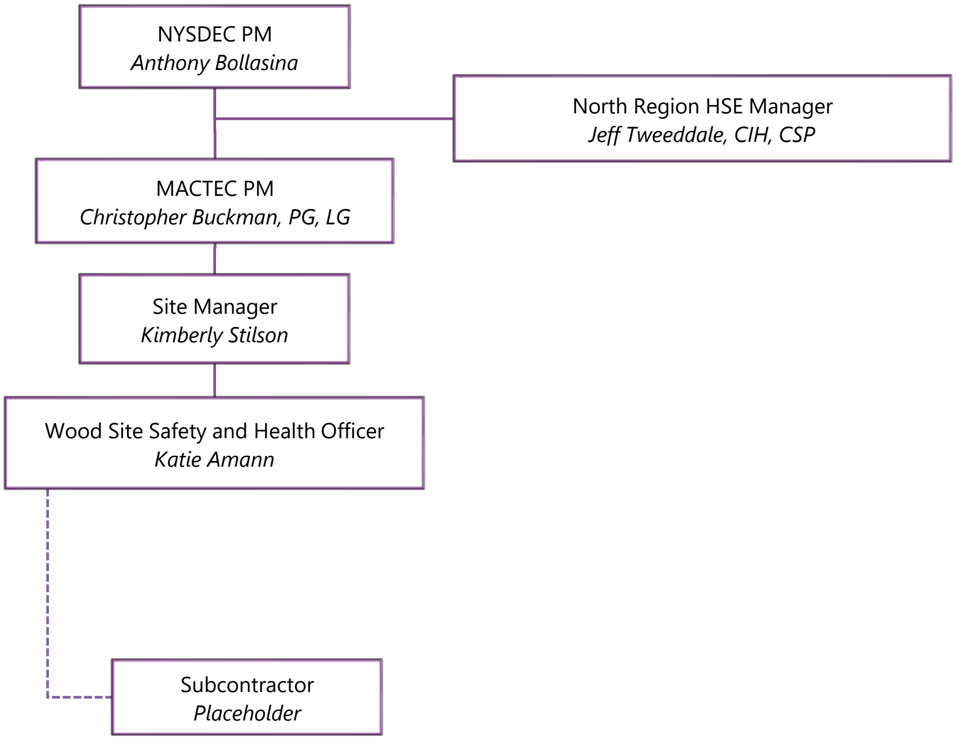
Site-Specific Health and Safety Plan
Short Form

Life Saving Rules:

The following MACTEC Life Saving Rules potentially apply to the work being conducted at the site:

☐ **Bypassing Safety Controls** - Obtain authorization before overriding or disabling safety controls
☐ **Confined Space** - Obtain authorization before entering a confined space
☑ **Driving** - Follow safe driving rules
☐ **Energy Isolation** - Verify isolation and zero energy before work begins
☐ **Hot Work** - Control flammables and ignition sources
☑ **Line of Fire** - Keep yourself and others out of the line of fire
☑ **Safe Mechanical Lifting** - Plan lifting operations and control the area
☑ **Work Authorization** - Work with a valid permit when required
☐ **Working at Height** - Protect yourself against a fall when working at height

Project Organization Chart:



Site-Specific Health and Safety Plan
Short Form

Dates of Required Training and Medical Surveillance:

Add additional training topics, as required. **Verify training in online training database**: **LINK**

Name:	Christopher Buckman	Katie Amann	Kimberly Stilson		Michael Lounsbury
Job duties:	Project Manager	SSHO	Field Staff	Field Staff	Field Staff
	Dates	Dates	Dates	Dates	Dates
Medical Surveillance	6/29/2021	2/16/2022	10/12/2021		1/15/2022
Exam Type (A3, B, C)	C	B	B		C
40-Hour Initial	6/29/2000	12/07/2009	2/18/2018		2/24/1989
8-Hour Supervisor [2]	7/20/2006	12/14/2009	5/31/2021		2/24/1989
8-Hour Refresher	1/29/2022	1/29/2022	12/21/2021		2/18/2022
First Aid[1]		2/12/2021			2/23/2022
CPR[1]		2/12/2021			2/23/2022
Hazard Comm.	7/29/2006				8/30/2013
Fire Extinguisher					4/16/2012
Drilling					
30-Hour Construction					

[1] At least one worker must be trained in First Aid/CPR

[2] Required for Site Manager and Site Health and Safety Officer. Does not expire.

[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 HSSE Coordinator 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
☑ Daily HSE Inspections (documented)
☑ Monthly Leadership (PM) HSSE Inspections
☑ HEART observations as needed
☐

Meetings:

The following meetings will be held at the site:

	Lead by		Frequency				
Meeting	MACTEC	Sub	Initial	Daily	Weekly	Monthly	As Needed
☑ Project Kick-off [1]	☑	☐	☑	☐	☐	☐	☐
☑ Tailgate [2]	☑	☐	☐	☑	☐	☐	☐
☐ Safety Committee [1]	☐	☐	☐	☐	☐	☐	☐
☑ Incident Reviews [1]	☐	☐	☐	☐	☐	☐	☑
☐ E&IS Monthly Safety Topics [1]	☐	☐	☐	☐	☐	☐	☐
☐ HSSE Closeout Meetings [1]	☐	☐	☐	☐	☐	☐	☑
☐	☐	☐	☐	☐	☐	☐	☐

[1] Attended by subcontractor management representative

[2] Attended by all subcontractor employees and supervisors.

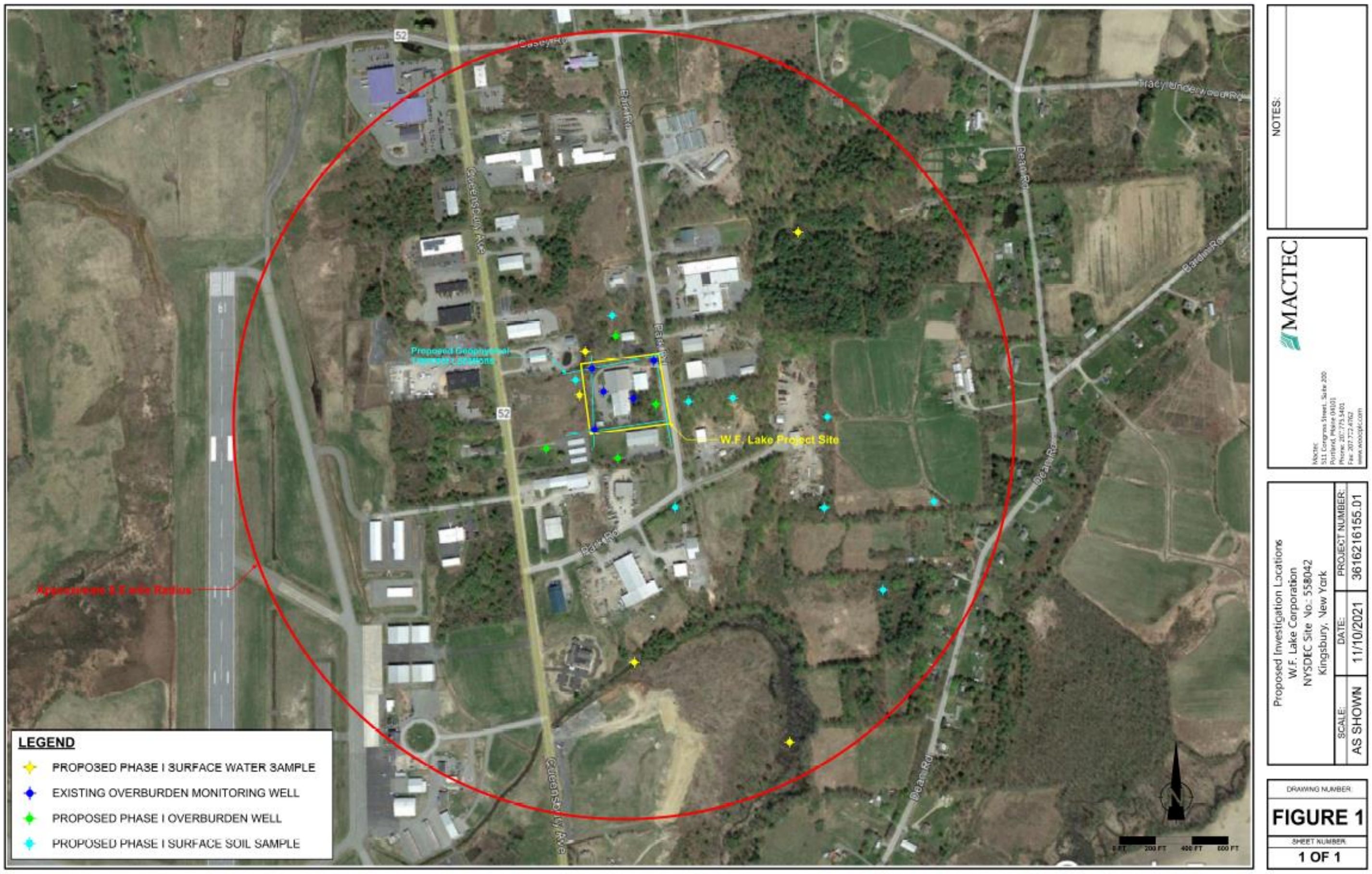
Inspections:

Regular inspections will be conducted by MACTEC E&IS 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.

	Lead by		Frequency			
Inspection Type	MACTEC	Sub	Daily	Weekly	Monthly	Before Use
☑ HSE (Visual)	☑	☐	☑	☐	☐	☐
☑ HSE (Documented)	☑	☐	☑	☐	☐	☐
☐ Leadership HSE (e.g., PM)	☐	☐	☐	☐	☐	☐
☐ Scaffolding	☐	☐	☐	☐	☐	☐
☐ Excavations	☐	☐	☐	☐	☐	☐
☑ Heavy Equipment (e.g., skid steer)	☐	☑	☐	☐	☐	☑
☑ PPE	☑	☐	☐	☐	☐	☑
☑ Tools/Equipment	☑	☐	☐	☐	☐	☑
☑ HEART/Observations	☑	☐	☐	☐	☐	☑
☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	☐	☐	☐

Site-Specific Health and Safety Plan
Short Form

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)	10	
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)	5	
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)	5	Covid-19
15. Is there an elevated risk of striking an animal on the roadway during this journey? (Yes = 5 pts)		
TOTAL	20	**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 (ug/kg)	Water/Groundwater (ng/L)	Soil Vapor (µg/m^3)	
Perfluorooctanoic Acid	380	3000	NA	NA

*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
NA	NA	NA	NA	NA

[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:

- ☑ Vehicle Travel – Journey Management Plan
- ☑ Field Work - General
- ☑ Decontamination
- ☑ Utility Clearance Activities
- ☑ Groundwater Sampling
- ☑ Soil Sampling
- ☑ Drilling Activities/Sonic

Hazard Specific AHAs:

- ☑ Insect Stings and Bites
- ☐ Soil Vapor Intrusion Sampling
- ☐ Working with Preservatives (Acids)
- ☑ Poisonous Plants

PPE and Monitoring Instruments:

Initial Level of PPE *

☐ Level D ☑ Modified Level D ☐ Level C * Cannot use Short Form HASP for Level B or A or Confined Space Entry work

Standard PPE

☑ Hard Hat ☑ Safety Boots ☑ Safety Glasses ☑ High Visibility Vest/Clothing

Eye and Face Protection

☐ Face Shield ☑ Vented Goggles ☐ Unvented Goggles ☐ Indirect Vented Goggles

Hearing Protection

☐ None ☑ Ear plugs ☐ Ear Muffs ☐ Ear plugs and muffs

Respiratory Protection

☑ None ☐ Upgrade Only ☐ Dust mask ☐ Full Face APR ☐ Half Face APR

Cartridge Type: NA Change Cartridges: NA

Protective Clothing

☑ Work Uniform ☐ White Uncoated Tyvek® ☐ Poly-coated Tyvek® ☐ Saranex®
☐ Boot Covers ☑ Reflective Vest/Clothing ☐ Chaps or Snake Legs ☐ Other: ____

Hand Protection

☐ None ☐ Cotton gloves ☐ Leather Gloves ☐ Glove liners ☐ Cut-resistant Gloves ☑ Other: Nitrile
☐ Outer Gloves: List Type: ____ ☐ Inner Gloves: List Type: ____

Monitoring Instruments Required*

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

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

☐ LEL/O2 Meter ☐ PID: ☐ 10.0/10.6 eV Lamp ☐ FID ☐ Hydrogen Sulfide meter
☐ 11.7 eV Lamp ☐ Carbon Monoxide meter

☐ Dräger Pump (or equivalent) ☐ Dust Meter: ☐ Respirable dust ☐ Other: ____
☐ Total dust
List Tubes: ____

*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?**
YSI Buffer Solution pH 4.00	☑
YSI Buffer Solution pH 7.00	☑
HI 7021 240 mV ORP Solution	☑
Stablecal 10 NTU Standard	☑
Stablecal 20 NTU Standard	☑
Stablecal 100 NTU Standard	☑
Stablecal 800 NTU Standard	☑
Conductivity standard 1412 uS/cm	☑
Hydrochloric acid	☐
Nitric Acid	☐
LIQUINOX	☑
Sulfuric Acid	☐
Deionized water	☑
Isobutylene gas 100 ppm	☐
DO Probe Electrolyte Solution	☑
	☐
	☐

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:

☑ Verbal

☑ Two-way radio (when needed)

☑ 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: Glens Falls Hospital	(845) 348-2000		
WorkCare (Early case management)	1-888-449-7787		
Police Department:	911		
	Office	**Cell**	
Site Safety and Health Officer:	NA		
Client Contact: Anthony Bollasina	(518) 402-2754		
Project Manager: Chris Buckman	(207) 828-3534	(331) 222-2271	
*Sr. HSSE Manager: Jeff Tweedale		(860) 805 5883	
Corporate SVP of HSE: Vlad Ivensky	(610) 877-6144	(484) 919-5175	
USEPA/NYSDEC (if applicable):	(518) 402-9662		
Other: Ambulance	911		

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

Emergency Equipment:

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

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

Emergency Procedures:

- The 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 MACTEC employee, the HSE Coordinator or Site Manager are to implement the MACTEC 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 Group Sr. HSE Manager. 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.

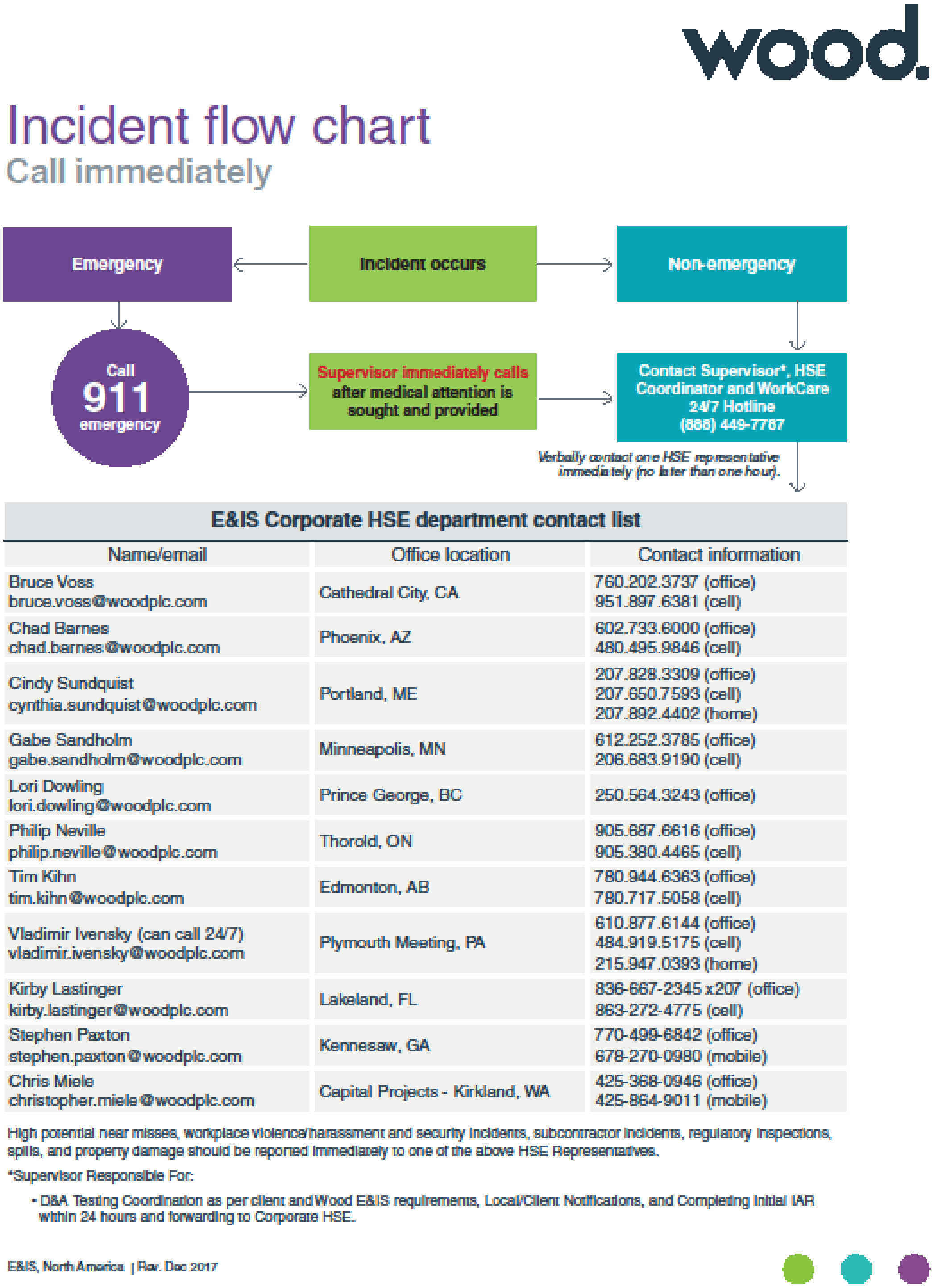
MACTEC E&IS Early Injury Case Management Program

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

<table>
<tr>
<td>• Determine the nature of the concern.
• Provide appropriate medical advice to the caller.
• Determine appropriate path forward with the caller.
• Maintain appropriate medical confidentiality.
• Help caller to execute path forward, including referral to the appropriate local medical facility.
• Send an email notification to the Corporate HSE Department.</td>
<td>• Request copies of all medical records from clinic.
• Send an email update to the Corporate HSE Department.</td>
</tr>
<tr>
<td colspan="2">3. IMMEDIATELY after contacting WorkCare send a brief email notification AND inform verbally (direct contact is required) ONE of HSE corporate representatives See Figure 11.3.
4. Make all other local notifications and client notifications.
5. Local Supervisor, HSE Coordinator, SSHO and any applicable safety committees to complete preliminary investigation, along with the initial Incident Report within 24 hours.
6. Corporate Loss Prevention Manager to complete Worker's Compensation Insurance notifications as needed.
7. Corporate HSE to conduct further incident notifications, investigation, include in statistics, classify, and develop lessons learned materials.
* - **NOTE: Step 2 is only applicable to the North-American operations and to incidents involving MACTEC personnel. High potential near misses, subcontractors' incidents, regulatory inspections, spills and property damages above $1,000 should be reported immediately, following directions from Step 3.**</td>
</tr>
</table>

Site Specific Emergency Procedures are as follows:

INCIDENT FLOW CHART



Incident flow chart

Call immediately

Emergency

Incident occurs

Non-emergency

Call
911
emergency

Supervisor immediately calls after medical attention is sought and provided

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

Verbally contact one HSE representative immediately (no later than one hour).

E&IS Corporate HSE department contact list

Name/email	Office location	Contact information
Bruce Voss bruce.voss@woodplc.com	Cathedral City, CA	760.202.3737 (office) 951.897.6381 (cell)
Chad Barnes chad.barnes@woodplc.com	Phoenix, AZ	602.733.6000 (office) 480.495.9846 (cell)
Cindy Sundquist cynthia.sundquist@woodplc.com	Portland, ME	207.828.3309 (office) 207.650.7593 (cell) 207.892.4402 (home)
Gabe Sandholm gabe.sandholm@woodplc.com	Minneapolis, MN	612.252.3785 (office) 206.683.9190 (cell)
Lori Dowling lori.dowling@woodplc.com	Prince George, BC	250.564.3243 (office)
Philip Neville philip.neville@woodplc.com	Thorold, ON	905.687.6616 (office) 905.380.4465 (cell)
Tim Kihn tim.kihn@woodplc.com	Edmonton, AB	780.944.6363 (office) 780.717.5058 (cell)
Vladimir Ivensky (can call 24/7) vladimir.ivensky@woodplc.com	Plymouth Meeting, PA	610.877.6144 (office) 484.919.5175 (cell) 215.947.0393 (home)
Kirby Lastinger kirby.lastinger@woodplc.com	Lakeland, FL	836-667-2345 x207 (office) 863-272-4775 (cell)
Stephen Paxton stephen.paxton@woodplc.com	Kennesaw, GA	770-499-6842 (office) 678-270-0980 (mobile)
Chris Miele christopher.miele@woodplc.com	Capital Projects - Kirkland, WA	425-368-0946 (office) 425-864-9011 (mobile)

High potential near misses, 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:

- D&A Testing Coordination as per client and Wood E&IS requirements, Local/Client Notifications, and Completing Initial IAR within 24 hours and forwarding to Corporate HSE.

E&IS, North America | Rev. Dec 2017

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:

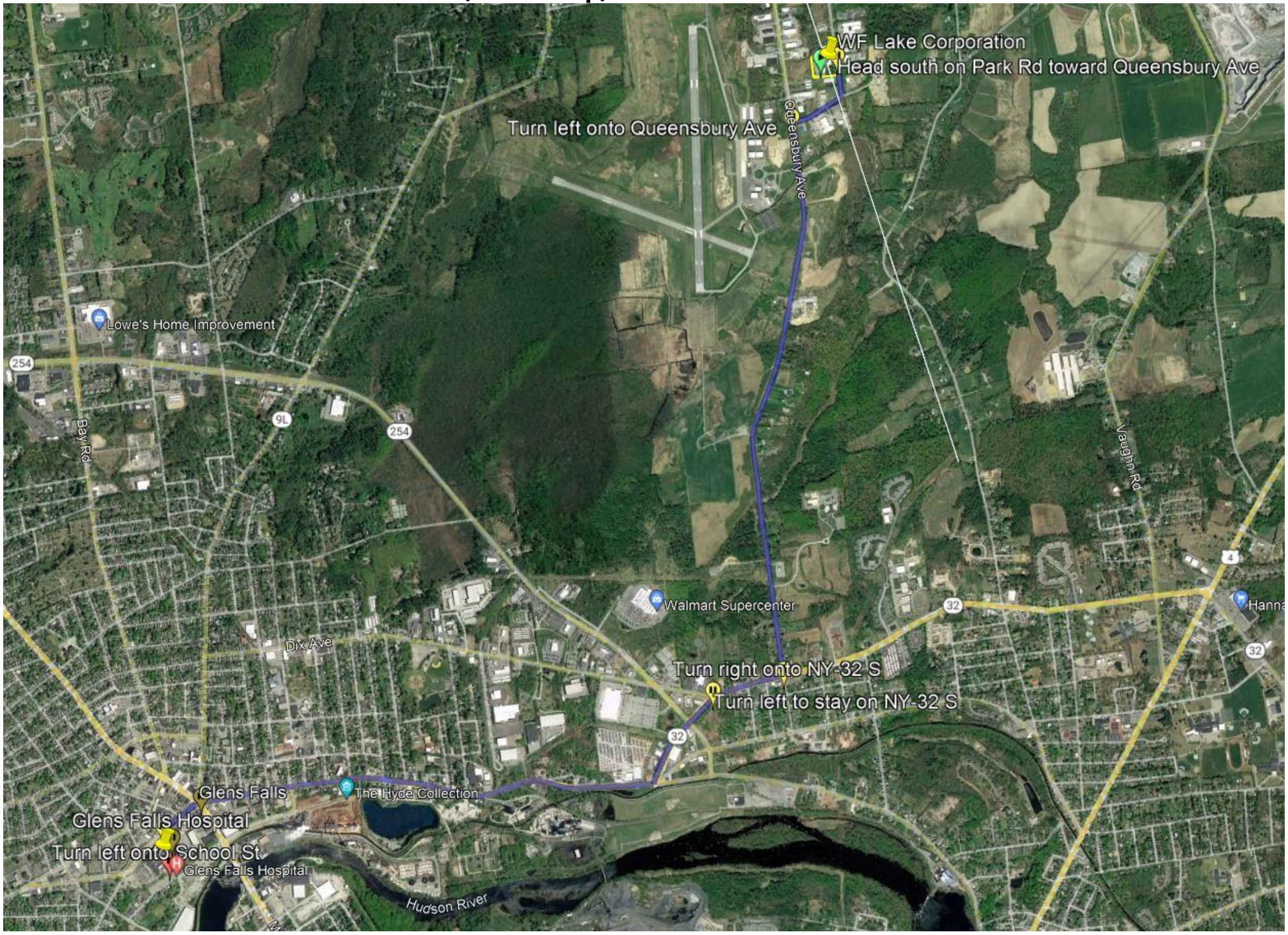
HOSPITAL (for immediate emergency treatment):

Facility Name: Glens Falls Hospital

Address: 100 Park Street, Glens Falls, NY 12801

Telephone Number: (518) 926-1000

DIRECTIONS TO PRIMARY HOSPITAL (attach map):



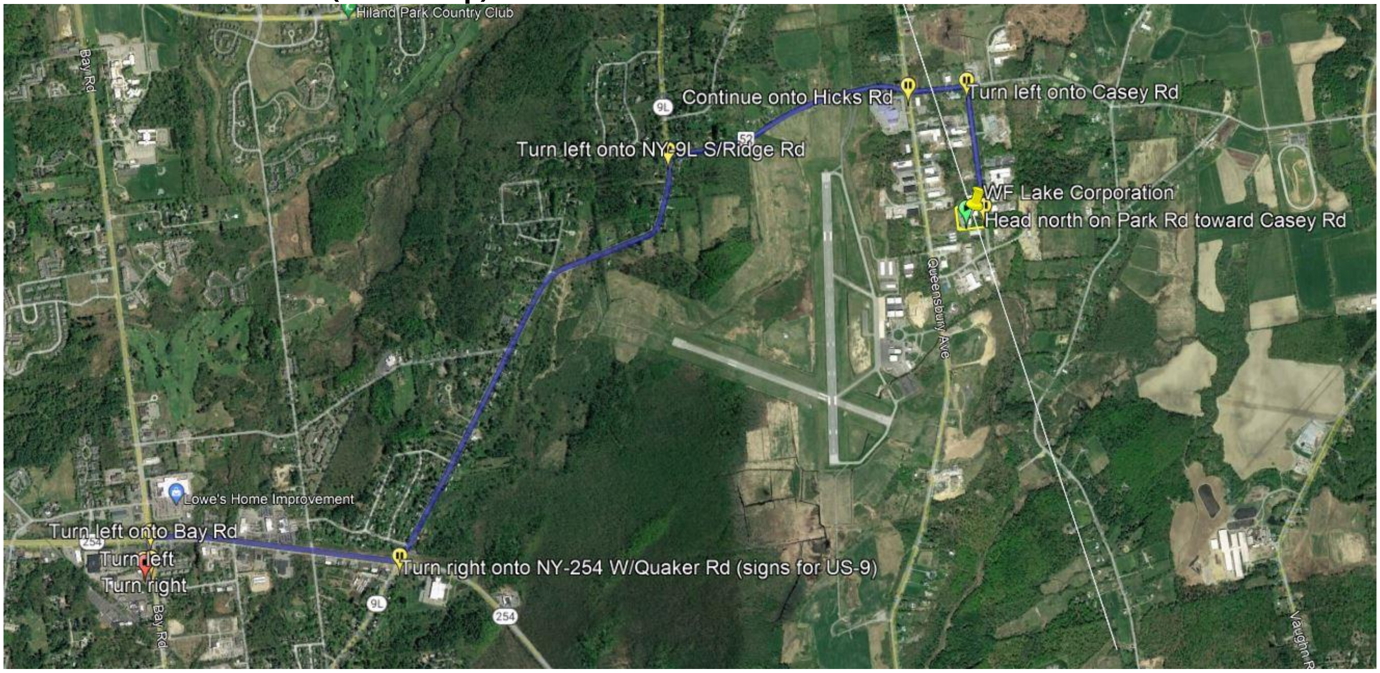
CLINIC (for non-emergency medical treatment)

Facility Name: Convenient Medical Care PC

Address: 319 Bay Road, Queensbury, NY 12804

Telephone Number: (518) 792-2181

DIRECTIONS TO CLINIC (attach map):



MACTEC HSSE Management System "Blue Book:"

The MACTEC HSSE management system is defined by the HSSE Management System Standard -the Blue Book. It consists of fifteen elements that set mandatory minimum standards for the management of HSSE across MACTEC. These minimum standards define how MACTEC leads, plans and organizes itself to ensure HSSE risks are controlled and to deliver continuous improvement in HSSE performance. The Blue Book is supported by MACTEC HSSE standards, procedures, guidelines and tools which provide further direction and advice on how to comply with the Blue Book's requirements.

MACTEC's core ***Vision*** is to:

Inspire with ingenuity, partner with agility, create new possibilities…
The MACTEC ***Values*** are:

- ***Care*** -Working safely, with integrity, respecting and valuing each other and our communities
- ***Commitment*** - Consistently delivering to all our stakeholders
- ***Courage*** - Pushing the boundaries to create smarter, more sustainable solutions

The MACTEC HSSE management system helps translate our Vision and Values into action by:

- Providing structure and consistency in the way we manage HSSE
- Focusing our attention on risk management, ensuring compliance and undertaking assurance activities
- Supporting the development of a positive HSSE culture which in turn supports the management system
- Providing a framework for continuous improvement

Refer to the MACTEC "Blue Book" for additional information (LINK).

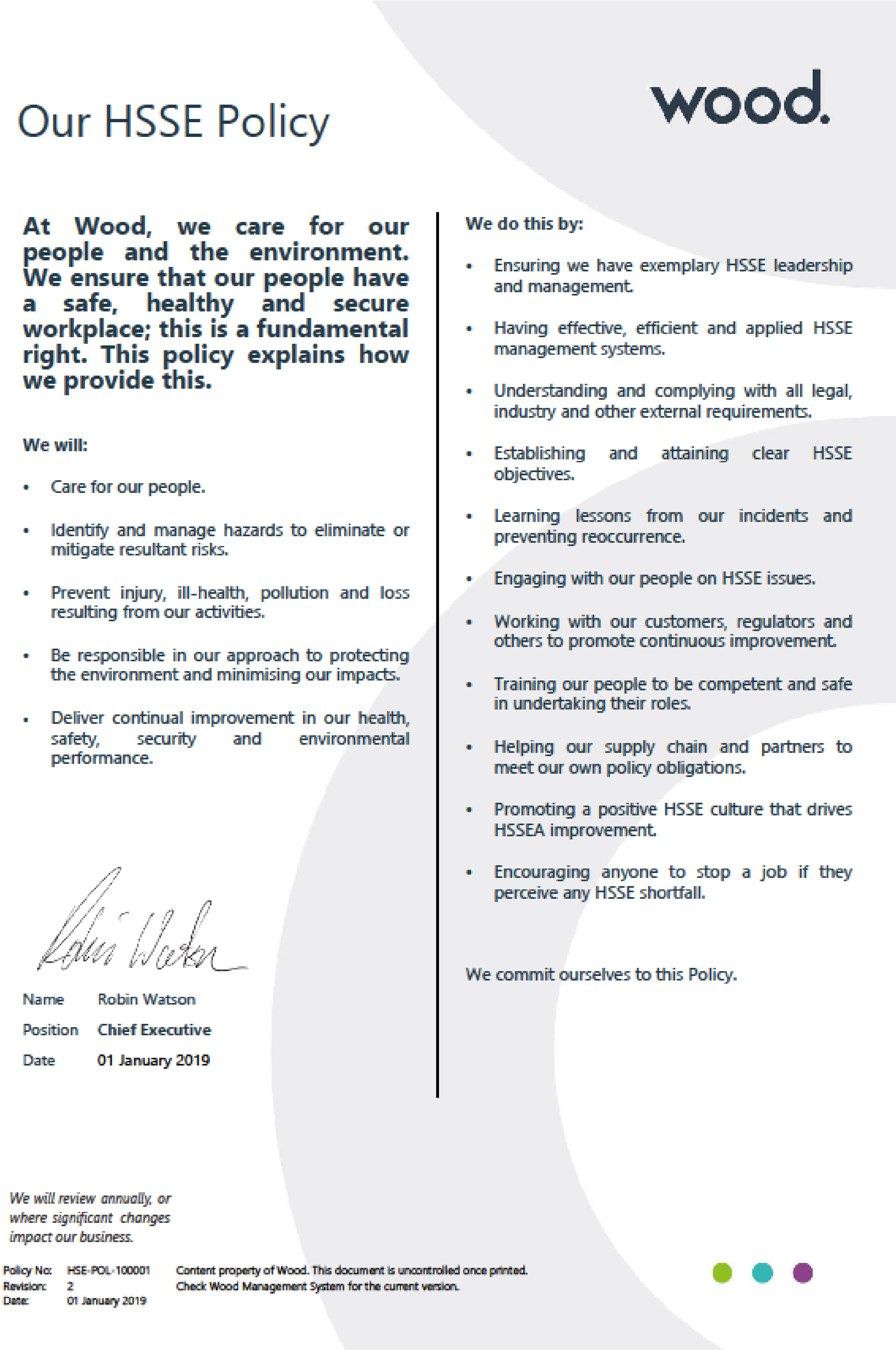
MACTEC E&IS HSE Management System Manual and California IIPP):

The MACTEC E&IS Health, Safety, Security and Environment (HSSE) Management System Manual and California Injury and Illness Prevention Plan (IIPP) describes the HSSE system and tools developed & implemented at MACTEC E&IS. The manual addresses HSSE requirements for offices, laboratories and projects, including those of various duration, scale, location, and jurisdiction.

MACTEC E&IS'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 MACTEC plc Health, Safety, Security and Environment (HSSE) Policy Statement:



wood.

Our HSSE Policy

At Wood, we care for our people and the environment. We ensure that our people have a safe, healthy and secure workplace; this is a fundamental right. This policy explains how we provide this.

We will:

- Care for our people.
- Identify and manage hazards to eliminate or mitigate resultant risks.
- Prevent injury, ill-health, pollution and loss resulting from our activities.
- Be responsible in our approach to protecting the environment and minimising our impacts.
- Deliver continual improvement in our health, safety, security and environmental performance.

Robin Watson

Name Robin Watson

Position **Chief Executive**

Date **01 January 2019**

We do this by:

- Ensuring we have exemplary HSSE leadership and management.
- Having effective, efficient and applied HSSE management systems.
- Understanding and complying with all legal, industry and other external requirements.
- Establishing and attaining clear HSSE objectives.
- Learning lessons from our incidents and preventing reoccurrence.
- Engaging with our people on HSSE issues.
- Working with our customers, regulators and others to promote continuous improvement.
- Training our people to be competent and safe in undertaking their roles.
- Helping our supply chain and partners to meet our own policy obligations.
- Promoting a positive HSSE culture that drives HSSEA improvement.
- Encouraging anyone to stop a job if they perceive any HSSE shortfall.

We commit ourselves to this Policy.

We will review annually, or where significant changes impact our business.

Policy No: HSE-POL-100001
Revision: 2
Date: 01 January 2019

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Check Wood Management System for the current version.

MACTEC Safety Shield:

A metaphor for protection - pulls together our HSSE processes and procedures to drive a simplistic and consistent message to our workforce around HSSE.

Aligned with our values, the three elements of the shield are:

- Prepare: It takes commitment to prepare.
- Engage: It takes care to engage.
- Intervene: It takes courage to intervene.

The Safety Shield seeks to educate, inform, monitor, improve and recognize our employees.

wood.
Safety Shield
Prepare. Engage. Intervene.

Six Safety Essentials:

The Six Safety Essentials are designed to support the safe execution of work in all our operating locations with the development of a "common set of behaviors" that we can all share. MACTEC, in our goal to be recognized as a world-class leader in HSSE safety must strive to ensure our daily overall consistency of HSE standards, leadership and performance.

When performing work at the site, the MACTEC **Six Safety Essentials** will be followed:

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

MACTEC Nine Life Saving Rules:

The Life Saving Rules are MACTEC's minimum standard - it is an expectation that everyone must comply with the rules. Everyone needs to understand that:

- You must comply with the Life Saving Rules because non-compliance could result in serious injury or fatality to you or your colleagues
- If you breach a Life Saving Rule you may be subject to disciplinary action.

Supervisors and Managers must understand that:

- Breaking the Life Saving Rules will not be tolerated - no matter how urgent or important a task is.

- You have a duty to ensure that people undertaking a task have the right instruction, equipment and training to comply with the Life Saving Rules.

Bypassing Safety Controls

Confined Space

Driving

Energy Isolations

Hot Work

Line of Fire

Safe Mechanical Lifting

Work Authorization

Working at Height

Stand Up for Safety:

MACTEC's Stand up for Safety initiative focuses on four hazards that were identified by analyzing MACTEC's HSE incidents and High Potential events. These are four are areas of primary concern and are hazards that MACTEC employees face collectively as a global business. These four hazardous areas are:

- Dropped objects
- Driving
- Working at Height
- Process Safety

Extra attention will be paid to these four key areas if applicable when working on the project site.

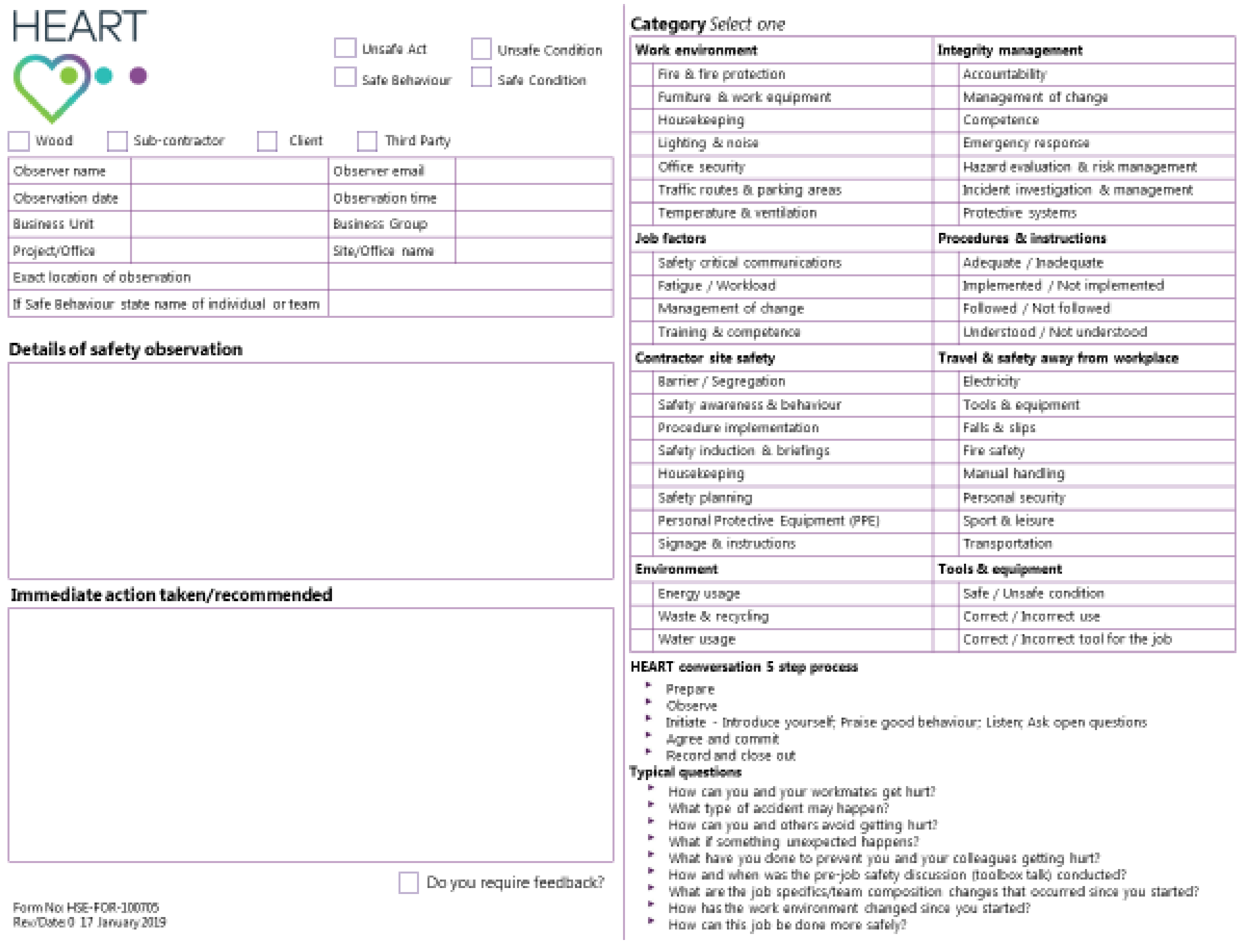
HEART:

HEART is the corporate observation reporting system that all MACTEC employees are to use to report safety or environmental observations.

To enter a HEART observation, use the following link: https://cfapps.Woodfw.com/HEART/

HEART is also accessible from mobile devices. Click here for instructions on how to access HEART from a mobile device.

A manual HEART observation form can be accessed from here.



HEART

☐ Unsafe Act ☐ Unsafe Condition
☐ Safe Behaviour ☐ Safe Condition

☐ Wood ☐ Sub-contractor ☐ Client ☐ Third Party

Observer name		Observer email	
Observation date		Observation time	
Business Unit		Business Group	
Project/Office		Site/Office name	
Exact location of observation			
If Safe Behaviour state name of individual or team			

Details of safety observation

Immediate action taken/recommended

☐ Do you require feedback?

Form No: HSE-FOR-100705
Rev/Date 0 17 January 2019

Category *Select one*

Work environment		**Integrity management**	
	Fire & fire protection		Accountability
	Furniture & work equipment		Management of change
	Housekeeping		Competence
	Lighting & noise		Emergency response
	Office security		Hazard evaluation & risk management
	Traffic routes & parking areas		Incident investigation & management
	Temperature & ventilation		Protective systems
Job factors		**Procedures & instructions**	
	Safety critical communications		Adequate / Inadequate
	Fatigue / Workload		Implemented / Not implemented
	Management of change		Followed / Not followed
	Training & competence		Understood / Not understood
Contractor site safety		**Travel & safety away from workplace**	
	Barrier / Segregation		Electricity
	Safety awareness & behaviour		Tools & equipment
	Procedure implementation		Falls & slips
	Safety induction & briefings		Fire safety
	Housekeeping		Manual handling
	Safety planning		Personal security
	Personal Protective Equipment (PPE)		Sport & leisure
	Signage & instructions		Transportation
Environment		**Tools & equipment**	
	Energy usage		Safe / Unsafe condition
	Waste & recycling		Correct / Incorrect use
	Water usage		Correct / Incorrect tool for the job

HEART conversation 5 step process

- Prepare
- Observe
- Initiate - Introduce yourself; Praise good behaviour; Listen; Ask open questions
- Agree and commit
- Record and close out

Typical questions

- How can you and your workmates get hurt?
- What type of accident may happen?
- How can you and others avoid getting hurt?
- What if something unexpected happens?
- What have you done to prevent you and your colleagues getting hurt?
- How and when was the pre-job safety discussion (toolbox talk) conducted?
- What are the job specifics/team composition changes that occurred since you started?
- How has the work environment changed since you started?
- How can this job be done more safely?

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*

Planned Activities: ______________________

____

____

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: ______________________

____

Tailgate Safety Meeting Form

Safety Suggestions by Site Workers: ______________________________

Action Taken on Previous Suggestions: ______________________________

Injuries/Incidents/Personnel Changes since last meeting: ______________________________

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

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

Additional Comments: ______________________________

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

Name (Print)	Company	Signature

Meeting Conducted by: ______________________________ Title: ______________________________
Print

Signature: ______________________________ Time: ______________________________
Print

PPE Selection Guidelines

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

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

SAFETY DATA SHEETS

SDSs included:

Liquinox
YSI Buffer Solution (pH 4)
YSI Buffer Solution (pH 7)
Conductivity Standard (1413 µS/cm) Light's
Solution and ORP Standards (240mV)
Dissolved Oxygen (Low Range) Reagent
10 NTU Verification Standard
20 NTU Verification Standard
100 NTU Verification Standard
800 NTU Verification Standard
Dissolved Oxygen Probe Electrolyte Solution

Safety Data Sheet

Effective date: 11 May 2020 **Revision** : 11 May 2020

Trade Name: Liquinox®

1 Identification of the substance/mixture and of the supplier

1.1 GHS Product identifier

Trade Name: Liquinox®
Product number: 1201, 1201-1, 1205, 1215, 1230, 1232, 1232-1, 1255

1.2 Application of the substance / the mixture: Cleaning material/Detergent

1.2.1 Recommended dilution ratio: 1 - 2% in water

1.3 Details of the supplier of the Safety Data Sheet

Manufacturer: **Supplier:**

Alconox Inc.
30 Glenn St
White Plains, NY 10603
(914) 948-4040

Emergency telephone number:
ChemTel Inc
North America: 1-888-255-3924
International: +1 813-248-0573

2 Hazards identification

2.1 Classification of the substance or mixture:

In compliance with EC regulation No. 1272, 29CFR1910/1200 and GHS requirements.

Hazard-determining components of labeling:
Alcohol ethoxylate
Sodium alkylbenzene sulfonate
Sodium xylenesulphonate
Lauramine oxide

2.2 Label elements:

Eye damage, category 1.
Skin irritation, category 2.

Product at recommended dilution:

Eye irritation, category 2B

Hazard pictograms:

Signal word: Danger

Hazard statements:
H315 Causes skin irritation.
H318 Causes serious eye damage.

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.

Hazardous Elements at Use Dilution:

Hazard pictograms:

Signal word: Warning

Hazard statements:

H320 Causes eye irritation

Precautionary statements:

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.
P501 Dispose of contents and container as instructed in Section 13

Additional information: None.

Hazard description

Hazards Not Otherwise Classified (HNOC): May cause surfaces to become slippery. Use caution in areas of foot traffic if on floors.

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, 29CFR1910/1200 and GHS, 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 or 68411-30-3	Sodium Alkylbenzene Sulfonate	Acute Tox. 4; H303 Skin Irrit. 2 ; H315 Eye Dam. 1; H318	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

At use dilution:

CAS number: 68081-81-2 or 68411-30-3	Sodium Alkylbenzene Sulfonate	Eye Irr. 2B; H319	0.1-0.25

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

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

No additional information.

First aid measure at recommended dilution:

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.

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.

After swallowing:
Rinse mouth thoroughly. Seek medical attention if irritation, discomfort, or vomiting develops.

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.

7.2 Conditions for safe storage, including any incompatibilities

Store in a cool, well-ventilated area.

7.3 Specific end use(s):

No additional information.

8 Exposure controls/personal protection

8.1 Control parameters :

25322-68-3, Poly(ethylene oxide), AIHA TWA 10 mg/m3 (<0.15% present in concentrate)

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.

Exposure Control and Personal Protective Equipment at recommended dilution:

Under normal use and operational conditions, no special personal protective equipment or engineering controls will be necessary. Handle with care.

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 flammable	**Viscosity**:	a. Kinematic: Not determined or not available. b. Dynamic: Not determined or not available.
Density at 20°C:	1.08 g/mL		

10 Stability and reactivity

10.1 Reactivity: Not determined or not available.
10.2 Chemical stability: Not determined or not available.
10.3 Possibility hazardous reactions: Not determined or not available.
10.4 Conditions to avoid: Not determined or not available.
10.5 Incompatible materials: Not determined or not available.
10.6 Hazardous decomposition products: Not determined or not available.

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 (raw materials):

Alcohol Ethoxylate: May cause mild to moderate skin irritation.

Sodium Alkylbenzene Sulfonate: Causes skin irritation.

Lauramine oxide: Causes skin irritation.

Serious eye damage/irritation (raw materials):

Sodium Alkylbenzene Sulfonate: Causes serious eye damage.

Alcohol Ethoxylate: Causes moderate to severe eye irritation and conjunctivitis.

Sodium xylenesulphonate: irritating to eyes.

Lauramine oxide: Causes serious eye damage.

Product information at recommended dilution:

Eye irritation may occur upon direct contact with eyes. No specific hazards for skin contact, inhalation, or chronic exposure are expected within normal use parameters.

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 2.9 mg/l, 48 hours. Sodium Alkylbenzene Sulfonate: Aquatic Plants, EC50 Algae 29 mg/l, 96 hours.
Lauramine oxide: Fish, LC50 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
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 as active.
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.

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.

EU

REACH Article 57 (SVHC): None of the ingredients are listed.

Germany MAK: Not classified.

16 Other information

Abbreviations and Acronyms: None

Summary of Phrases

Hazard statements:

H315 Causes skin irritation.
H318 Causes serious eye damage.

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.

	At recommended dilution:
NFPA: 1-0-0	NFPA: 1-0-0
HMIS: 1-0-0	HMIS: 1-0-0

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

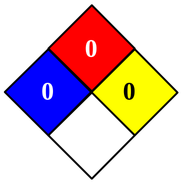
Potassium Hydrogen Phthalate (877-24-7)
Listed on the United States TSCA (Toxic Substances Control Act) inventory
Water (7732-18-5)
Listed on the United States TSCA (Toxic Substances Control Act) inventory

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

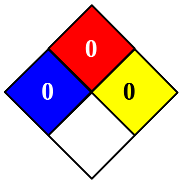
Potassium Hydrogen Phthalate (7778-77-0)
Listed on the United States TSCA (Toxic Substances Control Act) inventory
Water (7732-18-5)
Listed on the United States TSCA (Toxic Substances Control Act) inventory

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

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 wast 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 Hazar 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.

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.

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.

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)

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

Issue Date 09-Jan-2020 **Revision Date** 09-Jan-2020 **Version** 1.6

1. Identification

Product identifier

Product Name Dissolved Oxygen (Low Range) Reagent

Other means of identification

Product Code(s) 2501025-LM

Recommended use of the chemical and restrictions on use

Recommended Use Determination of dissolved oxygen. Standard solution.

Details of the supplier of the safety data sheet

Manufacturer Address
Hach Company P.O.Box 389 Loveland, CO 80539 USA +1(970) 669-3050

Emergency telephone number

Emergency Telephone +1(303) 623-5716 - 24 Hour Service

2. Hazards identification

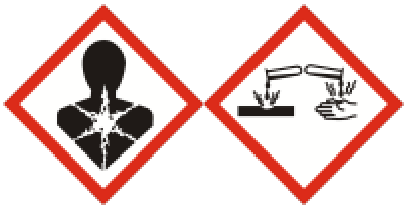
Classification

Acute toxicity - Oral	Category 5 - (H303)
Skin corrosion/irritation	Category 3 - (H316)
Serious eye damage/eye irritation	Category 1 - (H318)
Reproductive toxicity	Category 1B - (H360)

Label elements

Signal word - Danger

Hazard statements
H303 - May be harmful if swallowed
H316 - Causes mild skin irritation
H318 - Causes serious eye damage
H360 - May damage fertility or the unborn child



Health hazard
Corrosion

Precautionary statements
P332 + P313 - If skin irritation occurs: Get medical advice/attention
P280 - Wear protective gloves/protective clothing/eye protection/face protection
P305 + P351 + P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
P310 - Immediately call a POISON CENTER or doctor
P201 - Obtain special instructions before use
P308 + P313 - IF exposed or concerned: Get medical advice/attention
P405 - Store locked up
P501 - Dispose of contents/ container to an approved waste disposal plant

Other Hazards Known

Not applicable

3. Composition/information on ingredients

Substance

Not applicable.

Mixture

Chemical Family Mixture.

Chemical name	CAS No.	Synonyms	Percent Range
1-Imidazole	**288-32-4**	**No information available**	**1 - 5%**
Citric acid	**77-92-9**	**2-hydroxypropane-1,2,3-tricarboxylic acid**	**1 - 5%**
Tin	**7440-31-5**	**No information available**	**<1%**
C.I. Acid Blue 74	**860-22-0**	**No information available**	**<0.1%**

4. First aid measures

Description of first aid measures

General advice Immediate medical attention is required. Show this safety data sheet to the doctor in attendance.

Inhalation Remove to fresh air. Get medical attention immediately if symptoms occur.

Eye contact Get immediate medical advice/attention. Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Keep eye wide open while rinsing. Do not rub affected area.

Skin contact Wash off immediately with soap and plenty of water for at least 15 minutes. Get medical attention if irritation develops and persists.

Ingestion Clean mouth with water and drink afterwards plenty of water. Never give anything by mouth to an unconscious person. Do NOT induce vomiting. Call a physician.

Self-protection of the first aider	Avoid contact with skin, eyes or clothing. Wear personal protective clothing (see section 8).

Most important symptoms and effects, both acute and delayed

Symptoms	Burning sensation. Prolonged contact may cause redness and irritation.

Indication of any immediate medical attention and special treatment needed

Note to physicians	Treat symptomatically.

5. Fire-fighting measures

Suitable Extinguishing Media	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Unsuitable extinguishing media	CAUTION: Use of water spray when fighting fire may be inefficient.
Specific hazards arising from the chemical	No information available.
Hazardous combustion products	This material will not burn.
Explosion data	
Sensitivity to mechanical impact	None.
Sensitivity to static discharge	None.
Special protective actions for fire-fighters	Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protection equipment.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

Personal precautions	Avoid contact with skin, eyes or clothing. Use personal protective equipment as required.
Other information	Refer to protective measures listed in Sections 7 and 8.

Environmental precautions

Environmental precautions	Prevent further leakage or spillage if safe to do so.

Methods and material for containment and cleaning up

Methods for containment	Prevent further leakage or spillage if safe to do so.
Methods for cleaning up	Pick up and transfer to properly labeled containers.
Prevention of secondary hazards	Clean contaminated objects and areas thoroughly observing environmental regulations.

7. Handling and storage

Precautions for safe handling

Advice on safe handling	Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes or clothing. Do not eat, drink or smoke when using this product. Remove contaminated clothing and shoes.

Conditions for safe storage, including any incompatibilities

Storage Conditions	Keep containers tightly closed in a dry, cool and well-ventilated place. Store locked up. Keep out of the reach of children.

8. Exposure controls/personal protection

Control parameters

Exposure Limits	This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

Appropriate engineering controls

Engineering controls	Showers Eyewash stations Ventilation systems.

Individual protection measures, such as personal protective equipment

Eye/face protection	Tight sealing safety goggles.
Hand protection	Wear suitable gloves.
Skin and body protection	Wear suitable protective clothing.
Respiratory protection	No protective equipment is needed under normal use conditions. If exposure limits are exceeded or irritation is experienced, ventilation and evacuation may be required.
General hygiene considerations	Avoid contact with skin, eyes or clothing. Wear suitable gloves and eye/face protection. Do not eat, drink or smoke when using this product. Wash hands before breaks and immediately after handling the product.

9. Physical and chemical properties

Information on basic physical and chemical properties

Physical state	Liquid		
Appearance	aqueous solution	**Color**	yellow
Odor	Odorless	**Odor threshold**	No data available

Property	**Values**	**Remarks • Method**
Molecular weight	No data available	
pH	6.8	
Melting point/freezing point	-5 °C / 23 °F	
Boiling point / boiling range	101 °C / 214 °F	

Evaporation rate	0.98 (water = 1)
Vapor pressure	23.027 mm Hg / 3.07 kPa at 25 °C / 77 °F
Vapor density (air = 1)	0.61
Specific gravity (water = 1 / air = 1)	1.08
Partition Coefficient (n-octanol/water)	Not applicable
Soil Organic Carbon-Water Partition Coefficient	Not applicable
Autoignition temperature	No data available
Decomposition temperature	No data available
Dynamic viscosity	~ 1 cP (mPa s)
Kinematic viscosity	~ 0.926 cSt (mm^2/s)

Solubility(ies)

Water solubility

Water solubility classification	Water solubility	Water Solubility Temperature
Soluble	> 1000 mg/L	25 °C / 77 °F

Solubility in other solvents

Chemical Name	Solubility classification	Solubility	Solubility Temperature
Acid	Soluble	> 1000 mg/L	25 °C / 77 °F

Other Information

Metal Corrosivity

Steel Corrosion Rate	< 2.03 mm/yr / < 0.08 in/yr
Aluminum Corrosion Rate	< 2.03 mm/yr / < 0.08 in/yr

Volatile Organic Compounds (VOC) Content

Chemical name	CAS No.	Volatile organic compounds (VOC) content	CAA (Clean Air Act)
1-Imidazole	288-32-4	No data available	-
Citric acid	77-92-9	Not applicable	-
Tin	7440-31-5	No data available	-
C.I. Acid Blue 74	860-22-0	No data available	-

Explosive properties

Upper explosion limit	No data available
Lower explosion limit	No data available

Flammable properties

Flash point	No data available

Flammability Limit in Air

Upper flammability limit	No data available

Lower flammability limit	No data available
Oxidizing properties	No data available.
Bulk density	No data available

10. Stability and reactivity

Reactivity	No information available.
Chemical stability	Stable under normal conditions.
Possibility of Hazardous Reactions	None under normal processing.
Conditions to avoid	None known based on information supplied.
Incompatible materials	Strong acids. Strong bases. Strong oxidizing agents.
Hazardous Decomposition Products	None known based on information supplied.

11. Toxicological information

Information on Likely Routes of Exposure

Product Information

Inhalation	No known effect based on information supplied.
Eye contact	Severely irritating to eyes. Causes serious eye damage. May cause burns. May cause irreversible damage to eyes.
Skin contact	May cause irritation. Causes mild skin irritation.
Ingestion	Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea.
Symptoms	Redness. Burning. May cause blindness. Prolonged contact may cause redness and irritation.

Acute toxicity

Based on available data, the classification criteria are not met

Product Acute Toxicity Data

No data available.

Ingredient Acute Toxicity Data

No data available.

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
1-Imidazole (1 - 5%) CAS#: 288-32-4	Rat LD_{50}	220 mg/kg	None reported	None reported	IUCLID (The International Uniform Chemical Information Database)
Citric acid (1 - 5%) CAS#: 77-92-9	Rat LD_{50}	3000 mg/kg	None reported	None reported	IUCLID (The International Uniform Chemical Information Database)
C.I. Acid Blue 74 (<0.1%)	Rat LD_{50}	2000 mg/kg	None reported	None reported	Vendor SDS

CAS#: 860-22-0					

Unknown acute toxicity
0 % of the mixture consists of ingredient(s) of unknown toxicity.

0 % of the mixture consists of ingredient(s) of unknown acute oral toxicity
0 % of the mixture consists of ingredient(s) of unknown acute dermal toxicity
0 % of the mixture consists of ingredient(s) of unknown acute inhalation toxicity (dust/mist)
0 % of the mixture consists of ingredient(s) of unknown acute inhalation toxicity (vapor)
0 % of the mixture consists of ingredient(s) of unknown acute inhalation toxicity (gas)

Acute Toxicity Estimations (ATE)

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral)	4,495.00
ATEmix (dermal)	No information available
ATEmix (inhalation-dust/mist)	No information available
ATEmix (inhalation-vapor)	No information available
ATEmix (inhalation-gas)	No information available

Skin corrosion/irritation
May cause skin irritation.

Product Skin Corrosion/Irritation Data
No data available.

Ingredient Skin Corrosion/Irritation Data
No data available.

Chemical name	Test method	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
1-Imidazole (1 - 5%) CAS#: 288-32-4	OECD Test 404: Acute Dermal Corrosion/Irritation	Rabbit	800 mg	1 hours	Corrosive to skin	ECHA (The European Chemicals Agency)
Citric acid (1 - 5%) CAS#: 77-92-9	Standard Draize Test	Rabbit	500 mg	24 hours	Mild skin irritant	RTECS (Registry of Toxic Effects of Chemical Substances)

Serious eye damage/eye irritation
Classification based on data available for ingredients. Causes burns. Risk of serious damage to eyes.

Product Serious Eye Damage/Eye Irritation Data
No data available.

Ingredient Eye Damage/Eye Irritation Data
No data available.

Chemical name	Test method	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
1-Imidazole (1 - 5%) CAS#: 288-32-4	Standard Draize Test	Rabbit	100 mg	None reported	Corrosive to eyes	ECHA (The European Chemicals Agency)
Citric acid (1 - 5%) CAS#: 77-92-9	Standard Draize Test	Rabbit	0.750 mg	24 hours	Eye irritant	RTECS (Registry of Toxic Effects of Chemical Substances)

Respiratory or skin sensitization
Based on available data, the classification criteria are not met.

Product Sensitization Data

No data available.

Ingredient Sensitization Data
No data available.

Chemical name	Test method	Species	Results	Key literature references and sources for data
C.I. Acid Blue 74 (<0.1%) CAS#: 860-22-0	None reported	None reported	Confirmed to be a respiratory sensitizer	No information available

STOT - single exposure
Based on available data, the classification criteria are not met.

Product Specific Target Organ Toxicity Single Exposure Data
No data available.

Ingredient Specific Target Organ Toxicity Single Exposure Data
No data available.

STOT - repeated exposure
Based on available data, the classification criteria are not met.

Product Specific Target Organ Toxicity Repeat Dose Data
No data available.

Ingredient Specific Target Organ Toxicity Repeat Exposure Data
No data available.

Carcinogenicity
Based on available data, the classification criteria are not met.

Product Carcinogenicity Data
No data available.

Ingredient Carcinogenicity Data
No data available.

Chemical name	CAS No.	ACGIH	IARC	NTP	OSHA
1-Imidazole	288-32-4	-	-	-	-
Citric acid	77-92-9	-	-	-	-
Tin	7440-31-5	-	-	-	-
C.I. Acid Blue 74	860-22-0	-	-	-	-

Legend

ACGIH (American Conference of Governmental Industrial Hygienists)	Does not apply
IARC (International Agency for Research on Cancer)	Does not apply
NTP (National Toxicology Program)	Does not apply
OSHA (Occupational Safety and Health Administration of the US Department of Labor)	Does not apply

Germ cell mutagenicity
Based on available data, the classification criteria are not met.

Product Germ Cell Mutagenicity *invitro* Data
No data available.

Ingredient Germ Cell Mutagenicity *invitro* Data
No data available.

Chemical name	Test	Cell Strain	Reported	Exposure	Results	Key literature

			dose	**time**		**references and sources for data**
C.I. Acid Blue 74 (<0.1%) CAS#: 860-22-0	Cytogenetic analysis	Mouse	60 mg/kg	30 days	Positive test result for mutagenicity	ERMA (New Zealands Environmental Risk Management Authority)

Product Germ Cell Mutagenicity *invivo* Data
No data available.

Ingredient Germ Cell Mutagenicity *invivo* Data
No data available.

Chemical name	Test	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
C.I. Acid Blue 74 (<0.1%) CAS#: 860-22-0	Cytogenetic analysis	Mouse	5400 mg/kg	90 days	Positive test result for mutagenicity	ERMA (New Zealands Environmental Risk Management Authority)

Reproductive toxicity
Classification based on data available for ingredients. Contains a known or suspected reproductive toxin. The table below indicates ingredients above the cut-off threshold considered as relevant which are listed as reproductive toxins.

Product Reproductive Toxicity Data
No data available.

Ingredient Reproductive Toxicity Data
No data available.

Aspiration hazard
Based on available data, the classification criteria are not met.

12. Ecological information

Ecotoxicity .

Unknown aquatic toxicity 0% of the mixture consists of components(s) of unknown hazards to the aquatic environment.

Product Ecological Data

Aquatic Acute Toxicity
No data available.

Aquatic Chronic Toxicity
No data available.

Ingredient Ecological Data

Aquatic Acute Toxicity
No data available.

Chemical name	Exposure time	Species	Endpoint type	Reported dose	Key literature references and sources for data
1-Imidazole (1 - 5%)	96 hours	*Leuciscus idus*	LC_{50}	284 mg/L	IUCLID (The International Uniform Chemical Information

CAS#: 288-32-4					Database)
Chemical name	**Exposure time**	**Species**	**Endpoint type**	**Reported dose**	**Key literature references and sources for data**
1-Imidazole (1 - 5%) CAS#: 288-32-4	48 Hours	*Daphnia magna*	EC_{50}	250 mg/L	IUCLID (The International Uniform Chemical Information Database)

Aquatic Chronic Toxicity
No data available.

Persistence and degradability

Product Biodegradability Data
No data available.

Bioaccumulation

Product Bioaccumulation Data
No data available.

Partition Coefficient (n-octanol/water)	Not applicable

Mobility

Soil Organic Carbon-Water Partition Coefficient	Not applicable

Other adverse effects
Contains a substance with an endocrine-disrupting potential.

13. Disposal considerations

Waste treatment methods

Waste from residues/unused products	Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.
Contaminated packaging	Do not reuse empty containers.

14. Transportation information

MEX	Not regulated
Note:	No special precautions necessary.
TDG	Not regulated
DOT	Not regulated
ICAO (air)	Not regulated
IATA	Not regulated
IMDG	Not regulated
RID	Not regulated
ADR	Not regulated
ADN	Not regulated

Additional information
There is a possibility that this product could be contained in a reagent set or kit composed of various compatible dangerous goods.
If the item is not in a reagent set or kit, the classification given above applies.
If the item is part of a reagent set or kit the classification would change to the following:
UN3316 Chemical Kit, Hazard Class 9, Packing Group II or III.
If the item is not regulated, the Chemical Kit classification does not apply.

15. Regulatory information

Safety, health and environmental regulations/legislation specific for the substance or mixture

International Regulations

The Montreal Protocol on Substances that Deplete the Ozone Layer Not applicable

The Stockholm Convention on Persistent Organic Pollutants Not applicable

The Rotterdam Convention Not applicable

International Inventories

TSCA	Complies.
DSL/NDSL	Complies.
EINECS/ELINCS	Complies.
ENCS	Contact supplier for inventory compliance status.
IECSC	Complies.
KECL	Complies.
PICCS	Complies.
AICS	Complies.

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

16. Other information

NFPA	**Health hazards** 3	**Flammability** 0	**Instability** 0	**Physical and chemical properties** -
HMIS	**Health hazards** 3 *	**Flammability** 0	**Physical hazards** 0	**Personal protection** X

Key or legend to abbreviations and acronyms used in the safety data sheet

Legend Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
Ceiling	Maximum limit value	SKN*	Skin designation

Key literature references and sources for data used to compile the SDS
Agency for Toxic Substances and Disease Registry (ATSDR)
U.S. Environmental Protection Agency ChemView Database
European Food Safety Authority (EFSA)
EPA (Environmental Protection Agency)
Acute Exposure Guideline Level(s) (AEGL(s))
U.S. Environmental Protection Agency Federal Insecticide, Fungicide, and Rodenticide Act
U.S. Environmental Protection Agency High Production Volume Chemicals

Food Research Journal
Hazardous Substance Database
International Uniform Chemical Information Database (IUCLID)
Japan GHS Classification
Australia National Industrial Chemicals Notification and Assessment Scheme (NICNAS)
NIOSH (National Institute for Occupational Safety and Health)
National Library of Medicine's ChemID Plus (NLM CIP)
National Library of Medicine's PubMed database (NLM PUBMED)
National Toxicology Program (NTP)
New Zealand's Chemical Classification and Information Database (CCID)
Organization for Economic Co-operation and Development Environment, Health, and Safety Publications
Organization for Economic Co-operation and Development High Production Volume Chemicals Program
Organization for Economic Co-operation and Development Screening Information Data Set
RTECS (Registry of Toxic Effects of Chemical Substances)
World Health Organization

Prepared By	Hach Product Compliance Department.
Issue Date	09-Jan-2020
Revision Date	09-Jan-2020
Revision Note	None

NOM-018-STPS-2015

The information is believed to be accurate, but it is not exhaustive and must be used only as guidance. It is based on the current state of knowledge of the chemical substance or mixture and is applicable to the appropriate safety precautions for the product.

Disclaimer

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

End of Safety Data Sheet

SAFETY DATA SHEET

1. IDENTIFICATION

Product identifier

Product Name	10 NTU Verification Standard

Other means of identification

Product Code(s)	2961801
Safety data sheet number	M03414

Recommended use of the chemical and restrictions on use

Recommended Use	Water Analysis. Standard solution.
Uses advised against	Consumer use.
Restrictions on use	For Laboratory Use Only.

Details of the supplier of the safety data sheet

Manufacturer Address
Hach Company P.O.Box 389 Loveland, CO 80539 USA +1(970) 669-3050

Emergency telephone number
+1(303) 623-5716 - 24 Hour Service

2. HAZARDS IDENTIFICATION

Classification

Regulatory Status
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Respiratory sensitization	Category 1
Skin sensitization	Category 1

Hazards not otherwise classified (HNOC)
Not applicable

Label elements

Signal word
Danger

Hazard statements
H317 - May cause an allergic skin reaction
H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled

Precautionary statements
P261 - Avoid breathing dust/fume/gas/mist/vapors/spray
P285 - In case of inadequate ventilation wear respiratory protection
P304 + P341 - IF INHALED: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing
P342 + P311 - If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician
P501 - Dispose of contents/ container to an approved waste disposal plant
P272 - Contaminated work clothing should not be allowed out of the workplace
P280 - Wear protective gloves, protective clothing, eye protection, and face protection
P302 + P352 - IF ON SKIN: Wash with plenty of soap and water
P333 + P313 - If skin irritation or rash occurs: Get medical advice/attention
P363 - Wash contaminated clothing before reuse

Other Hazards Known
None

3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance
Not applicable

Mixture

Chemical Family	Mixture.
Chemical nature	aqueous solution.

Percent ranges are used where confidential product information is applicable.

Chemical name	CAS No	Percent Range	HMRIC #
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane	100-97-0	<10%	-
Sodium sulfate	7757-82-6	<1%	-
Formaldehyde	50-00-0	<0.1%	-
Diammonium sulfate	7783-20-2	<0.01%	-

4. FIRST AID MEASURES

Description of first aid measures

General advice	Show this safety data sheet to the doctor in attendance.
Inhalation	May cause allergic respiratory reaction. If breathing has stopped, give artificial respiration. Get medical attention immediately. Remove to fresh air. Avoid direct contact with skin. Use barrier to give mouth-to-mouth resuscitation. Get immediate medical advice/attention.
Eye contact	Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a physician.
Skin contact	Wash with soap and water. May cause an allergic skin reaction. In the case of skin irritation or allergic reactions see a physician.
Ingestion	May produce an allergic reaction. Do NOT induce vomiting. Clean mouth with water and drink afterwards plenty of water. Never give anything by mouth to an unconscious person. Get immediate medical advice/attention.

Self-protection of the first aider	Ensure that medical personnel are aware of the material(s) involved, take precautions to protect themselves and prevent spread of contamination. Avoid contact with skin, eyes or clothing. Avoid direct contact with skin. Use barrier to give mouth-to-mouth resuscitation.

Most important symptoms and effects, both acute and delayed

Symptoms	May cause allergy or asthma symptoms or breathing difficulties if inhaled. Coughing and/ or wheezing. Itching. Rashes. Hives.

Indication of any immediate medical attention and special treatment needed

Note to physicians	May cause sensitization in susceptible persons. Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Unsuitable Extinguishing Media	Caution: Use of water spray when fighting fire may be inefficient.
Specific hazards arising from the chemical	Product is or contains a sensitizer. May cause sensitization by inhalation and skin contact. May cause sensitization by skin contact.
Hazardous combustion products	This material will not burn. Ammonia. Carbon monoxide. Formaldehyde. Nitrogen oxides (NOx).
Special protective equipment for fire-fighters	Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protection equipment.

6. ACCIDENTAL RELEASE MEASURES

U.S. Notice	Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance. Outside of the US, only persons properly qualified according to state or local regulations should respond to a spill involving chemicals.

Personal precautions, protective equipment and emergency procedures

Personal precautions	Avoid contact with skin, eyes or clothing. Ensure adequate ventilation. Use personal protective equipment as required. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak.
Other Information	Refer to protective measures listed in Sections 7 and 8.

Environmental precautions

Environmental precautions	Prevent further leakage or spillage if safe to do so.

Methods and material for containment and cleaning up

Methods for containment	Prevent further leakage or spillage if safe to do so.
Methods for cleaning up	Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust). Take up mechanically, placing in appropriate containers for disposal.

Prevention of secondary hazards Clean contaminated objects and areas thoroughly observing environmental regulations.

Reference to other sections See section 8 for more information. See section 13 for more information.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes or clothing. Ensure adequate ventilation. Provide extract ventilation to points where emissions occur. In case of insufficient ventilation, wear suitable respiratory equipment. Do not eat, drink or smoke when using this product. Remove contaminated clothing and shoes. Take off contaminated clothing and wash before reuse.

Conditions for safe storage, including any incompatibilities

Storage Conditions Keep containers tightly closed in a dry, cool and well-ventilated place. Store locked up. Keep out of the reach of children.

Flammability class Not applicable

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines

Chemical name	ACGIH TLV	OSHA PEL	NIOSH
Formaldehyde CAS#: 50-00-0	STEL: 0.3 ppm TWA: 0.1 ppm	TWA: 0.75 ppm (vacated) TWA: 3 ppm (vacated) STEL: 10 ppm (vacated) Ceiling: 5 ppm STEL: 2 ppm	IDLH: 20 ppm Ceiling: 0.1 ppm 15 min TWA: 0.016 ppm

Appropriate engineering controls

Engineering Controls Showers
Eyewash stations
Ventilation systems.

Individual protection measures, such as personal protective equipment

Respiratory protection No protective equipment is needed under normal use conditions. If exposure limits are exceeded or irritation is experienced, ventilation and evacuation may be required.

Hand Protection Wear suitable gloves. Gloves must be inspected prior to use. The selected protective gloves have to satisfy the specifications of EU Directive 2016/425 and the standard EN 374 derived from it. Chemical resistant gloves made of butyl rubber or nitrile rubber category III according to EN 374-1:2016.

Eye/face protection Wear safety glasses with side shields (or goggles).

Skin and body protection Wear suitable protective clothing.

General Hygiene Considerations Avoid contact with skin, eyes or clothing. Wear suitable gloves and eye/face protection. Do not eat, drink or smoke when using this product. Remove and wash contaminated clothing and gloves, including the inside, before re-use.

Environmental exposure controls	Local authorities should be advised if significant spillages cannot be contained. Do not allow into any sewer, on the ground or into any body of water.
Thermal hazards	None under normal processing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Liquid		
Appearance	Turbid solution aqueous solution	**Color**	white
Odor	Odorless	**Odor threshold**	No data available

Property	Values	Remarks • Method
Molecular weight	No data available	
pH	8.48	@ 20 °C
Melting point/freezing point	~ 0 °C / 32 °F	
Boiling point / boiling range	~ 100 °C / 212 °F	
Evaporation rate	1 (water = 1)	
Vapor pressure	17.477 mm Hg / 2.33 kPa at 20 °C / 68 °F	
Relative vapor density	0.62	
Specific gravity (water = 1 / air = 1)	1.02	
Partition Coefficient (n-octanol/water)	Not applicable	
Soil Organic Carbon-Water Partition Coefficient	Not applicable	
Autoignition temperature	No data available	
Decomposition temperature	No data available	
Dynamic viscosity	No data available	
Kinematic viscosity	No data available	

Solubility(ies)

Water solubility

Water solubility classification	Water solubility	Water Solubility Temperature
Soluble	> 1000 mg/L	25 °C / 77 °F

Solubility in other solvents

Chemical Name	Solubility classification	Solubility	Solubility Temperature
None reported	No information available	No data available	No information available

Other information

Metal Corrosivity

Steel Corrosion Rate	No data available

Aluminum Corrosion Rate No data available

Volatile Organic Compounds (VOC) Content
No information available See ingredients information below

Chemical name	CAS No	Volatile organic compounds (VOC) content	CAA (Clean Air Act)
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane	100-97-0	Not applicable	X
Sodium sulfate	7757-82-6	No data available	-
Formaldehyde	50-00-0	No data available	X
Diammonium sulfate	7783-20-2	No data available	-

Explosive properties

Upper explosion limit No data available
Lower explosion limit No data available

Flammable properties

Flash point No data available

Flammability Limit in Air
Upper flammability limit: No data available
Lower flammability limit: No data available

Oxidizing properties No data available.

Bulk density No data available

10. STABILITY AND REACTIVITY

Reactivity
Not applicable.

Chemical stability
Stable under normal conditions.

Explosion data
Sensitivity to Mechanical Impact None.
Sensitivity to Static Discharge None.

Possibility of hazardous reactions
None under normal processing.

Hazardous polymerization
Hazardous polymerization does not occur.

Conditions to avoid
None known based on information supplied.

Incompatible materials
Strong oxidizing agents, strong acids, and strong bases.

Hazardous decomposition products

Ammonia. Carbon monoxide. Formaldehyde. Nitrogen oxides. Sodium oxides. Sulfur oxides.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Product Information

Inhalation	May cause sensitization in susceptible persons.
Eye contact	No known effect based on information supplied.
Skin contact	Repeated or prolonged skin contact may cause allergic reactions with susceptible persons. May cause sensitization by skin contact.
Ingestion	May cause additional affects as listed under "Inhalation".
Symptoms	Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain, or flushing. Coughing and/ or wheezing. Itching. Rashes. Hives.

Acute toxicity
Based on available data, the classification criteria are not met

Product Acute Toxicity Data
No data available.

Ingredient Acute Toxicity Data
Test data reported below.

Oral Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rat LD_{50}	100 mg/kg	None reported	None reported	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)
Diammonium sulfate (<0.01%) CAS#: 7783-20-2	Rat LD_{50}	2840 mg/kg	None reported	None reported	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)

Dermal Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rabbit LD_{50}	270 mg/kg	None reported	None reported	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)

Inhalation (Dust/Mist) Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rat LC_{50}	0.578 mg/L	4 hours	None reported	LOLI

Unknown Acute Toxicity
1E-05% of the mixture consists of ingredient(s) of unknown toxicity.

Acute Toxicity Estimations (ATE)

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral)	No information available
ATEmix (dermal)	No information available
ATEmix (inhalation-dust/mist)	No information available
ATEmix (inhalation-vapor)	No information available
ATEmix (inhalation-gas)	No information available

Skin corrosion/irritation
Based on available data, the classification criteria are not met.

Product Skin Corrosion/Irritation Data
No data available.

Ingredient Skin Corrosion/Irritation Data
Test data reported below.

Chemical name	Test method	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	OECD Test 404: Acute Dermal Corrosion/Irritation	Rabbit	500 mg	4 hours	Not corrosive or irritating to skin	ECHA (The European Chemicals Agency)
Sodium sulfate (<1%) CAS#: 7757-82-6	Standard Draize Test	Rabbit	500 mg	4 hours	Not corrosive or irritating to skin	ECHA (The European Chemicals Agency)
Formaldehyde (<0.1%) CAS#: 50-00-0	Standard Draize Test	Human	0.150 mg	72 hours	Corrosive to skin	RTECS (Registry of Toxic Effects of Chemical Substances)
Diammonium sulfate (<0.01%) CAS#: 7783-20-2	Standard Draize Test	Rabbit	800 mg	20 hours	Not corrosive or irritating to skin	ECHA (The European Chemicals Agency)

Serious eye damage/irritation
Based on available data, the classification criteria are not met.

Product Serious Eye Damage/Eye Irritation Data
No data available.

Ingredient Eye Damage/Eye Irritation Data
Test data reported below.

Chemical name	Test method	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	OECD Test 405: Acute Eye Corrosion/Irritation	Rabbit	100 mg	24 hours	Not corrosive or irritating to eyes	ECHA (The European Chemicals Agency)
Sodium sulfate (<1%)	Standard Draize Test	Rabbit	90 mg	24 hours	Not corrosive or irritating to eyes	ECHA (The European Chemicals Agency)

CAS#: 7757-82-6						
Formaldehyde (<0.1%) CAS#: 50-00-0	Rinse Test	Human	1 ppm	6 minutes	Corrosive to eyes	RTECS (Registry of Toxic Effects of Chemical Substances)
Diammonium sulfate (<0.01%) CAS#: 7783-20-2	Standard Draize Test	Rabbit	0.050 mL	None reported	Not corrosive or irritating to eyes	ECHA (The European Chemicals Agency)

Respiratory or skin sensitization

May cause sensitization by inhalation. May cause sensitization by skin contact.

Product Sensitization Data

No data available.

Ingredient Sensitization Data

Test data reported below.

Skin Sensitization Exposure Route

Chemical name	Test method	Species	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	OECD Test No. 406: Skin Sensitization	Guinea pig	Confirmed to be a skin sensitizer	ECHA (The European Chemicals Agency)
Sodium sulfate (<1%) CAS#: 7757-82-6	OECD Test No. 406: Skin Sensitization	Guinea pig	Not confirmed to be a skin sensitizer	HSDB (Hazardous Substances Data Bank)
Formaldehyde (<0.1%) CAS#: 50-00-0	Patch test	Human	Confirmed to be a skin sensitizer	ERMA (New Zealands Environmental Risk Management Authority)

Respiratory Sensitization Exposure Route

Chemical name	Test method	Species	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	Based on human experience	Human	Confirmed to be a respiratory sensitizer	HSDB (Hazardous Substances Data Bank)
Formaldehyde (<0.1%) CAS#: 50-00-0	IgE Specific Immune Response Test	Guinea pig	Confirmed to be a respiratory sensitizer	CICAD (Concise International Chemical Assessment Documents)

STOT - single exposure

Based on available data, the classification criteria are not met.

Product Specific Target Organ Toxicity Single Exposure Data

No data available.

Ingredient Specific Target Organ Toxicity Single Exposure Data

Test data reported below.

Oral Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde	Human	70 mg/kg	None	**Gastrointestinal**	RTECS (Registry of Toxic

(<0.1%) CAS#: 50-00-0	LD$_{Lo}$		reported	**Kidney, Ureter, or Bladder** **Liver** Other changes Ulcerated stomach Other changes	Effects of Chemical Substances)
Diammonium sulfate (<0.01%) CAS#: 7783-20-2	Man TD$_{Lo}$	1500 mg/kg	None reported	**Gastrointestinal** Gas	RTECS (Registry of Toxic Effects of Chemical Substances)

STOT - repeated exposure

Based on available data, the classification criteria are not met.

Product Specific Target Organ Toxicity Repeat Dose Data

No data available.

Ingredient Specific Target Organ Toxicity Repeat Exposure Data

Test data reported below.

Oral Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	Rat NOAEL	80 mg/kg	None reported	None reported	Vendor SDS

Inhalation (Dust/Mist) Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	Rat TC$_{Lo}$	350 mg/m^3	21 days	**Kidney, Ureter, or Bladder** Urine volume decreased or anuria **Nutritional and Gross Metabolic** Weight loss or decreased weight gain **Biochemical** Enzyme inhibition, induction, or change in blood or tissue levels (true cholinesterase)	RTECS (Registry of Toxic Effects of Chemical Substances)

Inhalation (Vapor) Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Human TC$_{Lo}$	0.017 mg/L	0.5 days	**Eye** **Lungs, Thorax, or Respiration** Lacrimation Other changes	RTECS (Registry of Toxic Effects of Chemical Substances)

Carcinogenicity

Based on available data, the classification criteria are not met.

Product Carcinogenicity Data

No data available.

Ingredient Carcinogenicity Data
Test data reported below.

Chemical name	CAS No	ACGIH	IARC	NTP	OSHA
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane	100-97-0	-	-	-	-
Sodium sulfate	7757-82-6	-	-	-	-
Formaldehyde	50-00-0	A1	Group 1	Known	X
Diammonium sulfate	7783-20-2	-	-	-	-

Legend

ACGIH (American Conference of Governmental Industrial Hygienists)	A2 - Suspected Human Carcinogen
IARC (International Agency for Research on Cancer)	Group 1 - Carcinogenic to Humans
NTP (National Toxicology Program)	Known - Known Carcinogen
OSHA (Occupational Safety and Health Administration of the US Department of Labor)	X - Present

Inhalation (Vapor) Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rat	15 mg/L	78 weeks	**Olfaction** Tumors	RTECS (Registry of Toxic Effects of Chemical Substances)

Germ cell mutagenicity
Based on available data, the classification criteria are not met.

Product Germ Cell Mutagenicity *invitro* **Data**
No data available.

Ingredient Germ Cell Mutagenicity *invitro* **Data**
Test data reported below.

Chemical name	Test	Cell Strain	Reported dose	Exposure time	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	Cytogenetic analysis	Human HeLa Cell	1 mmol/L	None reported	Positive test result for mutagenicity	RTECS (Registry of Toxic Effects of Chemical Substances)

Product Germ Cell Mutagenicity *invivo* **Data**
No data available.

Ingredient Germ Cell Mutagenicity *invivo* **Data**
Test data reported below.

Oral Exposure Route

Chemical name	Test	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	Dominant lethal test	Mouse	25000 mg/kg	None reported	Positive test result for mutagenicity	RTECS (Registry of Toxic Effects of Chemical Substances)

Inhalation (Vapor) Exposure Route

Chemical name	Test	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Micronucleus test	Human	.000985 mg/L	8.5 years	Positive test result for mutagenicity	RTECS (Registry of Toxic Effects of Chemical Substances)

Reproductive toxicity
Based on available data, the classification criteria are not met.

Product Reproductive Toxicity Data
No data available.

Ingredient Reproductive Toxicity Data
Test data reported below.

Oral Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Sodium sulfate (<1%) CAS#: 7757-82-6	Mouse TD$_{Lo}$	14000 mg/kg	4 days	**Effects on Newborn** Other neonatal measures or effects	RTECS (Registry of Toxic Effects of Chemical Substances)

Inhalation (Vapor) Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rat TC$_{Lo}$	40 mg/L	14 days	**Effects on Embryo or Fetus** Fetotoxicity (except death e.g. stunted fetus)	RTECS (Registry of Toxic Effects of Chemical Substances)

Aspiration hazard
Based on available data, the classification criteria are not met.

12. ECOLOGICAL INFORMATION

Ecotoxicity	Based on available data, the classification criteria are not met.
Unknown aquatic toxicity	1E-05 % of the mixture consists of component(s) of unknown hazards to the aquatic environment.

Product Ecological Data

Aquatic Acute Toxicity
No data available.

Aquatic Chronic Toxicity
No data available.

Ingredient Ecological Data

Aquatic Acute Toxicity
Test data reported below.

Fish

Chemical name	Exposure time	Species	Endpoint type	Reported dose	Key literature references and sources for data
Sodium sulfate (<1%) CAS#: 7757-82-6	96 hours	None reported	LC_{50}	56 mg/L	IUCLID (The International Uniform Chemical Information Database)
Formaldehyde (<0.1%) CAS#: 50-00-0	96 hours	*Morone saxatilis*	LC_{50}	6.7 mg/L	PEEN (Pan European Ecological Network)
Diammonium sulfate (<0.01%) CAS#: 7783-20-2	96 hours	*Oncorhynchus mykiss*	LC_{50}	36.7 mg/L	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)

Crustacea

Chemical name	Exposure time	Species	Endpoint type	Reported dose	Key literature references and sources for data
Sodium sulfate (<1%) CAS#: 7757-82-6	48 Hours	*Daphnia magna*	EC_{50}	3150 mg/L	IUCLID (The International Uniform Chemical Information Database)
Formaldehyde (<0.1%) CAS#: 50-00-0	48 Hours	*Daphnia pulex*	EC_{50}	5.8 mg/L	PEEN (Pan European Ecological Network)
Diammonium sulfate (<0.01%) CAS#: 7783-20-2	48 Hours	None reported	LC_{50}	14 mg/L	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)

Aquatic Chronic Toxicity
No data available.

Persistence and degradability

Product Biodegradability Data
No data available.

Product Bioaccumulation Data
No data available.

Partition Coefficient (n-octanol/water) Not applicable

Mobility

Soil Organic Carbon-Water Partition Coefficient Not applicable

Other adverse effects
No information available

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Waste from residues/unused products	Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.
Contaminated packaging	Do not reuse empty containers.
US EPA Waste Number	Not applicable, U122

Chemical name	RCRA	RCRA - Basis for Listing	RCRA - D Series Wastes	RCRA - U Series Wastes
Formaldehyde 50-00-0	U122	Included in waste streams: K009, K010, K038, K040, K156, K157	-	U122

14. TRANSPORT INFORMATION

DOT	Not regulated
TDG	Not regulated
IATA	Not regulated
IMDG	Not regulated
Note:	No special precautions necessary.

Additional information

15. REGULATORY INFORMATION

National Inventories

TSCA	Complies
DSL/NDSL	Complies

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

International Inventories

EINECS/ELINCS	Complies
ENCS	Does not comply
IECSC	Complies
KECL - Existing substances	Complies
PICCS	Does not comply
TCSI	Complies
AICS	Complies
NZIoC	Complies

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
TCSI - Taiwan Chemical Substances Inventory
AICS - Australian Inventory of Chemical Substances
NZIoC - New Zealand Inventory of Chemicals

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 %

Formaldehyde (CAS #: 50-00-0)	0.1
Diammonium sulfate (CAS #: 7783-20-2)	1.0

SARA 311/312 Hazard Categories

Acute health hazard	Yes
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
Formaldehyde 50-00-0	100 lb	-	-	X

CERCLA

Chemical name	Hazardous Substances RQs	CERCLA/SARA RQ	Reportable Quantity (RQ)
Formaldehyde 50-00-0	100 lb	100 lb	RQ 100 lb final RQ RQ 45.4 kg final RQ

U.S. - Department of Homeland Security - Chemical Facility Anti-Terrorism Standards (CFATS) - Security Issues

Chemical name	U.S. - Department of Homeland Security - Chemical Facility Anti-Terrorism Standards (CFATS) - Security Issues
Formaldehyde (<0.1%) CAS#: 50-00-0	Release - Toxic (solution)

US State Regulations

California Proposition 65

This product contains the following Proposition 65 chemicals

Chemical name	California Proposition 65
Formaldehyde (CAS #: 50-00-0)	Carcinogen

⚠**WARNING:** This product can expose you to chemicals including Formaldehyde, which is known to the State of California to cause cancer.
For more information, go to http://www.P65Warnings.ca.gov

IMERC: Not applicable

U.S. State Right-to-Know Regulations

This product may contain substances regulated by state right-to-know regulations.

Chemical name	New Jersey	Massachusetts	Pennsylvania
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane 100-97-0	X	-	-
Sodium sulfate 7757-82-6	-	X	X
Formaldehyde 50-00-0	X	X	X
Diammonium sulfate	-	X	X

7783-20-2			

U.S. EPA Label Information

Chemical name	FIFRA	FDA
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane	180.0910	-
Sodium sulfate	-	21 CFR 186.1797
Diammonium sulfate	180.0910	21 CFR 184.1143

16. OTHER INFORMATION, INCLUDING DATE OF PREPARATION OF THE LAST REVISION

Special Comments
None

Additional information

Global Automotive Declarable Substance List (GADSL)

Chemical name	Global Automotive Declarable Substance List Classifications	Global Automotive Declarable Substance List Thersholds
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane 100-97-0	Declarable Substance (FI)	0.1 %
Formaldehyde 50-00-0	Declarable Substance (FI) Prohibited Substance (FI) Declarable Substance (LR) Prohibited Substance (LR)	0 % 0.1 %

NFPA and HMIS Classifications

NFPA	**Health hazards** - 2	**Flammability** - 0	**Instability** - 0	**Physical and chemical properties** -
HMIS	**Health hazards** - 2 - *	**Flammability** - 0	**Physical hazards** - 0	**Personal protection** - X - I

Key or legend to abbreviations and acronyms used in the safety data sheet

NIOSH IDLH	*Immediately Dangerous to Life or Health*
ACGIH	ACGIH (American Conference of Governmental Industrial Hygienists)
NDF	*no data*

Legend - Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
MAC	Maximum Allowable Concentration	Ceiling	Ceiling Limit Value
X	Listed	Vacated	These values have no official status. The only binding levels of contaminants are those listed in the final OSHA PEL. These lists are for reference purposes only. Please note that some reference state regulations of these "liberated" exposure limits in their state regulations.
SKN*	Skin designation	SKN+	Skin sensitization

RSP+	Respiratory sensitization	**	Hazard Designation
C	Carcinogen	R	Reproductive toxicant
M	mutagen		

Prepared By	Hach Product Compliance Department
Issue Date	30-07-2019
Revision Date	15-Feb-2021
Revision Note	None

Disclaimer

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

End of Safety Data Sheet

SAFETY DATA SHEET

1. IDENTIFICATION

Product identifier

Product Name	STABLCAL® FORMAZIN STANDARD 20 NTU

Other means of identification

Product Code(s)	2684801
Safety data sheet number	M03409

Recommended use of the chemical and restrictions on use

Recommended Use	Standard solution. Water Analysis.
Uses advised against	Consumer use.
Restrictions on use	For Laboratory Use Only.

Details of the supplier of the safety data sheet

Manufacturer Address
Hach Company P.O.Box 389 Loveland, CO 80539 USA +1(970) 669-3050

Emergency telephone number
+1(303) 623-5716 - 24 Hour Service

2. HAZARDS IDENTIFICATION

Classification

Regulatory Status
Safety Data Sheets are a sub-requirement of the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard, 29 CFR Subpart 1910.1200. This Hazard Communication Standard does not apply to various subcategories including anything defined by OSHA as an "article".
According to OSHA, Article means a manufactured item other than a fluid or particle: (i) which is formed to a specific shape or design during manufacture; (ii) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and (iii) which under normal conditions of use does not release more than very small quantities, e.g., minute or trace amounts of a hazardous chemical (as determined under paragraph (d) of this section), and does not pose a physical hazard or health risk to employees.

Respiratory sensitization	Category 1
Skin sensitization	Category 1

Hazards not otherwise classified (HNOC)
Not applicable

Label elements

Signal word
Danger

Hazard statements
H317 - May cause an allergic skin reaction
H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled

Precautionary statements
P261 - Avoid breathing dust/fume/gas/mist/vapors/spray
P285 - In case of inadequate ventilation wear respiratory protection
P304 + P341 - IF INHALED: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing
P342 + P311 - If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician
P501 - Dispose of contents/ container to an approved waste disposal plant
P272 - Contaminated work clothing should not be allowed out of the workplace
P280 - Wear protective gloves, protective clothing, eye protection, and face protection
P302 + P352 - IF ON SKIN: Wash with plenty of soap and water
P333 + P313 - If skin irritation or rash occurs: Get medical advice/attention
P363 - Wash contaminated clothing before reuse

Other Hazards Known
None

3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance
Not applicable

Mixture

Chemical Family	Mixture.
Chemical nature	aqueous solution.

Percent ranges are used where confidential product information is applicable.

Chemical name	CAS No	Percent Range	HMRIC #
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane	100-97-0	<10%	-
Sodium sulfate	7757-82-6	<1%	-
Formaldehyde	50-00-0	<0.1%	-
Diammonium sulfate	7783-20-2	<0.01%	-

4. FIRST AID MEASURES

Description of first aid measures

General advice	Show this safety data sheet to the doctor in attendance.
Inhalation	May cause allergic respiratory reaction. If breathing has stopped, give artificial respiration. Get medical attention immediately. Remove to fresh air. Avoid direct contact with skin. Use barrier to give mouth-to-mouth resuscitation. Get immediate medical advice/attention.
Eye contact	Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids.

	Consult a physician.
Skin contact	Wash with soap and water. May cause an allergic skin reaction. In the case of skin irritation or allergic reactions see a physician.
Ingestion	May produce an allergic reaction. Do NOT induce vomiting. Clean mouth with water and drink afterwards plenty of water. Never give anything by mouth to an unconscious person. Get immediate medical advice/attention.
Self-protection of the first aider	Ensure that medical personnel are aware of the material(s) involved, take precautions to protect themselves and prevent spread of contamination. Avoid contact with skin, eyes or clothing. Avoid direct contact with skin. Use barrier to give mouth-to-mouth resuscitation.

Most important symptoms and effects, both acute and delayed

Symptoms	May cause allergy or asthma symptoms or breathing difficulties if inhaled. Coughing and/ or wheezing. Itching. Rashes. Hives.

Indication of any immediate medical attention and special treatment needed

Note to physicians	May cause sensitization in susceptible persons. Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Unsuitable Extinguishing Media	Caution: Use of water spray when fighting fire may be inefficient.
Specific hazards arising from the chemical	Product is or contains a sensitizer. May cause sensitization by inhalation and skin contact. May cause sensitization by skin contact.
Hazardous combustion products	This material will not burn. Carbon monoxide. Ammonia. Formaldehyde. Nitrogen oxides.
Special protective equipment for fire-fighters	Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protection equipment.

6. ACCIDENTAL RELEASE MEASURES

U.S. Notice	Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance. Outside of the US, only persons properly qualified according to state or local regulations should respond to a spill involving chemicals.

Personal precautions, protective equipment and emergency procedures

Personal precautions	Avoid contact with skin, eyes or clothing. Ensure adequate ventilation. Use personal protective equipment as required. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak.
Other Information	Refer to protective measures listed in Sections 7 and 8.

Environmental precautions

Environmental precautions	Prevent further leakage or spillage if safe to do so.

Methods and material for containment and cleaning up

Methods for containment	Prevent further leakage or spillage if safe to do so.
Methods for cleaning up	Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust). Take up mechanically, placing in appropriate containers for disposal.
Prevention of secondary hazards	Clean contaminated objects and areas thoroughly observing environmental regulations.
Reference to other sections	See section 8 for more information. See section 13 for more information.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling	Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes or clothing. Ensure adequate ventilation. Provide extract ventilation to points where emissions occur. In case of insufficient ventilation, wear suitable respiratory equipment. Do not eat, drink or smoke when using this product. Remove contaminated clothing and shoes. Take off contaminated clothing and wash before reuse.

Conditions for safe storage, including any incompatibilities

Storage Conditions	Keep containers tightly closed in a dry, cool and well-ventilated place. Store locked up. Keep out of the reach of children.
Flammability class	Not applicable

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines

Chemical name	ACGIH TLV	OSHA PEL	NIOSH
Formaldehyde CAS#: 50-00-0	STEL: 0.3 ppm TWA: 0.1 ppm	TWA: 0.75 ppm (vacated) TWA: 3 ppm (vacated) STEL: 10 ppm (vacated) Ceiling: 5 ppm STEL: 2 ppm	IDLH: 20 ppm Ceiling: 0.1 ppm 15 min TWA: 0.016 ppm

Appropriate engineering controls

Engineering Controls	Showers Eyewash stations Ventilation systems.

Individual protection measures, such as personal protective equipment

Respiratory protection	No protective equipment is needed under normal use conditions. If exposure limits are exceeded or irritation is experienced, ventilation and evacuation may be required. Wear breathing apparatus if exposed to vapors/dusts/aerosols.
Hand Protection	Wear suitable gloves. Gloves must be inspected prior to use. The selected protective gloves have to satisfy the specifications of EU Directive 2016/425 and the standard EN 374 derived from it. Chemical resistant gloves made of butyl rubber or nitrile rubber category III according to EN 374-1:2016.

Eye/face protection	Wear safety glasses with side shields (or goggles).
Skin and body protection	Wear suitable protective clothing.
General Hygiene Considerations	Avoid contact with skin, eyes or clothing. Wear suitable gloves and eye/face protection. Do not eat, drink or smoke when using this product. Remove and wash contaminated clothing and gloves, including the inside, before re-use. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.
Environmental exposure controls	Local authorities should be advised if significant spillages cannot be contained. Do not allow into any sewer, on the ground or into any body of water.
Thermal hazards	None under normal processing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Liquid		
Appearance	Turbid solution aqueous solution	**Color**	white
Odor	Odorless	**Odor threshold**	No data available

Property	Values	Remarks • Method
Molecular weight	No data available	
pH	8.26	@ 20 °C
Melting point/freezing point	~ 0 °C / 32 °F	
Boiling point / boiling range	~ 100 °C / 212 °F	
Evaporation rate	1 (water = 1)	
Vapor pressure	17.477 mm Hg / 2.33 kPa at 20 °C / 68 °F	
Relative vapor density	0.62	
Specific gravity (water = 1 / air = 1)	1.02	
Partition Coefficient (n-octanol/water)	Not applicable	
Soil Organic Carbon-Water Partition Coefficient	Not applicable	
Autoignition temperature	No data available	
Decomposition temperature	No information available	
Dynamic viscosity	No data available	
Kinematic viscosity	No data available	

Solubility(ies)

Water solubility

Water solubility classification	Water solubility	Water Solubility Temperature
Soluble	> 1000 mg/L	25 °C / 77 °F

Solubility in other solvents

Chemical Name	Solubility classification	Solubility	Solubility Temperature
None reported	No information available	No data available	No information available

Other information

Metal Corrosivity

Steel Corrosion Rate	No data available
Aluminum Corrosion Rate	No data available

Volatile Organic Compounds (VOC) Content
No information available See ingredients information below

Chemical name	CAS No	Volatile organic compounds (VOC) content	CAA (Clean Air Act)
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane	100-97-0	Not applicable	X
Sodium sulfate	7757-82-6	No data available	-
Formaldehyde	50-00-0	No data available	X
Diammonium sulfate	7783-20-2	No data available	-

Explosive properties

Upper explosion limit	No data available
Lower explosion limit	No data available

Flammable properties

Flash point	No data available

Flammability Limit in Air

Upper flammability limit:	No data available
Lower flammability limit:	No data available

Oxidizing properties	No data available.
Bulk density	No data available

10. STABILITY AND REACTIVITY

Reactivity
Not applicable.

Chemical stability
Stable under normal conditions.

Explosion data

Sensitivity to Mechanical Impact	None.
Sensitivity to Static Discharge	None.

Possibility of hazardous reactions

None under normal processing.

Hazardous polymerization

Hazardous polymerization does not occur.

Conditions to avoid

None known based on information supplied.

Incompatible materials

Strong oxidizing agents, strong acids, and strong bases.

Hazardous decomposition products

Ammonia. Carbon monoxide. Formaldehyde. Nitrogen oxides. Sodium oxides. Sulfur oxides.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Product Information

Inhalation	May cause sensitization in susceptible persons.
Eye contact	No known effect based on information supplied.
Skin contact	Repeated or prolonged skin contact may cause allergic reactions with susceptible persons. May cause sensitization by skin contact.
Ingestion	May cause additional affects as listed under "Inhalation".
Symptoms	Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain, or flushing. Coughing and/ or wheezing. Itching. Rashes. Hives.

Acute toxicity

Based on available data, the classification criteria are not met

Product Acute Toxicity Data

No data available.

Ingredient Acute Toxicity Data

Test data reported below.

Oral Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rat LD_{50}	100 mg/kg	None reported	None reported	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)
Diammonium sulfate (<0.01%) CAS#: 7783-20-2	Rat LD_{50}	2840 mg/kg	None reported	None reported	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)

Dermal Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rabbit LD_{50}	270 mg/kg	None reported	None reported	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)

Inhalation (Dust/Mist) Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rat LC_{50}	0.578 mg/L	4 hours	None reported	LOLI

Unknown Acute Toxicity
6E-07% of the mixture consists of ingredient(s) of unknown toxicity.

Acute Toxicity Estimations (ATE)

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral)	No information available
ATEmix (dermal)	No information available
ATEmix (inhalation-dust/mist)	No information available
ATEmix (inhalation-vapor)	No information available
ATEmix (inhalation-gas)	No information available

Skin corrosion/irritation
Based on available data, the classification criteria are not met.

Product Skin Corrosion/Irritation Data
No data available.

Ingredient Skin Corrosion/Irritation Data
Test data reported below.

Chemical name	Test method	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	OECD Test 404: Acute Dermal Corrosion/Irritation	Rabbit	500 mg	4 hours	Not corrosive or irritating to skin	ECHA (The European Chemicals Agency)
Sodium sulfate (<1%) CAS#: 7757-82-6	Standard Draize Test	Rabbit	500 mg	4 hours	Not corrosive or irritating to skin	ECHA (The European Chemicals Agency)
Formaldehyde (<0.1%) CAS#: 50-00-0	Standard Draize Test	Human	0.150 mg	72 hours	Corrosive to skin	RTECS (Registry of Toxic Effects of Chemical Substances)
Diammonium sulfate (<0.01%) CAS#: 7783-20-2	Standard Draize Test	Rabbit	800 mg	20 hours	Not corrosive or irritating to skin	ECHA (The European Chemicals Agency)

Serious eye damage/irritation
Based on available data, the classification criteria are not met.

Product Serious Eye Damage/Eye Irritation Data
No data available.

Ingredient Eye Damage/Eye Irritation Data
Test data reported below.

Chemical name	Test method	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	OECD Test 405: Acute Eye Corrosion/Irritation	Rabbit	100 mg	24 hours	Not corrosive or irritating to eyes	ECHA (The European Chemicals Agency)
Sodium sulfate (<1%) CAS#: 7757-82-6	Standard Draize Test	Rabbit	90 mg	24 hours	Not corrosive or irritating to eyes	ECHA (The European Chemicals Agency)
Formaldehyde (<0.1%) CAS#: 50-00-0	Rinse Test	Human	1 ppm	6 minutes	Corrosive to eyes	RTECS (Registry of Toxic Effects of Chemical Substances)
Diammonium sulfate (<0.01%) CAS#: 7783-20-2	Standard Draize Test	Rabbit	0.050 mL	None reported	Not corrosive or irritating to eyes	ECHA (The European Chemicals Agency)

<u>Respiratory or skin sensitization</u>
May cause sensitization by inhalation. May cause sensitization by skin contact.

Product Sensitization Data
No data available.

Ingredient Sensitization Data
Test data reported below.

Skin Sensitization Exposure Route

Chemical name	Test method	Species	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	OECD Test No. 406: Skin Sensitization	Guinea pig	Confirmed to be a skin sensitizer	ECHA (The European Chemicals Agency)
Sodium sulfate (<1%) CAS#: 7757-82-6	OECD Test No. 406: Skin Sensitization	Guinea pig	Not confirmed to be a skin sensitizer	HSDB (Hazardous Substances Data Bank)
Formaldehyde (<0.1%) CAS#: 50-00-0	Patch test	Human	Confirmed to be a skin sensitizer	ERMA (New Zealands Environmental Risk Management Authority)

Respiratory Sensitization Exposure Route

Chemical name	Test method	Species	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	Based on human experience	Human	Confirmed to be a respiratory sensitizer	HSDB (Hazardous Substances Data Bank)
Formaldehyde	IgE Specific	Guinea pig	Confirmed to be a respiratory	CICAD (Concise International

(<0.1%) CAS#: 50-00-0	Immune Response Test		sensitizer	Chemical Assessment Documents)

STOT - single exposure

Based on available data, the classification criteria are not met.

Product Specific Target Organ Toxicity Single Exposure Data

No data available.

Ingredient Specific Target Organ Toxicity Single Exposure Data

Test data reported below.

Oral Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Human LD_{Lo}	70 mg/kg	None reported	**Gastrointestinal** **Kidney, Ureter, or Bladder** **Liver** Other changes Ulcerated stomach Other changes	RTECS (Registry of Toxic Effects of Chemical Substances)
Diammonium sulfate (<0.01%) CAS#: 7783-20-2	Man TD_{Lo}	1500 mg/kg	None reported	**Gastrointestinal** Gas	RTECS (Registry of Toxic Effects of Chemical Substances)

STOT - repeated exposure

Based on available data, the classification criteria are not met.

Product Specific Target Organ Toxicity Repeat Dose Data

No data available.

Ingredient Specific Target Organ Toxicity Repeat Exposure Data

Test data reported below.

Oral Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	Rat NOAEL	80 mg/kg	None reported	None reported	Vendor SDS

Inhalation (Dust/Mist) Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	Rat TC_{Lo}	350 mg/m^3	21 days	**Kidney, Ureter, or Bladder** Urine volume decreased or anuria **Nutritional and Gross Metabolic** Weight loss or decreased weight gain **Biochemical** Enzyme inhibition, induction, or change in blood or tissue levels	RTECS (Registry of Toxic Effects of Chemical Substances)

				(true cholinesterase)	

Inhalation (Vapor) Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Human TC_{Lo}	0.017 mg/L	0.5 days	**Eye** **Lungs, Thorax, or Respiration** Lacrimation Other changes	RTECS (Registry of Toxic Effects of Chemical Substances)

Carcinogenicity

Based on available data, the classification criteria are not met.

Product Carcinogenicity Data

No data available.

Ingredient Carcinogenicity Data

Test data reported below.

Chemical name	CAS No	ACGIH	IARC	NTP	OSHA
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane	100-97-0	-	-	-	-
Sodium sulfate	7757-82-6	-	-	-	-
Formaldehyde	50-00-0	A1	Group 1	Known	X
Diammonium sulfate	7783-20-2	-	-	-	-

Legend

ACGIH (American Conference of Governmental Industrial Hygienists)	A2 - Suspected Human Carcinogen
IARC (International Agency for Research on Cancer)	Group 1 - Carcinogenic to Humans
NTP (National Toxicology Program)	Known - Known Carcinogen
OSHA (Occupational Safety and Health Administration of the US Department of Labor)	X - Present

Inhalation (Vapor) Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rat	15 mg/L	78 weeks	**Olfaction** Tumors	RTECS (Registry of Toxic Effects of Chemical Substances)

Germ cell mutagenicity

Based on available data, the classification criteria are not met.

Product Germ Cell Mutagenicity *invitro* **Data**

No data available.

Ingredient Germ Cell Mutagenicity *invitro* **Data**

Test data reported below.

Chemical name	Test	Cell Strain	Reported dose	Exposure time	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane	Cytogenetic analysis	Human HeLa Cell	1 mmol/L	None reported	Positive test result for mutagenicity	RTECS (Registry of Toxic Effects of Chemical

(<10%) CAS#: 100-97-0						Substances)

Product Germ Cell Mutagenicity *invivo* Data
No data available.

Ingredient Germ Cell Mutagenicity *invivo* Data
Test data reported below.

Oral Exposure Route

Chemical name	Test	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	Dominant lethal test	Mouse	25000 mg/kg	None reported	Positive test result for mutagenicity	RTECS (Registry of Toxic Effects of Chemical Substances)

Inhalation (Vapor) Exposure Route

Chemical name	Test	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Micronucleus test	Human	.000985 mg/L	8.5 years	Positive test result for mutagenicity	RTECS (Registry of Toxic Effects of Chemical Substances)

Reproductive toxicity
Based on available data, the classification criteria are not met.

Product Reproductive Toxicity Data
No data available.

Ingredient Reproductive Toxicity Data
Test data reported below.

Oral Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Sodium sulfate (<1%) CAS#: 7757-82-6	Mouse TD_{Lo}	14000 mg/kg	4 days	**Effects on Newborn** Other neonatal measures or effects	RTECS (Registry of Toxic Effects of Chemical Substances)

Inhalation (Vapor) Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rat TC_{Lo}	40 mg/L	14 days	**Effects on Embryo or Fetus** Fetotoxicity (except death e.g. stunted fetus)	RTECS (Registry of Toxic Effects of Chemical Substances)

Aspiration hazard
Based on available data, the classification criteria are not met.

12. ECOLOGICAL INFORMATION

Ecotoxicity Based on available data, the classification criteria are not met.

Unknown aquatic toxicity 0 % of the mixture consists of component(s) of unknown hazards to the aquatic environment.

Product Ecological Data

Aquatic Acute Toxicity
No data available.

Aquatic Chronic Toxicity
No data available.

Ingredient Ecological Data

Aquatic Acute Toxicity
Test data reported below.

Fish

Chemical name	Exposure time	Species	Endpoint type	Reported dose	Key literature references and sources for data
Sodium sulfate (<1%) CAS#: 7757-82-6	96 hours	None reported	LC_{50}	56 mg/L	IUCLID (The International Uniform Chemical Information Database)
Formaldehyde (<0.1%) CAS#: 50-00-0	96 hours	*Morone saxatilis*	LC_{50}	6.7 mg/L	PEEN (Pan European Ecological Network)
Diammonium sulfate (<0.01%) CAS#: 7783-20-2	96 hours	*Oncorhynchus mykiss*	LC_{50}	36.7 mg/L	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)

Crustacea

Chemical name	Exposure time	Species	Endpoint type	Reported dose	Key literature references and sources for data
Sodium sulfate (<1%) CAS#: 7757-82-6	48 Hours	*Daphnia magna*	EC_{50}	3150 mg/L	IUCLID (The International Uniform Chemical Information Database)
Formaldehyde (<0.1%) CAS#: 50-00-0	48 Hours	*Daphnia pulex*	EC_{50}	5.8 mg/L	PEEN (Pan European Ecological Network)
Diammonium sulfate (<0.01%) CAS#: 7783-20-2	48 Hours	None reported	LC_{50}	14 mg/L	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)

Aquatic Chronic Toxicity
No data available.

Persistence and degradability

Product Biodegradability Data
No data available.

Product Bioaccumulation Data
No data available.

Partition Coefficient (n-octanol/water)	Not applicable

Mobility

Soil Organic Carbon-Water Partition Coefficient	Not applicable

Other adverse effects
No information available

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Waste from residues/unused products	Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.
Contaminated packaging	Do not reuse empty containers.
US EPA Waste Number	U122

Chemical name	RCRA	RCRA - Basis for Listing	RCRA - D Series Wastes	RCRA - U Series Wastes
Formaldehyde 50-00-0	U122	Included in waste streams: K009, K010, K038, K040, K156, K157	-	U122

14. TRANSPORT INFORMATION

DOT **Special Provisions**	Not regulated
TDG	Not regulated
IATA	Not regulated
IMDG	Not regulated
Note:	No special precautions necessary.

Additional information

15. REGULATORY INFORMATION

National Inventories

TSCA	Complies
DSL/NDSL	Complies

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

International Inventories

EINECS/ELINCS	Complies
ENCS	Does not comply
IECSC	Complies

KECL - Existing substances	Complies
PICCS	Does not comply
TCSI	Complies
AICS	Complies
NZIoC	Complies

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
TCSI - Taiwan Chemical Substances Inventory
AICS - Australian Inventory of Chemical Substances
NZIoC - New Zealand Inventory of Chemicals

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 %
Formaldehyde (CAS #: 50-00-0)	0.1
Diammonium sulfate (CAS #: 7783-20-2)	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	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
Formaldehyde 50-00-0	100 lb	-	-	X

CERCLA

Chemical name	Hazardous Substances RQs	CERCLA/SARA RQ	Reportable Quantity (RQ)
Formaldehyde 50-00-0	100 lb	100 lb	RQ 100 lb final RQ RQ 45.4 kg final RQ

U.S. - Department of Homeland Security - Chemical Facility Anti-Terrorism Standards (CFATS) - Security Issues

Chemical name	U.S. - Department of Homeland Security - Chemical Facility Anti-Terrorism Standards (CFATS) - Security Issues
Formaldehyde (<0.1%) CAS#: 50-00-0	Release - Toxic (solution)

US State Regulations

California Proposition 65

This product contains the following Proposition 65 chemicals

Chemical name	California Proposition 65
Formaldehyde (CAS #: 50-00-0)	Carcinogen

⚠**WARNING:** This product can expose you to chemicals including Formaldehyde, which is known to the State of California to cause cancer.
For more information, go to http://www.P65Warnings.ca.gov

IMERC: Not applicable

U.S. State Right-to-Know Regulations

This product may contain substances regulated by state right-to-know regulations.

Chemical name	New Jersey	Massachusetts	Pennsylvania
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane 100-97-0	X	-	-
Sodium sulfate 7757-82-6	-	X	X
Formaldehyde 50-00-0	X	X	X
Diammonium sulfate 7783-20-2	-	X	X

U.S. EPA Label Information

Chemical name	FIFRA	FDA
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane	180.0910	-
Sodium sulfate	-	21 CFR 186.1797
Diammonium sulfate	180.0910	21 CFR 184.1143

16. OTHER INFORMATION, INCLUDING DATE OF PREPARATION OF THE LAST REVISION

Special Comments
None

Additional information

Global Automotive Declarable Substance List (GADSL)

Chemical name	Global Automotive Declarable Substance List Classifications	Global Automotive Declarable Substance List Thersholds
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane 100-97-0	Declarable Substance (FI)	0.1 %
Formaldehyde 50-00-0	Declarable Substance (FI) Prohibited Substance (FI) Declarable Substance (LR) Prohibited Substance (LR)	0 % 0.1 %

NFPA and HMIS Classifications

NFPA	**Health hazards** - 2	**Flammability** - 0	**Instability** - 0	**Physical and chemical properties** -
HMIS	**Health hazards** - 2 - *	**Flammability** - 0	**Physical hazards** - 0	**Personal protection** - X - I

Key or legend to abbreviations and acronyms used in the safety data sheet

NIOSH IDLH	*Immediately Dangerous to Life or Health*
ACGIH	ACGIH (American Conference of Governmental Industrial Hygienists)
NDF	*no data*

Legend - Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
MAC	Maximum Allowable Concentration	Ceiling	Ceiling Limit Value
X	Listed	Vacated	These values have no official status. The only binding levels of contaminants are those listed in the final OSHA PEL. These lists are for reference purposes only. Please note that some reference state regulations of these "liberated" exposure limits in their state regulations.
SKN*	Skin designation	SKN+	Skin sensitization
RSP+	Respiratory sensitization	**	Hazard Designation
C	Carcinogen	R	Reproductive toxicant
M	mutagen		

Prepared By	Hach Product Compliance Department
Issue Date	25-Jan-2021
Revision Date	25-Jan-2021
Revision Note	None

Disclaimer

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

End of Safety Data Sheet

SAFETY DATA SHEET

1. IDENTIFICATION

Product identifier
Product Name STABLCAL® FORMAZIN STANDARD 100 NTU

Other means of identification
Product Code(s) 2684901

Safety data sheet number M03412

Recommended use of the chemical and restrictions on use
Recommended Use Standard solution. Water Analysis.
Uses advised against Consumer use.
Restrictions on use For Laboratory Use Only.

Details of the supplier of the safety data sheet

Manufacturer Address
Hach Company P.O.Box 389 Loveland, CO 80539 USA +1(970) 669-3050

Emergency telephone number
+1(303) 623-5716 - 24 Hour Service

2. HAZARDS IDENTIFICATION

Classification

Regulatory Status
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Respiratory sensitization	Category 1
Skin sensitization	Category 1

Hazards not otherwise classified (HNOC)
Not applicable

Label elements

Signal word
Danger

Hazard statements

H317 - May cause an allergic skin reaction
H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled

Precautionary statements
P261 - Avoid breathing dust/fume/gas/mist/vapors/spray
P285 - In case of inadequate ventilation wear respiratory protection
P304 + P341 - IF INHALED: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing
P342 + P311 - If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician
P501 - Dispose of contents/ container to an approved waste disposal plant
P272 - Contaminated work clothing should not be allowed out of the workplace
P280 - Wear protective gloves, protective clothing, eye protection, and face protection
P302 + P352 - IF ON SKIN: Wash with plenty of soap and water
P333 + P313 - If skin irritation or rash occurs: Get medical advice/attention
P363 - Wash contaminated clothing before reuse

Other Hazards Known
None

3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance
Not applicable

Mixture

Chemical Family	Mixture.
Chemical nature	aqueous solution.

Percent ranges are used where confidential product information is applicable.

Chemical name	CAS No	Percent Range	HMRIC #
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane	100-97-0	<10%	-
Sodium sulfate	7757-82-6	<1%	-
Formaldehyde	50-00-0	<0.1%	-
Diammonium sulfate	7783-20-2	<0.1%	-

4. FIRST AID MEASURES

Description of first aid measures

General advice	Show this safety data sheet to the doctor in attendance.
Inhalation	May cause allergic respiratory reaction. If breathing has stopped, give artificial respiration. Get medical attention immediately. Remove to fresh air. Avoid direct contact with skin. Use barrier to give mouth-to-mouth resuscitation. Get immediate medical advice/attention.
Eye contact	Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a physician.
Skin contact	Wash with soap and water. May cause an allergic skin reaction. In the case of skin irritation or allergic reactions see a physician.
Ingestion	May produce an allergic reaction. Do NOT induce vomiting. Clean mouth with water and drink afterwards plenty of water. Never give anything by mouth to an unconscious person. Get immediate medical advice/attention.

Self-protection of the first aider	Ensure that medical personnel are aware of the material(s) involved, take precautions to protect themselves and prevent spread of contamination. Avoid contact with skin, eyes or clothing. Avoid direct contact with skin. Use barrier to give mouth-to-mouth resuscitation.

Most important symptoms and effects, both acute and delayed

Symptoms	May cause allergy or asthma symptoms or breathing difficulties if inhaled. Coughing and/ or wheezing. Itching. Rashes. Hives.

Indication of any immediate medical attention and special treatment needed

Note to physicians	May cause sensitization in susceptible persons. Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Unsuitable Extinguishing Media	Caution: Use of water spray when fighting fire may be inefficient.
Specific hazards arising from the chemical	May cause sensitization by inhalation and skin contact. Product is or contains a sensitizer. May cause sensitization by skin contact.
Hazardous combustion products	This material will not burn. Ammonia. Carbon monoxide. Formaldehyde. Nitrogen oxides (NOx).
Special protective equipment for fire-fighters	Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protection equipment.

6. ACCIDENTAL RELEASE MEASURES

U.S. Notice	Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance. Outside of the US, only persons properly qualified according to state or local regulations should respond to a spill involving chemicals.

Personal precautions, protective equipment and emergency procedures

Personal precautions	Avoid contact with skin, eyes or clothing. Ensure adequate ventilation. Use personal protective equipment as required. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak.
Other Information	Refer to protective measures listed in Sections 7 and 8.

Environmental precautions

Environmental precautions	Prevent further leakage or spillage if safe to do so.

Methods and material for containment and cleaning up

Methods for containment	Prevent further leakage or spillage if safe to do so.
Methods for cleaning up	Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust). Take up mechanically, placing in appropriate containers for disposal.

Prevention of secondary hazards Clean contaminated objects and areas thoroughly observing environmental regulations.

Reference to other sections See section 8 for more information. See section 13 for more information.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling Provide extract ventilation to points where emissions occur. Remove contaminated clothing and shoes. Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes or clothing. Ensure adequate ventilation. In case of insufficient ventilation, wear suitable respiratory equipment. Do not eat, drink or smoke when using this product. Take off contaminated clothing and wash before reuse.

Conditions for safe storage, including any incompatibilities

Storage Conditions Keep containers tightly closed in a dry, cool and well-ventilated place. Store locked up. Keep out of the reach of children.

Flammability class Not applicable

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines

Chemical name	ACGIH TLV	OSHA PEL	NIOSH
Formaldehyde CAS#: 50-00-0	STEL: 0.3 ppm TWA: 0.1 ppm	TWA: 0.75 ppm (vacated) TWA: 3 ppm (vacated) STEL: 10 ppm (vacated) Ceiling: 5 ppm STEL: 2 ppm	IDLH: 20 ppm Ceiling: 0.1 ppm 15 min TWA: 0.016 ppm

Appropriate engineering controls

Engineering Controls Showers
Eyewash stations
Ventilation systems.

Individual protection measures, such as personal protective equipment

Respiratory protection No protective equipment is needed under normal use conditions. If exposure limits are exceeded or irritation is experienced, ventilation and evacuation may be required. Wear breathing apparatus if exposed to vapors/dusts/aerosols.

Hand Protection Wear suitable gloves. Gloves must be inspected prior to use. The selected protective gloves have to satisfy the specifications of EU Directive 2016/425 and the standard EN 374 derived from it. Chemical resistant gloves made of butyl rubber or nitrile rubber category III according to EN 374-1:2016.

Eye/face protection Wear safety glasses with side shields (or goggles).

Skin and body protection Wear suitable protective clothing.

General Hygiene Considerations Avoid contact with skin, eyes or clothing. Wear suitable gloves and eye/face protection. Do not eat, drink or smoke when using this product. Remove and wash contaminated clothing and gloves, including the inside, before re-use.

Environmental exposure controls Local authorities should be advised if significant spillages cannot be contained. Do not allow into any sewer, on the ground or into any body of water.

Thermal hazards None under normal processing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state Liquid

Appearance	Turbid solution aqueous solution	**Color**	white
Odor	Odorless	**Odor threshold**	No data available

Property	**Values**	**Remarks • Method**
Molecular weight	No data available	
pH	8.26	@ 20 °C
Melting point/freezing point	~ 0 °C / 32 °F	
Boiling point / boiling range	~ 100 °C / 212 °F	
Evaporation rate	1 (water = 1)	
Vapor pressure	17.477 mm Hg / 2.33 kPa at 20 °C / 68 °F	
Relative vapor density	0.62	
Specific gravity (water = 1 / air = 1)	1.02	
Partition Coefficient (n-octanol/water)	Not applicable	
Soil Organic Carbon-Water Partition Coefficient	Not applicable	
Autoignition temperature	No data available	
Decomposition temperature	No data available	
Dynamic viscosity	No data available	
Kinematic viscosity	No data available	

Solubility(ies)

Water solubility

Water solubility classification	Water solubility	Water Solubility Temperature
Soluble	> 1000 mg/L	25 °C / 77 °F

Solubility in other solvents

Chemical Name	Solubility classification	Solubility	Solubility Temperature
None reported	No information available	No data available	No information available

Other information

Metal Corrosivity

Steel Corrosion Rate	No data available
Aluminum Corrosion Rate	No data available

Volatile Organic Compounds (VOC) Content
No information available See ingredients information below

Chemical name	CAS No	Volatile organic compounds (VOC) content	CAA (Clean Air Act)
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane	100-97-0	Not applicable	X
Sodium sulfate	7757-82-6	No data available	-
Formaldehyde	50-00-0	No data available	X
Diammonium sulfate	7783-20-2	No data available	-

Explosive properties

Upper explosion limit	No data available
Lower explosion limit	No data available

Flammable properties

Flash point	Not applicable

Flammability Limit in Air

Upper flammability limit:	No data available
Lower flammability limit:	No data available
Oxidizing properties	No data available.
Bulk density	No data available

10. STABILITY AND REACTIVITY

Reactivity
Not applicable.

Chemical stability
Stable under normal conditions.

Explosion data

Sensitivity to Mechanical Impact	None.
Sensitivity to Static Discharge	None.

Possibility of hazardous reactions
None under normal processing.

Hazardous polymerization
None under normal processing.

Conditions to avoid
None known based on information supplied.

Incompatible materials
Strong oxidizing agents, strong acids, and strong bases.

Hazardous decomposition products
Ammonia. Carbon monoxide. Formaldehyde. Nitrogen oxides. Sodium oxides. Sulfur oxides.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Product Information

Inhalation	May cause sensitization in susceptible persons.
Eye contact	No known effect based on information supplied.
Skin contact	May cause sensitization by skin contact. Repeated or prolonged skin contact may cause allergic reactions with susceptible persons.
Ingestion	May cause additional affects as listed under "Inhalation".
Symptoms	Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain, or flushing. Coughing and/ or wheezing. Itching. Rashes. Hives.

Acute toxicity
Based on available data, the classification criteria are not met

Product Acute Toxicity Data
No data available.

Ingredient Acute Toxicity Data
Test data reported below.

Oral Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rat LD_{50}	100 mg/kg	None reported	None reported	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)
Diammonium sulfate (<0.1%) CAS#: 7783-20-2	Rat LD_{50}	2840 mg/kg	None reported	None reported	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)

Dermal Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rabbit LD_{50}	270 mg/kg	None reported	None reported	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)

Inhalation (Dust/Mist) Exposure Route

Chemical name	Endpoint	Reported	Exposure	Toxicological effects	Key literature references and

	type	dose	time		sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rat LC$_{50}$	0.578 mg/L	4 hours	None reported	LOLI

Unknown Acute Toxicity
3.731E-05% of the mixture consists of ingredient(s) of unknown toxicity.

Acute Toxicity Estimations (ATE)

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral)	No information available
ATEmix (dermal)	No information available
ATEmix (inhalation-dust/mist)	No information available
ATEmix (inhalation-vapor)	No information available
ATEmix (inhalation-gas)	No information available

Skin corrosion/irritation
Based on available data, the classification criteria are not met.

Product Skin Corrosion/Irritation Data
No data available.

Ingredient Skin Corrosion/Irritation Data
Test data reported below.

Chemical name	Test method	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	OECD Test 404: Acute Dermal Corrosion/Irritation	Rabbit	500 mg	4 hours	Not corrosive or irritating to skin	ECHA (The European Chemicals Agency)
Sodium sulfate (<1%) CAS#: 7757-82-6	Standard Draize Test	Rabbit	500 mg	4 hours	Not corrosive or irritating to skin	ECHA (The European Chemicals Agency)
Formaldehyde (<0.1%) CAS#: 50-00-0	Standard Draize Test	Human	0.150 mg	72 hours	Corrosive to skin	RTECS (Registry of Toxic Effects of Chemical Substances)
Diammonium sulfate (<0.1%) CAS#: 7783-20-2	Standard Draize Test	Rabbit	800 mg	20 hours	Not corrosive or irritating to skin	ECHA (The European Chemicals Agency)

Serious eye damage/irritation
Based on available data, the classification criteria are not met.

Product Serious Eye Damage/Eye Irritation Data
No data available.

Ingredient Eye Damage/Eye Irritation Data
Test data reported below.

Chemical name	Test method	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyc	OECD Test 405:	Rabbit	100 mg	24 hours	Not corrosive or	ECHA (The European

lo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	Acute Eye Corrosion/Irritation				irritating to eyes	Chemicals Agency)
Sodium sulfate (<1%) CAS#: 7757-82-6	Standard Draize Test	Rabbit	90 mg	24 hours	Not corrosive or irritating to eyes	ECHA (The European Chemicals Agency)
Formaldehyde (<0.1%) CAS#: 50-00-0	Rinse Test	Human	1 ppm	6 minutes	Corrosive to eyes	RTECS (Registry of Toxic Effects of Chemical Substances)
Diammonium sulfate (<0.1%) CAS#: 7783-20-2	Standard Draize Test	Rabbit	0.050 mL	None reported	Not corrosive or irritating to eyes	ECHA (The European Chemicals Agency)

Respiratory or skin sensitization

May cause sensitization by inhalation. May cause sensitization by skin contact.

Product Sensitization Data

No data available.

Ingredient Sensitization Data

Test data reported below.

Skin Sensitization Exposure Route

Chemical name	Test method	Species	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	OECD Test No. 406: Skin Sensitization	Guinea pig	Confirmed to be a skin sensitizer	ECHA (The European Chemicals Agency)
Sodium sulfate (<1%) CAS#: 7757-82-6	OECD Test No. 406: Skin Sensitization	Guinea pig	Not confirmed to be a skin sensitizer	HSDB (Hazardous Substances Data Bank)
Formaldehyde (<0.1%) CAS#: 50-00-0	Patch test	Human	Confirmed to be a skin sensitizer	ERMA (New Zealands Environmental Risk Management Authority)

Respiratory Sensitization Exposure Route

Chemical name	Test method	Species	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	Based on human experience	Human	Confirmed to be a respiratory sensitizer	HSDB (Hazardous Substances Data Bank)
Formaldehyde (<0.1%) CAS#: 50-00-0	IgE Specific Immune Response Test	Guinea pig	Confirmed to be a respiratory sensitizer	CICAD (Concise International Chemical Assessment Documents)

STOT - single exposure

Based on available data, the classification criteria are not met.

Product Specific Target Organ Toxicity Single Exposure Data

No data available.

Ingredient Specific Target Organ Toxicity Single Exposure Data

Test data reported below.

Oral Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Human LD_{Lo}	70 mg/kg	None reported	**Gastrointestinal** **Kidney, Ureter, or Bladder** **Liver** Other changes Ulcerated stomach Other changes	RTECS (Registry of Toxic Effects of Chemical Substances)
Diammonium sulfate (<0.1%) CAS#: 7783-20-2	Man TD_{Lo}	1500 mg/kg	None reported	**Gastrointestinal** Gas	RTECS (Registry of Toxic Effects of Chemical Substances)

STOT - repeated exposure
Based on available data, the classification criteria are not met.

Product Specific Target Organ Toxicity Repeat Dose Data
No data available.

Ingredient Specific Target Organ Toxicity Repeat Exposure Data
Test data reported below.

Oral Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	Rat NOAEL	80 mg/kg	None reported	None reported	Vendor SDS

Inhalation (Dust/Mist) Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	Rat TC_{Lo}	350 mg/m^3	21 days	**Kidney, Ureter, or Bladder** Urine volume decreased or anuria **Nutritional and Gross Metabolic** Weight loss or decreased weight gain **Biochemical** Enzyme inhibition, induction, or change in blood or tissue levels (true cholinesterase)	RTECS (Registry of Toxic Effects of Chemical Substances)

Inhalation (Vapor) Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Human TC_{Lo}	0.017 mg/L	0.5 days	**Eye** **Lungs, Thorax, or Respiration** Lacrimation	RTECS (Registry of Toxic Effects of Chemical Substances)

				Other changes	

Carcinogenicity

Based on available data, the classification criteria are not met.

Product Carcinogenicity Data

No data available.

Ingredient Carcinogenicity Data

Test data reported below.

Chemical name	CAS No	ACGIH	IARC	NTP	OSHA
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane	100-97-0	-	-	-	-
Sodium sulfate	7757-82-6	-	-	-	-
Formaldehyde	50-00-0	A1	Group 1	Known	X
Diammonium sulfate	7783-20-2	-	-	-	-

Legend

ACGIH (American Conference of Governmental Industrial Hygienists)	A2 - Suspected Human Carcinogen
IARC (International Agency for Research on Cancer)	Group 1 - Carcinogenic to Humans
NTP (National Toxicology Program)	Known - Known Carcinogen
OSHA (Occupational Safety and Health Administration of the US Department of Labor)	X - Present

Inhalation (Vapor) Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rat	15 mg/L	78 weeks	**Olfaction** Tumors	RTECS (Registry of Toxic Effects of Chemical Substances)

Germ cell mutagenicity

Based on available data, the classification criteria are not met.

Product Germ Cell Mutagenicity *invitro* Data

No data available.

Ingredient Germ Cell Mutagenicity *invitro* Data

Test data reported below.

Chemical name	Test	Cell Strain	Reported dose	Exposure time	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	Cytogenetic analysis	Human HeLa Cell	1 mmol/L	None reported	Positive test result for mutagenicity	RTECS (Registry of Toxic Effects of Chemical Substances)

Product Germ Cell Mutagenicity *invivo* Data

No data available.

Ingredient Germ Cell Mutagenicity *invivo* Data

Test data reported below.

Oral Exposure Route

Chemical name	Test	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	Dominant lethal test	Mouse	25000 mg/kg	None reported	Positive test result for mutagenicity	RTECS (Registry of Toxic Effects of Chemical Substances)

Inhalation (Vapor) Exposure Route

Chemical name	Test	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Micronucleus test	Human	.000985 mg/L	8.5 years	Positive test result for mutagenicity	RTECS (Registry of Toxic Effects of Chemical Substances)

Reproductive toxicity
Based on available data, the classification criteria are not met.

Product Reproductive Toxicity Data
No data available.

Ingredient Reproductive Toxicity Data
Test data reported below.

Oral Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Sodium sulfate (<1%) CAS#: 7757-82-6	Mouse TD_{Lo}	14000 mg/kg	4 days	**Effects on Newborn** Other neonatal measures or effects	RTECS (Registry of Toxic Effects of Chemical Substances)

Inhalation (Vapor) Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rat TC_{Lo}	40 mg/L	14 days	**Effects on Embryo or Fetus** Fetotoxicity (except death e.g. stunted fetus)	RTECS (Registry of Toxic Effects of Chemical Substances)

Aspiration hazard
Based on available data, the classification criteria are not met.

12. ECOLOGICAL INFORMATION

Ecotoxicity	Based on available data, the classification criteria are not met.
Unknown aquatic toxicity	4E-05 % of the mixture consists of component(s) of unknown hazards to the aquatic environment.

Product Ecological Data

Aquatic Acute Toxicity
No data available.

Aquatic Chronic Toxicity

No data available.

Ingredient Ecological Data

Aquatic Acute Toxicity

Test data reported below.

Fish

Chemical name	Exposure time	Species	Endpoint type	Reported dose	Key literature references and sources for data
Sodium sulfate (<1%) CAS#: 7757-82-6	96 hours	None reported	LC_{50}	56 mg/L	IUCLID (The International Uniform Chemical Information Database)
Formaldehyde (<0.1%) CAS#: 50-00-0	96 hours	*Morone saxatilis*	LC_{50}	6.7 mg/L	PEEN (Pan European Ecological Network)
Diammonium sulfate (<0.1%) CAS#: 7783-20-2	96 hours	*Oncorhynchus mykiss*	LC_{50}	36.7 mg/L	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)

Crustacea

Chemical name	Exposure time	Species	Endpoint type	Reported dose	Key literature references and sources for data
Sodium sulfate (<1%) CAS#: 7757-82-6	48 Hours	*Daphnia magna*	EC_{50}	3150 mg/L	IUCLID (The International Uniform Chemical Information Database)
Formaldehyde (<0.1%) CAS#: 50-00-0	48 Hours	*Daphnia pulex*	EC_{50}	5.8 mg/L	PEEN (Pan European Ecological Network)
Diammonium sulfate (<0.1%) CAS#: 7783-20-2	48 Hours	None reported	LC_{50}	14 mg/L	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)

Aquatic Chronic Toxicity

No data available.

Persistence and degradability

Product Biodegradability Data

No data available.

Product Bioaccumulation Data

No data available.

Partition Coefficient (n-octanol/water) Not applicable

Mobility

Soil Organic Carbon-Water Partition Coefficient Not applicable

Other adverse effects

No information available

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Waste from residues/unused products	Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.
Contaminated packaging	Do not reuse empty containers.
US EPA Waste Number	Not applicable, U122

Chemical name	RCRA	RCRA - Basis for Listing	RCRA - D Series Wastes	RCRA - U Series Wastes
Formaldehyde 50-00-0	U122	Included in waste streams: K009, K010, K038, K040, K156, K157	-	U122

14. TRANSPORT INFORMATION

DOT	Not regulated
TDG	Not regulated
IATA	Not regulated
IMDG	Not regulated
Note:	No special precautions necessary.

Additional information

15. REGULATORY INFORMATION

National Inventories

TSCA	Complies
DSL/NDSL	Complies

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

International Inventories

EINECS/ELINCS	Complies
ENCS	Does not comply
IECSC	Complies
KECL - Existing substances	Complies
PICCS	Does not comply
TCSI	Complies
AICS	Complies
NZIoC	Complies

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
TCSI - Taiwan Chemical Substances Inventory
AICS - Australian Inventory of Chemical Substances
NZIoC - New Zealand Inventory of Chemicals

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 %
Formaldehyde (CAS #: 50-00-0)	0.1
Diammonium sulfate (CAS #: 7783-20-2)	1.0

SARA 311/312 Hazard Categories

Acute health hazard	Yes
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
Formaldehyde 50-00-0	100 lb	-	-	X

CERCLA

Chemical name	Hazardous Substances RQs	CERCLA/SARA RQ	Reportable Quantity (RQ)
Formaldehyde 50-00-0	100 lb	100 lb	RQ 100 lb final RQ RQ 45.4 kg final RQ

U.S. - Department of Homeland Security - Chemical Facility Anti-Terrorism Standards (CFATS) - Security Issues

Chemical name	U.S. - Department of Homeland Security - Chemical Facility Anti-Terrorism Standards (CFATS) - Security Issues
Formaldehyde (<0.1%) CAS#: 50-00-0	Release - Toxic (solution)

US State Regulations

California Proposition 65

This product contains the following Proposition 65 chemicals

Chemical name	California Proposition 65
Formaldehyde (CAS #: 50-00-0)	Carcinogen

⚠**WARNING:** This product can expose you to chemicals including Formaldehyde, which is known to the State of California to cause cancer.
For more information, go to http://www.P65Warnings.ca.gov

IMERC: Not applicable

U.S. State Right-to-Know Regulations

This product may contain substances regulated by state right-to-know regulations.

Chemical name	New Jersey	Massachusetts	Pennsylvania
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane 100-97-0	X	-	-
Sodium sulfate 7757-82-6	-	X	X
Formaldehyde 50-00-0	X	X	X
Diammonium sulfate 7783-20-2	-	X	X

U.S. EPA Label Information

Chemical name	FIFRA	FDA
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane	180.0910	-
Sodium sulfate	-	21 CFR 186.1797
Diammonium sulfate	180.0910	21 CFR 184.1143

16. OTHER INFORMATION, INCLUDING DATE OF PREPARATION OF THE LAST REVISION

Special Comments
None

Additional information

Global Automotive Declarable Substance List (GADSL)

Chemical name	Global Automotive Declarable Substance List Classifications	Global Automotive Declarable Substance List Thersholds
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane 100-97-0	Declarable Substance (FI)	0.1 %
Formaldehyde 50-00-0	Declarable Substance (FI) Prohibited Substance (FI) Declarable Substance (LR) Prohibited Substance (LR)	0 % 0.1 %

NFPA and HMIS Classifications

NFPA	**Health hazards** - 2	**Flammability** - 0	**Instability** - 0	**Physical and chemical properties** -
HMIS	**Health hazards** - 2 - *	**Flammability** - 0	**Physical hazards** - 0	**Personal protection** - X - I

Key or legend to abbreviations and acronyms used in the safety data sheet

NIOSH IDLH	*Immediately Dangerous to Life or Health*
ACGIH	ACGIH (American Conference of Governmental Industrial Hygienists)
NDF	*no data*

Legend - Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
MAC	Maximum Allowable Concentration	Ceiling	Ceiling Limit Value
X	Listed	Vacated	These values have no official status. The only binding levels of contaminants are those listed in the final OSHA PEL. These lists are for reference purposes only. Please note that some reference state regulations of these "liberated" exposure limits in their state regulations.
SKN*	Skin designation	SKN+	Skin sensitization
RSP+	Respiratory sensitization	**	Hazard Designation
C	Carcinogen	R	Reproductive toxicant
M	mutagen		

Prepared By	Hach Product Compliance Department
Issue Date	25-Jan-2021
Revision Date	25-Jan-2021
Revision Note	None

Disclaimer

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

End of Safety Data Sheet

SAFETY DATA SHEET

1. IDENTIFICATION

Product identifier

Product Name	STABLCAL® FORMAZIN STANDARD 800 NTU

Other means of identification

Product Code(s)	2660501
Safety data sheet number	M03413

Recommended use of the chemical and restrictions on use

Recommended Use	Laboratory Use. Standard solution.
Uses advised against	Consumer use.
Restrictions on use	For Laboratory Use Only.

Details of the supplier of the safety data sheet

Manufacturer Address
Hach Company P.O.Box 389 Loveland, CO 80539 USA +1(970) 669-3050

Emergency telephone number
+1(303) 623-5716 - 24 Hour Service

2. HAZARDS IDENTIFICATION

Classification

Regulatory Status
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Respiratory sensitization	Category 1
Skin sensitization	Category 1

Hazards not otherwise classified (HNOC)
Not applicable

Label elements

Signal word
Danger

Hazard statements

H317 - May cause an allergic skin reaction
H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled

Precautionary statements
P261 - Avoid breathing dust/fume/gas/mist/vapors/spray
P285 - In case of inadequate ventilation wear respiratory protection
P304 + P341 - IF INHALED: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing
P342 + P311 - If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician
P501 - Dispose of contents/ container to an approved waste disposal plant
P272 - Contaminated work clothing should not be allowed out of the workplace
P280 - Wear protective gloves, protective clothing, eye protection, and face protection
P302 + P352 - IF ON SKIN: Wash with plenty of soap and water
P333 + P313 - If skin irritation or rash occurs: Get medical advice/attention
P363 - Wash contaminated clothing before reuse

Other Hazards Known
None

3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance
Not applicable

Mixture

Chemical Family Mixture.
Chemical nature aqueous solution.

Percent ranges are used where confidential product information is applicable.

Chemical name	CAS No	Percent Range	HMRIC #
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane	100-97-0	<10%	-
Sodium sulfate	7757-82-6	<1%	-
Formaldehyde	50-00-0	<0.1%	-
Diammonium sulfate	7783-20-2	<0.1%	-

4. FIRST AID MEASURES

Description of first aid measures

General advice	Show this safety data sheet to the doctor in attendance.
Inhalation	May cause allergic respiratory reaction. If breathing has stopped, give artificial respiration. Get medical attention immediately. Remove to fresh air. Avoid direct contact with skin. Use barrier to give mouth-to-mouth resuscitation. Get immediate medical advice/attention.
Eye contact	Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a physician.
Skin contact	Wash with soap and water. May cause an allergic skin reaction. In the case of skin irritation or allergic reactions see a physician.
Ingestion	May produce an allergic reaction. Do NOT induce vomiting. Clean mouth with water and drink afterwards plenty of water. Never give anything by mouth to an unconscious person. Get immediate medical advice/attention.

Self-protection of the first aider	Ensure that medical personnel are aware of the material(s) involved, take precautions to protect themselves and prevent spread of contamination. Avoid contact with skin, eyes or clothing. Avoid direct contact with skin. Use barrier to give mouth-to-mouth resuscitation.

Most important symptoms and effects, both acute and delayed

Symptoms	May cause allergy or asthma symptoms or breathing difficulties if inhaled. Coughing and/ or wheezing. Itching. Rashes. Hives.

Indication of any immediate medical attention and special treatment needed

Note to physicians	May cause sensitization in susceptible persons. Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Unsuitable Extinguishing Media	Caution: Use of water spray when fighting fire may be inefficient.
Specific hazards arising from the chemical	Product is or contains a sensitizer. May cause sensitization by inhalation and skin contact. May cause sensitization by skin contact.
Hazardous combustion products	This material will not burn. Carbon dioxide (CO2). Carbon monoxide. Nitrogen oxides (NOx). Formaldehyde.
Special protective equipment for fire-fighters	Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protection equipment.

6. ACCIDENTAL RELEASE MEASURES

U.S. Notice	Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance. Outside of the US, only persons properly qualified according to state or local regulations should respond to a spill involving chemicals.

Personal precautions, protective equipment and emergency procedures

Personal precautions	Avoid contact with skin, eyes or clothing. Ensure adequate ventilation. Use personal protective equipment as required. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak.
Other Information	Refer to protective measures listed in Sections 7 and 8.

Environmental precautions

Environmental precautions	Prevent further leakage or spillage if safe to do so.

Methods and material for containment and cleaning up

Methods for containment	Prevent further leakage or spillage if safe to do so.
Methods for cleaning up	Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust). Take up mechanically, placing in appropriate containers for disposal.

Prevention of secondary hazards Clean contaminated objects and areas thoroughly observing environmental regulations.

Reference to other sections See section 8 for more information. See section 13 for more information.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes or clothing. Ensure adequate ventilation. Provide extract ventilation to points where emissions occur. In case of insufficient ventilation, wear suitable respiratory equipment. Do not eat, drink or smoke when using this product. Remove contaminated clothing and shoes. Take off contaminated clothing and wash before reuse.

Conditions for safe storage, including any incompatibilities

Storage Conditions Keep containers tightly closed in a dry, cool and well-ventilated place. Store locked up. Keep out of the reach of children.

Flammability class Not applicable

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines

Chemical name	ACGIH TLV	OSHA PEL	NIOSH
Formaldehyde CAS#: 50-00-0	STEL: 0.3 ppm TWA: 0.1 ppm	TWA: 0.75 ppm (vacated) TWA: 3 ppm (vacated) STEL: 10 ppm (vacated) Ceiling: 5 ppm STEL: 2 ppm	IDLH: 20 ppm Ceiling: 0.1 ppm 15 min TWA: 0.016 ppm

Appropriate engineering controls

Engineering Controls
Showers
Eyewash stations
Ventilation systems.

Individual protection measures, such as personal protective equipment

Respiratory protection No protective equipment is needed under normal use conditions. If exposure limits are exceeded or irritation is experienced, ventilation and evacuation may be required.

Hand Protection Wear suitable gloves. Gloves must be inspected prior to use. The selected protective gloves have to satisfy the specifications of EU Directive 2016/425 and the standard EN 374 derived from it. Chemical resistant gloves made of butyl rubber or nitrile rubber category III according to EN 374-1:2016.

Eye/face protection Wear safety glasses with side shields (or goggles).

Skin and body protection Wear suitable protective clothing.

General Hygiene Considerations Avoid contact with skin, eyes or clothing. Wear suitable gloves and eye/face protection. Do not eat, drink or smoke when using this product. Remove and wash contaminated clothing and gloves, including the inside, before re-use.

Environmental exposure controls	Local authorities should be advised if significant spillages cannot be contained. Do not allow into any sewer, on the ground or into any body of water.
Thermal hazards	None under normal processing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Liquid		
Appearance	Turbid solution aqueous solution	**Color**	white
Odor	Odorless	**Odor threshold**	No data available

Property	Values	Remarks • Method
Molecular weight	No data available	
pH	7.36	@ 20 °C
Melting point/freezing point	~ 0 °C / 32 °F	
Boiling point / boiling range	~ 100 °C / 212 °F	
Evaporation rate	1 (water = 1)	
Vapor pressure	17.477 mm Hg / 2.33 kPa at 20 °C / 68 °F	
Relative vapor density	0.62	
Specific gravity (water = 1 / air = 1)	1.02	
Partition Coefficient (n-octanol/water)	Not applicable	
Soil Organic Carbon-Water Partition Coefficient	Not applicable	
Autoignition temperature	No data available	
Decomposition temperature	No data available	
Dynamic viscosity	No data available	
Kinematic viscosity	No data available	

Solubility(ies)

Water solubility

Water solubility classification	Water solubility	Water Solubility Temperature
Soluble	> 1000 mg/L	25 °C / 77 °F

Solubility in other solvents

Chemical Name	Solubility classification	Solubility	Solubility Temperature
None reported	No information available	No data available	No information available

Other information

Metal Corrosivity

Steel Corrosion Rate	No data available
Aluminum Corrosion Rate	No data available

Volatile Organic Compounds (VOC) Content
No information available See ingredients information below

Chemical name	CAS No	Volatile organic compounds (VOC) content	CAA (Clean Air Act)
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane	100-97-0	Not applicable	X
Sodium sulfate	7757-82-6	No data available	-
Formaldehyde	50-00-0	No data available	X
Diammonium sulfate	7783-20-2	No data available	-

Explosive properties

Upper explosion limit	No data available
Lower explosion limit	No data available

Flammable properties

Flash point	No data available

Flammability Limit in Air

Upper flammability limit:	No data available
Lower flammability limit:	No data available
Oxidizing properties	No data available.
Bulk density	No data available

10. STABILITY AND REACTIVITY

Reactivity
Not applicable.

Chemical stability
Stable under normal conditions.

Explosion data
Sensitivity to Mechanical Impact None.
Sensitivity to Static Discharge None.

Possibility of hazardous reactions
None under normal processing.

Hazardous polymerization
None under normal processing.

Conditions to avoid
None known based on information supplied.

Incompatible materials

Strong oxidizing agents, strong acids, and strong bases.

Hazardous decomposition products
Ammonia. Carbon monoxide. Formaldehyde. Nitrogen oxides. Sodium oxides. Sulfur oxides.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Product Information

Inhalation	May cause sensitization in susceptible persons.
Eye contact	No known effect based on information supplied.
Skin contact	Repeated or prolonged skin contact may cause allergic reactions with susceptible persons. May cause sensitization by skin contact.
Ingestion	May cause additional affects as listed under "Inhalation".
Symptoms	Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain, or flushing. Coughing and/ or wheezing. Itching. Rashes. Hives.

Acute toxicity
Based on available data, the classification criteria are not met

Product Acute Toxicity Data
No data available.

Ingredient Acute Toxicity Data
Test data reported below.

Oral Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rat LD_{50}	100 mg/kg	None reported	None reported	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)
Diammonium sulfate (<0.1%) CAS#: 7783-20-2	Rat LD_{50}	2840 mg/kg	None reported	None reported	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)

Dermal Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rabbit LD_{50}	270 mg/kg	None reported	None reported	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)

Inhalation (Dust/Mist) Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data

Formaldehyde (<0.1%) CAS#: 50-00-0	Rat LC$_{50}$	0.578 mg/L	4 hours	None reported	LOLI

Unknown Acute Toxicity

0% of the mixture consists of ingredient(s) of unknown toxicity.

Acute Toxicity Estimations (ATE)

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral)	No information available
ATEmix (dermal)	No information available
ATEmix (inhalation-dust/mist)	No information available
ATEmix (inhalation-vapor)	No information available
ATEmix (inhalation-gas)	No information available

Skin corrosion/irritation

Based on available data, the classification criteria are not met.

Product Skin Corrosion/Irritation Data

No data available.

Ingredient Skin Corrosion/Irritation Data

Test data reported below.

Chemical name	Test method	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	OECD Test 404: Acute Dermal Corrosion/Irritation	Rabbit	500 mg	4 hours	Not corrosive or irritating to skin	ECHA (The European Chemicals Agency)
Sodium sulfate (<1%) CAS#: 7757-82-6	Standard Draize Test	Rabbit	500 mg	4 hours	Not corrosive or irritating to skin	ECHA (The European Chemicals Agency)
Formaldehyde (<0.1%) CAS#: 50-00-0	Standard Draize Test	Human	0.150 mg	72 hours	Corrosive to skin	RTECS (Registry of Toxic Effects of Chemical Substances)
Diammonium sulfate (<0.1%) CAS#: 7783-20-2	Standard Draize Test	Rabbit	800 mg	20 hours	Not corrosive or irritating to skin	ECHA (The European Chemicals Agency)

Serious eye damage/irritation

Based on available data, the classification criteria are not met.

Product Serious Eye Damage/Eye Irritation Data

No data available.

Ingredient Eye Damage/Eye Irritation Data

Test data reported below.

Chemical name	Test method	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decan	OECD Test 405: Acute Eye	Rabbit	100 mg	24 hours	Not corrosive or irritating to eyes	ECHA (The European Chemicals Agency)

e (<10%) CAS#: 100-97-0	Corrosion/Irritation					
Sodium sulfate (<1%) CAS#: 7757-82-6	Standard Draize Test	Rabbit	90 mg	24 hours	Not corrosive or irritating to eyes	ECHA (The European Chemicals Agency)
Formaldehyde (<0.1%) CAS#: 50-00-0	Rinse Test	Human	1 ppm	6 minutes	Corrosive to eyes	RTECS (Registry of Toxic Effects of Chemical Substances)
Diammonium sulfate (<0.1%) CAS#: 7783-20-2	Standard Draize Test	Rabbit	0.050 mL	None reported	Not corrosive or irritating to eyes	ECHA (The European Chemicals Agency)

Respiratory or skin sensitization

May cause sensitization by inhalation. May cause sensitization by skin contact.

Product Sensitization Data

No data available.

Ingredient Sensitization Data

Test data reported below.

Skin Sensitization Exposure Route

Chemical name	Test method	Species	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	OECD Test No. 406: Skin Sensitization	Guinea pig	Confirmed to be a skin sensitizer	ECHA (The European Chemicals Agency)
Sodium sulfate (<1%) CAS#: 7757-82-6	OECD Test No. 406: Skin Sensitization	Guinea pig	Not confirmed to be a skin sensitizer	HSDB (Hazardous Substances Data Bank)
Formaldehyde (<0.1%) CAS#: 50-00-0	Patch test	Human	Confirmed to be a skin sensitizer	ERMA (New Zealands Environmental Risk Management Authority)

Respiratory Sensitization Exposure Route

Chemical name	Test method	Species	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	Based on human experience	Human	Confirmed to be a respiratory sensitizer	HSDB (Hazardous Substances Data Bank)
Formaldehyde (<0.1%) CAS#: 50-00-0	IgE Specific Immune Response Test	Guinea pig	Confirmed to be a respiratory sensitizer	CICAD (Concise International Chemical Assessment Documents)

STOT - single exposure

Based on available data, the classification criteria are not met.

Product Specific Target Organ Toxicity Single Exposure Data

No data available.

Ingredient Specific Target Organ Toxicity Single Exposure Data

Test data reported below.

Oral Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Human LD_{Lo}	70 mg/kg	None reported	**Gastrointestinal** **Kidney, Ureter, or Bladder** **Liver** Other changes Ulcerated stomach Other changes	RTECS (Registry of Toxic Effects of Chemical Substances)
Diammonium sulfate (<0.1%) CAS#: 7783-20-2	Man TD_{Lo}	1500 mg/kg	None reported	**Gastrointestinal** Gas	RTECS (Registry of Toxic Effects of Chemical Substances)

STOT - repeated exposure
Based on available data, the classification criteria are not met.

Product Specific Target Organ Toxicity Repeat Dose Data
No data available.

Ingredient Specific Target Organ Toxicity Repeat Exposure Data
Test data reported below.

Oral Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	Rat NOAEL	80 mg/kg	None reported	None reported	Vendor SDS

Inhalation (Dust/Mist) Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	Rat TC_{Lo}	350 mg/m³	21 days	**Kidney, Ureter, or Bladder** Urine volume decreased or anuria **Nutritional and Gross Metabolic** Weight loss or decreased weight gain **Biochemical** Enzyme inhibition, induction, or change in blood or tissue levels (true cholinesterase)	RTECS (Registry of Toxic Effects of Chemical Substances)

Inhalation (Vapor) Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Human TC_{Lo}	0.017 mg/L	0.5 days	**Eye** **Lungs, Thorax, or Respiration** Lacrimation Other changes	RTECS (Registry of Toxic Effects of Chemical Substances)

Carcinogenicity

Based on available data, the classification criteria are not met.

Product Carcinogenicity Data
No data available.

Ingredient Carcinogenicity Data
Test data reported below.

Chemical name	CAS No	ACGIH	IARC	NTP	OSHA
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane	100-97-0	-	-	-	-
Sodium sulfate	7757-82-6	-	-	-	-
Formaldehyde	50-00-0	A1	Group 1	Known	X
Diammonium sulfate	7783-20-2	-	-	-	-

Legend

ACGIH (American Conference of Governmental Industrial Hygienists)	A2 - Suspected Human Carcinogen A1 - Known Human Carcinogen
IARC (International Agency for Research on Cancer)	Group 1 - Carcinogenic to Humans
NTP (National Toxicology Program)	Known - Known Carcinogen
OSHA (Occupational Safety and Health Administration of the US Department of Labor)	X - Present

Inhalation (Vapor) Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rat	15 mg/L	78 weeks	**Olfaction** Tumors	RTECS (Registry of Toxic Effects of Chemical Substances)

Germ cell mutagenicity

Based on available data, the classification criteria are not met.

Product Germ Cell Mutagenicity *invitro* Data
No data available.

Ingredient Germ Cell Mutagenicity *invitro* Data
Test data reported below.

Chemical name	Test	Cell Strain	Reported dose	Exposure time	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	Cytogenetic analysis	Human HeLa Cell	1 mmol/L	None reported	Positive test result for mutagenicity	RTECS (Registry of Toxic Effects of Chemical Substances)

Product Germ Cell Mutagenicity *invivo* Data
No data available.

Ingredient Germ Cell Mutagenicity *invivo* Data
Test data reported below.

Oral Exposure Route

Chemical name	Test	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane (<10%) CAS#: 100-97-0	Dominant lethal test	Mouse	25000 mg/kg	None reported	Positive test result for mutagenicity	RTECS (Registry of Toxic Effects of Chemical Substances)

Inhalation (Vapor) Exposure Route

Chemical name	Test	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Micronucleus test	Human	.000985 mg/L	8.5 years	Positive test result for mutagenicity	RTECS (Registry of Toxic Effects of Chemical Substances)

Reproductive toxicity
Based on available data, the classification criteria are not met.

Product Reproductive Toxicity Data
No data available.

Ingredient Reproductive Toxicity Data
Test data reported below.

Oral Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Sodium sulfate (<1%) CAS#: 7757-82-6	Mouse TD_{Lo}	14000 mg/kg	4 days	**Effects on Newborn** Other neonatal measures or effects	RTECS (Registry of Toxic Effects of Chemical Substances)

Inhalation (Vapor) Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Formaldehyde (<0.1%) CAS#: 50-00-0	Rat TC_{Lo}	40 mg/L	14 days	**Effects on Embryo or Fetus** Fetotoxicity (except death e.g. stunted fetus)	RTECS (Registry of Toxic Effects of Chemical Substances)

Aspiration hazard
Based on available data, the classification criteria are not met.

12. ECOLOGICAL INFORMATION

Ecotoxicity	Based on available data, the classification criteria are not met.
Unknown aquatic toxicity	0 % of the mixture consists of component(s) of unknown hazards to the aquatic environment.

Product Ecological Data

Aquatic Acute Toxicity
No data available.

Aquatic Chronic Toxicity
No data available.

Ingredient Ecological Data

Aquatic Acute Toxicity
Test data reported below.

Fish

Chemical name	Exposure time	Species	Endpoint type	Reported dose	Key literature references and sources for data
Sodium sulfate (<1%) CAS#: 7757-82-6	96 hours	None reported	LC_{50}	56 mg/L	IUCLID (The International Uniform Chemical Information Database)
Formaldehyde (<0.1%) CAS#: 50-00-0	96 hours	*Morone saxatilis*	LC_{50}	6.7 mg/L	PEEN (Pan European Ecological Network)
Diammonium sulfate (<0.1%) CAS#: 7783-20-2	96 hours	*Oncorhynchus mykiss*	LC_{50}	36.7 mg/L	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)

Crustacea

Chemical name	Exposure time	Species	Endpoint type	Reported dose	Key literature references and sources for data
Sodium sulfate (<1%) CAS#: 7757-82-6	48 Hours	*Daphnia magna*	EC_{50}	3150 mg/L	IUCLID (The International Uniform Chemical Information Database)
Formaldehyde (<0.1%) CAS#: 50-00-0	48 Hours	*Daphnia pulex*	EC_{50}	5.8 mg/L	PEEN (Pan European Ecological Network)
Diammonium sulfate (<0.1%) CAS#: 7783-20-2	48 Hours	None reported	LC_{50}	14 mg/L	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)

Aquatic Chronic Toxicity
No data available.

Persistence and degradability

Product Biodegradability Data
No data available.

Product Bioaccumulation Data
No data available.

Partition Coefficient (n-octanol/water) Not applicable

Mobility

Soil Organic Carbon-Water Partition Coefficient Not applicable

Other adverse effects
No information available

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Waste from residues/unused products	Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.
Contaminated packaging	Do not reuse empty containers.
US EPA Waste Number	U122

Chemical name	RCRA	RCRA - Basis for Listing	RCRA - D Series Wastes	RCRA - U Series Wastes
Formaldehyde 50-00-0	U122	Included in waste streams: K009, K010, K038, K040, K156, K157	-	U122

14. TRANSPORT INFORMATION

DOT	Not regulated
Special Provisions	
TDG	Not regulated
IATA	Not regulated
IMDG	Not regulated
Note:	No special precautions necessary.

Additional information

15. REGULATORY INFORMATION

National Inventories

TSCA	Complies
DSL/NDSL	Complies

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

International Inventories

EINECS/ELINCS	Complies
ENCS	Does not comply
IECSC	Complies
KECL - Existing substances	Complies
PICCS	Does not comply
TCSI	Complies
AICS	Complies
NZIoC	Complies

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
TCSI - Taiwan Chemical Substances Inventory
AICS - Australian Inventory of Chemical Substances
NZIoC - New Zealand Inventory of Chemicals

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 %
Formaldehyde (CAS #: 50-00-0)	0.1
Diammonium sulfate (CAS #: 7783-20-2)	1.0

SARA 311/312 Hazard Categories

Acute health hazard	Yes
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
Formaldehyde 50-00-0	100 lb	-	-	X

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	Reportable Quantity (RQ)
Formaldehyde 50-00-0	100 lb	100 lb	RQ 100 lb final RQ RQ 45.4 kg final RQ

U.S. - Department of Homeland Security - Chemical Facility Anti-Terrorism Standards (CFATS) - Security Issues

Chemical name	U.S. - Department of Homeland Security - Chemical Facility Anti-Terrorism Standards (CFATS) - Security Issues
Formaldehyde (<0.1%) CAS#: 50-00-0	Release - Toxic (solution)

US State Regulations

California Proposition 65

This product contains the following Proposition 65 chemicals

Chemical name	California Proposition 65
Formaldehyde (CAS #: 50-00-0)	Carcinogen

⚠**WARNING:** This product can expose you to chemicals including Formaldehyde, which is known to the State of California to cause cancer.

For more information, go to http://www.P65Warnings.ca.gov

IMERC: Not applicable

U.S. State Right-to-Know Regulations

This product may contain substances regulated by state right-to-know regulations.

Chemical name	New Jersey	Massachusetts	Pennsylvania
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane 100-97-0	X	-	-
Sodium sulfate 7757-82-6	-	X	X
Formaldehyde 50-00-0	X	X	X
Diammonium sulfate 7783-20-2	-	X	X

U.S. EPA Label Information

Chemical name	FIFRA	FDA
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane	180.0910	-
Sodium sulfate	-	21 CFR 186.1797
Diammonium sulfate	180.0910	21 CFR 184.1143

16. OTHER INFORMATION, INCLUDING DATE OF PREPARATION OF THE LAST REVISION

Special Comments
None

Additional information

Global Automotive Declarable Substance List (GADSL)

Chemical name	Global Automotive Declarable Substance List Classifications	Global Automotive Declarable Substance List Thersholds
1,3,5,7-Tetraazatricyclo[3.3.1.1(3,7)]decane 100-97-0	Declarable Substance (FI)	0.1 %
Formaldehyde 50-00-0	Declarable Substance (FI) Prohibited Substance (FI) Declarable Substance (LR) Prohibited Substance (LR)	0 % 0.1 %

NFPA and HMIS Classifications

NFPA	**Health hazards** - 2	**Flammability** - 0	**Instability** - 0	**Physical and chemical properties** -
HMIS	**Health hazards** - 2 - *	**Flammability** - 0	**Physical hazards** - 0	**Personal protection** - X - I

Key or legend to abbreviations and acronyms used in the safety data sheet

NIOSH IDLH	*Immediately Dangerous to Life or Health*

ACGIH	ACGIH (American Conference of Governmental Industrial Hygienists)
NDF	*no data*

Legend - Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
MAC	Maximum Allowable Concentration	Ceiling	Ceiling Limit Value
X	Listed	Vacated	These values have no official status. The only binding levels of contaminants are those listed in the final OSHA PEL. These lists are for reference purposes only. Please note that some reference state regulations of these "liberated" exposure limits in their state regulations.
SKN*	Skin designation	SKN+	Skin sensitization
RSP+	Respiratory sensitization	**	Hazard Designation
C	Carcinogen	R	Reproductive toxicant
M	mutagen		

Prepared By	Hach Product Compliance Department
Issue Date	25-Jan-2021
Revision Date	25-Jan-2021
Revision Note	None

Disclaimer

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

End of Safety Data Sheet

SAFETY DATA SHEET

Issue Date 13-May-2019 **Revision Date** 13-May-2019 **Version** 2

1. Identification

Product identifier

Product Name Dissolved Oxygen Probe Electrolyte Solution

Other means of identification

Product Code(s) 2759123

Recommended use of the chemical and restrictions on use

Recommended Use Reference electrode solution.

Restrictions on use For Laboratory Use Only.

Uses advised against Consumer use

Details of the supplier of the safety data sheet

Manufacturer Address
Hach Company P.O.Box 389 Loveland, CO 80539 USA +1(970) 669-3050

Emergency telephone number

Emergency Telephone +1(303) 623-5716 - 24 Hour Service

2. Hazards identification

Classification

Respiratory sensitization	Category 1 - (H334)
Skin sensitization	Category 1 - (H317)

Label elements

Signal word - Danger

Hazard statements
H317 - May cause an allergic skin reaction
H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled

Health hazard

Precautionary statements
P261 - Avoid breathing dust/fume/gas/mist/vapors/spray
P284 - In case of inadequate ventilation wear respiratory protection
P304 + P340 - IF INHALED: Remove person to fresh air and keep comfortable for breathing
P342 + P311 - If experiencing respiratory symptoms: Call a POISON CENTER or doctor
P501 - Dispose of contents/ container to an approved waste disposal plant
P272 - Contaminated work clothing should not be allowed out of the workplace
P280 - Wear protective gloves/protective clothing/eye protection/face protection
P302 + P352 - IF ON SKIN: Wash with plenty of water and soap
P333 + P313 - If skin irritation or rash occurs: Get medical advice/attention
P362 + P364 - Take off contaminated clothing and wash it before reuse

Other Hazards Known
Not applicable

3. Composition/information on ingredients

Substance

Not applicable.

Mixture

Chemical Family Aqueous solution of organic solvents.

Chemical nature aqueous solution.

Chemical name	CAS No.	Synonyms	Percent Range
1,2,3-Propanetriol	56-81-5	Glycerin	20 - 30%
Glutaraldehyde	111-30-8	5-Oxopentanal	<1%

4. First aid measures

Description of first aid measures

General advice Show this safety data sheet to the doctor in attendance.

Inhalation May cause allergic respiratory reaction. If breathing has stopped, give artificial respiration. Get medical attention immediately. Remove to fresh air. Avoid direct contact with skin. Use barrier to give mouth-to-mouth resuscitation. Get immediate medical advice/attention.

Eye contact Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a physician.

Skin contact Wash with soap and water. May cause an allergic skin reaction. In the case of skin irritation or allergic reactions see a physician.

Ingestion May produce an allergic reaction. Do NOT induce vomiting. Clean mouth with water and drink afterwards plenty of water. Never give anything by mouth to an unconscious person. Get immediate medical advice/attention.

Self-protection of the first aider Ensure that medical personnel are aware of the material(s) involved, take precautions to protect themselves and prevent spread of contamination. Avoid contact with skin, eyes or clothing. Avoid direct contact with skin. Use barrier to give mouth-to-mouth resuscitation. Use personal protective equipment as required. See section 8 for more information.

Most important symptoms and effects, both acute and delayed

Symptoms	May cause allergy or asthma symptoms or breathing difficulties if inhaled. Coughing and/ or wheezing. Itching. Rashes. Hives.

Indication of any immediate medical attention and special treatment needed

Note to physicians	May cause sensitization in susceptible persons. Treat symptomatically.

5. Fire-fighting measures

Suitable Extinguishing Media	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Unsuitable extinguishing media	CAUTION: Use of water spray when fighting fire may be inefficient.
Specific hazards arising from the chemical	Product is or contains a sensitizer. May cause sensitization by inhalation and skin contact. May cause sensitization by skin contact.
Hazardous combustion products	This material will not burn.
Explosion data	
Sensitivity to mechanical impact	None.
Sensitivity to static discharge	None.
Special protective actions for fire-fighters	Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protection equipment.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

Personal precautions	Avoid contact with skin, eyes or clothing. Ensure adequate ventilation. Use personal protective equipment as required. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak.
Other information	Refer to protective measures listed in Sections 7 and 8.

Environmental precautions

Environmental precautions	Prevent further leakage or spillage if safe to do so.

Methods and material for containment and cleaning up

Methods for containment	Prevent further leakage or spillage if safe to do so.
Methods for cleaning up	Pick up and transfer to properly labeled containers.
Prevention of secondary hazards	Clean contaminated objects and areas thoroughly observing environmental regulations.

7. Handling and storage

Precautions for safe handling

Advice on safe handling	Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes or clothing. Ensure adequate ventilation. Provide extract ventilation to points

where emissions occur. In case of insufficient ventilation, wear suitable respiratory equipment. Do not eat, drink or smoke when using this product. Remove contaminated clothing and shoes. Take off contaminated clothing and wash before reuse.

Conditions for safe storage, including any incompatibilities

Storage Conditions Keep containers tightly closed in a dry, cool and well-ventilated place. Store locked up. Keep out of the reach of children.

8. Exposure controls/personal protection

Control parameters

Exposure Limits Based on NOM-010-STPS-2014.

Chemical name	TWA	STEL	Ceiling Limit Value
1,2,3-Propanetriol 56-81-5	10 mg/m³	-	-
Glutaraldehyde 111-30-8	-	-	0.05 ppm

Appropriate engineering controls

Engineering controls Showers
Eyewash stations
Ventilation systems.

Individual protection measures, such as personal protective equipment

Eye/face protection Wear safety glasses with side shields (or goggles).

Hand protection Wear suitable gloves.

Skin and body protection Wear suitable protective clothing.

Respiratory protection No protective equipment is needed under normal use conditions. If exposure limits are exceeded or irritation is experienced, ventilation and evacuation may be required.

General hygiene considerations Avoid contact with skin, eyes or clothing. Wear suitable gloves and eye/face protection. Do not eat, drink or smoke when using this product. Remove and wash contaminated clothing and gloves, including the inside, before re-use.

9. Physical and chemical properties

Information on basic physical and chemical properties

Physical state Liquid

Appearance	aqueous solution	**Color**	colorless
Odor	Odorless	**Odor threshold**	No information available

Property	Values	Remarks • Method
Molecular weight	No data available	
pH	7	
Melting point/freezing point	~ -14 °C / 6.8 °F	

Boiling point / boiling range	~ 104 °C / 219.2 °F
Evaporation rate	0.78 (water = 1)
Vapor pressure	0.3 mm Hg / 0.04 kPa at 20 °C / 68 °F
Vapor density (air = 1)	0.62
Specific gravity (water = 1 / air = 1)	1.1
Partition Coefficient (n-octanol/water)	Not applicable
Soil Organic Carbon-Water Partition Coefficient	Not applicable
Autoignition temperature	No data available
Decomposition temperature	No information available
Dynamic viscosity	No data available
Kinematic viscosity	No information available

Solubility(ies)

Water solubility

Water solubility classification	Water solubility	Water Solubility Temperature
Soluble	> 1000 mg/L	25 °C / 77 °F

Solubility in other solvents

Chemical Name	Solubility classification	Solubility	Solubility Temperature
None reported	No information available	No data available	No information available

Other Information

Metal Corrosivity

Steel Corrosion Rate	No data available
Aluminum Corrosion Rate	No data available

Volatile Organic Compounds (VOC) Content
See ingredients information below

Chemical name	CAS No.	Volatile organic compounds (VOC) content	CAA (Clean Air Act)
1,2,3-Propanetriol	56-81-5	No data available	X
Glutaraldehyde	111-30-8	100%	-

Explosive properties

Upper explosion limit	No data available
Lower explosion limit	No data available

Flammable properties

Flash point	No data available

Flammability Limit in Air

Upper flammability limit	No data available

Lower flammability limit	No data available
Oxidizing properties	No data available.
Bulk density	No data available

10. Stability and reactivity

Reactivity	No information available.
Chemical stability	Stable under normal conditions.
Possibility of Hazardous Reactions	None under normal processing.
Hazardous polymerization	Hazardous polymerization does not occur.
Conditions to avoid	None known based on information supplied.
Incompatible materials	None known based on information supplied.
Hazardous Decomposition Products	Acrolein. Carbon dioxide. Carbon monoxide. Chlorides. Potassium oxide. Hydrogen chloride. Hydrogen chloride.

11. Toxicological information

Information on Likely Routes of Exposure

Product Information

Inhalation	May cause sensitization in susceptible persons.
Eye contact	No known effect based on information supplied.
Skin contact	Repeated or prolonged skin contact may cause allergic reactions with susceptible persons. May cause sensitization by skin contact.
Ingestion	May cause additional affects as listed under "Inhalation".
Symptoms	Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain, or flushing. Coughing and/ or wheezing. Itching. Rashes. Hives.

Acute toxicity
Based on available data, the classification criteria are not met

Product Acute Toxicity Data
No data available.

Ingredient Acute Toxicity Data
Test data reported below.

Oral Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
1,2,3-Propanetriol (20 - 30%) CAS#: 56-81-5	Rat LD_{50}	12600 mg/kg	None reported	None reported	RTECS (Registry of Toxic Effects of Chemical Substances)

Glutaraldehyde (<1%) CAS#: 111-30-8	Rat LD_{50}	134 mg/kg	None reported	None reported	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)

Dermal Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
1,2,3-Propanetriol (20 - 30%) CAS#: 56-81-5	Rabbit LD_{50}	> 10000 mg/kg	None reported	None reported	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)

Inhalation (Dust/Mist) Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Glutaraldehyde (<1%) CAS#: 111-30-8	Rat LC_{50}	0.39 mg/L	4 hours	None reported	ECHA (The European Chemicals Agency)

Unknown acute toxicity
1E-06 % of the mixture consists of ingredient(s) of unknown toxicity.

1E-06 % of the mixture consists of ingredient(s) of unknown acute oral toxicity
1E-06 % of the mixture consists of ingredient(s) of unknown acute dermal toxicity
1E-06 % of the mixture consists of ingredient(s) of unknown acute inhalation toxicity (dust/mist)
1E-06 % of the mixture consists of ingredient(s) of unknown acute inhalation toxicity (vapor)
1E-06 % of the mixture consists of ingredient(s) of unknown acute inhalation toxicity (gas)

Acute Toxicity Estimations (ATE)

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral)	26,589.30
ATEmix (dermal)	No information available
ATEmix (inhalation-dust/mist)	325.00
ATEmix (inhalation-vapor)	No information available
ATEmix (inhalation-gas)	No information available

Skin corrosion/irritation
Based on available data, the classification criteria are not met.

Product Skin Corrosion/Irritation Data
No data available.

Ingredient Skin Corrosion/Irritation Data
Test data reported below.

Chemical name	Test method	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
Glutaraldehyde (<1%) CAS#: 111-30-8	OECD Test 404: Acute Dermal Corrosion/Irritation	Rabbit	0.5 mL	4 hours	Corrosive to skin	ECHA (The European Chemicals Agency)

Serious eye damage/eye irritation
Based on available data, the classification criteria are not met.

Product Serious Eye Damage/Eye Irritation Data

No data available.

Ingredient Eye Damage/Eye Irritation Data
Test data reported below.

Chemical name	Test method	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
Glutaraldehyde (<1%) CAS#: 111-30-8	Standard Draize Test	Rabbit	0.1 mL	24 hours	Corrosive to eyes	ECHA (The European Chemicals Agency)

Respiratory or skin sensitization
May cause sensitization by inhalation. May cause sensitization by skin contact.

Product Sensitization Data
No data available.

Ingredient Sensitization Data
Test data reported below.

Skin Sensitization Exposure Route

Chemical name	Test method	Species	Results	Key literature references and sources for data
Glutaraldehyde (<1%) CAS#: 111-30-8	Open Epicutaneous Test	Guinea pig	Confirmed to be a skin sensitizer	ECHA (The European Chemicals Agency)

Respiratory Sensitization Exposure Route

Chemical name	Test method	Species	Results	Key literature references and sources for data
Glutaraldehyde (<1%) CAS#: 111-30-8	Based on human experience	Human	Confirmed to be a respiratory sensitizer	Japan National Institute of Technology and Evaluation (NITE)

STOT - single exposure
Based on available data, the classification criteria are not met.

Product Specific Target Organ Toxicity Single Exposure Data
No data available.

Ingredient Specific Target Organ Toxicity Single Exposure Data
Test data reported below.

Oral Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
1,2,3-Propanetriol (20 - 30%) CAS#: 56-81-5	Human LD_{Lo}	1428 mg/kg	None reported	**Kidney, Ureter, or Bladder** Changes in tubules (including acute renal failure, acute tubular necrosis)	RTECS (Registry of Toxic Effects of Chemical Substances)

STOT - repeated exposure
Based on available data, the classification criteria are not met.

Product Specific Target Organ Toxicity Repeat Dose Data
No data available.

Ingredient Specific Target Organ Toxicity Repeat Exposure Data
Test data reported below.

Oral Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
1,2,3-Propanetriol (20 - 30%) CAS#: 56-81-5	Rat TD_{Lo}	96000 mg/kg	30 days	**Biochemical** Enzyme inhibition, induction, or change in blood or tissue levels (true cholinesterase) **Blood**	RTECS (Registry of Toxic Effects of Chemical Substances)
Glutaraldehyde (<1%) CAS#: 111-30-8	Rat NOAEL	29.9 mg/kg	90 days	**Nutritional and Gross Metabolic** Weight loss or decreased weight gain	ECHA (The European Chemicals Agency)

Dermal Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Glutaraldehyde (<1%) CAS#: 111-30-8	Rat NOAEL	150 mg/kg	90 days	No toxicological effects observed	ECHA (The European Chemicals Agency)

Inhalation (Vapor) Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
Glutaraldehyde (<1%) CAS#: 111-30-8	Rat NOAEC	0.125 mg/L	730 days	**Nutritional and Gross Metabolic** Weight loss or decreased weight gain	ECHA (The European Chemicals Agency)

Carcinogenicity
Based on available data, the classification criteria are not met.

Product Carcinogenicity Data
No data available.

Ingredient Carcinogenicity Data
Test data reported below.

Chemical name	CAS No.	ACGIH	IARC	NTP	OSHA
1,2,3-Propanetriol	56-81-5	-	-	-	-
Glutaraldehyde	111-30-8	-	-	-	-

Legend

ACGIH (American Conference of Governmental Industrial Hygienists)	Does not apply
IARC (International Agency for Research on Cancer)	Does not apply
NTP (National Toxicology Program)	Does not apply
OSHA (Occupational Safety and Health Administration of the US Department of Labor)	Does not apply

Oral Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
1,2,3-Propanetriol (20 - 30%)	Mouse	87500 mg/kg	25 weeks	**Lungs, Thorax, or Respiration**	RTECS (Registry of Toxic Effects of Chemical

CAS#: 56-81-5				Tumors	Substances)
Glutaraldehyde (<1%) CAS#: 111-30-8	Rat TDLo	2912 mg/kg	2 years	**Blood** Leukemia	RTECS (Registry of Toxic Effects of Chemical Substances)

Germ cell mutagenicity

Based on available data, the classification criteria are not met.

Product Germ Cell Mutagenicity *invitro* Data

No data available.

Ingredient Germ Cell Mutagenicity *invitro* Data

Test data reported below.

Chemical name	Test	Cell Strain	Reported dose	Exposure time	Results	Key literature references and sources for data
1,2,3-Propanetriol (20 - 30%) CAS#: 56-81-5	DNA inhibition	Human lymphocyte	200 mmol/L	None reported	Positive test result for mutagenicity	RTECS (Registry of Toxic Effects of Chemical Substances)
Glutaraldehyde (<1%) CAS#: 111-30-8	Mutation in microorganisms	*Salmonella typhimurium*	5 mg/plate	None reported	Positive test result for mutagenicity	ECHA (The European Chemicals Agency)

Product Germ Cell Mutagenicity *invivo* Data

No data available.

Ingredient Germ Cell Mutagenicity *invivo* Data

Test data reported below.

Oral Exposure Route

Chemical name	Test	Species	Reported dose	Exposure time	Results	Key literature references and sources for data
1,2,3-Propanetriol (20 - 30%) CAS#: 56-81-5	Cytogenetic analysis	Rat	1000 mg/kg	None reported	Positive test result for mutagenicity	RTECS (Registry of Toxic Effects of Chemical Substances)

Reproductive toxicity

Based on available data, the classification criteria are not met.

Product Reproductive Toxicity Data

No data available.

Ingredient Reproductive Toxicity Data

Test data reported below.

Oral Exposure Route

Chemical name	Endpoint type	Reported dose	Exposure time	Toxicological effects	Key literature references and sources for data
1,2,3-Propanetriol (20 - 30%) CAS#: 56-81-5	Rat TDLo	100 mg/kg	None reported	**Effects on Fertility** Litter size (e.g. # fetuses per litter; measured before birth) Post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants)	RTECS (Registry of Toxic Effects of Chemical Substances)

Glutaraldehyde (<1%) CAS#: 111-30-8	Rat NOAEL	500 ppm	Multiple generations	No reproductive or developmental toxic effects observed	ECHA (The European Chemicals Agency)

Aspiration hazard
Based on available data, the classification criteria are not met.

12. Ecological information

Ecotoxicity Based on available data, the classification criteria are not met.

Unknown aquatic toxicity 0% of the mixture consists of components(s) of unknown hazards to the aquatic environment.

Product Ecological Data

Aquatic Acute Toxicity
No data available.

Aquatic Chronic Toxicity
No data available.

Ingredient Ecological Data

Aquatic Acute Toxicity
Test data reported below.

Fish

Chemical name	Exposure time	Species	Endpoint type	Reported dose	Key literature references and sources for data
Glutaraldehyde (<1%) CAS#: 111-30-8	96 hours	None reported	LC_{50}	3.5 mg/L	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)

Crustacea

Chemical name	Exposure time	Species	Endpoint type	Reported dose	Key literature references and sources for data
1,2,3-Propanetriol (20 - 30%) CAS#: 56-81-5	48 Hours	*Daphnia magna*	LC_{50}	1955 mg/L	IUCLID (The International Uniform Chemical Information Database)
Glutaraldehyde (<1%) CAS#: 111-30-8	48 Hours	None reported	EC_{50}	0.75 mg/L	GESTIS (Information System on Hazardous Substances of the German Social Accident Insurance)

Algae

Chemical name	Exposure time	Species	Endpoint type	Reported dose	Key literature references and sources for data
Glutaraldehyde (<1%) CAS#: 111-30-8	72 Hours	*Scenedemus subspicatus*	EC_{50}	0.6 mg/L	ECHA (The European Chemicals Agency)

Aquatic Chronic Toxicity
Test data reported below.

Fish

Chemical name	Exposure time	Species	Endpoint type	Reported dose	Key literature references and sources for data
1,2,3-Propanetriol (20 - 30%) CAS#: 56-81-5	96 hours	*Oncorhynchus mykiss*	LC_{100}	51000 mg/L	IUCLID (The International Uniform Chemical Information Database)

Algae

Chemical name	Exposure time	Species	Endpoint type	Reported dose	Key literature references and sources for data
Glutaraldehyde (<1%) CAS#: 111-30-8	None reported	*Scenedemus subspicatus*	NOEC	< 0.0391 mg/L	ECHA (The European Chemicals Agency)

Persistence and degradability

Product Biodegradability Data
No data available.

Bioaccumulation

Product Bioaccumulation Data
No data available.

Partition Coefficient (n-octanol/water)	Not applicable

Mobility

Soil Organic Carbon-Water Partition Coefficient	Not applicable

Other adverse effects
No information available.

13. Disposal considerations

Waste treatment methods

Waste from residues/unused products	Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.
Contaminated packaging	Do not reuse empty containers.

14. Transportation information

MEX	Not regulated
Note:	No special precautions necessary.
TDG	Not regulated
DOT	Not regulated
ICAO (air)	Not regulated
IATA	Not regulated
IMDG	Not regulated
RID	Not regulated

ADR	Not regulated
ADN	Not regulated

Additional information
There is a possibility that this product could be contained in a reagent set or kit composed of various compatible dangerous goods.
If the item is not in a reagent set or kit, the classification given above applies.
If the item is part of a reagent set or kit the classification would change to the following:
UN3316 Chemical Kit, Hazard Class 9, Packing Group II or III.
If the item is not regulated, the Chemical Kit classification does not apply.

15. Regulatory information

Safety, health and environmental regulations/legislation specific for the substance or mixture

International Regulations

The Montreal Protocol on Substances that Deplete the Ozone Layer Not applicable

The Stockholm Convention on Persistent Organic Pollutants Not applicable

The Rotterdam Convention Not applicable

International Inventories

TSCA	Complies.
DSL/NDSL	Complies.
EINECS/ELINCS	Complies.
ENCS	Complies.
IECSC	Complies.
KECL	Complies.
PICCS	Complies.
AICS	Complies.

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

16. Other information

NFPA	**Health hazards** 2	**Flammability** 0	**Instability** 0	**Physical and chemical properties** -
HMIS	**Health hazards** 2 *	**Flammability** 0	**Physical hazards** 0	**Personal protection** X

Key or legend to abbreviations and acronyms used in the safety data sheet

Legend Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
Ceiling	Maximum limit value	SKN*	Skin designation

Key literature references and sources for data used to compile the SDS
Agency for Toxic Substances and Disease Registry (ATSDR)
U.S. Environmental Protection Agency ChemView Database
European Food Safety Authority (EFSA)
EPA (Environmental Protection Agency)

Acute Exposure Guideline Level(s) (AEGL(s))
U.S. Environmental Protection Agency Federal Insecticide, Fungicide, and Rodenticide Act
U.S. Environmental Protection Agency High Production Volume Chemicals
Food Research Journal
Hazardous Substance Database
International Uniform Chemical Information Database (IUCLID)
Japan GHS Classification
Australia National Industrial Chemicals Notification and Assessment Scheme (NICNAS)
NIOSH (National Institute for Occupational Safety and Health)
National Library of Medicine's ChemID Plus (NLM CIP)
National Library of Medicine's PubMed database (NLM PUBMED)
National Toxicology Program (NTP)
New Zealand's Chemical Classification and Information Database (CCID)
Organization for Economic Co-operation and Development Environment, Health, and Safety Publications
Organization for Economic Co-operation and Development High Production Volume Chemicals Program
Organization for Economic Co-operation and Development Screening Information Data Set
RTECS (Registry of Toxic Effects of Chemical Substances)
World Health Organization

Prepared By	Hach Product Compliance Department.
Issue Date	13-May-2019
Revision Date	13-May-2019
Revision Note	None

NOM-018-STPS-2015

The information is believed to be accurate, but it is not exhaustive and must be used only as guidance. It is based on the current state of knowledge of the chemical substance or mixture and is applicable to the appropriate safety precautions for the product.

Disclaimer

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

End of Safety Data Sheet

APPENDIX B-

FIELD INVESTIGATION SOPs

SOP # S1

MACTEC STANDARD OPERATING PROCEDURE #S1

DRINKING WATER SAMPLING FROM PRIVATE AND PUBLIC SUPPLY WELLS

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

DRINKING WATER SAMPLING FROM PRIVATE AND PUBLIC SUPPLY WELLS

1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes guidelines and procedures by which MACTEC personnel should conduct drinking water sampling at private and public supply wells for chemical analysis. Proper procedures are necessary to assure the quality and integrity of supply water analytical results. Construction and operation of supply wells will 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), 2019. Laboratory Services and Applied Science Division (LSASD) Operating Procedure: Potable Water Supply Sampling. ASBPROC-305-R4. Effective date June 11, 2019.

3.0 DEFINITIONS

Private Water Supply Well – A well that serves as a drinking water system and is not regulated.

Public Water Supply Well – A well and distribution system that is regulated by a government entity and must be sampled regularly to ensure the water is safe to drink.

Potable Water – A liquid that is suitable for drinking.

4.0 PROCEDURE

This section contains both the responsibilities and protocol for sampling private and public supply wells. 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. 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 supply well 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.

4.2 Preparation

Office Procedures

1. Ensure that the project manager or NYSDEC has acquired permission from the property owner or residence to collect the supply well sample.
2. Contact the well owner with the proposed schedule for sampling, and coordinate with the well owner on timing; obtain information on the pumping rate and frequency during the last several weeks, if available.
3. Review pertinent information with regards to well construction, development, and sampling information on the wells to be tested, if available.
4. Assemble appropriate logbooks and field data records to complete the field assignment.

Sampling Considerations

This SOP assumes that private or public supply wells are equipped with operational pumps and plumbing to purge the mechanical systems and collect samples. If the mechanical systems for supply wells are not operational, then the sampling should be conducted using Low Flow Groundwater Sampling Procedures.

The following should be considered when choosing the location to collect a potable water sample from a private and/or public water supply well (EPA, 2019):

- Sample locations selected should be supplied with water from a service pipe connected directly to a water main in the segment of interest.

- Whenever possible, choose the tap closest to the water source, and prior to the water lines entering the residence, office, building, etc., and prior to any holding or pressurization tanks.
- The sampling tap must be protected from exterior contamination associated with being too close to a sink bottom or to the ground. Contaminated water or soil from the faucet exterior may enter the bottle during the collection procedure because it is difficult to place a bottle under a low tap without grazing the neck interior against the outside faucet surface. If the tap is too close to the ground for direct collection into the appropriate sample container, it is acceptable to use a smaller container to transfer sample to a larger container.
- When filling any sample container, care should be taken that splashing drops of water from the ground or sink do not enter the bottle or cap.
- Leaking taps that allow water to discharge from around the valve stem handle and down the outside of the faucet or taps in which water tends to run up on the outside of the lip are to be avoided as sampling locations.
- Disconnect any hoses, filters, or aerators attached to the tap before sampling. These devices can harbor a bacterial population if they are not routinely cleaned or replaced when worn or cracked.
- Taps where the water flow is not constant should be avoided because temporary fluctuation in line pressure may cause clumps of microbial growth that are lodged in a pipe section or faucet connection to break loose. A smooth flowing water stream at moderate pressure without splashing should be used. The sample should be collected without changing the water flow.

Data Form

The Water Grab Sample Field Data Record (FDR) shall be used to record sampling information and observations (**example Attached**). All entries shall be made in indelible ink.

4.3 Field Procedures

Private and public supply well samples will be collected by filling sample containers from a tap, sample port or spigot.

Private drinking water sampling:

1. Don gloves.
2. Evaluate the water supply system for the presence of treatment systems (e.g. carbon filters, sediment filters, water softeners). If a treatment system is identified select a sampling location before the treatment system.
3. If the sampling location is at a faucet evaluate if an aerator is present and remove prior to sampling.
4. Purge water at the sampling point until sufficient volume has been purged to ensure the water collected is from the well. This is generally 10 minutes of purging or until the well pump turns on.
5. Collect samples in laboratory-supplied containers.
6. Follow standard sample handling and custody procedures to contain and transport samples to the off-site laboratory.

Public Drinking Water Supply Sampling:

1. Don gloves.
2. Identify the sampling location closest to the well head and prior to treatment systems and storage tanks. Typically, this will be the location where the system owner collects regulatory compliance samples.
3. Purging the system may not be necessary if the location selected is in line with the direct delivery system and water is continuously pumped from the well. If the sampling location is not in direct line with the delivery system purge sufficient water to clear potentially stagnant water.
4. Collect samples in laboratory-supplied containers.
5. Follow standard sample handling and custody procedures to contain and transport samples to the off-site laboratory.

5.0 ATTACHMENTS

Drinking Water Grab Sampling Record

DRINKING WATER SAMPLING FIELD DATA RECORD

PROJECT NAME		Sampler Signature:	Print Name:
PROJECT NUMBER		Checked By:	Date:

Owner:

Address:

LOCATION ID	**SAMPLE TAP LOCATION**	**PURGE START TIME (minimum 10 min.)**	**WATER TREATMENT SYSTEM** Yes / No
SAMPLE ID	**SAMPLE DATE**	**PURGE END TIME/ SAMPLE TIME**	**Comment:**

ANALYTICAL PARAMETERS

	PARAMETER	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED
☐				
☐				
☐				
☐				
☐				
☐				

Owner:

Address:

LOCATION ID	**SAMPLE TAP LOCATION**	**PURGE START TIME (minimum 10 min.)**	**WATER TREATMENT SYSTEM** Yes / No
SAMPLE ID	**SAMPLE DATE**	**PURGE END TIME/ SAMPLE TIME**	**Comment:**

ANALYTICAL PARAMETERS

	PARAMETER	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED
☐				
☐				
☐				
☐				
☐				
☐				

Owner:

Address:

LOCATION ID	**SAMPLE TAP LOCATION**	**PURGE START TIME (minimum 10 min.)**	**WATER TREATMENT SYSTEM** Yes / No
SAMPLE ID	**SAMPLE DATE**	**PURGE END TIME/ SAMPLE TIME**	**Comment:**

ANALYTICAL PARAMETERS

	PARAMETER	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED
☐				
☐				
☐				
☐				
☐				
☐				

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
- ☐ PERISTALTIC
- ☐ SUBMERSIBLE
- ☐ BLADDER ______
- ☐ WATTERA
- ☐ OTHER ______
- ☐ OTHER ______

DECON FLUIDS USED
- ☐ ALCONOX
- ☐ DEIONIZED WATER
- ☐ POTABLE WATER
- ☐ NITRIC ACID
- ☐ HEXANE
- ☐ METHANOL
- ☐ OTHER ______

TUBING/PUMP/BLADDER MATERIALS
- ☐ SILICON TUBING
- ☐ HDPE TUBING
- ☐ LDPE TUBING
- ☐ OTHER ______
- ☐ OTHER ______
- ☐ S. STEEL PUMP MATERIAL
- ☐ PVC PUMP MATERIAL
- ☐ GEOPROBE SCREEN
- ☐ OTHER ______
- ☐ 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 ☐

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	°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

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 # S6

MACTEC STANDARD OPERATING PROCEDURE #S6

PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) FIELD SAMPLING PROTOCOLS

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

PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) FIELD SAMPLING PROTOCOLS

1.0 PURPOSE

The purpose of this SOP is to describe the procedures/considerations when collecting soil, sediment, surface water, and groundwater samples for per- and polyfluoroalkyl substances (PFAS) characterization at a site. This SOP also describes a tiered approach that should be used to assist with field decisions. Sampling specific SOPs should also be reviewed prior to conducting field sampling activities for PFAS characterization.

This procedure applies to all MACTEC personnel and subcontractors who collect or otherwise handle samples of soil, sediment, surface water, and groundwater for analysis of PFAS. This SOP should be reviewed by all on-site personnel prior to implementation of field activities.

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 log book and field forms.

Procedures and protocols in this SOP and the Program QAPP have been designed to comply with NYSDEC PFAS Sampling Guidelines (NYSDEC, 2020) (**Attached**).

2.0 REFERENCES

NYSDEC, 2020. Guidelines for Sampling and Analysis of PFAS Under NYSDEC's Part 375 Remedial Programs. January 2020.

3.0 PROCEDURES

Given the low detection limits associated with laboratory PFAS analysis, and the many potential sources of trace levels of PFAS, field personnel are advised to act on the side of caution by strictly following the subject protocols, frequently replacing nitrile gloves, and rinsing field equipment to help mitigate the potential for false detections of PFAS.

This section contains both the responsibilities and procedures involved with field sampling for analysis of PFAS.

3.1 Responsibilities

Project Manager

The project manager (PM) shall provide the Quality Assurance Program Plan (QAPP) and site-specific field activities plan (FAP) to project personnel, which shall include the sampling requirements for each investigation. The PM will detail deviations to the procedure provided in this SOP in the site-specific FAP.

Field Operations Lead

The field operations lead (FOL) shall ensure that samples are collected using procedures that are in accordance with the QAPP, site-specific FAPs, and applicable SOPs. The FOL shall also be required to make rational and justifiable decisions when deviations from these procedures are necessary because of field conditions or unforeseen issues and report the deviations to the PM.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing their tasks according to specifications outlined in the QAPP, site-specific FAPs, applicable SOPs, and other appropriate procedures. Field personnel are responsible for reporting deviations from procedures to the FOL and PM and documented in the field logbook and field data record.

3.2 Field Procedures/Considerations

The following are procedures/considerations to be made during field activities for PFAS sampling. A summary of the prohibited and acceptable items for PFAS investigation areas is included in Table 1. A checklist (**Attached)** shall be used daily prior to the commencement of fieldwork to ensure the field team is in compliance with this protocol.

Field Equipment

- **Do not use Teflon®-containing materials** (e.g., Teflon® tubing, bailers, tape, plumbing paste, or other Teflon® materials) since Teflon® contains fluorinated compounds.
- Sample containers and collected samples will be stored and shipped using dedicated coolers provided by the laboratory.
- Stainless steel, high-density polyethylene (HDPE), polypropylene, and silicone materials are acceptable for sampling. Samples should not be collected with tubing or stored in containers made of low-density polyethylene (LDPE) materials (fluorinated compounds are known to adsorb to LDPE). All sampling equipment components and sample containers should not come in contact with aluminum foil, LDPE, glass or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.
- MACTEC will use peristaltic pumps for groundwater sample collection at depths shallower than 25 feet. MACTEC will use ProActive SS Pumps with polyvinyl chloride (PVC) leads or Geotech SS Geosub pumps for groundwater sample collection at depths greater than 25 feet. These pumps are constructed with stainless steel and will minimize introductions of PFAS. PFAS-free bladder pumps may also be used for sampling. PVC (e.g. Whale®) pumps can be used for well development, if needed, but should not be used for sampling, or left in the wells.
- When using liners to collect soil samples during direct-push technology or during conventional drilling and sampling methodologies, acetate liners are to be used.
- Field reports will be documented on loose paper secured on masonite or aluminum clipboards (i.e. plastic clipboards, binders, or spiral hard cover notebooks are not acceptable) using a pen or pencil.
- **Post-It Notes are not allowed** on project sites.

- Use ballpoint pens. Pens will be used when documenting field activities in the field log and on field forms as well as labeling sample containers and preparing the Chain of Custody.
- **Do not use chemical (blue) ice packs** during the sampling program. This includes the use of ice packs for the storage of food and/or samples.

Field Clothing and Personal Protective Equipment

- **Do not wear water resistant, waterproof, or stain-treated clothing** during the field program. Field clothing made of synthetic and natural fibers (preferably cotton) are acceptable. Field clothing should be laundered without the use of fabric softener. Preferably, field gear should be cotton construction and well laundered (i.e., washed a minimum of three times prior to use after purchase). New clothing may contain PFAS related treatments. **Do not use new clothing** while sampling or sample handling.
- **Do not wear clothing or boots containing Gore-Tex™** during the sampling program as it contains a PFAS membrane.
- Safety footwear will consist of steel-toed boots made with polyurethane and PVC, untreated leather boots, or well-worn leather boots. Newer leather boots may be worn if they are covered with polypropylene, polyethane, or PVC boot covers.
- Disposable nitrile gloves must be worn at all times. Further, a new pair of nitrile gloves shall be donned prior to the following activities at each sample location:
  - Decontamination of re-usable sampling equipment.
  - Handling sample bottles or water containers.
  - Insertion of anything into the well (e.g., HDPE tubing, HydraSleeve™, bailer, etc.).
  - Insertion of silicone tubing into the peristaltic pump.
  - Sample Collection after completion of monitor well purging; and,
  - Handling of any quality assurance/quality control samples including field blanks and equipment blanks.

  In addition, gloves should be changed after the handling of any non-dedicated sampling equipment, contact with non-decontaminated surfaces, or when judged necessary by field personnel.

Sample Containers

- Different laboratories may supply sample collection containers of varying sizes dependent on the type of media to be sampled (e.g., soil, groundwater, etc.). All samples should be collected in polypropylene or HDPE bottles. The screw cap will be made of polypropylene or HDPE and may be lined or unlined. However, if lined, the liner may not be made of Teflon® or other material containing PFAS.
- Container labels will be completed using pen after the caps have been placed back on each bottle.
- Glass sample containers are not to be used due to potential loss of analyte through adsorption.

Wet Weather

- Field sampling occurring during wet weather (e.g., rainfall and snowfall) should be conducted while wearing appropriate clothing that will not pose a risk for cross-contamination. Teams will avoid synthetic gear that has been treated with water-repellant finishes containing PFAS. Use rain gear made from polyurethane, vinyl, and wax or rubber-coated materials.

- Teams should consider the use of a gazebo tent, which can be erected overtop of the sample location and provide shelter from the rain. It should be noted that the canopy material is likely a treated surface and should be handled as such; therefore, gloves should be worn when setting up and moving the tent, changed immediately afterwards and further contact with the tent should be avoided until all sampling activities have been finished and the team is ready to move on to the next sample location.

Equipment Decontamination

- Field sampling equipment used at each sample location, will require cleaning between uses. Alconox® and Liquinox® soap is acceptable for use since the Safety Data Sheets do not list fluoro-surfactants as an ingredient (do not use Liquinox® soap if also sampling for 1,4-dioxane). However, Decon 90 will not be used during decontamination activities. Water used for the final rinse during decontamination of sampling equipment will be laboratory certified "PFAS-free" water.
- For larger equipment (e.g., drill rig and large downhole drilling and sampling equipment), decontamination will be conducted with potable water using a high-pressure washer and then rinsed using potable water.

Groundwater Sampling

- At sites with dedicated sampling equipment installed in the wells that contains Teflon (e.g., tubing, pumps), this equipment should be removed from the wells and replaced with HDPE tubing and non-Teflon containing equipment, if possible. These wells will be re-developed by removing three well volumes of water, if possible, and letting the wells recover for at least 48 hours prior to sampling.
- At sites with dedicated sampling equipment installed in the wells that contain LDPE tubing, this tubing should be removed from the wells and replaced with HDPE tubing. These wells can be sampled immediately following replacement of tubing; however, attempts should be made to remove one well volume prior to sampling. For larger wells, with higher volumes of water, it may be preferable to redevelop the wells and remove one well volume with a higher volume pump. In such cases the wells should be allowed to recover for at least 48 hours prior to sampling.

Personnel Hygiene

- Field personnel will not use cosmetics, moisturizers, hand cream, or other related products as part of their personal cleaning/showering routine on the morning of a sampling event, unless the products are applied to a part of the body that will be coved by clothing. These products may contain surfactants and represent a potential source of PFAS.
- All clothing worn by sampling personnel must have been laundered multiple times.
- Many manufactured sunblock and insect repellants contain PFAS and should not be brought or used on-site. Sunblock and insect repellants that are used on-site should consist of 100% natural

ingredients, unless previously vetted by the project chemist. A list of acceptable sunscreens and insect repellents is provided in Table 1.

- For washroom breaks, field personnel will leave the exclusion zone and then remove gloves and overalls. Field personnel should wash as normal with extra time for rinsing with water after soap use. When finished washing, the use of a mechanical dryer is preferred and the use of paper towel for drying is to be avoided (if possible).

Food Considerations

- No food or drink shall be brought on-site, with the exception of bottled water and hydration drinks (e.g., Gatorade® and Powerade®), which will only be allowed to be brought and consumed within the staging area.

Visitors

- Visitors to the investigation area are asked to remain outside of the exclusion zone during sampling activities.

4.0 TIERED APPROACH TO ASSIST WITH FIELD DECISIONS

In evaluating whether products contain PFAS and are suitable for use in the field, the tiered approach presented in Table 2 will be used to assist with field decisions. Any member of the field team should contact the project manager with questions.

Table 1. Summary of Prohibited and Acceptable Items for PFAS Sampling

Prohibited Items	Acceptable Items
Field Equipment	
Teflon® containing materials	High-density polyethylene (HDPE) materials
Storage of samples in containers made of LDPE materials	Acetate liners, HDPE bottles
Teflon® tubing	HDPE or silicone tubing
Waterproof field books not manufactured by Rite in the Rain	Rite in the Rain products or Loose paper (non-waterproof)
Plastic clipboards, binders, or spiral hard cover notebooks	Aluminum field clipboards or with Masonite
Sharpies®, if possible	Ballpoint pens
Post-It Notes	
Chemical (blue) ice packs	Regular ice
Excel Purity Paste TFW Multipurpose Thread Sealant Vibra-Tite Thread Sealant	Gasoils NT Non-PTFE Thread Sealant Bentonite
Equipment with Viton Components (need to be evaluated on a case by case basis, Viton contains PTFE, but may be acceptable if used in gaskets or O-rings that are sealed away and will not come into contact with sample or sampling equipment.)	

Field Clothing and PPE	
New clothing or water resistant, waterproof, or stain-treated clothing, clothing containing Gore-Tex™	Well-laundered clothing, defined as clothing that has been washed three or more times after purchase, made of synthetic or natural fibers (preferable cotton)
Clothing laundered using fabric softener	
Boots containing Gore-Tex™	Boots made with polyurethane and PVC, well-worn or untreated leather boots, leather boots with boot covers
	Reflective safety vests, Tyvek®, Cotton Clothing, synthetic under clothing, body braces
No cosmetics, moisturizers, hand cream, or other related products as part of personal cleaning/showering routine on the morning of sampling, unless the products are applied to body parts that will be covered by clothing.	**Sunscreens** - Alba Organics Natural Sunscreen, Yes to Cucumbers, Aubrey Organics, Jason Natural Sun Block, Kiss my face, Baby sunscreens that are "free" or "natural" **Insect Repellents** - Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus Insect repellant, Herbal Armor, California Baby Natural Bug Spray, BabyGanics, Deep Woods Off **Sunscreen and insect repellant -** Avon Skin So Soft Bug Guard Plus – SPF 30 Lotion
Sample Containers	
LDPE or glass containers	HDPE or polypropylene
Teflon®-lined caps	Lined or unlined HDPE or polypropylene caps
Rain Events	
Waterproof or resistant rain gear	Polyurethane, vinyl, wax or rubber-coated rain gear. Gazebo tent that is only touched or moved prior to and following sampling activities
Equipment Decontamination	
Decon 90	Alconox® and/or Liquinox® (Do not use Liquinox® if also sampling for 1,4-dioxane).
Water from an on-site well	Potable water from municipal drinking water supply
Food Considerations	
All food and drink, with exceptions noted on the right	Bottled water and hydration drinks (i.e. Gatorade® and Powerade®) to be brought and consumed only in the staging area

Table 2. Tiered Approach

Tier and Description	Action
Tier 1: Products that *will come into direct contact* with field samples include, but are not limited to, drilling grease, sampling equipment, sample containers, and well construction materials	These products will undergo the greatest scrutiny and requires chemist's input to help evaluate the materials as a possible source of contamination[A] and as possible sampling and/or storage materials
Tier 2: Products that *will not come into direct contact* with samples, but could be *reasonably expected to contain PFAS*, such as waterproof or nonstick products	Project team/affected person can review the Safety Data Sheet (SDS)[B] and if it shows PFAS, product should not be used. If product SDS does not indicate PFAS, confirm with chemist before use

Tier 3: Products that *will not come into direct contact* with samples and are *not expected to contain PFAS*, such as ballpoint pens, zipper bags, and body braces	Project team/affected person can review SDS and if no PFAS, then appropriate to use

[A] Tier 1 products will undergo the closest scrutiny. It may be necessary to have Tier 1 products analyzed for PFAS to confirm that a specific batch or lot number does not contain PFAS. Alternate products will need to be evaluated/used if PFAS are identified in the product.

[B] SDS Check: To evaluate product SDS and/or manufacturing specs, check if the product contains anything with "fluoro" in the name or the acronyms TPE, FEP, ETFE, and/or PFA. If fluorinated compounds are not listed in the manufacturing specs and/or on the SDSs, product can be used.

5.0 ATTACHMENTS

Daily PFAS Protocol Checklist Record

NYSDEC Guidelines for Sampling and Analysis of PFAS

DAILY PFAS PROTOCOL CHECKLIST RECORD

MACTEC

511 Congress Street
Suite 200
Portland, Maine 04101

PROJECT NAME

PROJECT NUMBER

INSTALLATION

DATE

START TIME

WEATHER

Field Clothing and PPE (as applicable):

- ☐ Field crew in compliance with Tables 1 and 2, SOP S6
- ☐ Field crew has not used fabric softener on clothing
- ☐ Field crew has not used cosmetics, moisturizers, hand cream, or other related products on exposed body parts this morning
- ☐ Field crew has not applied unacceptable sunscreen or insect repellant

Field Clothing and PPE (as applicable):

- ☐ No Teflon® containing materials on-site
- ☐ All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene
- ☐ No waterproof field books on-site other than Rite-in-the-Rain® Products

- ☐ No plastic clipboards, binders, or spiral hard cover notebooks on-site
- ☐ No adhesives (Post-it® Notes) on-site
- ☐ Coolers filled with regular ice only. No chemical (blue) ice packs in possession

Sample Containers:

- ☐ All sample containers made of HDPE or polypropylene. Samples are not stored in containers made of LDPE
- ☐ Caps are lined or unlined and made of HDPE or polypropylene

Wet Weather (as applicable):

- ☐ For personnel in direct contact with samples and/or sampling equipment, wet weather gear made of Vinyl, polyurethane, PVC, latex or rubber-coated materials only

Equipment Decontamination:

- ☐ "PFAS-free" water on-site for decontamination of sample equipment
- ☐ Alconox and Liquinox to be used as decontamination materials

Food and Drink

- ☐ No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area

If any applicable boxes cannot be checked, the Field Lead shall describe the noncompliance issues below and work with field personnel to address noncompliance issues prior to commencement of that day's work. Corrective action shall include removal of noncompliance items from the investigation area or removal of worker offsite until in compliance. Repeated failure to comply with PFC sample protocols will result in the permanent removal of worker(s) from the investigation area.

Sampler Signature:

Print Name:

Checked By:

Date:

Describe the noncompliance issues (include personnel not in compliance) and action/outcome of noncompliance:

NEW YORK STATE OF OPPORTUNITY. | Department of Environmental Conservation

GUIDELINES FOR SAMPLING AND ANALYSIS OF PFAS

Under NYSDEC's Part 375 Remedial Programs

January 2020

www.dec.ny.gov

Contents

ERRATA SHEET for

Guidelines for Sampling and Analysis of PFAS Under NYSDEC's Part 375 Program
Issued January 17, 2020

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January 2020

Guidelines for Sampling and Analysis of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs

Objective

New York State Department of Environmental Conservation's Division of Environmental Remediation (DER) performs or oversees sampling of environmental media and subsequent analysis of PFAS as part of remedial programs implemented under 6 NYCRR Part 375. To ensure consistency in sampling, analysis and reporting of PFAS, DER has developed this document to summarize procedures and update previous DER technical guidance pertaining to PFAS.

Applicability

Sampling for PFAS has already been initiated at numerous sites under DER-approved work plans, in accordance with specified procedures. All future work plans should include PFAS sampling and analysis procedures that conform to the guidelines provided herein.

As part of a site investigation or remedial action compliance program, whenever samples of potentially affected media are collected and analyzed for the standard Target Analyte List/Target Compound List (TAL/TCL), PFAS analysis should also be performed. Potentially affected media can include soil, groundwater, surface water, and sediment. Based upon the potential for biota to be affected, biota sampling and analysis for PFAS may also be warranted as determined pursuant to a Fish and Wildlife Impact Analysis. Soil vapor sampling for PFAS is not required.

Field Sampling Procedures

DER-10 specifies technical guidance applicable to DER's remedial programs. Given the prevalence and use of PFAS, DER has developed "best management practices" specific to sampling for PFAS. As specified in DER-10 Chapter 2, quality assurance procedures are to be submitted with investigation work plans. Typically, these procedures are incorporated into a work plan, or submitted as a stand-alone document (e.g., a Quality Assurance Project Plan). Quality assurance guidelines for PFAS are listed in Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS.

Field sampling for PFAS performed under DER remedial programs should follow the appropriate procedures outlined for soils, sediments or other solids (Appendix B), non-potable groundwater (Appendix C), surface water (Appendix D), public or private water supply wells (Appendix E), and fish tissue (Appendix F).

QA/QC samples (e.g. duplicates, MS/MSD) should be collected as specified in DER-10, Section 2.3(c). For sampling equipment coming in contact with aqueous samples only, rinsate or equipment blanks should be collected. Equipment blanks should be collected at a minimum frequency of one per day or one per twenty samples, whichever is more frequent.

Data Assessment and Application to Site Cleanup

Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFAS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10.

Water Sample Results

PFAS should be further assessed and considered as a potential contaminant of concern in groundwater or surface water if PFOA or PFOS is detected in any water sample at or above 10 ng/L (ppt). In addition, further assessment of water may be warranted if either of the following screening levels are met:

a. any other individual PFAS (not PFOA or PFOS) is detected in water at or above 100 ng/L; or
b. total concentration of PFAS (including PFOA and PFOS) is detected in water at or above 500 ng/L

If PFAS are identified as a contaminant of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.

Soil Sample Results

The extent of soil contamination for purposes of delineation and remedy selection should be determined by having certain soil samples tested by Synthetic Precipitation Leaching Procedure (SPLP) and the leachate analyzed for PFAS. Soil exhibiting SPLP results above 70 ppt for either PFOA or PFOS (individually or combined) are to be evaluated during the cleanup phase.

Sites in the site management phase should evaluate for PFAS to determine if modification to any components of the SMP is necessary (e.g., monitoring for PFAS, upgrading treatment facilities, or performing an RSO).

Testing for Imported Soil

Soil imported to a site for use in a soil cap, soil cover, or as backfill is to be tested for PFAS in general conformance with DER-10, Section 5.4(e) for the *PFAS Analyte List* (Appendix F) using the analytical procedures discussed below and the criteria in DER-10 associated with SVOCs.

If PFOA or PFOS is detected in any sample at or above 1 µg/kg, then soil should be tested by SPLP and the leachate analyzed for PFAS. If the SPLP results exceed 10 ppt for either PFOA or PFOS (individually) then the source of backfill should be rejected, unless a site-specific exemption is provided by DER. SPLP leachate criteria is based on the Maximum Contaminant Levels proposed for drinking water by New York State's Department of Health, this value may be updated based on future Federal or State promulgated regulatory standards. Remedial parties have the option of analyzing samples concurrently for both PFAS in soil and in the SPLP leachate to minimize project delays. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.

Analysis and Reporting

As of January 2020, the United States Environmental Protection Agency (EPA) does not have a validated method for analysis of PFAS for media commonly analyzed under DER remedial programs (non-potable waters, solids). DER has developed the following guidelines to ensure consistency in analysis and reporting of PFAS.

The investigation work plan should describe analysis and reporting procedures, including laboratory analytical procedures for the methods discussed below. As specified in DER-10 Section 2.2, laboratories should provide a full Category B deliverable. In addition, a Data Usability Summary Report (DUSR) should be prepared by an independent, third party data validator. Electronic data submissions should meet the requirements provided at: https://www.dec.ny.gov/chemical/62440.html.

DER has developed a *PFAS Analyte List* (Appendix F) for remedial programs to understand the nature of contamination at sites. It is expected that reported results for PFAS will include, at a minimum, all the compounds listed. If lab and/or matrix specific issues are encountered for any analytes, the DER project manager, in consultation with the DER chemist, will make case-by-case decisions as to whether certain analytes may be temporarily or permanently discontinued from analysis at each site. As with other contaminants that are analyzed for at a site, the *PFAS Analyte List* may be refined for future sampling events based on investigative findings.

Routine Analysis

Currently, New York State Department of Health's Environmental Laboratory Approval Program (ELAP) does not offer certification for PFAS in matrices other than finished drinking water. However, laboratories analyzing environmental samples for PFAS (e.g., soil, sediments, and groundwater) under DER's Part 375 remedial programs need to hold ELAP certification for PFOA and PFOS in drinking water by EPA Method 537.1 or ISO 25101. Laboratories should adhere to the guidelines and criteria set forth in the DER's laboratory guidelines for PFAS in non-potable water and solids (Appendix H - Laboratory Guidelines for Analysis of PFAS in Non-Potable Water and Solids). Data review guidelines were developed by DER to ensure data comparability and usability (Appendix H - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids).

LC-MS/MS analysis for PFAS using methodologies based on EPA Method 537.1 is the procedure to use for environmental samples. Isotope dilution techniques should be utilized for the analysis of PFAS in all media. Reporting limits for PFOA and PFOS in aqueous samples should not exceed 2 ng/L. Reporting limits for PFOA and PFOS in solid samples should not exceed 0.5 µg/kg. Reporting limits for all other PFAS in aqueous and solid media should be as close to these limits as possible. If laboratories indicate that they are not able to achieve these reporting limits for the entire *PFAS Analyte List*, site-specific decisions regarding acceptance of elevated reporting limits for specific PFAS can be made by the DER project manager in consultation with the DER chemist.

Additional Analysis

Additional laboratory methods for analysis of PFAS may be warranted at a site, such as the Synthetic Precipitation Leaching Procedure (SPLP) and Total Oxidizable Precursor Assay (TOP Assay). Commercially methods are also available for biota and air samples.

SPLP is a technique used to determine the mobility of chemicals in liquids, soils and wastes, and may be useful in determining the need for addressing PFAS-containing material as part of the remedy. SPLP by EPA Method 1312 should be used unless otherwise specified by the DER project manager in consultation with the DER chemist.

Impacted materials can be made up of PFAS that are not analyzable by routine analytical methodology. A TOP Assay can be utilized to conceptualize the amount and type of oxidizable PFAS which could be liberated in the environment, which approximates the maximum concentration of perfluoroalkyl substances that could be generated if all polyfluoroalkyl substances were oxidized. For example, some polyfluoroalkyl substances may degrade or transform to form perfluoroalkyl substances (such as PFOA or PFOS), resulting in an increase in perfluoroalkyl substance concentrations as contaminated groundwater moves away from a source. The TOP Assay converts, through oxidation, polyfluoroalkyl substances (precursors) into perfluoroalkyl substances that can be detected by routine analytical methodology.

Please note that TOP Assay analysis of highly-contaminated samples, such as those from an AFFF (aqueous film-forming foam) site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances.

Commercial laboratories have adopted methods which allow for the quantification of targeted PFAS in air and biota. The EPA's Office of Research and Development (ORD) is currently developing methods which allow for air emissions characterization of PFAS, including both targeted and non-targeted analysis of PFAS. Consult with the DER project manager and the DER chemist for assistance on analyzing biota/tissue and air samples.

Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS

The following guidelines (general and PFAS-specific) can be used to assist with the development of a QAPP for projects within DER involving sampling and analysis of PFAS.

General Guidelines in Accordance with DER-10

- Document/work plan section title – Quality Assurance Project Plan
- Summarize project scope, goals, and objectives
- Provide project organization including names and resumes of the project manager, Quality Assurance Officer (QAO), field staff, and Data Validator
    - The QAO should not have another position on the project, such as project or task manager, that involves project productivity or profitability as a job performance criterion
- List the ELAP-approved lab(s) to be used for analysis of samples
- Include a site map showing sample locations
- Provide detailed sampling procedures for each matrix
- Include Data Quality Usability Objectives
- List equipment decontamination procedures
- Include an “Analytical Methods/Quality Assurance Summary Table” specifying:
    - Matrix type
    - Number or frequency of samples to be collected per matrix
    - Number of field and trip blanks per matrix
    - Analytical parameters to be measured per matrix
    - Analytical methods to be used per matrix with minimum reporting limits
    - Number and type of matrix spike and matrix spike duplicate samples to be collected
    - Number and type of duplicate samples to be collected
    - Sample preservation to be used per analytical method and sample matrix
    - Sample container volume and type to be used per analytical method and sample matrix
    - Sample holding time to be used per analytical method and sample matrix
- Specify Category B laboratory data deliverables and preparation of a DUSR

Specific Guidelines for PFAS

- Include in the text that sampling for PFAS will take place
- Include in the text that PFAS will be analyzed by LC-MS/MS for PFAS using methodologies based on EPA Method 537.1
- Include the list of PFAS compounds to be analyzed (*PFAS Analyte List*)
- Include the laboratory SOP for PFAS analysis
- List the minimum method-achievable Reporting Limits for PFAS
    - Reporting Limits should be less than or equal to:
        - Aqueous – 2 ng/L (ppt)
        - Solids – 0.5 µg/kg (ppb)
- Include the laboratory Method Detection Limits for the PFAS compounds to be analyzed
- Laboratory should have ELAP certification for PFOA and PFOS in drinking water by EPA Method 537.1, EPA Method 533, or ISO 25101
- Include detailed sampling procedures
    - Precautions to be taken
    - Pump and equipment types
    - Decontamination procedures
    - Approved materials only to be used
- Specify that regular ice only will be used for sample shipment
- Specify that equipment blanks should be collected at a minimum frequency of 1 per day per matrix

Appendix B - Sampling Protocols for PFAS in Soils, Sediments and Solids

General

The objective of this protocol is to give general guidelines for the collection of soil, sediment and other solid samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Containers

Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in to contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel spoon
- stainless steel bowl
- steel hand auger or shovel without any coatings

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification. Previous results of "non-detect" for PFAS from the UCMR3 water supply testing program are acceptable as verification.

Sampling Techniques

Sampling is often conducted in areas where a vegetative turf has been established. In these cases, a pre-cleaned trowel or shovel should be used to carefully remove the turf so that it may be replaced at the conclusion of sampling. Surface soil samples (e.g. 0 to 6 inches below surface) should then be collected using a pre-cleaned, stainless steel spoon. Shallow subsurface soil samples (e.g. 6 to ~36 inches below surface) may be collected by digging a hole using a pre-cleaned hand auger or shovel. When the desired subsurface depth is reached, a pre-cleaned hand auger or spoon shall be used to obtain the sample.

When the sample is obtained, it should be deposited into a stainless steel bowl for mixing prior to filling the sample containers. The soil should be placed directly into the bowl and mixed thoroughly by rolling the material into the middle until the material is homogenized. At this point the material within the bowl can be placed into the laboratory provided container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A soil log or sample log shall document the location of the sample/borehole, depth of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix C - Sampling Protocols for PFAS in Monitoring Wells

General

The objective of this protocol is to give general guidelines for the collection of groundwater samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation’s Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including plumbers tape and sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel inertia pump with HDPE tubing
- peristaltic pump equipped with HDPE tubing and silicone tubing
- stainless steel bailer with stainless steel ball
- bladder pump (identified as PFAS-free) with HDPE tubing

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Monitoring wells should be purged in accordance with the sampling procedure (standard/volume purge or low flow purge) identified in the site work plan, which will determine the appropriate time to collect the sample. If sampling using standard purge techniques, additional purging may be needed to reduce turbidity levels, so samples contain a limited amount of sediment within the sample containers. Sample containers that contain sediment may cause issues at the laboratory, which may result in elevated reporting limits and other issues during the sample preparation that can compromise data usability. Sampling personnel should don new nitrile gloves prior to sample collection due to the potential to contact PFAS containing items (not related to the sampling equipment) during the purging activities.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Collect one equipment blank every day that sampling is conducted and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Additional equipment blank samples may be collected to assess other equipment that is utilized at the monitoring well
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A purge log shall document the location of the sample, sampling equipment, groundwater parameters, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix D - Sampling Protocols for PFAS in Surface Water

General

The objective of this protocol is to give general guidelines for the collection of surface water samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel cup

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Where conditions permit, (e.g. creek or pond) sampling devices (e.g. stainless steel cup) should be rinsed with site medium to be sampled prior to collection of the sample. At this point the sample can be collected and poured into the sample container.

If site conditions permit, samples can be collected directly into the laboratory container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification.   Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Collect one equipment blank every day that sampling is conducted and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A sample log shall document the location of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix E - Sampling Protocols for PFAS in Private Water Supply Wells

General

The objective of this protocol is to give general guidelines for the collection of water samples from private water supply wells (with a functioning pump) for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Drinking water samples collected using this protocol are intended to be analyzed for PFAS by ISO Method 25101. The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation’s Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials (e.g. plumbers tape), including sample bottle cap liners with a PTFE layer.

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Locate and assess the pressure tank and determine if any filter units are present within the building. Establish the sample location as close to the well pump as possible, which is typically the spigot at the pressure tank. Ensure sampling equipment is kept clean during sampling as access to the pressure tank spigot, which is likely located close to the ground, may be obstructed and may hinder sample collection.

Prior to sampling, a faucet downstream of the pressure tank (e.g., wash room sink) should be run until the well pump comes on and a decrease in water temperature is noted which indicates that the water is coming from the well. If the homeowner is amenable, staff should run the water longer to purge the well (15+ minutes) to provide a sample representative of the water in the formation rather than standing water in the well and piping system including the pressure tank. At this point a new pair of nitrile gloves should be donned and the sample can be collected from the sample point at the pressure tank.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- If equipment was used, collect one equipment blank every day that sampling is conducted and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A sample log shall document the location of the private well, sample point location, owner contact information, sampling equipment, purge duration, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate and available (e.g. well construction, pump type and location, yield, installation date). Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appendix F - Sampling Protocols for PFAS in Fish

This appendix contains a copy of the latest guidelines developed by the Division of Fish and Wildlife (DFW) entitled "General Fish Handling Procedures for Contaminant Analysis" (Ver. 8).

Procedure Name: General Fish Handling Procedures for Contaminant Analysis

Number: FW-005

Purpose: This procedure describes data collection, fish processing and delivery of fish collected for contaminant monitoring. It contains the chain of custody and collection record forms that should be used for the collections.

Organization: Environmental Monitoring Section
Bureau of Ecosystem Health
Division of Fish and Wildlife (DFW)
New York State Department of Environmental Conservation (NYSDEC)
625 Broadway
Albany, New York 12233-4756

Version: 8

Previous Version Date: 21 March 2018

Summary of Changes to this Version: Updated bureau name to Bureau of Ecosystem Health. Added direction to list the names of all field crew on the collection record. Minor formatting changes on chain of custody and collection records.

Originator or Revised by: Wayne Richter, Jesse Becker

Date: 26 April 2019

Quality Assurance Officer and Approval Date: Jesse Becker, 26 April 2019

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

GENERAL FISH HANDLING PROCEDURES FOR CONTAMINANT ANALYSES

A. Original copies of all continuity of evidence (i.e., Chain of Custody) and collection record forms must accompany delivery of fish to the lab. A copy shall be directed to the Project Leader or as appropriate, Wayne Richter. All necessary forms will be supplied by the Bureau of Ecosystem Health. Because some samples may be used in legal cases, it is critical that each section is filled out completely. Each Chain of Custody form has three main sections:

1. The top box is to be filled out **and signed** by the person responsible for the fish collection (e.g., crew leader, field biologist, researcher). This person is responsible for delivery of the samples to DEC facilities or personnel (e.g., regional office or biologist).

2. The second section is to be filled out **and signed** by the person responsible for the collections while being stored at DEC, before delivery to the analytical lab. This may be the same person as in (1), but it is still required that they complete the section. Also important is the **range of identification numbers** (i.e., tag numbers) included in the sample batch.

3. Finally, the bottom box is to record any transfers between DEC personnel and facilities. Each subsequent transfer should be **identified, signed, and dated**, until laboratory personnel take possession of the fish.

B. The following data are required on each **Fish Collection Record** form:

1. Project and Site Name.

2. DEC Region.

3. All personnel (and affiliation) involved in the collection.

4. Method of collection (gill net, hook and line, etc.)

5. Preservation Method.

C. The following data are to be taken on each fish collected and recorded on the **Fish Collection Record** form:

1. Tag number - Each specimen is to be individually jaw tagged at time of collection with a unique number. Make sure the tag is turned out so that the number can be read without opening the bag. Use tags in sequential order. For small fish or composite samples place the tag inside the bag with the samples. The Bureau of Ecosystem Health can supply the tags.

2. Species identification (please be explicit enough to enable assigning genus and species). Group fish by species when processing.

3. Date collected.

4. Sample location (waterway and nearest prominent identifiable landmark).

5. Total length (nearest mm or smallest sub-unit on measuring instrument) and weight (nearest g or

smallest sub-unit of weight on weighing instrument). Take all measures as soon as possible with calibrated, protected instruments (e.g. from wind and upsets) and prior to freezing.

6. Sex - fish may be cut enough to allow sexing or other internal investigation, but do not eviscerate. Make any incision on the right side of the belly flap or exactly down the midline so that a left-side fillet can be removed.

D. General data collection recommendations:

1. It is helpful to use an ID or tag number that will be unique. It is best to use metal striped bass or other uniquely numbered metal tags. If uniquely numbered tags are unavailable, values based on the region, water body and year are likely to be unique: for example, R7CAY11001 for Region 7, Cayuga Lake, 2011, fish 1. If the fish are just numbered 1 through 20, we have to give them new numbers for our database, making it more difficult to trace your fish to their analytical results and creating an additional possibility for errors.

2. Process and record fish of the same species sequentially. Recording mistakes are less likely when all fish from a species are processed together. Starting with the bigger fish species helps avoid missing an individual.

3. If using Bureau of Ecosystem Health supplied tags or other numbered tags, use tags in sequence so that fish are recorded with sequential Tag Numbers. This makes data entry and login at the lab and use of the data in the future easier and reduces keypunch errors.

4. Record length and weight as soon as possible after collection and before freezing. Other data are recorded in the field upon collection. An age determination of each fish is optional, but if done, it is recorded in the appropriate “Age” column.

5. For composite samples of small fish, record the number of fish in the composite in the Remarks column. Record the length and weight of each individual in a composite. All fish in a composite sample should be of the same species and members of a composite should be visually matched for size.

6. Please submit photocopies of topographic maps or good quality navigation charts indicating sampling locations. GPS coordinates can be entered in the Location column of the collection record form in addition to or instead for providing a map. These records are of immense help to us (and hopefully you) in providing documented location records which are not dependent on memory and/or the same collection crew. In addition, they may be helpful for contaminant source trackdown and remediation/control efforts of the Department.

7. When recording data on fish measurements, it will help to ensure correct data recording for the data recorder to call back the numbers to the person making the measurements.

E. Each fish is to be placed in its own individual plastic bag. For small fish to be analyzed as a composite, put all of the fish for one composite in the same bag but use a separate bag for each composite. It is important to individually bag the fish to avoid difficulties or cross contamination when processing the fish for chemical analysis. Be sure to include the fish’s tag number inside the bag, preferably attached to the fish with the tag number turned out so it can be read. Tie or otherwise secure the bag closed. **The Bureau of Ecosystem Health will supply the bags.** If necessary, food grade bags may be procured from a suitable vendor (e.g., grocery store). It is preferable to redundantly label each bag with a manila tag tied between the knot and the body of the bag. This tag should be labeled with the project name, collection location, tag number, collection date, and fish species. If scales are collected, the scale envelope should be labeled with the same information.

F. Groups of fish, by species, are to be placed in one large plastic bag per sampling location. **The Bureau of Ecosystem Health will supply the larger bags.** Tie or otherwise secure the bag closed. Label the site bag with a manila tag tied between the knot and the body of the bag. The tag should contain: project, collection location, collection date, species and **tag number ranges**. Having this information on the manila tag enables lab staff to know what is in the bag without opening it.

G. Do not eviscerate, fillet or otherwise dissect the fish unless specifically asked to. If evisceration or dissection is specified, the fish must be cut along the exact midline or on the right side so that the left side fillet can be removed intact at the laboratory. If filleting is specified, the procedure for taking a standard fillet (SOP PREPLAB 4) must be followed, including removing scales.

H. Special procedures for PFAS: Unlike legacy contaminants such as PCBs, which are rarely found in day to day life, PFAS are widely used and frequently encountered. Practices that avoid sample contamination are therefore necessary. While no standard practices have been established for fish, procedures for water quality sampling can provide guidance. The following practices should be used for collections when fish are to be analyzed for PFAS:

No materials containing Teflon.
No Post-it notes.
No ice packs; only water ice or dry ice.
Any gloves worn must be powder free nitrile.
No Gore-Tex or similar materials (Gore-Tex is a PFC with PFOA used in its manufacture).
No stain repellent or waterproof treated clothing; these are likely to contain PFCs.
Avoid plastic materials, other than HDPE, including clipboards and waterproof notebooks.
Wash hands after handling any food containers or packages as these may contain PFCs. Keep pre-wrapped food containers and wrappers isolated from fish handling.
Wear clothing washed at least six times since purchase.
Wear clothing washed without fabric softener.
Staff should avoid cosmetics, moisturizers, hand creams and similar products on the day of sampling as many of these products contain PFCs (Fujii et al. 2013). Sunscreen or insect repellent should not contain ingredients with “fluor” in their name. Apply any sunscreen or insect repellent well downwind from all materials. Hands must be washed after touching any of these products.

I. All fish must be kept at a temperature <45° F (<8° C) immediately following data processing. As soon as possible, freeze at -20° C ± 5° C. Due to occasional freezer failures, daily freezer temperature logs are required. The freezer should be locked or otherwise secured to maintain chain of custody.

J. In most cases, samples should be delivered to the Analytical Services Unit at the Hale Creek field station. Coordinate delivery with field station staff and send copies of the collection records, continuity of evidence forms and freezer temperature logs to the field station. For samples to be analyzed elsewhere, non-routine collections or other questions, contact Wayne Richter, Bureau of Ecosystem Health, NYSDEC, 625 Broadway, Albany, New York 12233-4756, 518-402-8974, or the project leader about sample transfer. Samples will then be directed to the analytical facility and personnel noted on specific project descriptions.

K. A recommended equipment list is at the end of this document.

page ______ of ______

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF FISH AND WILDLIFE
FISH COLLECTION RECORD

Project and Site Name ____ DEC Region ____________

Collections made by (include all crew) ____

Sampling Method: ☐Electrofishing ☐Gill netting ☐Trap netting ☐Trawling ☐Seining ☐Angling ☐Other ____________________

Preservation Method: ☐Freezing ☐Other ______________________ Notes (SWFDB survey number): ____________________

FOR LAB USE ONLY- LAB ENTRY NO.	COLLECTION OR TAG NO.	SPECIES	DATE TAKEN	LOCATION	AGE	SEX &/OR REPROD. CONDIT	LENGTH ( )	WEIGHT ( )	REMARKS

richter: revised 2011, 5/7/15, 10/4/16, 3/20/17; becker: 3/23/17, 4/26/19

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
CHAIN OF CUSTODY

I, ______________________________, of ____ collected the
(Print Name) (Print Business Address)

following on ____________________, 20____ from ____
(Date) (Water Body)

in the vicinity of ____
(Landmark, Village, Road, etc.)

Town of ____, in __________________________________ County.

Item(s) ____

____

Said sample(s) were in my possession and handled according to standard procedures provided to me prior to collection. The sample(s) were placed in the custody of a representative of the New York State Department of Environmental Conservation on ____________________________________, 20______.

____ ____________________________
Signature Date

I, ___________________________________, received the above mentioned sample(s) on the date specified and assigned identification number(s) ____ to the sample(s). I have recorded pertinent data for the sample(s) on the attached collection records. The sample(s) remained in my custody until subsequently transferred, prepared or shipped at times and on dates as attested to below.

____ ____________________
Signature Date

SECOND RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
THIRD RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
FOURTH RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
RECEIVED IN LABORATORY BY (Print Name)	TIME & DATE	REMARKS
SIGNATURE	UNIT	
LOGGED IN BY (Print Name)	TIME & DATE	ACCESSION NUMBERS
SIGNATURE	UNIT	

richter: revised 21 April 2014; becker: 23 March 2017, 26 April, 2019

NOTICE OF WARRANTY

By signature to the chain of custody (reverse), the signatory warrants that the information provided is truthful and accurate to the best of his/her ability. The signatory affirms that he/she is willing to testify to those facts provided and the circumstances surrounding the same. Nothing in this warranty or chain of custody negates responsibility nor liability of the signatories for the truthfulness and accuracy of the statements provided.

HANDLING INSTRUCTIONS

On day of collection, collector(s) name(s), address(es), date, geographic location of capture (attach a copy of topographic map or navigation chart), species, number kept of each species, and description of capture vicinity (proper noun, if possible) along with name of Town and County must be indicated on reverse.

Retain organisms in manila tagged plastic bags to avoid mixing capture locations. Note appropriate information on each bag tag.

Keep samples as cool as possible. Put on ice if fish cannot be frozen within 12 hours. If fish are held more than 24 hours without freezing, they will not be retained or analyzed.

Initial recipient (either DEC or designated agent) of samples from collector(s) is responsible for obtaining and recording information on the collection record forms which will accompany the chain of custody. This person will seal the container using packing tape and writing his signature, the time and the date across the tape onto the container with indelible marker. Any time a seal is broken, for whatever purpose, the incident must be recorded on the Chain of Custody (reason, time, and date) in the purpose of transfer block. Container then is resealed using new tape and rewriting signature, with time and date.

EQUIPMENT LIST

Scale or balance of appropriate capacity for the fish to be collected.

Fish measuring board.

Plastic bags of an appropriate size for the fish to be collected and for site bags.

Individually numbered metal tags for fish.

Manila tags to label bags.

Small envelops, approximately 2” x 3.5”, if fish scales are to be collected.

Knife for removing scales.

Chain of custody and fish collection forms.

Clipboard.

Pens or markers.

Paper towels.

Dish soap and brush.

Bucket.

Cooler.

Ice.

Duct tape.

Appendix G – PFAS Analyte List

Group	Chemical Name	Abbreviation	CAS Number
Perfluoroalkyl sulfonates	Perfluorobutanesulfonic acid	PFBS	375-73-5
	Perfluorohexanesulfonic acid	PFHxS	355-46-4
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanesulfonic acid	PFOS	1763-23-1
	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluoroalkyl carboxylates	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	PFHpA	375-85-9
	Perfluorooctanoic acid	PFOA	335-67-1
	Perfluorononanoic acid	PFNA	375-95-1
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUA/PFUdA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTriA/PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7
Fluorinated Telomer Sulfonates	6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2
	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
Perfluorooctane-sulfonamides	Perfluroroctanesulfonamide	FOSA	754-91-6
Perfluorooctane-sulfonamidoacetic acids	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6

Appendix H - Laboratory Guidelines for Analysis of PFAS in Non-Potable Water and Solids

General

New York State Department of Environmental Conservation's Division of Environmental Remediation (DER) developed the following guidelines for laboratories analyzing environmental samples for PFAS under DER programs. If laboratories cannot adhere to the following guidelines, they should contact DER's Quality Assurance Officer, Dana Maikels, at dana.maikels@dec.ny.gov prior to analysis of samples.

Isotope Dilution

Isotope dilution techniques should be utilized for the analysis of PFAS in all media.

Extraction

For water samples, the entire sample bottle should be extracted, and the sample bottle rinsed with appropriate solvent to remove any residual PFAS.

For samples with high particulates, the samples should be handled in one of the following ways:

1. Spike the entire sample bottle with isotope dilution analytes (IDAs) prior to any sample manipulation. The sample can be passed through the SPE and if it clogs, record the volume that passed through.
2. If the sample contains too much sediment to attempt passing it through the SPE cartridge, the sample should be spiked with isotope dilution analytes, centrifuged and decanted.
3. If higher reporting limits are acceptable for the project, the sample can be diluted by taking a representative aliquot of the sample. If isotope dilution analytes will be diluted out of the sample, they can be added after the dilution. The sample should be homogenized prior to taking an aliquot.

If alternate sample extraction procedures are used, please contact the DER remedial program chemist prior to employing. Any deviations in sample preparation procedures should be clearly noted in the case narrative.

Signal to Noise Ratio

For all target analyte ions used for quantification, signal to noise ratio should be 3:1 or greater.

Blanks

There should be no detections in the method blanks above the reporting limits.

Ion Transitions

The ion transitions listed below should be used for the following PFAS:

PFOA	413 > 369
PFOS	499 > 80
PFHxS	399 > 80
PFBS	299 > 80
6:2 FTS	427 > 407
8:2 FTS	527 > 507
N-EtFOSAA	584 > 419
N-MeFOSAA	570 > 419

Branched and Linear Isomers

Standards containing both branched and linear isomers should be used when standards are commercially available. Currently, quantitative standards are available for PFHxS, PFOS, NMeFOSAA, and NEtFOSAA. As more standards become available, they should be incorporated in to the method. All isomer peaks present in the standard should be integrated and the areas summed. Samples should be integrated in the same manner as the standards.

Since a quantitative standard does not exist for branched isomers of PFOA, the instrument should be calibrated using just the linear isomer and a technical (qualitative) PFOA standard should be used to identify the retention time of the branched PFOA isomers in the sample. The total response of PFOA branched and linear isomers should be integrated in the samples and quantitated using the calibration curve of the linear standard.

Secondary Ion Transition Monitoring

Quantifier and qualifier ions should be monitored for all target analytes (PFBA and PFPeA are exceptions). The ratio of quantifier ion response to qualifier ion response should be calculated for each target analyte and the ratio compared to standards. Lab derived criteria should be used to determine if the ratios are acceptable.

Reporting

Detections below the reporting limit should be reported and qualified with a J qualifier.

The acid form of PFAS analytes should be reported. If the salt form of the PFAS was used as a stock standard, the measured mass should be corrected to report the acid form of the analyte.

Appendix H - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids

General

These guidelines are intended to be used for the validation of PFAS analytical results for projects within the Division of Environmental Remediation (DER) as well as aid in the preparation of a data usability summary report. Data reviewers should understand the methodology and techniques utilized in the analysis. Consultation with the end user of the data may be necessary to assist in determining data usability based on the data quality objectives in the Quality Assurance Project Plan. A familiarity with the laboratory's Standard Operating Procedure may also be needed to fully evaluate the data. If you have any questions, please contact DER's Quality Assurance Officer, Dana Maikels, at dana.maikels@dec.ny.gov.

Preservation and Holding Time

Samples should be preserved with ice to a temperature of less than 6°C upon arrival at the lab. The holding time is 14 days to extraction for aqueous and solid samples. The time from extraction to analysis for aqueous samples is 28 days and 40 days for solids.

Temperature greatly exceeds 6ºC upon arrival at the lab*	Use professional judgement to qualify detects and non-detects as estimated or rejected
Holding time exceeding 28 days to extraction	Use professional judgement to qualify detects and non-detects as estimated or rejected if holding time is grossly exceeded

*Samples that are delivered to the lab immediately after sampling may not meet the thermal preservation guidelines. Samples are considered acceptable if they arrive on ice or an attempt to chill the samples is observed.

Initial Calibration

The initial calibration should contain a minimum of five standards for linear fit and six standards for a quadratic fit. The relative standard deviation (RSD) for a quadratic fit calibration should be less than 20%. Linear fit calibration curves should have an R^2 value greater than 0.990.

The low-level calibration standard should be within 50% - 150% of the true value, and the mid-level calibration standard within 70% - 130% of the true value.

%RSD >20%	J flag detects and UJ non detects
R^2 >0.990	J flag detects and UJ non detects
Low-level calibration check <50% or >150%	J flag detects and UJ non detects
Mid-level calibration check <70% or >130%	J flag detects and UJ non detects

Initial Calibration Verification

An initial calibration verification (ICV) standard should be from a second source (if available). The ICV should be at the same concentration as the mid-level standard of the calibration curve.

ICV recovery <70% or >130%	J flag detects and non-detects

Continuing Calibration Verification

Continuing calibration verification (CCV) checks should be analyzed at a frequency of one per ten field samples. If CCV recovery is very low, where detection of the analyte could be in question, ensure a low level CCV was analyzed and use to determine data quality.

CCV recovery <70 or >130%	J flag results

Blanks

There should be no detections in the method blanks above the reporting limits. Equipment blanks, field blanks, rinse blanks etc. should be evaluated in the same manner as method blanks. Use the most contaminated blank to evaluate the sample results.

Blank Result	Sample Result	Qualification
Any detection	<Reporting limit	Qualify as ND at reporting limit
Any detection	>Reporting Limit and >10x the blank result	No qualification
>Reporting limit	>Reporting limit and <10x blank result	J+ biased high

Field Duplicates

A blind field duplicate should be collected at rate of one per twenty samples. The relative percent difference (RPD) should be less than 30% for analyte concentrations greater than two times the reporting limit. Use the higher result for final reporting.

RPD >30%	Apply J qualifier to parent sample

Lab Control Spike

Lab control spikes should be analyzed with each extraction batch or one for every twenty samples. In the absence of lab derived criteria, use 70% - 130% recovery criteria to evaluate the data.

Recovery <70% or >130% (lab derived criteria can also be used)	Apply J qualifier to detects and UJ qualifier to non detects

Matrix Spike/Matrix Spike Duplicate

One matrix spike and matrix spike duplicate should be collected at a rate of one per twenty samples. Use professional judgement to reject results based on out of control MS/MSD recoveries.

Recovery <70% or >130% (lab derived criteria can also be used)	Apply J qualifier to detects and UJ qualifier to non detects of parent sample only
RPD >30%	Apply J qualifier to detects and UJ qualifier to non detects of parent sample only

Extracted Internal Standards (Isotope Dilution Analytes)

Problematic analytes (e.g. PFBA, PFPeA, fluorotelomer sulfonates) can have wider recoveries without qualification. Qualify corresponding native compounds with a J flag if outside of the range.

Recovery <50% or >150%	Apply J qualifier
Recovery <25% or >150% for poor responding analytes	Apply J qualifier
Isotope Dilution Analyte (IDA) Recovery <10%	Reject results

Secondary Ion Transition Monitoring

Quantifier and qualifier ions should be monitored for all target analytes (PFBA and PFPeA are exceptions). The ratio of quantifier ion response to qualifier ion response should be calculated from the standards for each target analyte. Lab derived criteria should be used to determine if the ratios are acceptable. If the ratios fall outside of the laboratory criteria, qualify results as an estimated maximum concentration.

Signal to Noise Ratio

The signal to noise ratio for the quantifier ion should be at least 3:1. If the ratio is less than 3:1, the peak is discernable from the baseline noise and symmetrical, the result can be reported. If the peak appears to be baseline noise and/or the shape is irregular, qualify the result as tentatively identified.

Branched and Linear Isomers

Observed branched isomers in the sample that do not have a qualitative or quantitative standard should be noted and the analyte should be qualified as biased low in the final data review summary report. Note: The branched isomer peak should also be present in the secondary ion transition.

Reporting Limits

If project-specific reporting limits were not met, please indicate that in the report along with the reason (e.g. over dilution, dilution for non-target analytes, high sediment in aqueous samples).

Peak Integrations

Target analyte peaks should be integrated properly and consistently when compared to standards. Ensure branched isomer peaks are included for PFAS where standards are available. Inconsistencies should be brought to the attention of the laboratory or identified in the data review summary report.

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

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

Sampler Signature: Print Name:

Checked By: Date:

Deviations from the work Plan:

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
- ☐ PERISTALTIC
- ☐ SUBMERSIBLE
- ☐ BLADDER ________
- ☐ PDB
- ☐ HYDRASLEEVE ________
- ☐ OTHER ________

DECON FLUIDS USED
- ☐ ALCONOX
- ☐ DEIONIZED WATER
- ☐ POTABLE WATER
- ☐ NITRIC ACID
- ☐ HEXANE
- ☐ METHANOL
- ☐ OTHER ________

TUBING/PUMP/BLADDER MATERIALS
- ☐ SILICON TUBING
- ☐ HDPE TUBING
- ☐ LDPE TUBING
- ☐ OTHER ________
- ☐ OTHER ________
- ☐ S. STEEL PUMP MATERIAL
- ☐ PVC PUMP MATERIAL
- ☐ GEOPROBE SCREEN
- ☐ OTHER ________
- ☐ 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 ☐

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	°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:

Bradley B. LaF

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, HNO3, H2SO4, NaOH, HCl, Na2S2O3, 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 #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

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		**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

Sampler Signature:
Print Name:
Checked By:
Date:

SURFACE WATER AND SEDIMENT SAMPLING RECORD

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

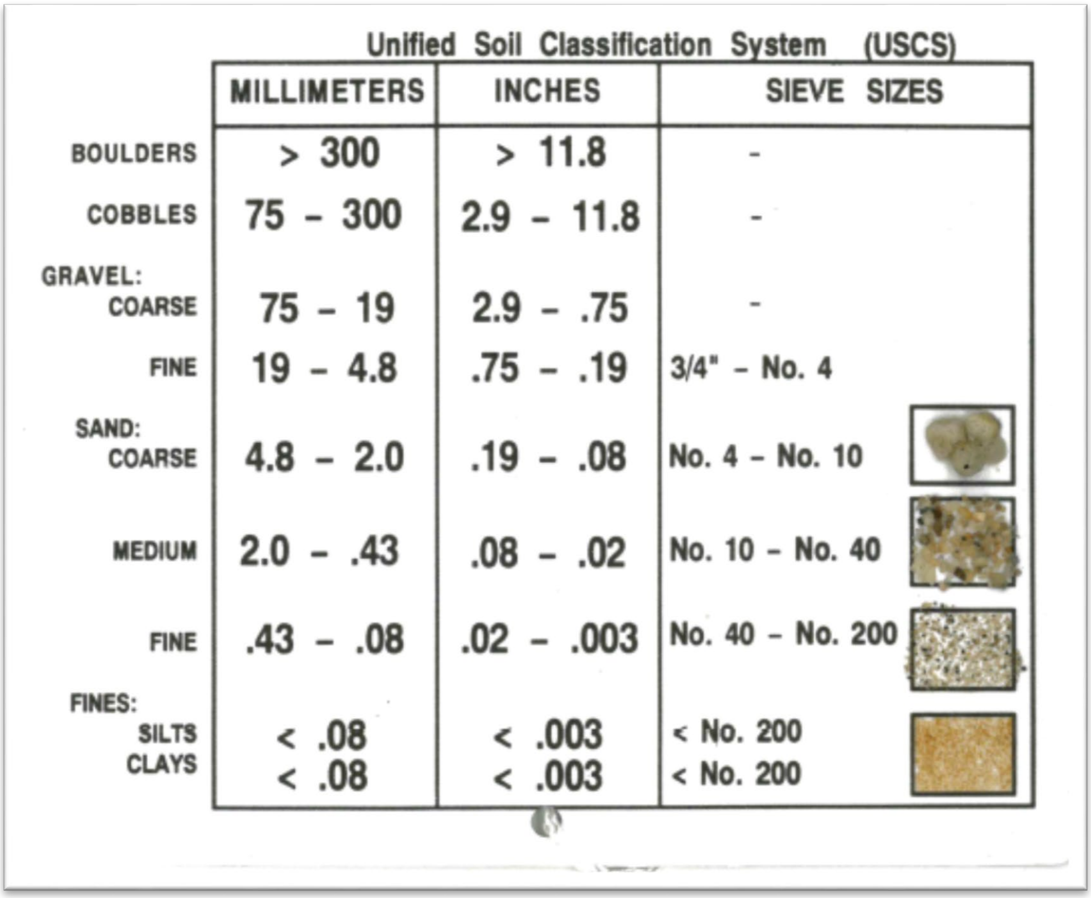
Soil will be classified in accordance with the Unified Soil Classification System (ASTM D2488). A summary of this system is attached. For environmental investigations, the hydrogeologic characteristics of the soil are generally more important than its mechanical properties. Soil descriptions should include 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 ≥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.)

Trace:	0 - 10%
Little:	10% - 25%
Some:	25% - 45%

TERMS DESCRIBING MATERIALS i.e. particles > 3", organics, debris, etc.)

Occasional:	Particles present, but < 10%
Some:	10% to 25%
Frequent:	>25%

TERMS DESCRIBING MOISTURE

Dry:	Absence of moisture; dusty
Moist:	Damp, but no visible water
Wet:	Visible/free water

TERMS DESCRIBING STRUCTURE

Layer:	> 3" thick
Seam:	1/16" to 3" thick
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)

$$RQD = \frac{\text{sum of the lengths of intact pieces of core* >100mm (0.3ft.)}}{\text{length of core advance}}$$

*Minimum NQ rock core (1.88 in. OD of core)

Quality Description	RQD
Very Poor	<25%
Poor	26% - 50%
Fair	51% - 75%
Good	76% - 90%
Excellent	>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

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:
Project Location:
Project No.:
Client: NYSDEC
Test Pit ID:
Page No. 1
of: 1

Test Pit Location:
Weather:
Surface Conditions:
Subcontractor:
Operator:
Equipment:
Reference Elevation:

Monitoring Equipment:
Photographs (Y/N):
Protection Level:
Length of Exc:
Width of Exc:
Date Started:
Date Completed:
Logged By:
Checked By:
Refusal Depth:
Total Depth:
Water Level:
Time:

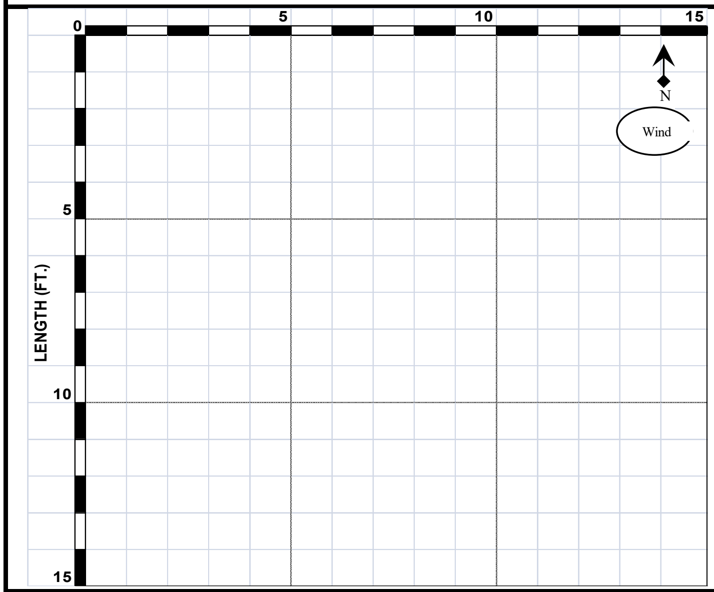
Location Sketch

N

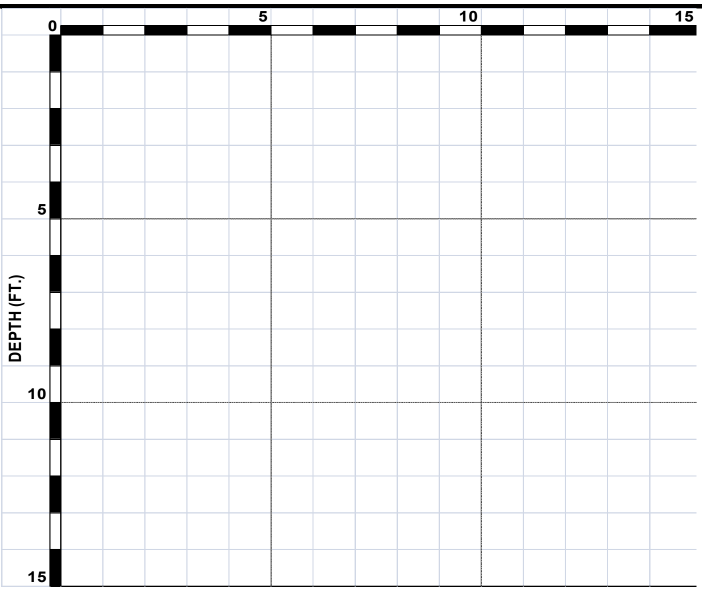
Wind

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

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:

Jean Firth

April 27, 2020

Jean Firth, PG, Program Manager

Date

Reviewed

Date

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.

Non-Core Procedures

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

<u>Rock Core Procedures</u>

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**				
Member of One Call	***Non Members**	**Utility Marked**	**Utility Responded not Present**	**Colors**	**Utility Company Name(s)**	**Utilities**
						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
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	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	°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 # 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:

Jean Firth

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? ______________

\\PLD2-FS1\Project\Projects\NYSDEC__General NYSDEC Information D009809\Program Requirements\D. Field Support-Guidance\b. QAPP_SOPs\SOPs\S17-jmf-bbl-done\S17A Utility Clearance Form.doc

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:
PROJECT NUMBER:
PROJECT LOCATION:
WEATHER CONDITIONS (AM):
WEATHER CONDITIONS (PM):
TASK NO:
DATE:
MACTEC CREW:
SAMPLER NAME:
SAMPLER SIGNATURE:
CHECKED BY:
DATE:

MULTI-PARAMETER WATER QUALITY METER

METER TYPE
MODEL NO.
UNIT ID NO.

AM CALIBRATION — **Start Time** ______ **/End Time** ______

POST CALIBRATION CHECK — **Start Time** ______ **/End Time** ______

	Units	**Standard Value**	**Meter Value**	***Acceptance Criteria (AM)**	**Standard Value**	**Meter Value**	***Acceptance Criteria (PM)**
pH (4)	SU	4.0		+/- 0.1 pH Units			
pH (7)	SU	7.0		+/- 0.1 pH Units	7.0		+/- 0.3 pH Units
pH (10)	SU	10.0		+/- 0.1 pH Units			
Redox	+/- mV	240		+/- 10 mV	240		+/- 10 mV
Conductivity	mS/cm	1.413		+/- 0.5 % of standard	1.413		+/- 5% of standard
DO (saturated)	%	100		+/- 2% of standard			
DO (saturated)	mg/L[1] (see Chart 1)			+/- 0.2 mg/L			+/- 0.5 mg/L of standard
DO (<0.1)	mg/L	<0.1		< 0.5 mg/L			
Temperature	^{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

MACTEC STANDARD OPERATING PROCEDURE #S18

SONIC DRILLING OVERSIGHT

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

SONIC DRILLING OVERSIGHT PROCEDURE

1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes methodologies for sonic drilling. This procedure includes the minimum required steps and quality checks that employees and subcontractors are to follow when drilling using this technique. This SOP addresses technical requirements and required documentation to be completed during sonic drilling oversight.

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

Boart Longyear: http://www.boartlongyear.com

3.0 DEFINITIONS

Cleanout Depth – The depth to which the end of the drill string has reached after an interval of cutting.

Drill String – The complete air rotary/air hammer drill assembly including hammer/bit, casing collars and stabilizers, and drill casing.

Hoist Line – Wire rope used on the draw works to hoist and lower loose augers, the removable center plug, sampling rods and split barrel, or the down-hole sampling hammer assembly.

Mast – A load-bearing structure on a drilling rig used for supporting the rotation head, pulldown hydraulics, hoisting lines, etc. It must be constricted to safely carry the expected loads encountered in drilling and completion of wells of the diameter and depth for which the rig manufacturer specifies the equipment. To allow for contingencies, it is recommended that the rated capacity of the mast should be at least twice the anticipated weight of the load or normal pulling load.

Oscillator Housing – Uses two eccentrics, counter-rotating balance weighs that are timed to direct 100% of the mechanical vibration energy at 0 degrees and 180 degrees to the drill pipe. An air spring system insulates the drill rig from the vibration. Counterbalances produce resonant energy waves that minimize borehole friction on the drill string.

Dual-Casing System – A 4-inch to 8-inch diameter core barrel, which is advanced for sampling purposes with an appropriately sized (6- to 10-inch diameter) outer drill pipe (casing). Typically, the core barrel is advanced ahead of the drill pipe for the length of the core run. The outer pipe is then advanced over the core barrel to keep the hole open for core and barrel retrieval. The outer drill pipe may be kept in the ground once total depth has been reached and may be used as casing material for the installation of wells.

4.0 SONIC DRILLING METHODOLOGY AND CONSIDERATIONS

Sonic drilling is a subsurface exploration technique that utilizes a dual-cased drilling system that is advanced hydraulically and with mechanical vibration (between 50 and 150 Hertz). The dual-cased system uses an inner core barrel, an outer large-diameter drill pipe, and a drill bit that are advanced during drilling. Sonic drilling commonly utilizes the vibration in consortium with a slow rotation and down-pressure to advance the drill string. The drill bit generates sinusoidal vibration waves that cause a cutting action at the bit face.

The cutting actions include fracturing, shearing, or displacement of the subsurface materials. Displacement often occurs as the vibration fluidizes unconsolidated deposits causing the material to move away from the drill string. Most of the formation, however, enters the core barrel and is contained within distinct plastic liners. Fracturing action is typically associated with drilling through cobbles and boulders, while shearing action is associated with drilling through elastic formations such as dense silt, clay, or shale.

Rotosonic/Rotasonic drilling is a modification of sonic drilling in which the core barrel is advanced sonically until full. The casing is then advanced sonically and in some cases with the use of water to cool the drill head and provide additional stability of the core upon retrieval. This method assists in reducing the overall system heat generation, which in turn prolongs equipment life, and reduces time. However, the application of water increases the volume of IDW over traditional sonic drilling methods.

Sonic drilling is typically utilized for soils that are too hard/dense for hollow stem auger borings and in which other methods, such as fluid rotary, are not considered cost or time effective due to proposed borehole depths. Standard penetration tests may be conducted with a sonic drilling rig with the appropriate equipment. Consult the **SOP for Drilling – Soil Boring and Rock Coring Oversight** for method guidance if this testing is designated in the field activities plan (FAP). Sonic drilling methods are also capable of sampling bedrock, however the method results in poor quality rock recovery which may not meet the data objectives of an environmental drilling program. If required to complete bedrock borings it is recommended to complete the soil sampling and casing deployment using the sonic drilling methods and then switch to more conventional rock coring techniques as discussed in the **SOP for Drilling – Soil Boring and Rock Coring Oversight**.

Potential difficulties in using the sonic drilling technique include: the potential for downtime as a result of the complexity of the drill head mechanics; vibration may cause heat to develop which may result in loss of contaminants from samples (particularly volatile organic compounds) or failure of the drill bit; fine-grained particles may migrate to the periphery of the core due to the vibratory action; and during retraction of the outer casing, the casing is vibrated which may cause the pin or box at the joints to fail resulting in casing remaining in the ground.

5.0 PROCEDURE

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 and by maintaining quality assurance/quality control (QA/QC).

The PM will select the appropriate drilling methodology based on the objectives of the project. The PM is also responsible for ensuring that the site-specific FAP is clear in defining drilling methods.

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.

5.1.1 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 (**Attachment S18A**) to document that utility locate activities and markout have been completed prior to the initialization of drilling activities.

Equipment Selection and Materials Considerations

- A drill rig of sufficient horsepower, hoisting capacity, and torque to drill borings of sufficient width and depth as specified in field activities plan (FAP) will be selected to complete the work.
- The rig should have the drill pipe handling system built into the drill mast. Optionally, a support truck may be mobilized with an on-board crane system for handling the drill piping.
- Casing, bit, and core barrel of sufficient size to complete the borings. Drill casings may need to be oversized to install bedrock casings.
- If lubricants are needed on rod joints, non-petroleum based lubricants will be used. If available, Teflon-based thread compound is recommended, however these compounds should be limited in use on site if sampling for emerging contaminants per- and polyfluoroalkyl substances (PFAS).
- A pump and tremie piping for pumping annular grout seal into the borehole. -Appropriate decontamination equipment (steam cleaner, materials for a decon pad, etc.) as necessary.

The following materials will be available, as required:

- 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 (HASP);
- 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 (FDRs);
- Photoionization detector (PID);
- Camera;
- Field notebook.

5.2 Field Procedures

Data and Records Management

The following records will be maintained by the field geologist/engineer:

- Field Logbook
- Soil Boring Log FDR
- Well Installation Diagram FDR

In the field book, the field 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 atached**). See **the Description and Identification of Soil Samples SOP (see Table A-1 for the SOP #)** for description methodology.

Drilling Procedures

1. Prior to mobilizing to the drilling location, the drill operator and the engineer/geologist will inspect the drill equipment for proper maintenance and condition. Out-of-specification materials will not be utilized or will be repaired.
2. Physical barriers or warning lines will be deployed in accordance with the HASP to create an exclusion zone to keep non-qualified personnel away from the rig. All materials and equipment will be staged in the exclusion zone.

3. Once the drill site is prepared, the drill should be stabilized and leveled using the hydraulic outriggers. Wooden blocking should be placed under the outrigger hydraulic rams on soft surfaces to stabilize the rig. The mast should be raised slowly such that no shifting of the rig occurs.
4. Careful measurement of all drilling tools, samplers, and casing must be exercised during all phases of the boring operations, to ensure maximum quality and recovery of the sample.
5. The borehole will be advanced by driving the outer casing, inner casing and core sampler in 5 or 10-ft runs (depending on the rig capacity or tooling capability).
6. The inner casing and core sampler is driven to the length of the chosen run. Drilling water is typically not used during this process to avoid impacting the environmental sample
7. The outer casing is then driven the length of the run to override the inner core casing to allow for retrieval of the soil sample by bringing the inner casing to the surface. Drilling water is typically used during this process to avoid binding the casings.
8. At the surface, a polyethylene or other appropriate material sample bag will be slid over the outside of the core sampler and the soils will be gently extruded into the sample bag.
9. The sample bag will be opened by the driller and laid out for the field geologist/engineer. A fresh face of the sample will be prepared by using a clean flat edged scraper (e.g. paint scraper) in perpendicular motions to the sample orientation. 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 (see Table A-1 for the SOP #)** for description methodology). 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 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 the **Soil Sampling and Field Preservation of VOC and GRO Samples [SOP #s listed on Table A-1]** for soil sampling methods.
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.
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.

15. If a monitoring well is to be installed see **Monitoring Well and Microwell Installation SOP** for methodology and installation details.
16. Decontaminate non-disposable equipment or tools that may have come into contact with subsurface soil in accordance with the FAP.
17. Discard all disposable equipment used during sampling activities in a designated location.
18. 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.

Once the boring/well installation is complete, the rig mast will be lowered, the outriggers will be lifted and the rig will be moved off of the boring location. All cuttings or other waste will be containerized or disposed of in accordance with 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 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.

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 **Monitoring Well and Piezometer Installation SOP.**

6.0 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? ____________________

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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:

Bradley B. L

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:

Bradley B.

April 27, 2020

Bradley LaForest, NRCC-EAC, Program Manager

Date

Reviewed

Date

______________________ ______________________

______________________ ______________________

______________________ ______________________

FIELD EQUIPMENT DECONTAMINATION

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

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 # 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:

Bradley B. L

April 27, 2020

Bradley LaForest, NRCC-EAC, Project Manager

Date

Reviewed

Date

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.

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. (^{o}C)	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	°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

APPENDIX C

DER-10: Appendix 1A Community Air Monitoring Program

Appendix 1A
New York State Department of Health
Generic Community Air Monitoring Plan

Overview

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

> **Continuous monitoring** will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.
>
> **Periodic monitoring** for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. “Periodic” monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or

overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

1. If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must 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.

2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/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 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

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

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

December 2009