November 2018
Portage Canal – Segment 2 Remedial Design

ANCHOR QEA

Field Sampling Plan

Portage, Wisconsin
BRRTS No.: 02-11-577055

Prepared for Wisconsin Department of Natural Resources

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ABBREVIATIONS

ACBM	asbestos-containing building material
CBSQG	Consensus-Based Sediment Quality Guidelines
CFR	Code of Federal Regulations
City	City of Portage
cm	centimeter
COC	chemical of concern
Corps	United States Army Corps of Engineers
CPR	Canadian Pacific Railway
DCP	dynamic cone penetration testing
DNR	Wisconsin Department of Natural Resources
DOT	Wisconsin Department of Transportation
DQO	data quality objective
EOC	elevation of contamination
FSP	Field Sampling Plan
FVST	field vane shear testing
GPS	global positioning system
IDW	investigation-derived waste
JSA	Job Safety Analysis
LBP	lead-based paint
mg/kg	milligram per kilogram
NAPL	non-aqueous phase liquid
OSHA	Occupational Safety and Health Administration
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PDI	pre-design investigation
PFAS	perfluoroalkyl and polyfluoroalkyl substances
PID	photoionization detector
PLM	polarized light microscopy
PPE	personal protective equipment
ppm	parts per million
QA/QC	quality assurance/quality control
RTK	real-time kinematic
SOP	standard operating procedure
SSP	Site Safety Plan
TCLP	toxicity characteristic leaching procedure
USCS	Unified Soil Classification System

USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound
XRF	x-ray florescence

1 Introduction

This Field Sampling Plan (FSP) describes the approach and procedures to collect pre-design data to support the Portage Canal Segment 2 remedial design. This project is being performed as a partnership between the Wisconsin Department of Natural Resources (DNR), the Wisconsin Department of Transportation (DOT), and the City of Portage (City) to accomplish three main goals, each with a different funding source, with one construction event. The project goals are as follows:

- Goal 1: Remediate the contaminated sediment
- Goal 2: Construct a shared use path
- Goal 3: Construct pedestrian bridges

This FSP details the activities required to support the development of design documents, which will define work to achieve Goal 1. The other goals will be completed in conjunction with other tasks in the canal area performed by the City and their consultant (Goals 2 and 3).

1.1 Project Objectives

The overall objective of the project is to achieve Goal 1 and the overall objective of this sampling is to collect additional data to support the remedial design. Specific data quality objectives (DQOs) developed to facilitate achievement of the overall objective are as follows:

- **DQO 1:** Update the project base map from Short Elliott Hendrickson to support development of the remedial design and contract drawings.
- **DQO 2:** Update topography and bathymetry to refine the removal volume estimates for construction bidding.
- **DQO 3:** Identify objects or structural impediments that may affect remedial work.
- **DQO 4:** Refine the presence and extent of soft sediment, debris, and hard surfaces in the canal as a line of evidence for removal volume estimates.
- **DQO 5:** Determine the extent of contaminated material on the bank of the Canal.
- **DQO 6:** Refine the vertical extent of contaminated sediment in removal areas to define the elevation of contamination (EOC).
- **DQO 7:** Refine the geotechnical engineering properties of the material to be removed to support excavation, material handling, dewatering, and landfill tonnage estimates for construction bidding.
- **DQO 8:** Refine waste characterization data to support landfill material acceptance.
- **DQO 9:** Acquire aerial video and photography of the site for public relations, DNR management, remedial contractors, and observations of site features in difficult-to-access areas.
- **DQO 10:** Collect information necessary to design the remedial action underneath and adjacent to the Canadian Pacific Railway (CPR) crossing.

- **DQO 11:** Collect geotechnical information to support a design objective of preventing bank destabilization.
- **DQO 12:** Conduct a pre-demolition investigation to collect information necessary for the demolition of the shed and storage building on the Portage levee property.

1.2 Field Sampling Plan Organization

This FSP is organized into six sections as follows:

- Section 1 (this section) presents the project purpose and the objectives of the FSP.
- Section 2 provides a site description and brief overview of the site history.
- Section 3 describes the field activities.
- Section 4 presents an overview of data management, with additional information provided in Appendix B (Quality Assurance/Quality Control [QA/QC] Plan).
- Section 5 presents a project schedule for conducting the investigations.
- Section 6 provides the list of references cited in this document.

2 Site Description and Background

This section provides information on the background of the site, including a brief site description and an overview of the site history.

2.1 Site Description

Portage Canal is a 2.5-mile long and 17-acre canal in Portage, Columbia County, Wisconsin (Figure 1). The canal begins at the Wisconsin River and flows northeast, through the city's downtown before emptying into the Upper Fox River. The canal project corridor includes four segments based on major road and rail crossings, per Table 1.

Table 1
General NR 700 Site Information

Segment	From	To	BRRTs No.	Length (feet)
1	Wisconsin River/Highway 51	Adams Street	02-11-543021[1]	700/2,100
2	Adams Street	CPR crossing	02-11-577055	3,500
3	CPR	Highway 33	02-11-577056	1,800
4	Highway 33	Fox River	02-11-577057	4,700

Notes:
1 The transportation enhancement project refers to Segment 1 as including from the Wisconsin River to Adams Street. The BRRTs case for Segment 1 (02-11-543021) excludes the 1,400-foot section from the Wisconsin River to Highway 51 because sampling showed it was not contaminated and the City dredged it in 2006.

The physical extent of this project includes 3,600 feet of the canal, from Adams Street to a location approximately 100 feet downstream of the CPR bridge near Center Street. This project consists of all of Segment 2 and approximately 100 feet of Segment 3. Adjacent land use includes: 43 parcels of residential houses on the north bank, 19 parcels including residential houses on the south bank, two commercial businesses (Alter Trading Corporation and Whaley Automotive) with parking lots, a County parking lot, and a DNR parcel with building and shed (which serves as the Portage levee maintenance facility).

2.2 Site History

Portage Canal is not a natural waterbody; private entities and U.S. Army Corps of Engineers (Corps) created it from 1838 to 1876. The remains of navigation locks lie at either end of the canal. Water flow through Portage Canal has been reduced since the Corps closed the locks and abandoned the canal in 1959. In 1961, the Corps transferred ownership of the canal to the State of Wisconsin by a quit claim deed.

Currently, water flow is largely from groundwater and stormwater during precipitation events. An intake structure in the Wisconsin River supplies a nominal amount of water to the canal beneath a levee constructed by the Corps in 1998. Portage Canal is in the Great Lakes Basin as a tributary to Lake Michigan. It is also listed on the National Register of Historic Places. Furthermore, the canal is considered a water of the state and a jurisdictional water under the Clean Water Act due to its history for navigation and interstate commerce.

2.3 Nature and Extent of Contamination

Mead and Hunt, working for the City as part of the Phase II for the transportation enhancement grant, discovered and reported contamination of canal sediments to the DNR in 2002. The DNR and others performed sediment characterization in 2003, 2004, 2009, 2013, 2015, and 2016 by collecting samples and testing for a total of 121 chemical parameters. The characterization identified heavy metals, polycyclic aromatic hydrocarbons (PAHs), petroleum, polychlorinated biphenyls (PCBs), and non-aqueous phase liquid (NAPL) as chemicals of concern (COCs). Nine heavy metals exceeded the DNR Consensus-Based Sediment Quality Guidelines (CBSQG) Interim Guidance WT-732 2003 threshold effect concentrations (DNR 2003), including cadmium, chromium, copper, iron, lead, mercury, nickel, silver, and zinc. Lead and mercury exceeded the CBSQG most consistently and by the highest margin, and are considered the primary contaminants of concern (Ramboll 2017). Lead and mercury concentrations within Portage Canal sediments were collocated and correlated. Therefore, mercury is used as the primary risk driver for the site. Mercury concentrations above levels of concern are confined to organic silt and silty sand sediment between the existing canal banks and do not extend into the underlining native sand material (Ramboll 2017).

Sediment consists primarily of dark brown to black silty sand containing variable amounts of organics, clay, and gravel. The sediment also contains various amounts of debris that includes a range of urban garbage, such as plastics and cans, and large cobbles. Material under the soft sediment is a poorly graded fine sand and is visually distinct from the overlying sediment. Mercury in sediment core samples ranges from non-detect to 11 milligrams per kilogram (mg/kg) and averages between 2 to 3 mg/kg. The thickness of the soft sediment in Segment 2 ranges from 0.4 to 5.0 feet. Normal water depths vary from 0 to 2.1 feet.

Exposure pathways are complete for both human and ecological receptors based on the Conceptual Site Model (Ramboll 2017). Exposure pathways for humans are complete for recreational activities such as paddle sports and fishing. Paddle sports pathways include dermal contact and incidental ingestion of sediment. Fishing pathways include the ingestion of fish tissue from fish caught from the canal. The DNR has a posted a fish consumption advisory specific to Portage Canal for PCBs in common carp based on fish tissue testing. Exposure pathways for ecological receptors are complete for benthic invertebrates as well as fish and piscivores through the food chain. The canal is on the impaired waters list because of the contaminated sediment.

The sediment remedial cleanup goal for the canal is 0.36 mg/kg total mercury, and the *Remedial Actions Options Report* (Ramboll 2018) developed the following remedial objectives for the site:

- **Remedial Objective 1:** Reduce human exposures to chemicals of concern associated with incidental sediment ingestion and fish consumption from the canal by reducing the bioavailability and concentration of chemicals of concern in sediments that are above protective levels.
- **Remedial Objective 2:** Reduce the exposure of the aquatic community and wildlife populations to sediment chemicals of concern at concentrations that are above protective levels.
- **Remedial Objective 3:** Minimize downstream transport of chemicals of concern during remedial action implementation.

As documented in the *Segment 1 Remediation Construction Documentation Report* (DNR 2017), sheen was observed during sediment coring and also on geotextile tubes during remediation of Segment 1. Also documented in the *Site Investigation Report* (Ramboll 2017), Gruber Automotive is presumed to have been dumping petroleum substances into Portage Canal. The storm sewers from the former Gruber facility empty directly into the most upstream section of Segment 2. In addition, inspection of Sanborn maps identified a former manufactured gas plant along Segment 1 that operated from the 1890s to between 1910 and 1920. Note that only one core location (other than a composite in Segment 1) has been analyzed for PAHs. A sample maximum concentration of 68 mg/kg total PAH18 was reported for that core (PC13-56).

The DNR previously identified the EOC at sediment core locations by measuring the elevation of the transition point from sediment to underlying native sand. The DNR confirmed the validity of this approach through chemical analysis of the sediment and underlying native sand. The native sand bottom also represents the original dredging by the Corps from when the canal was constructed. The EOC was apparent unless multi-depositional or intra-bedded sand layers were present. Several observations and conclusions from previous investigations are as follows:

- The EOC was clear in 24 of the 28 cores collected in Segment 2 and the cores did not have multi-depositional layers.
- Multi-deposition layers existed at locations PC13-55, PC13-56, PC13-61S, and PC13-33. Except for PC13-33, all these locations are in the delta area in the most upstream part of Segment 2.
- Peat was encountered below contaminated sediment at locations PC13-53, PC13-55, and PC13-57S and in all cases, the native peat material was uncontaminated.

2.4 Selected Remedy

Remedial Action Option 4 is the selected remedy from the *Remedial Actions Options Report* (Ramboll 2018). RAO 4 includes the removal of contaminated sediment by dredging, followed by

placement of a sediment cover. Removed material will be transported to a staging and processing area where it will be dewatered and processed to meet landfill requirements. The processed material will be transported to pre-approved licensed disposal facilities. Capping will be conducted where there are concerns for utilities and bank stabilization. The remedy underneath the railroad bridge is under negotiation and will be determined at a subsequent date, following data collection activities.

3 Pre-Design Investigation

The purpose of the pre-design investigation (PDI) sampling described herein is to collect additional information to support the design of the selected remedy. The appendices (Appendix A – Standard Operating Procedures [SOPs], Appendix B – QA/QC Plan, and Appendix C – Site Safety Plan [SSP]) have been developed as documents to support the PDI activities.

This section describes the investigation activities to be performed at the site, consisting of both field surveys and sampling, as follows:

- Field surveys
  - Topographic survey
  - Bathymetric survey
  - Objects survey
  - Sediment poling
  - Drone
  - Protected species
- Sampling
  - Sediment cores
    - EOC determination
    - Waste and geotechnical characterization
    - Bulk sediment sampling for sand separation bench-scale study
  - Canal banks
    - Chemistry characterization
    - Geotechnical characterization
  - Building
    - Asbestos inspection
    - Lead-based paint (LBP) inspection
    - Hazardous material inventory

Prior to commencing work, communications and notifications will occur, as follows:

- A kickoff meeting with the DNR; Anchor QEA, LLC; The Sigma Group, Inc.; DOT; and the City has been scheduled for November 12, 2018
- Diggers hotline will be contacted for utility markout
- CPR will be notified, and work will not be conducted until approved
- The City will notify property owners of impending field work

3.1 Field Surveys

Five field surveys are planned as part of the investigation activities, to address DQOs 1 through 4 and DQO 9, by refining the project base map and other supporting information for engineering analyses. The engineering analyses include refining the bathymetry and topography to estimate removal volume estimates and establish constructability offsets from structures. Information obtained during the surveys will be recorded in the field database or logbook, as appropriate, following procedures described in SOP-01 – Field Records (Appendix A).

All survey information will be collected in the following coordinate system:

- Horizontal datum: North American Datum 1983 High Accuracy Reference Network Wisconsin Coordinate Reference System Columbia County U.S. Feet
- Vertical datum: North American Vertical Datum of 1988, U.S. feet
- Vertical accuracy: +/- 0.1 foot

3.1.1 Topographic Survey

County Light Detection and Ranging (LiDAR) data are available, and the City has already collected topography and created a base map to support Goals 2 and 3, as discussed in Section 1.1. However, additional site topography is necessary along the banks of the canal to connect the bathymetry measurements to the existing topography. A topographic survey will be performed by a licensed Wisconsin surveying firm to primarily support DQOs 1 and 2. Topographic measurements will be taken along 76 transects on the banks of the canal to the water's edge (Figures 2a through 2e). An adaptive management plan will be used to space the data along Segment 2. Initially, topographic survey data will be collected on 25-foot transects for the first eight transects. If the elevations of the adjacent transects are similar (less than 6 inches), then the transect spacing will be increased to 50 feet. These measurements will connect with top of sediment bed elevations as discussed in Section 3.1.2. Survey resolution is expected to be consistent with that typically achieved with a real-time kinematic (RTK) global positioning system (GPS) or total station methodology (approximately 1 to 2 centimeters [cm] horizontal and 2 to 4 cm vertical).

Survey control will also be installed as part of the topographic work. A staff gauge will be installed and surveyed within the canal for maintaining vertical control during sediment poling and sediment coring activities that are conducted from a boat or wading. The location of the staff gauge will be determined in the field, but a centrally located area with visual access from shore on the DNR property will be targeted (Figure 2e).

3.1.2 Bathymetric Survey

To accurately map the sediment bed elevations, a detailed bathymetric survey will be performed within the canal to support DQO 2. This survey will support engineering analyses, including the

refinement of sediment removal volumes, and provide an understanding of current site bathymetry (i.e., water depths and sediment bed elevations throughout the site).

Based on the dense vegetation in and overhanging the canal and shallow water depths, bathymetry measurements will be collected from a flat-bottomed vessel or personnel wearing waders (depending on site conditions) using traditional surveying techniques of a calibrated survey rod outfitted with a sediment plate and a total station (Figures 2 a through 2e). Top-of-sediment elevations will be collected at approximately 10 feet intervals along 76 transects (Figures 2 a through 2e). An adaptive management plan will be used to space the data along Segment 2. Initially, bathymetric survey data will be collected on 25-foot transects for the first eight transects. If the elevations of the adjacent transects are similar (less than 6 inches), then the transect spacing will be increased to 50 feet. These bathymetric measurements will have a vertical accuracy of approximately +/- 0.1 foot.

3.1.3 Objects Survey

An object survey will be performed to observe, survey, and qualitatively evaluate objects within and adjacent to the canal as well as the anticipated remedial support and sediment processing areas to support DQOs 3 and 10. The object survey within the canal will be performed from a flat-bottomed vessel or personnel wearing waders. The object survey will be used within the design to identify objects or structural impediments that may affect remedial work.

The following includes but is not limited to potential objects of interest when performing the survey:

- Large debris in work areas such as downed trees, cobbles and boulders, and urban debris (e.g., shopping carts, tires)
- Storm sewers or other outfalls
- Shoreline support walls, including retaining walls, riprap, and the remnants of the original timber revetment canal walls at the bottom of both banks
- Piles, bridge piers, and abutments, particularly at the CPR bridge
- Utility crossings
- Upland structures in close proximity (within 20 feet) to the canal
- Trees (number and type) in the expected remedial support and sediment processing areas
- Surface structures (parking lots, building, roads) in the expected remedial support and sediment processing areas
- Clearance measurement to determine equipment needs underneath the CPR bridge

Information will be recorded on the appropriate field form (see forms provided in the SOPs in Appendix A).

In addition to collecting photographs and measurements of the objects as described previously, a video survey of the culverts under Adams Street will also be performed.

3.1.4 Sediment Poling

In support of DQO 4, sediment poling will be performed at the site to identify the presence and extent of soft sediments and to also identify debris within the canal. Sediment thickness data will be primarily used to estimate removal volumes. During all poling activities, the water depth, top-of-sediment elevation (see Section 3.1.2), bottom-of-sediment elevation, horizontal coordinates, relative sediment consistency, location, date, time, and any pertinent visual observations will be recorded. Horizontal position data will be collected with a RTK GPS or total station. Vertical accuracy will be within +/- 0.1 feet.

Poling will be conducted from a shallow draft vessel where possible. In shallow water areas, or in areas of sediment that are exposed (mudflats), the probing will be conducted by wading or walking. Poling will be performed utilizing a small (less than 0.5 inch) -diameter steel rod advanced manually through the sediment to refusal. Additional rod lengths will be available to accommodate deep water and/or thick sediment deposits. A standard survey rod (approximately 2-inch diameter) will be used to measure water depth and identify the sediment-water interface.

Sediment poling will be performed concurrent with the bathymetry and topography along transects spaced approximately 25 feet apart along the alignment of the canal (Figures 2 a through 2e). Similar to the topographic and bathymetric survey data collection, an adaptive management plan will be used for poling. Initially, sediment poling will be collected on 25-foot transects for the first eight transects. If the elevations of the adjacent transects are similar (less than 6 inches), then the transect spacing will be increased to 50 feet. Poling locations across a transect will include the edge of water (both sides), bottom of the banks, every 10 feet in between the banks, and any major changes in grade. If the location of the bottom of the banks do not coincide with the timber revetment, an additional sediment poling point will be placed 1 foot from the timber revetment to understand the thickness of sediment that may be left behind when assessing bank stability

3.1.5 Drone Survey

A drone survey will be performed to support DQOs 9 and 10. The unmanned aircraft system (drone) technology will be used to aerially map the site in conjunction with traditional ground survey procedures (total station surveying methods). Aerial drone survey will be completed once the leaves have fallen from the trees. A pre-flight checklist is included as an appendix to SOP 1 – Field Records. This checklist will be filled out as mandated by the Federal Aviation Administration prior to operation of the drone. Specific aerial photographs include the following:

- An overview of the entire canal, including the locks
- Both banks of the canal in Segment 2
- Objects flagged for drone footage from the object survey (e.g., downed trees)
- The CPR bridge, particularly along the piles/abutments

- Expected upland areas of placement of remedial support area(s) and sediment processing areas

3.1.6 Protected Species

During the PDI, field staff will note and attempt to photograph wood turtles (*Glyptemys insculpta*) if observed. Documentation of visual observation will include the date, time, location in the canal, and surrounding habitat (e.g., marsh, in-water). Documentation will then be provided to the DNR Project Manager. The wood turtle is designated a threated species in Wisconsin per the Wisconsin Department of Natural Resources website and is potentially found in Columbia County (DNR 2018).

3.2 Sampling

Three sampling tasks (sediment, canal bank, and building) are planned as part of the PDI to assess the EOC in the sediment and understand the extent of contamination on the canal banks. The third task is designed to assess the environmental concern of the Portage levee shed and storage building demolition. Each sampling task includes a discussion on the sampling process design as well as sampling methods and analyses. Additional information regarding sample management (e.g., containers, preservation, holding times, packing, handling, shipping) is provided Appendices A and B.

3.2.1 Sediment Sampling

This section provides the proposed sediment sampling DQOs and sampling methods and analyses.

3.2.1.1 Data Quality Objectives

Select areas in Segment 2 have been previously characterized as detailed in Section 2.3; however, further characterization is necessary to refine the EOC. Four DQOs were identified in Section 1.1 to address sediment characterization, as follows:

- **DQO 6:** Refine the vertical extent of contaminated sediment in removal areas driven by the EOC.
- **DQO 7:** Refine the geotechnical engineering properties of the material to be removed to support excavation, material handling, dewatering, and landfill tonnage estimates for construction bidding.
- **DQO 8:** Refine waste characterization data to support landfill material acceptance.
- **DQO 10:** Collect all information necessary to design the remedial action underneath and adjacent to the CPR crossing.

3.2.1.2 Sampling Methods and Analyses

In order to address the DQOs, three sediment coring programs were developed:

- Sediment coring for EOC
- Sediment coring for waste characterization
- Sediment coring for geotechnical characterization

3.2.1.2.1 Sediment Coring and Processing for EOC

Soft sediment samples have consistently showed mercury and lead concentrations greater than the DNR's cleanup goal, while the underlying native sand was not contaminated (Ramboll 2017). Also, historical sediment cores often depict a clear transition between the contaminated, soft sediment and the native sand. Based on these observations, the EOC typically aligns with the extent of soft sediment. Given the importance of the sediment poling data, the primary purpose of the sediment coring efforts to assess EOC will be to confirm sediment poling results.

Sediment coring to assess the EOC will occur under the following four circumstances:

- Initial correlation of the sediment poling results with the visual EOC
- QA/QC of sediment poling
- A difference is encountered in poling results of more than 50% across four adjacent transects where the soft sediment thickness is a minimum of 12 inches
- Presence of NAPL sheens or strong odors (e.g., petroleum) during sediment poling

First, the sediment poling accuracy will be assessed by collecting two cores per transect, at coincident sediment poling locations for the first four transects targeting a location approximately 15 feet from the timber revetment where the expected design dredging slope of 3 horizontal: 1 vertical would intersect with the EOC or at locations with difficult-to-interpret poling results. If sediment poling estimates are in good agreement (within 3 inches) with the physical demarcation of the EOC, sediment coring will continue to address the remaining three assessments. However, if they are not in agreement or if a physical demarcation of the EOC is not evident in the cores, sediment coring will continue on two additional transects. Thereafter, two cores per transect will be collected approximately every eighth 25-foot transect for 28% of the total number of transects (21 transects in Segment 2) as a QA/QC of poling (Table 2a and Figures 2 a through 2e).

Sediment cores will also be collected in areas where a difference in poling results of more than 50% across four adjacent transects occurs with a 12-inch minimum soft sediment thickness. Finally, sediment cores will also be collected if sheens or strong odors are present during sediment poling to investigate the extent of these observations.

Sediment cores will be collected using a flat-bottomed vessel or personnel wearing waders, depending on the water depths using direct-push coring techniques. The proposed sampling location will be located in accordance with SOP 03 – Navigation and Boat Positioning (Appendix A). Sediment cores will be collected by advancing a 2- to 4-inch-diameter section of Lexan tubing through the sediment by hand (see SOP 04 – Sediment Sampling; Appendix A). The Lexan tubing will be pushed, collecting a continuous sediment core from the sediment-water interface to the targeted collection depth of 6 inches into the sand layer or refusal. For each proposed location, the field crew will attempt to obtain the targeted collection depth and a targeted 70% recovery no more than three

times. In cases where attempts are unsuccessful, the core with the highest recovery will be kept. The recovered sediment will be capped within the tube, labeled, and transported to shore for processing.

At the processing area, the sediment cores will be processed in accordance with the procedures of SOP 05 – Sediment and Soil Core Processing (Appendix A). Any remaining water will be slowly decanted from the top of the sediment and the sediment core will be weighed to compute wet bulk density. Following weighing, the core will be split longitudinally, screened with a photoionization detector (PID), and logged using the Unified Soil Classification System (USCS) to include soil type, color, consistency, odors, and visible evidence of impacts (e.g., sheen). The native sand, where encountered, will be noted and the core (including demarcation) will be photographed.

If the EOC is not evident due to multi-depositional layers, the core will be divided into 6-inch segments. Each segment will be homogenized in a disposable tray or bowl and placed into the appropriate container, provided by the analytical testing laboratory, to be analyzed for mercury and lead. If visual NAPL or strong odors are observed and the PID readings are greater than 5 parts per million, the samples will either be individually analyzed for volatile organic compounds (VOCs) and PAHs or included in the waste characterization composite. This PID reading of 5 parts per million (ppm) will be reevaluated in the field, as necessary with input from the DNR, if PID readings are consistently greater than 5 parts per million. Once samples are prepared, the samples will be checked and information will be entered onto a chain-of-custody form for transport to the laboratory per SOP 06 – Sample Custody (Appendix A). Sample containers will be placed in a secure area and stored on wet ice or under refrigeration at 4°C, pending shipment to the analytical laboratory per SOP 07 – Sample Handling, Packaging, and Shipping (Appendix A).

3.2.1.2.2 Sediment Coring and Processing for Waste Characterization

Sediment cores will be collected from up to three locations to composite and analyze for waste characterization (Table 2b). Because analysis for perflouroalkyl and polyflouroalkyl substances (PFAS) is included in the waste characterization sample, sampling will be performed using PFAS-free protocols as described in SOP 4 – Sediment Sampling. The three locations will be selected after completion of the poling efforts and will target representative substrate (e.g., silt, sandy silt) to cover the range of sediment characteristics encountered within the canal.

If soft sediments are generally consistent throughout the canal, the three samples will be evenly spaced throughout the canal to divide it longitudinally into quarters. Soft sediments targeted for removal (i.e., above the EOC) from the three core locations will be homogenized into one composite sample. The sample will be analyzed for pH, flash point, reactive cyanide, toxicity characteristic leaching procedure (TCLP) metals, TCLP VOCs, TCLP semivolatile organic compounds, VOCs, metals (cadmium, chromium, copper, iron, lead, mercury, molybdenum, nickel, silver, and zinc), PCB Aroclors (1242 to 1268), PAHs, and PFAS. The sand layer will be segregated from the soft sediments for

geotechnical analysis as discussed in Section 3.2.1.2.3. Once samples are prepared, the samples will be checked and information will be entered onto a chain-of-custody form for transport to the laboratory per SOP 06 – Sample Custody (Appendix A). Sample containers will be placed in a secure area and stored on wet ice or under refrigeration at 4°C, pending shipment to the analytical laboratory per SOP 07 – Sample Handling, Packaging, and Shipping (Appendix A).

The homogenized waste characterization sample along with 30 gallons of Portage Canal surface water will also be submitted to Waste Stream Technology Inc., in Buffalo, New York, for bench-scale particle separation testing. This testing will be done to assess the economic viability of performing particle separation and reusing the sand portion of the material on site for sediment cover, capping, multi-use path fill, or off-site as road construction fill. The bench scale testing will include the following:

- Sand separation with wet sieving
- Dewatering treatability testing
- Stabilization testing prior to wet sieving and on dewatered fines
- Water treatment testing

Upon receipt of the bulk sediment and surface water samples to Waste Stream Technology, the sediment will be slurried with the canal water for testing. After slurrying, an initial bulk sediment sample will be collected and sent for analysis for metals, PAHs, PCBs, VOCs, and PFAS prior to separation. Wet sieving will then be conducted to separate the fines and the sands in the bulk sediment sample. The separated material (fines and sands) will be analyzed for metals, PAHs, PCBs, VOCs, and PFAS.

A dewatering treatability study will be performed on the silts and finer fraction separated out of the bulk sediment sample during wet sieving. The dewatering treatability study will evaluate four approaches for managing the finer fraction by measuring the water content and the ability to pass paint filter test. Four dewatering tests will be performed as follows.

- A jar test to screen polymers for use with other dewatering tests (up to six polymers will be tested with varying dosages to be determined based on observations)
- A rapid drainage test to understand the potential applicability of geotextile bags
- A filter test to find the optimum filter press options
- A belt press test to assess dewatering under multiple tensions

Once the dewatering treatability study is complete, a stabilization test will be performed on the dewatered material that does not pass the paint filter test. The stabilization test will investigate the efficiencies of various applications of Portland Cement, Calciment, and a locally available flyash dosed at 5%, 10%, and 15% by weight.

The effluent from each dewatering test (hanging bag test, filter press, belt press) will be collected and analyzed for total suspended solids, oil and grease, total recoverable mercury (ultra low level mercury), and PAHs.

An additional stabilization test will be performed on the bulk sediment sample (prior to any separation) to compare the bench testing to stabilization without separation. Portland Cement, Calciment, and flyash will be dosed at three application rates (5%, 10%, and 15% by weight) to assess stabilization of the bulk sediment sample by passing paint filter.

3.2.1.2.3 Sediment Coring and Processing for Geotechnical Characterization

Sediment cores will be collected for geotechnical characterization with grain-size, specific gravity, moisture content, and Atterberg Limits. Specific data uses for these data are as follows:

- Grain-size testing on collected samples to document particle size distribution and evaluate spatial variation of particle size in sediment at the site
  - Data will be used to determine the dredgability (e.g., ease in removal of dredged material) and the optimal transport, handling, and processing methodology
- Specific gravity and moisture content testing on collected samples to determine density and volume relationships of the sediment for use in volume estimation
- Atterberg Limits testing on cohesive samples to determine the consistency of cohesive sediments for handling and de-watering considerations

Sediment cores will be collected from three locations, to be selected after completion of the poling efforts, and will target representative substrate (e.g., silt, sandy silt) for general characterization of the sediments (Table 2a). Soft sediments targeted for removal (i.e., above the EOC) from the three core locations will be homogenized into one composite sample. The sample will be analyzed for particle size (including hydrometer for cohesive samples only), Atterberg Limits (cohesive samples only), specific gravity, and moisture content. The sand layer will also be segregated from the soft sediments and analyzed for specific gravity.

Additionally, sediment cores coupled with in-situ strength testing will be collected and performed at: 1) three locations along a transect adjacent to the CPR bridge to assess geotechnical properties near the abutments/piles; and 2) five locations along the southern shoreline within the proposed footprint of the multi-use path to assess the bearing capacity of the existing sediments (Table 2a and Figures 2 a through 2e). Sediment cores will be segmented based on changes in material type. The subsample will be homogenized, then placed into the container provided by the testing laboratory. Samples will be analyzed for particle size (including hydrometer for cohesive samples only), Atterberg Limits (cohesive samples only), specific gravity, and moisture content. In-situ strength testing will be performed by either field vane shear testing (FVST) or dynamic cone penetration testing (DCP) in accordance with SOP 10 – Vane Shear Testing or SOP 12 – Dynamic Cone Penetrometer, as

appropriate (Attachment A). Where soft cohesive sediments are expected (based on sediment core observations), field vane shear testing will be performed to estimate in the in-situ undrained shear strength. Where granular sediments are expected, DCP testing will be performed to assess the penetration resistance to estimate relative density. FVST or DCP tests will be performed at selected depths in the upper 5 to 10 feet below existing grade.

3.2.2 Canal Bank Sampling

This section provides the proposed canal bank sampling DQOs and sampling methods and analyses.

3.2.2.1 Data Quality Objectives

To date, no characterization of the canal banks has been performed. Three DQOs were identified in Section 1.1 to address canal bank characterization, as follows:

- **DQO 5:** Determine the extent of contaminated material on the banks of the canal.
- **DQO 11:** Collect geotechnical information to support a design objective of preventing bank destabilization.

3.2.2.2 Sampling Methods and Analyses

Canal bank investigations will occur to assess EOC along the banks and obtain geotechnical characterization for bank stability assessments.

3.2.2.2.1 Canal Bank Investigation for Contamination

Water is the transport mechanism that spreads contaminated material at Portage Canal; therefore, the canal bank sampling will attempt to establish a correlation with the elevation contour where contamination extends up the bank. Initially, canal bank cores will be collected from five transects spaced evenly throughout Segment 2 (see Table 2c and Figures 2 a through 2e). Each transect will include three sampling locations on each bank, including the bottom of the bank (near elevation 780 feet), and then in even 1-foot vertical elevation increments thereafter (elevation 781 feet, 782 feet) or to the extent of the property boundary, whichever is encountered first.

In addition, canal bank cores will be collected on the south bank of DNR's parcel near the Portage levee shop. Core collection will begin at the bottom of the bank (near elevation 780 feet), and then in even 1-foot vertical elevation increments to the full extent of the bank. Therefore, a total of 35 canal bank cores (30 canal bank transect locations and five DNR parcel bank sampling locations) will be collected.

Bank cores will be collected using either a hand auger or macrocore sampler (or equivalent), either hand or mechanically driven. If a proposed soil sample location is found to be underwater, sediment collection procedures and equipment will be employed for core collection. Boreholes will be backfilled with topsoil to grade and seeded. Each bank core will be advanced to a depth of 1.5 feet

below the ground surface, or to refusal if less than 1.5 feet of penetration is encountered. SOP 09 – Soil Sampling (Appendix A) provides detailed procedures and methods for sample collection of soils.

Bank cores will be brought to the processing area where the core will be split longitudinally, screened with a PID, and logged using the USCS to include soil type, color, consistency, odors, and visible evidence of impacts (e.g., sheen). Photographs will also be taken of the cores. Bank cores will be processed in accordance with SOP 05 – Sediment and Soil Core Processing. Up to three 6-inch samples will be collected from each bank core, representing the 1.5-foot depth (i.e., 0 to 0.5, 0.5 to 1, and 1 to 1.5 feet). Samples will be submitted to the analytical laboratory for mercury and lead analysis. Initially, only the top sample (0 to 0.5 foot) will be analyzed. The remaining samples will be archived at the laboratory and analyzed only if the mercury concentrations are greater than 0.3 mg/kg or if lead concentrations are greater than 80 mg/kg. A subset of five samples will also be analyzed for geotechnical parameters to provide a representative understanding of the bank materials. Geotechnical samples will be analyzed for particle size (including hydrometer for cohesive samples only), Atterberg Limits (cohesive samples only), specific gravity, and moisture content.

3.2.2.2.2 Canal Bank Investigation for Geotechnical Investigations

The in-situ geotechnical engineering properties of soil will be assessed by performing either FVST or DCP tests at up to five locations near steep banks (Table 2c). These locations will be chosen in the field based on sediment poling results and visual inspection the canal banks, targeting steep slopes with adjacent thicker sediment removal depths.

3.2.3 Portage Levee Shed and Storage Building Demolition

This section provides the Portage levee shed and storage building demolition investigation DQOs and sampling methods and analyses.

3.2.3.1 Data Quality Objectives

To date, limited information is available for the Portage Levee shop building (Inman 2018). One DQO was identified in Section 1.1 to address building characterization, as follows:

- **DQO 12:** Conduct a pre-demolition investigation to collect information necessary for the demolition of the shed and storage building on the Portage levee property

3.2.3.2 Sampling Methods and Analyses

An inspection and evaluation for asbestos-containing building material (ACBM), LBP, and other environmental concerns associated with the structures will be conducted. Building inspection will be in accordance with SOP 13 – Asbestos Sampling and Air Monitoring.

An asbestos inspection will be performed in substantial compliance with U.S. Environmental Protection Agency (USEPA) National Emissions Standards for Hazardous Air Pollutants and DNR

NR 447 Inspection and Sampling Protocol requirements for building demolition and management of associated demolition debris. The asbestos inspection will be performed by a Wisconsin-certified asbestos inspector and will include the following:

- Review of any available documentation of asbestos inspections, abatement activities, and operation and maintenance provided for the subject site prior to the start of field activities
- Visual inspection of all reasonably accessible areas of the above-referenced structures
  - Limited destructive investigation methods will be employed to identify additional materials not readily visible
- Collection of bulk samples of all identified suspect ACBM using appropriate sampling protocols
  - Samples will be submitted to International Asbestos Testing Laboratories in New Jersey, a National Voluntary Laboratory Accreditation Program- and American Industrial Hygiene Association-approved laboratory for asbestos content analysis by USEPA polarized light microscopy (PLM) methodology
  - Samples identified as having less than 10% asbestos using PLM analysis may be further analyzed by point counting in accordance with USEPA analysis methodology
    - The quantity of samples to be collected and analyzed will be determined in the field; however, it is estimated that a total of 20 samples (18 homogeneous materials) will be collected
- Physical assessment and documentation of the area of inspection including the type, location, condition, and general quantities of identified ACBM

During a site visit, it was observed that portions of building's structure were concrete and masonry and painted metal shed. Proper removal and management of the waste material generated during building demolition activities may be necessary.

Additionally, the Occupational Safety and Health Administration (OSHA) may require specific work practices, personal protective equipment (PPE), monitoring, and jobsite engineering controls to reduce lead exposure when conducting activities involving cutting, grinding, and shot blasting of LBP and lead-bearing materials.

The LBP inspection will include a general paint condition assessment of readily accessible painted surfaces. The inspection will include field-performed lead analysis using an x-ray florescence (XRF) instrument. The LBP inspection will provide a general evaluation of the presence of LBP by various coated media. Additionally, it should be noted that OSHA does not consider XRF to be an acceptable method of analysis for declaring coatings lead-free. Instead, XRF analysis will be used as a preliminary screening assessment of painted and otherwise coated surfaces.

A hazardous material assessment will also be conducted of the Portage levee buildings. Hazardous material management and disposal is required by USEPA and the DNR as defined in NR

Chapters 100, 400, 500, and 600. The DNR publication WA-651-03, *Pre-Demolition Environmental Checklist*, provides guidance regarding potential hazardous materials that must be identified and properly managed prior to building demolition.

In conjunction with the limited asbestos and LBP inspections, a hazardous material assessment will be completed of the structures for the presence of other potential hazardous/regulated materials in general accordance with the DNR's *Planning Your Demolition or Renovation Project: A Guide to Hazard Evaluation, Recycling and Waste Disposal* (2013). The hazardous material assessment will consist of a visual evaluation of reasonably accessible areas and general inventory of batteries, electrical transformers, fire extinguishers, fluorescent light bulbs, high-intensity discharge light bulbs, hydraulic fluids/oils, lighting ballasts and other PCB-containing devices, mercury-containing devices, oils, pesticides, pits/sumps/catch basins, radioactive devices (smoke alarms/exit signs), refrigerants, and solvents/cleaners. The intent of the assessment is to develop a general inventory of hazardous materials in the structure.

3.3 Decontamination

Field sampling equipment that comes into contact with contaminated media will be decontaminated prior to use, between sampling locations, and prior to leaving the site, in accordance with SOP 08 – Equipment Cleaning/Decontamination (Appendix A).

When practicable, disposable equipment will be used for sampling, homogenizing, and subsampling procedures (e.g., core liners, bowls, spoons, aluminum pans). However, when equipment is reused (e.g., hand auger), decontamination steps will be followed to ensure that samples are not cross-contaminated. Detailed decontamination procedures are outlined within SOP 08. In general, decontamination of sampling equipment and tools will consist of the following:

- Pre-rinse with site water
- Clean with non-phosphate detergent and potable water, using a brush to remove all visible particulate matter and surface films
- Rinse thoroughly with potable water

Standard decontamination practices will be followed for all investigation activities. No petroleum-based oils, greases, or other petroleum products will be used on any sampling equipment.

Large equipment (e.g., boats) used in field sampling activities will be cleaned to remove oil, grease, mud, or other foreign matter (including vegetation) prior to leaving the site.

3.4 Investigation-Derived Waste

Potentially contaminated sediment, soil, water, PPE, and other investigation-derived waste (IDW) materials generated during the field investigation will be collected and disposed of in accordance

with SOP 11 – Investigation-Derived Waste Handling and Disposal (Appendix A). IDW will be classified into two categories: 1) solid materials consisting of sediments, soils, used disposable sampling equipment (e.g., core liners), used PPE, and other materials used in the handling, processing, and storage of sediment; and 2) liquid wastes such as decontamination water or excess water from sediment or soils. To the extent practical, liquids generated during sampling and sample processing operations will be separated from the solid material.

3.4.1 Solid Waste

IDW solid waste will consist of two types of materials: sediment/soils solids and non-sediment/soils solids. Sediment/soil wastes include material in discarded cores or grab samples and excess sediment or soil not used for sample analyses. Such material will be containerized into properly labeled 55-gallon (closed-top) drums pending characterization and disposal. Non-sediment/soil wastes generated during the collection and processing of samples may include PPE and disposable sampling equipment, such as used core liners and caps, aluminum foil, aluminum pans, and plastic sheeting. Non-sediment and sediment wastes will be segregated, disposed of as a solid waste in plastic trash bags, and put in dumpsters for disposal in an approved, licensed landfill. Visible media (sediment or soil) will be removed from PPE and disposable sampling equipment prior to disposal.

3.4.2 Waste Water

Waste water will be generated during sediment/soil sample processing and decontamination activities. Waste water will be collected in properly labeled 55-gallon (closed-top) drums pending characterization and disposal.

3.4.3 Drum Handling

The following procedures will be followed for storing solid and liquid waste in drums:

- A unique drum number (consisting of the program identification and the sequential number) will be assigned to each drum and the drum number will be clearly marked on the drum.
- A label indicating that the drum contains IDW pending characterization will be placed on each drum. Information on the label will include the drum number, type of material (sediment/soil or waste water), start and end dates of generation, project number, and contact information.
- A log will be kept for each drum, listing the materials placed in that drum. All solid materials will be segregated based on the type of material (i.e., sediment/soils, core liners, and PPE/plastic/miscellaneous) and, to the extent practicable, by where they were generated (e.g., location within the site or station number and process area).
- Drums will be kept closed at all times except when material is being added to them.
- Drums will be sealed (bungs or lid bands tightened) when not in active use.

- Drums will be stored in a shed secured with a padlock adjacent to the staging area until proper disposal at an authorized facility can be coordinated.
- Prior to the disposal of IDW, the DNR will be informed of the intended disposal facility that will be receiving waste, the quantity of waste to be disposed of, and the entity responsible for transporting the waste.

3.5 Health and Safety

All site activities proposed under this FSP will follow the procedures outlined in the SSP. The SSP has been included in Appendix C, and was prepared in accordance with OSHA requirements contained in 29 Code of Federal Regulations (CFR) 1910, including the final rule contained in 29 CFR 1910.120. All Anchor QEA employees and visitors will read and comply with the SSP and sign an acknowledgement form contained in the SSP. Subcontractors will develop and provide an SSP to cover their respective scopes of work during field activities.

Field team staff will complete a Job Safety Analysis (JSA) form when new tasks or different investigative techniques are proposed that are not addressed in the SSP. The JSAs will be reviewed and approved by the Field Lead and completed forms will be reviewed with all field team staff performing the specific task prior to implementation.

The implementation of health and safety for the field investigation will be the shared responsibility of the Project Manager, the Field Lead, and field team staff and subcontractors implementing the PDI. All field team staff, subcontractors, and site visitors have the authority to **stop work** if they see a potential or actual hazard that may threaten the safety of people or the environment. Upon stopping work, the designated Field Lead must be immediately notified and provided with information regarding the nature of the safety, health, or environmental concern. Once the potential or actual hazard has been eliminated, work can proceed.

4 Data Management and Reporting

This section describes the data evaluation and deliverables to be prepared to support remedial design activities.

4.1 Data Management and Evaluation

Data management and quality is an important component of the PDI activities and ultimately provides the basis of data usability. The data management and quality includes every step in the PDI process, from sample collection through processing and analysis. All field activities will be conducted in accordance with this FSP, including the procedures, details, and SOPs provided in the appendices, as well as the details provided in the QA/QC Plan (Appendix B). The QA/QC Plan presents the structure and protocols for data acquisition (QA/QC samples), assessment and oversight, and data validation (sample and laboratory) and usability evaluations.

Following analytical data verification, data will be assessed and incorporated into the remedial design. Data will be specifically reviewed (evaluated and interpreted) to determine if the DQOs identified herein were satisfied. All relevant records, correspondences, reports, logs, data, field reports, field logs, pictures, videos, subcontractor reports, analytical data, data reviews, and any other documentation will be reviewed and evaluated. The PDI results will be utilized as the basis of design and data inputs to evaluate the primary components of the selected remedy.

4.2 Reporting

The results of the PDI activities will be presented as an appendix to the Design Report. The appendix will present the results of the activities presented in Section 3. All relevant field records including correspondence, reports, logs, data, field logs, pictures, videos, subcontractor reports, and any other related documentation will be provided. In addition, analytical results will be integrated into a site-specific database to support efficient future use.

5 Project Schedule

It is anticipated that the PDI activities will begin the week of November 12, 2018, and conclude on December 7, 2018. During the week of Thanksgiving, it is anticipated that the field crew will work Monday through Wednesday.

Prior to the start of field work, a kickoff meeting will be held with all project team members (as available). Field work will begin with the installation of the staff gage and the collection of canal bank samples for chemical and geotechnical analysis. Canal bank cores will be processed and sent to the laboratory during the first week of field activities. This timing will allow the data to be reviewed while the field team is working through other components of the field program, which will allow time for decisions to be made on potential step out cores prior to PDI demobilization.

Once the bank work is complete, the topographic, bathymetric, and poling surveys will be completed along with the sediment coring and in-situ geotechnical testing. Reasonable efforts will be made to collect data from Adams Street to Center Street to limit the number of times the field crew will have to backtrack. Finally, the object survey and drone survey will be conducted once all other field activities have been completed. The collection of additional bank samples will be performed, as needed, pending chemistry results from the initial bank sample collection.

The following is the anticipated schedule for field work:

- Canal bank sample collection beginning November 12, 2018 (estimate 3 days)
- Install staff gauge beginning November 12, 2018 (estimate 1 day)
- Topographic, bathymetric, and poling survey and sediment sample collection beginning November 14, 2018 (estimate 15 days)
- Estimate performing culvert video inspection the week of November 26, 2018
- Estimate performing building inspection beginning the week of November 26, 2018
- Receive and review bank sample chemistry data beginning December 4, 2018 (estimated based on a 10-day turnaround time from the laboratory)
- Object survey beginning December 5, 2018 (estimate 2 days)
- Additional canal bank sample collection (as needed) beginning December 5, 2018 (estimate 3 days)
- Drone survey beginning December 7, 2018 (estimate 1 day)
- Receive and review sediment sample analytical data beginning December 10, 2018 (estimated based on a 10-day turnaround time from the laboratory)

This schedule is subject to change based on weather delays, access agreements execution with property owners (as required), and other factors that are out of the project personnel's control.

6 References

DNR (Wisconsin Department of Natural Resources), 2003. *Consensus-Based Sediment Quality Guidelines, Recommendation for Use and Application, Interim Guidance*. Publication WT-732. December 2003.

DNR, 2013. *Planning Your Demolition or Renovation Project: A Guide to Hazard Evaluation, Recycling and Waste Disposal*. Publication WA-651. Revised 2013.

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Tables

Table 2a
Proposed Sediment Sample Locations

Sample Type	Transect	Shore	Location ID	Northing[4]	Easting[4]	Confirm Poling	Mercury[1]	Lead[1]	PAH[1]	VOC[1]	Geotechnical[2]	VST/DCP[3]
Sediment	1	South	2SD001-01	394201.17	538645.49	X						
		North	2SD001-02	394213.77	538635.69	X						
	2	South	2SD002-01	394215.44	538666.24	X						
		North	2SD002-02	394227.98	538656.35	X						
	3	South	2SD003-01	394230.92	538685.85	X						
		North	2SD003-02	394243.45	538675.96	X						
	4	South	2SD004-01	394243.47	538706.39	X						
		North	2SD004-02	394260.41	538695.76	X						
	12	South	2SD012-01	394350.02	538875.66	X					X	X
		North	2SD012-02	394366.95	538865.02	X						
	20	South	2SD020-01	394456.56	539044.91	X						
		North	2SD020-02	394473.50	539034.28	X						
	28	South	2SD028-01	394563.10	539214.16	X						
		North	2SD028-02	394580.04	539203.54	X						
	36	South	2SD036-01	394669.64	539383.42	X						
		North	2SD036-02	394686.59	539372.79	X						
	44	South	2SD044-01	394776.20	539552.69	X					X	X
		North	2SD044-02	394793.13	539542.05	X						
	52	South	2SD052-01	394882.73	539721.94	X						
		North	2SD052-02	394899.67	539711.31	X						
	60	South	2SD060-01	394989.28	539891.20	X						
		North	2SD060-02	395006.22	539880.57	X						
	68	South	2SD068-01	395095.82	540060.46	X					X	X
		North	2SD068-02	395112.76	540049.83	X						
	76	South	2SD076-01	395202.36	540229.71	X						
		North	2SD076-02	395219.31	540219.09	X						
	84	South	2SD084-01	395308.91	540398.97	X						
		North	2SD084-02	395325.85	540388.34	X						
	92	South	2SD092-01	395415.45	540568.23	X						
		North	2SD092-02	395432.39	540557.59	X						
	100	South	2SD100-01	395522.00	540737.49	X					X	X
		North	2SD100-02	395538.94	540726.86	X						
	108	South	2SD108-01	395628.54	540906.75	X						
		North	2SD108-02	395645.48	540896.12	X						
	116	South	2SD116-01	395735.08	541076.01	X						
		North	2SD116-02	395752.03	541065.38	X						
	124	South	2SD124-01	395853.73	541238.30	X					X	X
		North	2SD124-02	395868.47	541224.78	X						
	132	South	2SD132-01	395988.70	541385.94	X						
		North	2SD132-02	396003.41	541372.40	X						
	140	South	2SD140-01	396123.64	541533.55	X					X	X
		Center	2SD140-02	396131.02	541526.80						X	X
		North	2SD140-03	396138.40	541520.05	X					X	X

Notes:

1. Sediment cores will be sent to the lab for chemical analysis of mercury and lead if the elevation of contamination is not evident. If visual non-aqueous phase liquid or strong odors are observed and the photoionization detector readings are elevated, the samples will either be individually analyzed for VOCs and PAHs or included in the waste characterization composite. If the EOC is not evident due to multi-depositional layers, the core will be divided into 6-inch segments.
2. Geotechnical cores will be collected with a minimum of 6 inches of sand at the bottom of the core to allow for geotechnical analysis of the sand layer. Cores will be segmented based on changes in material type.
3. In-situ strength testing will be performed by either VST or DCP. Where soft cohesive sediments are expected VST will be performed. Where granular sediments are expected, DCP will be performed. Tests will be performed at selected depths in the upper 5 to 10 feet below existing grade.
4. Horizontal Datum: North American Datum 1983 High Accuracy Reference Network Wisconsin Coordinate Reference System Columbia County U.S. Feet. Vertical Datum: North American Vertical Datum of 1988, U.S. feet

DCP = dynamic cone penetrometer
PAH = polycyclic aromatic hydrocarbon
VOC = volatile organic compound
VST = vane shear test

Table 2b
Proposed Waste Characterization Samples

Sample Type	Transect	Parent Location	Composite ID	Waste Charactization[1]	Geotech[2]
Waste Characterization	44	2SD044-03	2SDXXX	X	X
	76	2SD076-03			
	108	2SD108-03			

Notes:
1. Three locations targeting representative substrate will be targeted. Samples will be homogenized into one composite sample and analyzed for pH, flash point, reactive cyanide, TCLP metals, TCLP VOCs, TCLP SVOCs, VOCs, metals (cadmium, chromium, copper, iron, lead, mercury, molybdenum, nickel, silver, and zinc), PCBs (Aroclors 1242 to 1268), PAHs, and PFAS. Only the soft sediment layer of the discrete samples will be composited. Waste characterization sample name will end in "-01".
2. Geotechnical cores will be collected with a minimum of 6 inches of sand at the bottom of the core to allow for geotechnical analysis of the sand layer. Cores will be composited based on changes in material type (two composited samples sent for waste characterization: soft sediment and native sand). The soft sediment sample will end in "-01" and the native sand sample will end in "-02".

PAH = polycyclic aromatic hydrocarbon

PCB = polychlorinated aromatic hydrocarbon

PFAS = perflouroalkyl and polyflouroalkyl substances

SVOC = semi- volatile organic compounds

TCLP = toxicity characteristic leaching procedure

VOC = volatile organic compound

Table 2c
Proposed Bank Sample Locations

Sample Type	Transect	Shore	Location ID	Northing[4]	Easting[4]	Mercury	Lead	PAH	VOC	Geotechnical[2]	VST/DCP[3]
Bank[1]	12	South	2BA012-01	394320.33	538894.35	X	X				
			2BA012-02	394323.71	538892.22	X	X				
			2BA012-03	394327.10	538890.09	X	X				
		North	2BA012-04	394372.15	538861.73	X	X				
			2BA012-05	394375.54	538859.60	X	X				
			2BA012-06	394378.93	538857.47	X	X			X	X
	44	South	2BA044-01	394747.08	539571.02	X	X			X	X
			2BA044-02	394750.46	539568.89	X	X				
			2BA044-03	394753.85	539566.76	X	X				
		North	2BA044-04	394799.65	539537.93	X	X				
			2BA044-05	394803.04	539535.80	X	X				
			2BA044-06	394806.42	539533.67	X	X				
	68	South	2BA068-01	395066.20	540079.12	X	X				
			2BA068-02	395069.58	540076.99	X	X				
			2BA068-03	395072.97	540074.86	X	X				
		North	2BA068-04	395118.34	540046.26	X	X				
			2BA068-05	395121.73	540044.13	X	X				
			2BA068-06	395125.11	540042.00	X	X			X	X
	100	South	2BA100-01	395493.08	540755.71	X	X			X	X
			2BA100-02	395496.46	540753.58	X	X				
			2BA100-03	395499.85	540751.45	X	X				
		North	2BA100-04	395545.15	540722.94	X	X				
			2BA100-05	395548.53	540720.80	X	X				
			2BA100-06	395551.92	540718.67	X	X				
	116	South	2BA116-01	395706.07	541094.44	X	X			X	X
			2BA116-02	395709.45	541092.29	X	X				
			2BA116-03	395712.82	541090.15	X	X				
			2BA116-04	395716.20	541088.00	X	X				
			2BA116-05	395719.57	541085.86	X	X				
	140	South	2BA140-01	396098.37	541557.20	X	X				
			2BA140-02	396101.32	541554.50	X	X				
			2BA140-03	396104.27	541551.79	X	X				
		North	2BA140-04	396146.98	541511.94	X	X				
			2BA140-05	396149.93	541509.24	X	X				
			2BA140-06	396152.88	541506.54	X	X				

Notes:

1. Each bank core will be advanced to a depth of 1.5 feet below the ground surface. Initially, the top sample (0 to 0.5 foot) will be analyzed. The remaining samples (segmeneted into 0.5 foot intervals) will be archived at the laboratory.

2. Geotechnical cores will be segmented based on changes in material type.

3. In-situ strength testing will be performed by either VST or DCP. Where soft cohesive sediments are expected, VST will be performed. Where granular sediments are expected, DCP will be performed. Tests will be performed at selected depths in the upper 5 to 10 feet below existing grade.

4. Horizontal Datum: North American Datum 1983 High Accuracy Reference Network Wisconsin Coordinate Reference System Columbia County U.S. Feet. Vertical Datum: North American Vertical Datum of 1988, U.S. feet

DCP = dynamic cone penetrometer

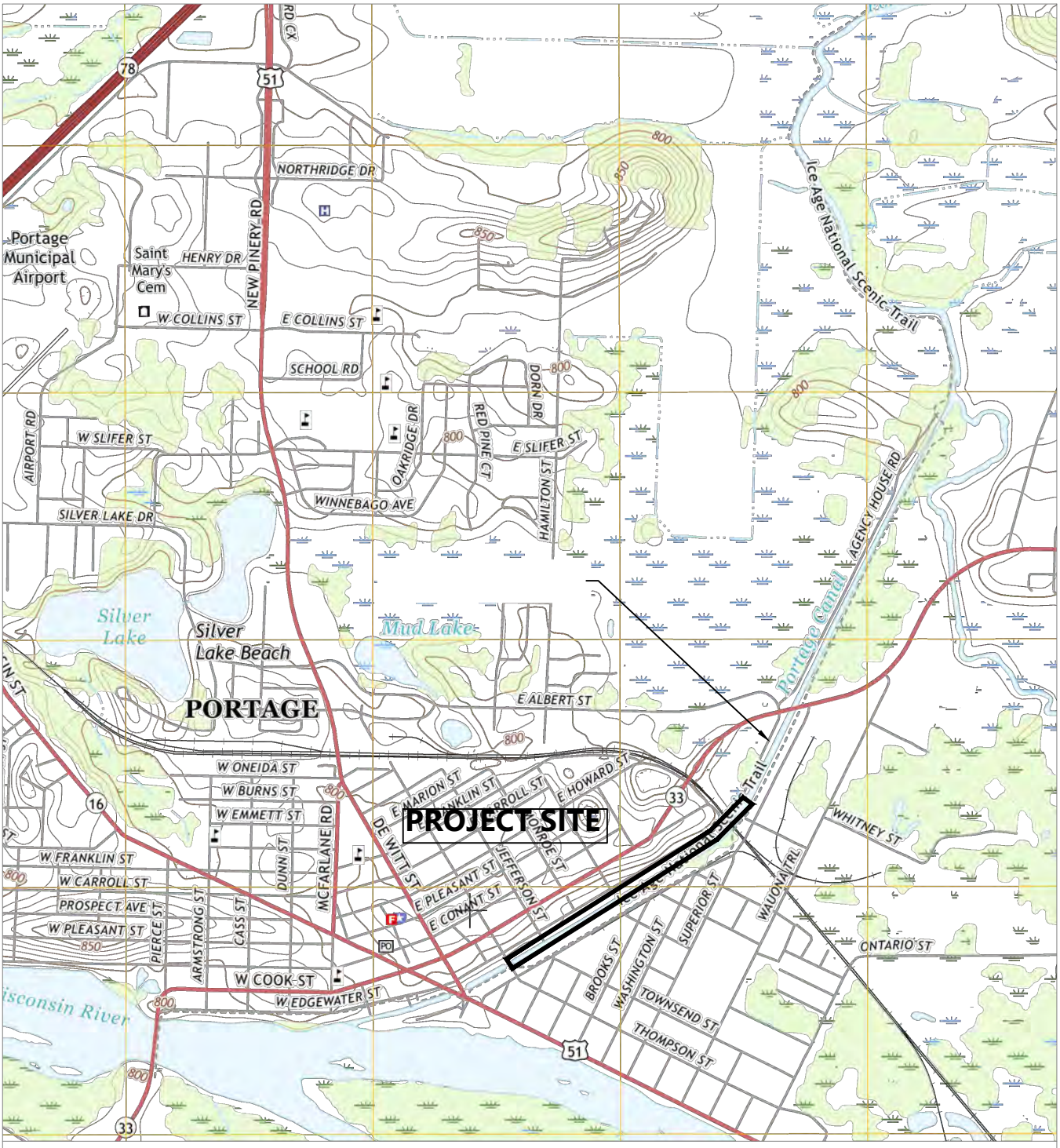
PAH = polycyclic aromatic hydrocarbon

TCLP = toxicity characteristic leaching procedure

VOC = volatile organic compound

VST = vane shear test

Figures



SOURCE: Bing Maps
HORIZONTAL DATUM: Wisconsin County Systems: Columbia County, US Foot
VERTICAL DATUM: NAVD88
NOTES:
Located in the NE $\frac{1}{4}$ of the NW $\frac{1}{4}$ of Section 8, SE $\frac{1}{4}$ of the SW $\frac{1}{4}$, SW $\frac{1}{4}$ of the SE $\frac{1}{4}$, SE $\frac{1}{4}$ of the SE 1/4 , and NE $\frac{1}{4}$ of the SE $\frac{1}{4}$ of Section 5, Township 12 North, Range 9 East.
USGS Portage Quadrangle (2016)
7.5 Minute, 1:24,000 Topographic Map Collection

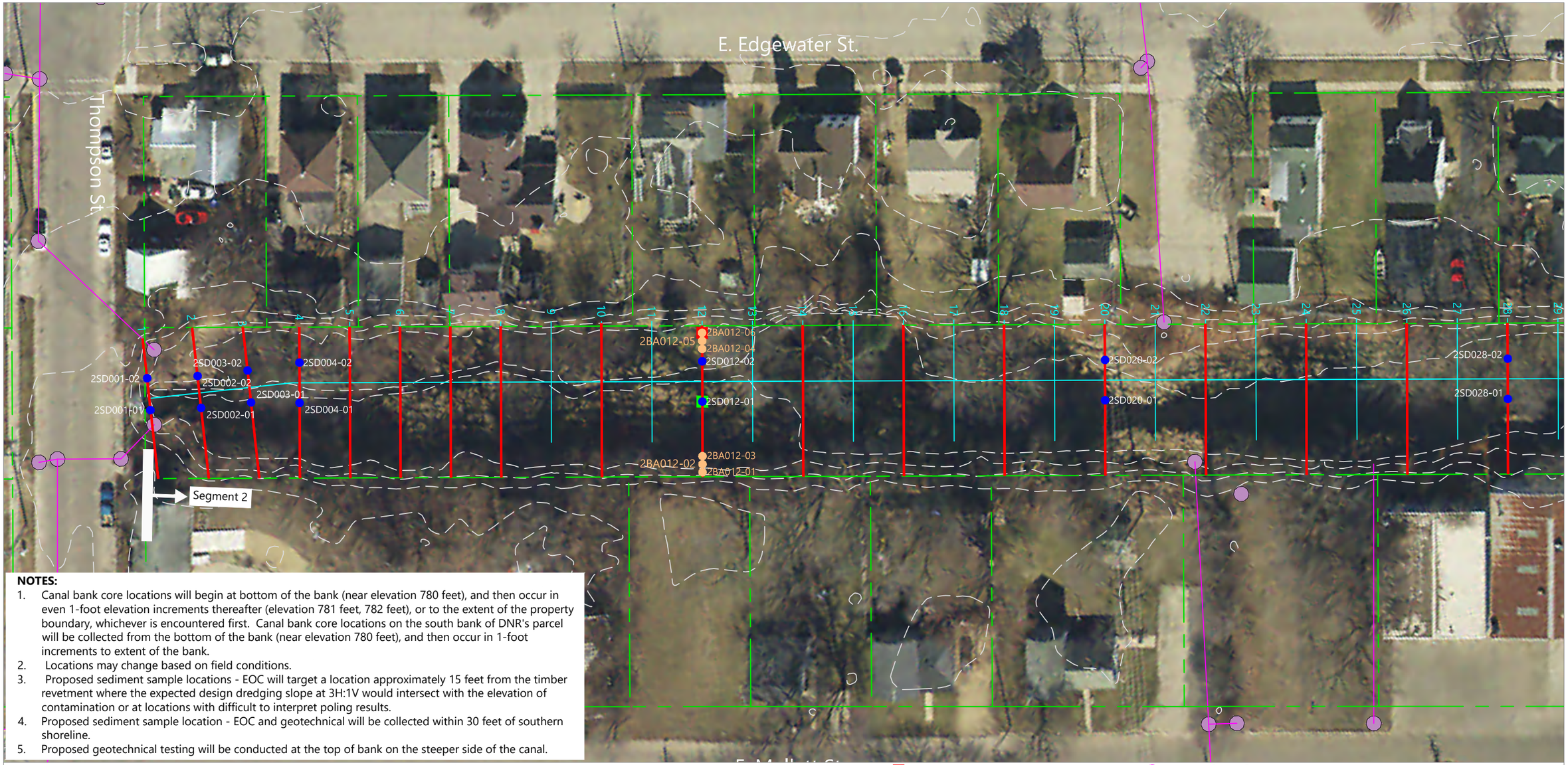
0 2000
Feet

Publish Date: 2018/10/29 1:12 PM | User: cyard
Filepath: K:\Projects\1779-Portage Canal\1779-RP-002 Location Figure.dwg Figure 1

ANCHOR QEA

Figure 1
Site Location Map

Portage Canal
Portage, WI



NOTES:

1. Canal bank core locations will begin at bottom of the bank (near elevation 780 feet), and then occur in even 1-foot elevation increments thereafter (elevation 781 feet, 782 feet), or to the extent of the property boundary, whichever is encountered first. Canal bank core locations on the south bank of DNR's parcel will be collected from the bottom of the bank (near elevation 780 feet), and then occur in 1-foot increments to extent of the bank.
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4. Proposed sediment sample location - EOC and geotechnical will be collected within 30 feet of southern shoreline.
5. Proposed geotechnical testing will be conducted at the top of bank on the steeper side of the canal.

SOURCE:
Aerial Photography- Columbia County Land Information Dept. 2015
Lidar Information - Columbia County Land Information Dept.
Storm Sewer- City of Portage
Parcel Information - Columbia County June 2018
HORIZONTAL DATUM: Wisconsin County Systems: Columbia County, US Foot NAD_1983_HARN_WISCRS_Columbia_County_Feet
VERTICAL DATUM: NAVD88

LEGEND:

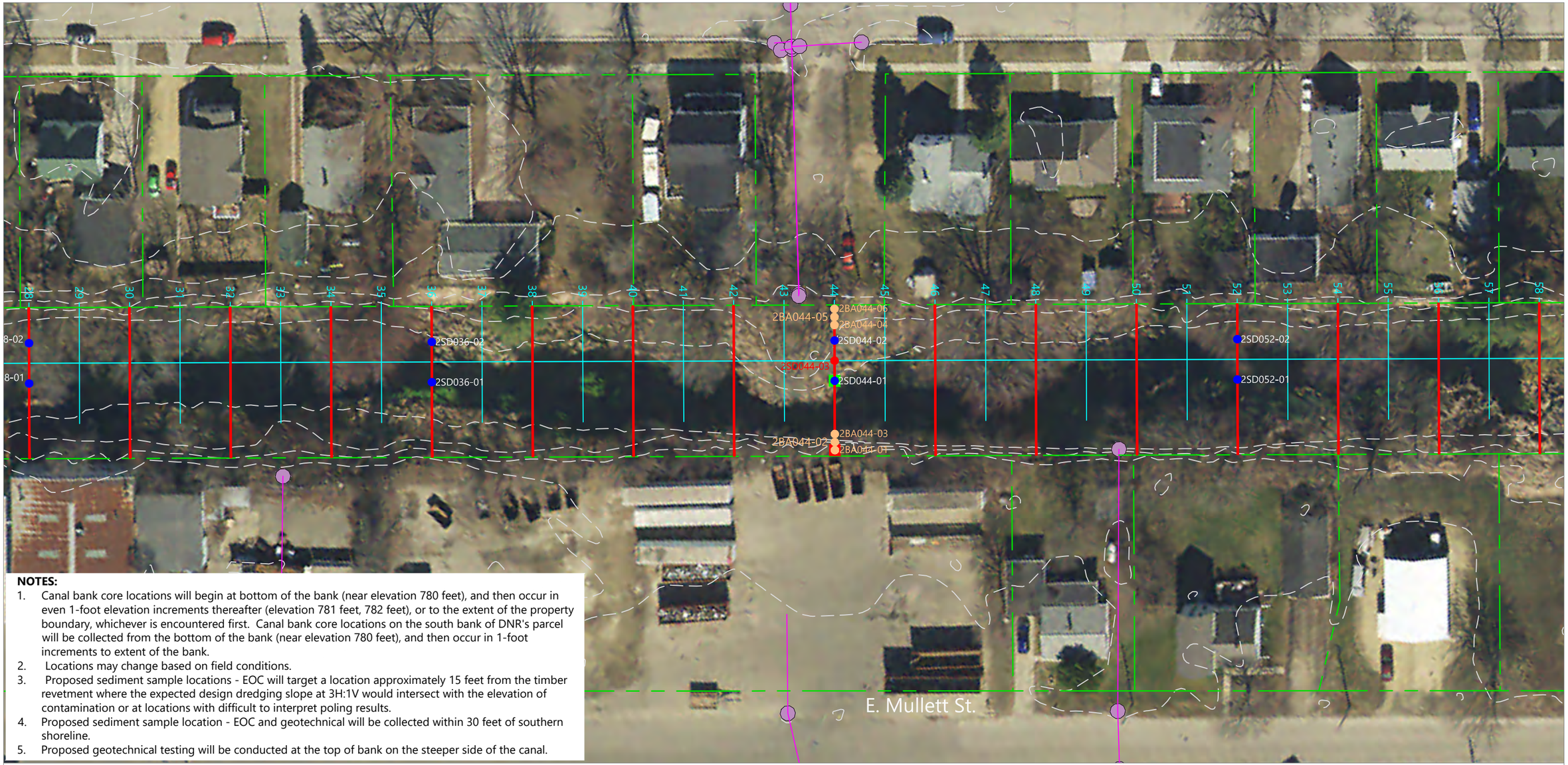
- Proposed Sediment Geotechnical Location
- Proposed Sediment Sample Location - EOC and Geotechnical [4]
- Proposed Sediment Sample Location - EOC [3]
- Waste and Geotechnical Characterization Location
- Proposed Bank Core- Chemical and Geotechnical Location [5]
- Proposed Bank Core- Chemical [1]
- Property Boundary
- 2-foot Contours (County Lidar Data)
- Storm Sewer
- Segment Boundary
- Proposed Topographic/Bathymetric, and Sediment Poling Transect [3]
- Project Baseline

0 50 Feet

Publish Date: 2018/11/06 3:52 PM | User: cyard
Filepath: K:\Projects\1779-Portage Canal\1779-RP-004 Proposed Sampling Locations_10-29-18.dwg Figure 2a

ANCHOR QEA

Figure 2a
Proposed Sampling Locations
Portage Canal
Portage, WI



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VERTICAL DATUM: NAVD88

LEGEND:

- Proposed Sediment Geotechnical Location
- Proposed Sediment Sample Location - EOC and Geotechnical [4]
- Proposed Sediment Sample Location - EOC [3]
- Waste and Geotechnical Characterization Location
- Proposed Bank Core- Chemical and Geotechnical Location [5]
- Proposed Bank Core- Chemical [1]
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- Storm Sewer
- Segment Boundary
- Proposed Topographic/Bathymetric, and Sediment Poling Transect [3]
- Project Baseline

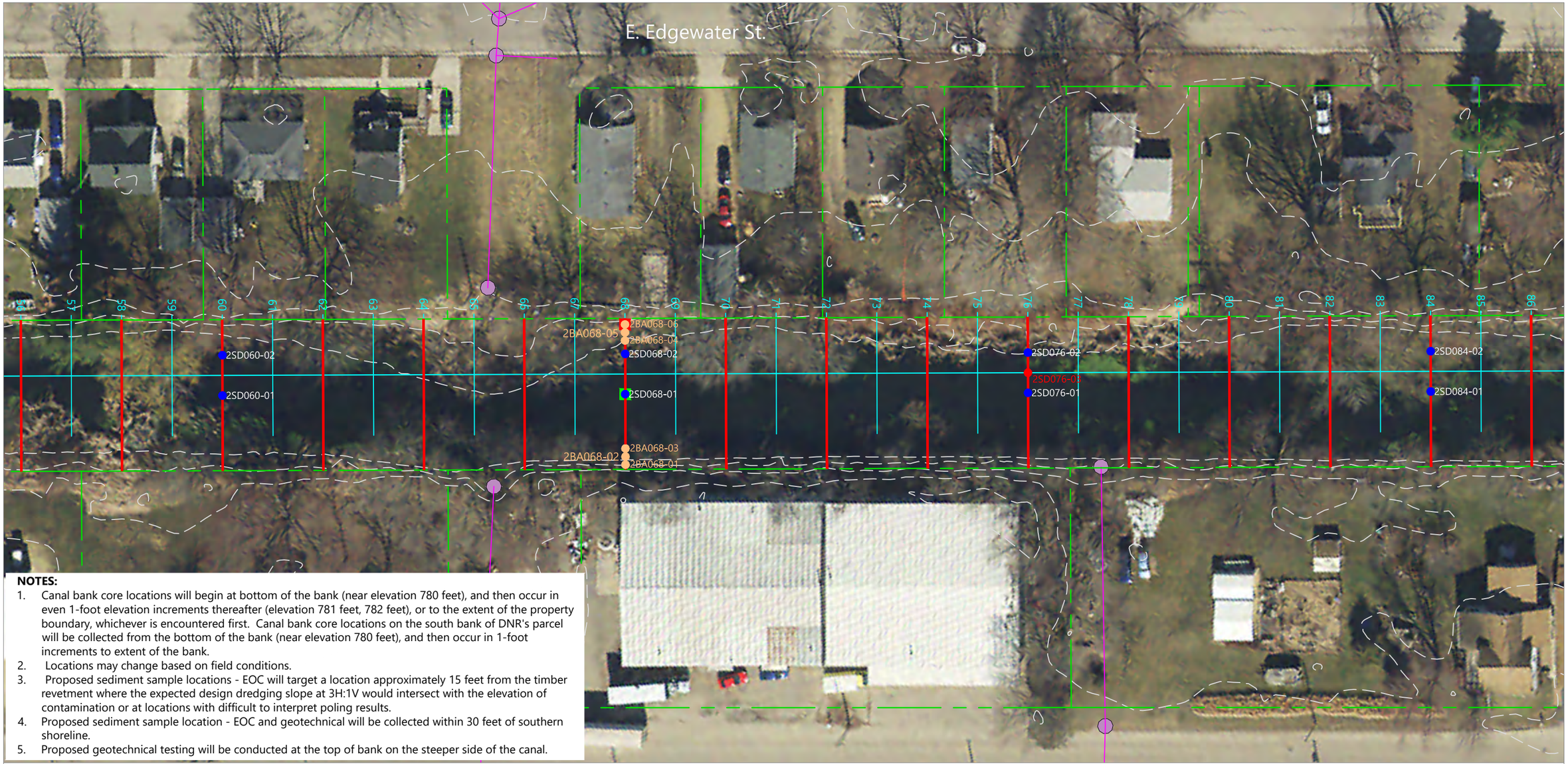
0 50
Feet

Publish Date: 2018/11/06 3:52 PM | User: cyard
Filepath: K:\Projects\1779-Portage Canal\1779-RP-004 Proposed Sampling Locations_10-29-18.dwg Figure 2b

ANCHOR QEA

Figure 2b
Proposed Sampling Locations

Portage Canal
Portage, WI



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VERTICAL DATUM: NAVD88

LEGEND:

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- Proposed Sediment Sample Location - EOC and Geotechnical [4]
- Proposed Sediment Sample Location - EOC [3]
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- Proposed Bank Core- Chemical and Geotechnical Location [5]
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- 2-foot Contours (County Lidar Data)
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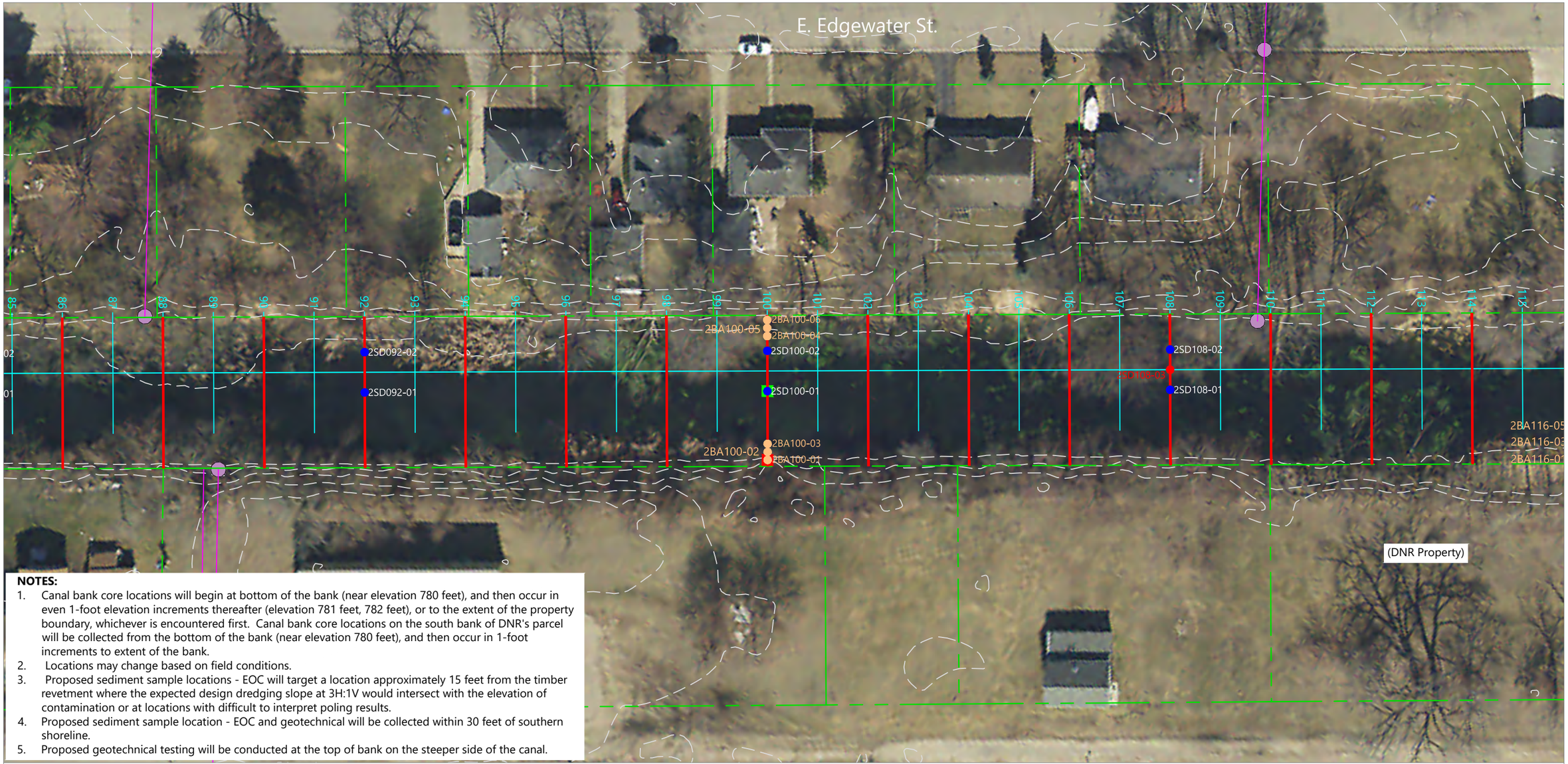
- Project Baseline

0 50 Feet

Publish Date: 2018/11/06 3:52 PM | User: cyard
Filepath: K:\Projects\1779-Portage Canal\1779-RP-004 Proposed Sampling Locations_10-29-18.dwg Figure 2c

ANCHOR QEA

Figure 2c
Proposed Sampling Locations
Portage Canal
Portage, WI



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VERTICAL DATUM: NAVD88

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- Project Baseline

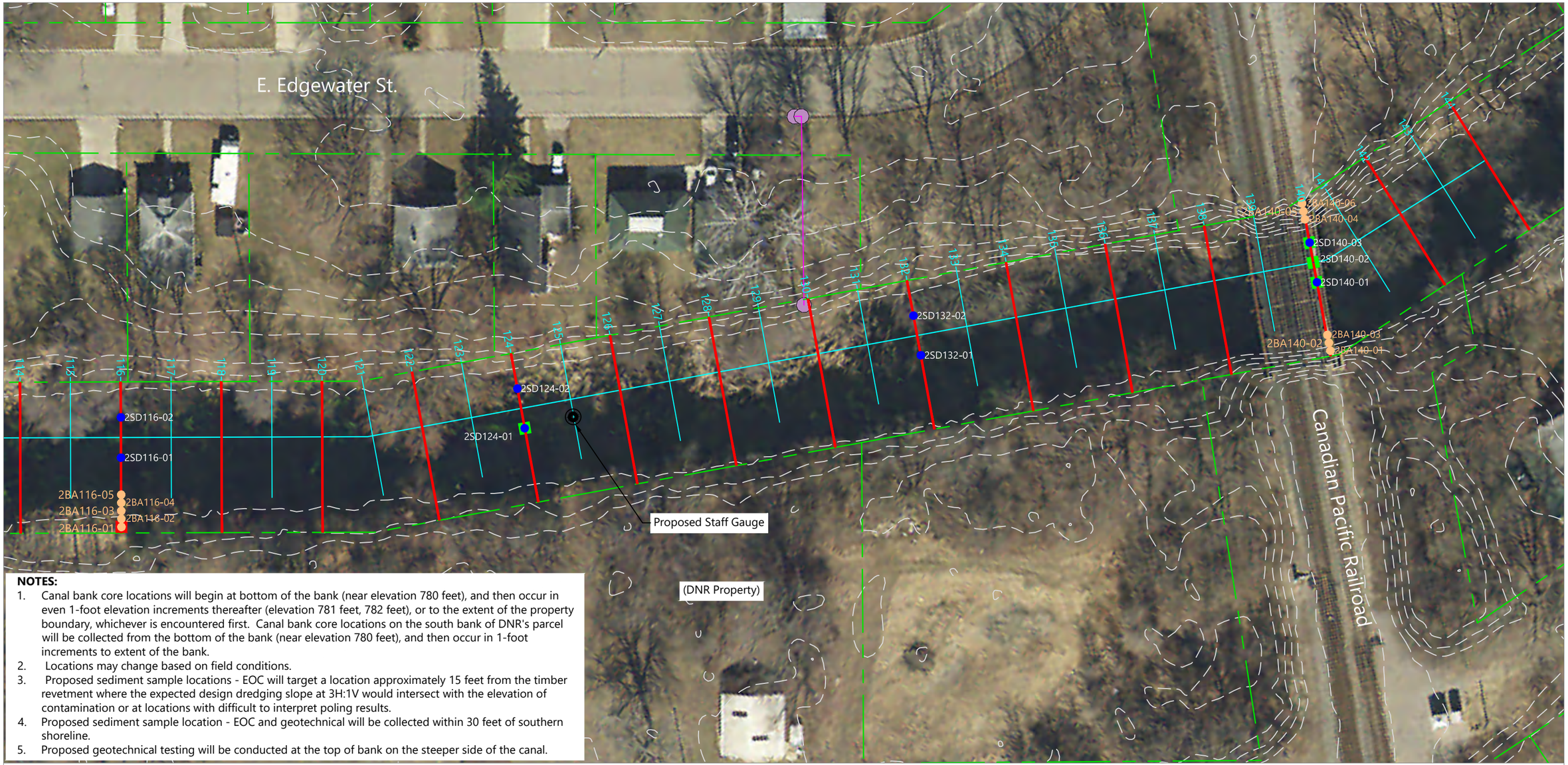
0 50 Feet

Publish Date: 2018/11/06 3:52 PM | User: cyard
Filepath: K:\Projects\1779-Portage Canal\1779-RP-004 Proposed Sampling Locations_10-29-18.dwg Figure 2d

ANCHOR QEA

Figure 2d
Proposed Sampling Locations

Portage Canal
Portage, WI



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- Proposed Topographic/Bathymetric, and Sediment Poling Transect [3]
- Project Baseline

0 50 Feet

Publish Date: 2018/11/06 3:52 PM | User: cyard
Filepath: K:\Projects\1779-Portage Canal\1779-RP-004 Proposed Sampling Locations_10-29-18.dwg Figure 2e

ANCHOR QEA

Figure 2e
Proposed Sampling Locations
Portage Canal
Portage, WI

Appendix A
Standard Operating Procedures

STANDARD OPERATING PROCEDURE SOP 01 – FIELD RECORDS

Prepared for

Wisconsin Department of Natural Resources

Prepared by

Anchor QEA, LLC

November 2018

STANDARD OPERATING PROCEDURE ACKNOWLEDGEMENT FORM

Project No. 181779-01.01 Project Name: Portage Canal – Segment 2

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) addresses the sampling program requirements for the documentation of field activities during implementation of field tasks for the Pre-Design Investigation. Field documentation will consist of bound field logbooks, sample collection forms, electronic field forms, photographs, and electronically recorded field measurements.

EQUIPMENT AND SUPPLIES

The following is a list of equipment that may be necessary to carry out the procedures contained in this SOP:

- Daily logs
- Chain-of-custody forms
- Field forms and records
- Field Deviation Form
- Bound field logbook (no waterproof field books)
- Ballpoint pen
- Camera
- Electronic field application (if applicable)

DOCUMENTATION PROCEDURES

Field Forms

Field team members will keep a daily record of significant events, observations, and measurements on field forms. All field activities will be recorded on forms specific to the collection activity and will be maintained by the Field Lead. Field notes should be maintained for all field activities (e.g., the collection of samples or the gathering of environmental data). The on-site field representative will record on the daily log forms information pertinent to the investigation, including, at a minimum, the following information:

- Project name
- Field personnel on site
- Visitors
- Health and safety discussions

- Sample station number
- Date and collection time of each sample
- Observations made during sample collection, including weather conditions, complications, vessel traffic, and other details associated with the sampling effort
- Sampling method and description of activities
- Any deviations from the Field Sampling Plan
- Conferences associated with field sampling activities

In addition to maintaining a daily log, sample collection forms or entries into the field database will be completed for each sample. The sample collection forms will include standard entries for station identifier, station coordinates, date and time of sample location, type of samples collected, type of analyses for each sample, and specific information pertaining to the matrix being collected. In general, sufficient information will be recorded during sampling so that reconstruction of the event can occur without relying on the memory of field personnel.

Field notes should be kept on paper (logbook), and all field documentation will be made using an indelible pen. Corrections will be made by drawing a single line through the error, writing in the correct information, then dating and initialing the change. Blank pages or lines in the field logbook will be lined-out, dated, and initialed at the end of each sampling day. The field forms will be scanned into the project file directory as convenient during the sampling event or upon completion of each sampling event.

Chain-of-Custody Forms

The documentation of chain-of-custody forms is described in SOP 06 – Sample Custody.

Sample Identification

The station and sample nomenclature are described below. Samples will be identified with a unique alpha-numeric system to facilitate sample tracking and data management. The alpha-numeric system will begin with a one-digit prefix indicating the segment within the site, followed by two letters describing the media/sample type, three digits indicating the transect location("XX" will be used in place of the transect number to denote the composite sample

for waste characterization), two digits following a hyphen indicating the sequential sample number on a given transect and day , and finally six digits (YYMMDD) following a hyphen indicating the date the sample was collected. The sample may further be identified after processing. The sampling interval of each sample will be added after the date, following a hyphen. The interval will be recorded in feet, with a hyphen placed between the range.

The media/sample types will be designated using the follow codes:

- Bank Sample – "BA"
- Sediment Sample – "SD"

Field equipment blank – "FB"

An example sample identification code is as follows:

2SD005-03-181115-0-0.5

This code signifies that a sediment sample was collected on November 15, 2018, from the Segment 2 at the fifth transect (05) and was the third core (03) collected from the south bank from the transect on that day. It was also the first sample (e.g., 0 to 0.5 feet) below the top of the sediment core.

Field duplicates (FD), matrix spike (MS) and matrix spike duplicate (MSD) analyses will be noted on the chain-of-custody forms, and extra sample mass collected, if required. Field equipment blanks and rinsate blanks (RB) will use the same coding system, with the prefix "FB" or "RB," media type, sequential order of field equipment or rinsate blanks performed, and 00 for the sample number (e.g., the second rinsate blank associated with sediment collection would be named RBSD02-00-181115). Field duplicates will be labeled as ordinary field samples with a unique identification number. Duplicate samples will not be identified, and the laboratory will analyze them as "blind" quality control (QC) samples.

Object Identification

Objects located during the object survey will be organized with a unique alpha-numeric system to facilitate object tracking and data management. The alpha-numeric system will

begin with one-number prefix indicating the segment within the site, followed by two letters describing the object type, and two digits sequentially counting up objects.
The object types will be designated using the follow codes:

- Outfall – "OF"
- Woody Debris – "WD"
- Industrial Debris – "ID"
- Timber Revetment – "TR"
- Shoreline Wall – "SW"
- Pilings/Abutments – "PA"
- Utility Crossing – "UC"
- Fence – "FE"
- Other – "OT"

INDEX OF SOPS

SOP 1 – Field Records
SOP 2 – Topographic and Bathymetric Survey and Sediment Poling
SOP 3 – Navigation and Boat Positioning
SOP 4 – Sediment Sampling
SOP 5 – Sediment and Soil Core Processing
SOP 6 – Sample Custody
SOP 7 – Sample Handling, Packaging, and Shipping
SOP 8 – Equipment Cleaning/Decontamination
SOP 9 – Soil Sampling
SOP 10 – Vane Shear Testing
SOP 11 – Investigation-Derived Waste Handling and Disposal
SOP 12 – Dynamic Cone Penetrometer
SOP 13 – Asbestos Sampling and Air Monitoring

LIST OF ATTACHMENTS

Attachment 1 – Daily Log
Attachment 2 – Field Deviation Form
Attachment 3 – Object Survey Form
Attachment 4 – Pre-Flight Drone Checklist

Daily Log

Anchor QEA L.L.C.
290 Elwood Davis Road, Suite 340
Liverpool, NY 13088
Phone 315.453.9009 Fax 315.453.9010

PROJECT NAME: Portage Canal - Segment 2 **DATE:**

SITE ADDRESS: **PERSONNEL:**

WEATHER: **WIND FROM:**

N	NE	E	SE	S	SW	W	NW
SUNNY		CLOUDY		RAIN		?	

LIGHT | MEDIUM | HEAVY

TEMPERATURE: ° F . ° C
[Circle appropriate units]

TIME	COMMENTS
See Notes on bottom of page for detailed logging	
Equipment on site:	
Visual Survey: (overland flow, flow from outfalls, impacts,)	
Samples delivered to lab:	

Notes: Work performed, Phone calls made, Problems Issues/Resolutions, Visitors on site, Deviations from the Workplan
Safety infractions, Important comments/instructions to contractors

Signature: _____

290 Elwood Davis Road, Suite 340
Liverpool, NY 13088
Phone 315.453.9009
Fax 315.453.9010
www.anchorqea.com

Field Deviation Form

Form No._____

Deviation subject:_____

Project name: Portage Canal - Segment 2

Standard procedure for field collection:

Reason for deviation:

Description of deviation:

Special equipment, materials, or personnel required:

Initiator's name:	**Date**:
Project Manager:	**Date**:
QA Coordinator:	**Date**:

ANCHOR QEA

290 Elwood Davis Road, Suite 340
Liverpool, NY 13088
Phone 315.453.9009
Fax 315.453.9010
www.anchorqea.com

Object Survey Information Data Collection Form

Object Number		**Field Personnel**	
Date		**Page**	of
Time		**River Stage**	
General Feature Description			
GPS Location			

	Description	**Water Depth to Mudline**	**Object Height Above Water**
Location 1			
Location 2			
Location 3			
Location 4			
Location 5			

Condition	Good Fair Poor	Sloped	Vertical
Visible Substrate Type	Riprap Gravel Soil Debris Vegetation Sediment Other_____		

Notes

Photograph Log	**Description**	**GPS Location**	

Day ____ Page ____ of ____ Initials ____

ANCHOR QEA

Small Unmanned Aerial System

Pre-Flight Checklist

Date: _____ **Remote PIC:** _____

RPIC Cert. No.: _____

Operating Environment

- ❑ Verify that operation will occur in uncontrolled (Class G) airspace
  - ❑ If in controlled airspace (Class, B, C, D, E), has a waiver/authorization been obtained?
- ❑ Check for other flight restrictions (NOTAMs, TFRs)
- ❑ Check weather conditions
- ❑ Check for persons, property, or other ground hazards around the planned operational area
- ❑ Obtain permission from property owner and/or client

Roles and Responsibilities

- ❑ Identify Remote Pilot-in-Command
- ❑ Identify Controller (if different than the Remote PIC), Visual Observer
- ❑ Discuss emergency/contingency procedures, roles and responsibilities, potential hazards
- ❑ Verify availability of required documentation (pilot certificate, sUAS registration, waiver[s])

Inspect Condition of the Aircraft

- ❑ Verify that batteries are charged (Remote Controller, Aircraft Flight Battery, Mobile Device)
- ❑ Verify that airframe structure, including undercarriage, and batteries are in good condition
- ❑ Propellers are mounted correctly and firmly
- ❑ MicroSD card has been inserted, if necessary
- ❑ Gimbal is operating normally
- ❑ Motors can start and are functioning normally
- ❑ Ensure that sensors for the Obstacle Sensing System are clean (if present)
- ❑ Registration markings are properly displayed and legible

Inspect Electronic Connections

- ❑ Verify that flight control app (DJI GO or analogous) is successfully connected to the aircraft
- ❑ Verify communication with an adequate number of GPS satellites (minimum of 4)
- ❑ Check navigation and communication data links between aircraft and control station
- ❑ Calibrate sUAS compass
- ❑ Establish home point; allow a minimum of 60 seconds at the home point location
- ❑ Start propellers to inspect for any imbalance or irregular operation
- ❑ At controlled low altitude, fly within range of any interference & recheck all controls/stability

STANDARD OPERATING PROCEDURE SOP 02 – TOPOGRAPHIC AND BATHYMETRIC SURVEY AND SEDIMENT POLING

Prepared for

Wisconsin Department of Natural Resources

Prepared by

Anchor QEA, LLC

November 2018

STANDARD OPERATING PROCEDURE ACKNOWLEDGEMENT FORM

Project No. 181779-01.01 Project Name: Portage Canal – Segment 2

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) is applicable to the collection of topographic and bathymetric survey data to determine site conditions and sediment poling to assess soft sediment thickness for the Pre-Design Investigation (PDI).

These PDI tasks have been combined into one SOP as each activity will be conducted in conjunction with one another. Procedures for sediment sampling outlined in this SOP are expected to be followed. Deviations from the procedures detailed in this SOP will be described on the Daily Log and in a Field Deviation Form (see SOP 01 – Field Records).

HEALTH AND SAFETY WARNINGS

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the Site Safety Plan (SSP). The SSP will be followed during all activities conducted by all field personnel, including subcontractors. Utility clearance will be performed prior to any intrusive work.

PERSONNEL QUALIFICATIONS

Field personnel executing these procedures will have read, be familiar with, and comply with the requirements of this SOP, the Field Sampling Plan (FSP), and the corresponding documents (i.e., SSP and Quality Assurance and Quality Control [QA/QC] Plan). Additionally, field personnel will be under the direct supervision of qualified professionals who are experienced in performing the tasks required herein.

EQUIPMENT AND SUPPLIES

The following is a list of equipment that may be necessary to carry out the procedures contained in this SOP. Additional equipment may be required, pending field conditions.

- Sampling vessel equipped with necessary real-time kinetic (RTK) global positioning system (GPS) navigation and communication equipment or total station
- Approved documents including SSP and QA/QC Plan
- Target coordinates for poling locations
- Less than 0.5-inch steel rod or equivalent marked in 1-inch intervals, 20 feet in length
- A standard survey rod (approximately 2-inch diameter) outfitted with a sediment plate

- Field logbook or field database
- Appropriate personal protective equipment and clothing as defined in the SSP
- 50-foot lead line
- 50-foot tape measure

PROCEDURES FOR TOPOGRAPHY, BATHYMETRY, AND SEDIMENT POLING

Bank elevations, top-of-sediment elevations, and soft sediment thickness will be measured along pre-determined transects as described in the FSP. Navigation and boat positioning procedures are described in SOP 03 – Navigation and Boat Positioning. Collection of sediment cores (SOP 04 – Sediment Sampling) as a QA/QC method to check poling results will be performed in conjunction with poling data collection.

Prior to performing intrusive work, confirm utility locate has been performed and that any existing utilities have been clearly marked or confirmation that no existence of utilities is present. Utilities will be cleared before poling is commenced. This may be accomplished through notifying Diggers Hotline (800-242-8511).

A staff gage will be installed per U.S. Army Corps of Engineers guidance prior to commencing topographic and bathymetric survey data (Corps 2018).

Topographic survey data will be performed using the following procedures:

1. At the beginning and end of each day, confirm the accuracy of the RTK GPS and/or total station by checking into the site control point.
2. Navigate to the proposed sample location.
3. Level the survey equipment
4. Record the horizontal and vertical coordinates either in the field database or in field logbook. Include note if proposed location is in water and record surface water level elevation on staff gage.

Bathymetric survey data and sediment poling will be performed using the following procedures:

1. At the beginning and end of each day, confirm the accuracy of the RTK GPS and or total station by checking into the site control point.

2. Record the water surface elevation from the staff gage in the field log at the beginning and end of each day. Additional staff gage data will be collected at the discretion of the field staff during weather events (rain) and if the water level elevation noticeably changes during the day.
3. Navigate the vessel to the proposed sample location (see SOP 03) or walk or wade to locations (as necessary).
4. Secure the vessel in place using anchors, as necessary.
5. At locations where water is present, use a standard survey rod (approximately 2-inch diameter) with a sediment plate to measure the top-of-sediment, water depth and identify sediment-water interface. Record coordinates of the top-of-sediment using RTK GPS or total station and note in the field logbook or field database if no water is present.
6. Use a less than 0.5-inch steel rod or equivalent to probe the sediment. The probe will be sharpened on one end and calibrated in 1-inch intervals.
7. Advance the probe into the sediment bed until refusal, noting the depth of penetration and type of resistance met by the probe. During poling collection, further investigate poling locations where results are extremely shallow (less than 6 inches) or deep by collecting step out poling data around the location of interest. Flag deep locations for core collection.
8. Record the water depth (to the nearest inch), distance from the top to the bottom of soft sediment, type of resistance (e.g., minimal, difficult, rough, abrasive), and sediment type (e.g., rock, fine-grained) in the field logbook or field database.

QUALITY ASSURANCE/QUALITY CONTROL

Entries in the field logbooks will be double-checked by the field team staff to verify that the information is correct. It is the responsibility of the Field Lead to periodically check to ensure that the procedures are in conformance with those stated in this SOP.

REFERENCES

Corps (U.S. Army Corps of Engineers), 2018. Staff Gage Setup Instructions. Omaha District. Accessed on November 5, 2018. Available from:

http://www.nwo.usace.army.mil/Media/Fact-Sheets/Fact-Sheet-Article-View/Article/487672/staff-gage-setup-instructions/.

STANDARD OPERATING PROCEDURE SOP 03 – NAVIGATION AND BOAT POSITIONING

Prepared for

Wisconsin Department of Natural Resources

Prepared by

Anchor QEA, LLC

November 2018

STANDARD OPERATING PROCEDURE ACKNOWLEDGEMENT FORM

Project No. 181779-01.01 Project Name: Portage Canal – Segment 2

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes the methods to be used for positioning boats for the Pre-Design Investigation.

Procedures for sediment sampling outlined in this SOP are expected to be followed. Deviations from the procedures detailed in this SOP will be described on the Daily Log and in a Field Deviation Form (see SOP 01 – Field Records).

HEALTH AND SAFETY WARNINGS

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the Site Safety Plan (SSP). The SSP will be followed during all activities conducted by all field personnel, including subcontractors.

PERSONNEL QUALIFICATIONS

Field personnel executing these procedures will have read, be familiar with, and comply with the requirements of this SOP, the Field Sampling Plan, and the corresponding documents (i.e., SSP and Quality Assurance/Quality Control Plan [QA/QC Plan]). Boat navigation and positioning will only be performed by field team staff or subcontractors experienced with boat operations and real-time kinematic (RTK) global positioning system (GPS) operation or total station operation.

EQUIPMENT AND SUPPLIES

The following is a list of equipment that may be necessary to carry out the procedures contained in this SOP. Additional equipment may be required, pending field conditions.

- Approved documents, including the SSP, Field Sampling Plan, and QA/QC Plan
- Daily Float Plan (Attachment 1) listing stations to be sampled, target station coordinates, access points along the site, and sample transfer and transport locations
- Ballpoint black ink pens
- Personal protective equipment as required by the SSP, including personal floatation devices as required

- Sampling vessel equipped with necessary RTK GPS navigation and communication equipment or total station equipment
- Weighted tape measure (lead line) for water depth measurements
- Boat spuds and an anchor system to stabilize boat on station
- Pre-determined sampling coordinates/waypoints and location figures

HORIZONTAL POSITIONING PROCEDURES

Horizontal positioning will be determined using a total station or RTK GPS based on target coordinates listed in the Field Sampling Plan. As described in the Field Sampling Plan, the sample locations may be modified based on field conditions. Measured geographic coordinates for station positions will be recorded and reported to the nearest 0.01 foot. In addition, : North American Datum 1983 High Accuracy Reference Network Wisconsin Coordinate Reference System Columbia County U.S. Feet coordinates will be reported to the nearest foot.

The following procedures describe the steps used to establish a position at a location as well as the steps to adjust the positioning for the collection of additional samples:

1. Sampling locations to be occupied will be selected by the Field Lead and communicated to field team staff each day. Coordinates for each sampling location will be entered as a waypoint into the RTK GPS unit or total station. The accuracy of each entry will be checked against the coordinates established in the Field Sampling Plan.
2. The RTK GPS antennae or total station equipment will be maintained in a safe location that accurately represents the actual sample or measurement collection point (e.g., mounted to the top of the davit or A-frame used for raising or lowering the sampling equipment).
3. Using navigational data from the RTK GPS or total station, the boat operator will navigate to and approach the actual sampling/measurement station. Line of sight will be required if using the total station.
4. For sediment, the boat will be secured within 5 feet of the sampling station by lowering anchors. Under some conditions, the boat may not be anchored based on safety as determined by the vessel operator.

5. Once the boat is on location (and secured for poling, coring, topography, and bathymetry), the coordinates from the RTK GPS unit or total station will be noted. With the boat on location, the coordinates will be stored electronically in the RTK GPS unit or total station and recorded on the appropriate field form. Line of sight will be required if using the total station.
6. For repeated attempts at a sampling location, the boat will be moved within the radius of 5 or fewer feet parallel to the shoreline or 5 or fewer feet perpendicular to the shoreline surrounding the target coordinates. The boat will be repositioned by adjusting an anchor line or motoring unattached until the new position for the sampling device has been established. The new position will be recorded on the appropriate field form or in the field database.

VERTICAL ELEVATION MEASUREMENT PROCEDURES

1. At each sampling station where elevation data is required, the water depth (from the top of the water level surface to the top of sediment surface) will be determined using a calibrated weighted line or tape measure.
2. The date and time of the measurement will be recorded on the appropriate data form.
3. Vertical elevation of each measurement station will be converted to the vertical datum (North American Vertical Datum of 1988, U.S. feet) after each field sampling event.
4. Water surface elevations will be determined using measured data from the staff gauges that will be installed prior to commencing water work.

QUALITY ASSURANCE/QUALITY CONTROL

RTK GPS system performance checks using built-in accuracy measurements and ground truths will be performed daily to confirm RTK GPS accuracy. Total station accuracy shall be checked at the beginning and end of each day using the control point designated on the site. It is the responsibility of the Field Lead to periodically check to ensure that the procedures are in conformance with those stated in this SOP.

LIST OF ATTACHMENTS

Attachment 1 – Daily Float Plan

ANCHOR QEA

DAILY FLOAT PLAN

Today's Date: _____

Vessel Name: _____

Operator: _____

Departure Time: _____ **Expected Time of Return:** _____

Cell Phone Number(s) _____

Office Contact Person Notified of Departure and Return: _____

Destination and Itinerary:

_____

_____

_____

Names of Personnel on Board:

_____

_____

_____

If expected time of return is exceeded by 1 hour, the following steps will be taken:

1. Office Contact Person will attempt to contact crew members.
2. Office Contact Person will notify Field Manager, if not the same person.

If Office Contact Person is not able to establish contact with crew the following steps will be taken in a logical order:

3. Field Manager will contact Health and Safety Officer.
4. Field Manager will contact Project Manager.
5. Local hospitals and emergency centers will be contacted.
6. Local search and rescue will be notified.

STANDARD OPERATING PROCEDURE SOP 04 – SEDIMENT SAMPLING

Prepared for

Wisconsin Department of Natural Resources

Prepared by

Anchor QEA, LLC

November 2018

STANDARD OPERATING PROCEDURE ACKNOWLEDGEMENT FORM

Project No. 181779-01.01 Project Name: Portage Canal – Segment 2

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) is applicable to the collection of sediment samples for the Pre-Design Investigation. Although Wisconsin statutes define sediment spatially as up to the ordinary high water mark, this SOP is only intended for sampling submerged materials. Sediment for chemistry and geotechnical testing will be collected by direct push methods. In shallow areas with sediments less than 6 inches thick, an Eckman dredge (or equivalent) will be used to collect surface sediments, as necessary. Core processing and sample collection procedures are described in SOP 05 – Sediment and Soil Core Processing.

Procedures for sediment sampling outlined in this SOP are expected to be followed. Deviations from the procedures detailed in this SOP will be described on the Daily Log and in a Field Deviation Form (see SOP 01 – Field Records).

HEALTH AND SAFETY WARNINGS

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the Site Safety Plan (SSP). The SSP will be followed during all activities conducted by all field personnel, including subcontractors. Utility clearance will be performed prior to any intrusive work.

PERSONNEL QUALIFICATIONS

Field personnel executing these procedures will have read, be familiar with, and comply with the requirements of this SOP, the Work Plan, and the corresponding documents (i.e., SSP and Quality Assurance and Quality Control [QA/QC] Plan). All field personnel are required to take a 40-hour Occupational Safety and Health Administration Hazardous Waste Operations and Emergency Response training course and annual refresher courses as well as participate in a medical monitoring program prior to engaging in core collection activities. Additionally, field personnel will be under the direct supervision of qualified professionals who are experienced in performing the tasks required for sample collection.

EQUIPMENT AND SUPPLIES

The following is a list of equipment that may be necessary to carry out the procedures contained in this SOP. Additional equipment may be required, pending field conditions.

- Sampling vessel equipped with necessary real-time kinematic (RTK) global positioning system (GPS) navigation and communication equipment or total station
- Approved documents including Field Sampling Plan, SSP, and QA/QC Plan
- Sample coordinates
- Push core sampler or piston core sampler
- Core tubes and caps
- Tubing cutters
- Sediment grab sampler (Eckman dredge, ponar, etc.)
- Core collection field forms or field database
- Duct tape
- Low-density polyethylene (LDPE) or high-density polyethylene (HDPE) bins
- Aluminum foil (aluminum foil shall not be used for perfluoroalkyl and polyfluoroalkyl substances [PFAS] sampling)
- Disposable aluminum pans
- Decontamination materials as described in SOP 08 – Equipment Cleaning/Decontamination
- Appropriate non-waterproof personal protective equipment and clothing as defined in the SSP
- Lead line
- Tape measure
- PFAS-free container for water

SAMPLING PROCEDURE USING A PISTON-CORE/DIRECT-PUSH SAMPLER

Sediment core samples will be collected by piston-core/direct-push sampler as the primary sampling method, due to the lack of access for larger sampling vessels. Navigation and boat positioning procedures are described in SOP 03 – Navigation and Boat Positioning. Collection of sediment samples will be conducted in conjunction with bathymetric survey and poling data collection to the extent practical.

Sediment core collection will be performed using the following procedures:

1. Confirm utility locate has been performed and that any existing utilities have been clearly marked or confirmation that no existence of utilities is present. Utilities will be cleared before sampling is commenced. This may be accomplished through notifying Diggers Hotline (800-242-8511).
2. The vessel will be navigated to the proposed sample location (see SOP 03).
3. A decontaminated core tube the length of the desired penetration depth will be assembled, checking to ensure that the core tube is securely fastened to the core apparatus (push core or piston-core head).
4. A bulk water sample will be collected prior to collecting the waste characterization sample for use in the bench-scale testing by submerging a PFAS-free water collection container and filling it with water.
5. The coring device will be placed on the sediment surface at the desired location using extension poles if necessary.
6. If a piston corer is used, the piston line will be secured. The core sampling apparatus will then be manually pushed vertically into the sediment. The depth of penetration will be recorded by measuring movement of the top of the core sampler in relation to the water surface. The core will be manually pushed into the sediment until refusal or the target depth has been achieved, including a minimum of 6 inches into the sand.
7. Proper back care will be exercised when pulling a stuck core out of the sediments. The extension pole will be removed as needed as the core is brought to the surface.
8. As the final extension pole is removed, a vertical alignment with the core will be maintained, and a cap will be placed over the bottom of the core before the core tube is brought above the water surface to prevent sediment from sliding out the bottom of the core.
9. The core will be secured in an upright position for measurements. Any disturbed sediment will be allowed to settle completely within the core tube, and the recovered sediment length will be measured.
10. Water above the sediment will be drained by drilling a hole in the core tube just above the sediment surface. The excess plastic tube will be cut off above the sediment surface, and immediately after that, the end will be capped and the caps secured on the top and bottom with duct tape.

11. The core sample will be evaluated at the visible ends of the core tube; the length of recovered sediment will be recorded; and, if accepted, the core will be transported to the core-processing location.

Acceptance criteria for sediment core samples are as follows:

- Overlying water is present and the surface is intact.
- The core tube appears intact without obstruction or blocking.
- Recovery is greater than 70% of drive length.
- Core includes 6 inches of native sand in the bottom of the core for cores used for QA/QC of the elevation of contamination and for the collection of geotechnical testing of the native sand.

If sample acceptance criteria are not achieved, the sample is rejected unless modified acceptance criteria are approved by the Field Lead and/or multiple attempts (three or more) have been made at the sampling location. In cases where three attempts are unsuccessful, the Field Lead will contact the Project Manager, and best professional judgment and field conditions will be used to determine if additional cores should be attempted. Additional attempts may be made using modified sampling techniques if determined possible by the field team. Modifications include changing the sample tube diameter, using a core catcher, or increasing the suction; these may be conducted on a different date than the original attempt. The location may also be relocated to another transect if approved by the Project Manager.

Field conditions and drive notes will be recorded in the field database or on a Sediment Core Collection Log (an example is provided in Attachment 1). The logs will include the following information:

- The sample station identification
- Water depth and time of measurement
- Geographic position of the actual coring location as determined by RTK GPS or total station
- Date and time of collection of each sediment core sample
- Names of field personnel collecting and handling the samples

- Observations made during sample collection, including weather conditions, complications, and other details associated with the sampling effort
- Length of drive penetration and recovery measurements
- Qualitative notation of apparent resistance of sediment column to coring (how the core drove)

Once the core samples are deemed acceptable, the following procedures will be followed:

1. The core tube will be labeled with the sample station number, segment letter, and an arrow pointing to the top of the core.
2. The appearance and length of the core sample will be evaluated by examination through the clear plastic core liner. Any stratigraphic intervals or other salient features will be noted in the field database or on the Sediment Core Collection Log sheet including the total length of the native material.
3. The cores will then be cut into appropriate lengths for transport to the core processing area for processing.
4. The cores will be sealed tightly to prevent leakage or disturbance during transport to the processing station.

SURFACE SAMPLING PROCEDURE USING GRAB SAMPLER

In areas where sediment deposits are less than 6 inches and difficult to sample using direct-push methods, an Eckman dredge or equivalent may be used to collect a representative sediment sample.

Surface sediment collection will be performed using the following procedures:

1. Prepare grab sampling device (Eckman dredge or equivalent) for deployment.
2. Depending on overlying water depth, personnel will wade or travel by boat to the target location.
3. At sample location, open or set the dredge and drop vertically making sure the end of the rope is maintained securely above the water.
4. Once the dredge has been allowed to settle into the bottom sediments, a hard pull on the rope will close the dredge and contain the sediments inside the dredge.

5. Open the dredge to allow the sediments to empty into a sample processing container (e.g., new or decontaminated [SOP 08]) LDPE or HDPE container). Process sediment sample in accordance with SOP 5 – Sediment and Soil Core Processing.

QUALITY ASSURANCE/QUALITY CONTROL

Entries in the field forms will be double-checked by the field team staff to verify that the information is correct. It is the responsibility of the Field Lead to periodically check to ensure that the procedures are in conformance with those stated in this SOP.

LIST OF ATTACHMENTS

Attachment 1 – Sediment Core Collection Log

Sediment Core Collection Log

Job: Portage Canal - Segment 2

	Station ID:
Job No:	**Attempt No.**
Field Staff:	**Date:**
Contractor:	**Logged By:**
Vertical Datum:	**Horizontal Datum:**

Field Collection Coordinates:

Lat/Northing: Long/Easting:

A. Water Depth	**B. Lake Level Measurements**	**C. Mudline Elevation**
DTM Depth Sounder:	Time:	
DTM Lead Line:	Height:	

Core Collection Recovery Details:

Core Accepted: Yes / No

Core Tube Length:

Drive Penetration:

Headspace Measurement:

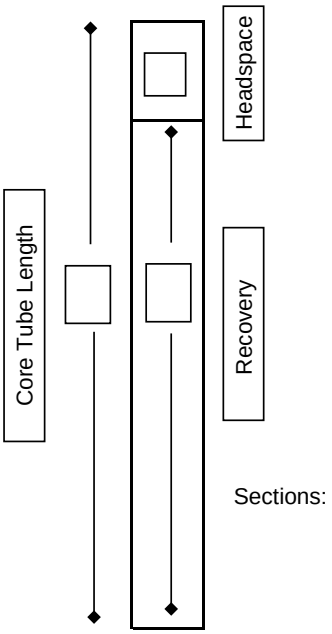
Recovery Measurement:

Recovery Percentage:

Total Length of Core To Process:

Is the EOC apparent? (If yes, record depth from top of core to EOC)

Drive Notes:



Core Field Observations and Description: Sediment type, moisture, color, minor modifier, MAJOR modifier, other constituents, odor, sheen, layering, anoxic layer, debris, plant matter, shells, biota

Notes:

STANDARD OPERATING PROCEDURE SOP 05 – SEDIMENT AND SOIL CORE PROCESSING

Prepared for

Wisconsin Department of Natural Resources

Prepared by

Anchor QEA, LLC

November 2018

STANDARD OPERATING PROCEDURE ACKNOWLEDGEMENT FORM

Project No. 181779-01.01 Project Name: Portage Canal – Segment 2

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) is applicable to the processing of sediment and soil core samples to characterize the chemical and geotechnical nature of subsurface sediments and soils as part of the Pre-Design Investigation. Core collection is described in SOP 04 – Sediment Sampling and SOP 09 – Soil Sampling.

Procedures for sediment sampling outlined in this SOP are expected to be followed. Deviations from the procedures detailed in this SOP will be described on the Daily Log and in a Field Deviation Form (see SOP 01 – Field Records).

HEALTH AND SAFETY WARNINGS

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the draft Site Safety Plan (SSP). The SSP will be followed during all activities conducted by all field personnel, including subcontractors.

PERSONNEL QUALIFICATIONS

Field personnel executing these procedures will have read, be familiar with, and comply with the requirements of this SOP, the Field Sampling Plan, and the corresponding documents (i.e., SSP and Quality Assurance and Quality Control Plan [QA/QC Plan]). All field personnel are required to take a 40-hour Occupational Safety and Health Administration Hazardous Waste Operations and Emergency Response training course and annual refresher courses, as well as participate in a medical monitoring program prior to engaging in core processing activities. Additionally, field personnel will be under the direct supervision of qualified professionals who are experienced in performing the tasks required for sample processing.

EQUIPMENT AND SUPPLIES

The following is a list of equipment that may be necessary to carry out the procedures contained in this SOP. Additional equipment may be required, pending field conditions.

- Approved documents including SSP, Field Sampling Plan, and QA/QC Plan
- Appropriate personal protective equipment and clothing as defined in the SSP

- Decontamination equipment described in SOP 08 – Equipment Cleaning/Decontamination
- Stainless-steel or disposable aluminum pans (aluminum pans prohibited for waste characterization processing)
- Low density polyethylene (LDPE) or high density polyethylene (HDPE) bins
- Stainless-steel or disposable plastic utensils (only stainless steel or polypropylene based plastic utensils may be used for waste characterization processing)
- Physical Description of Sediment and Soil Key (see example provided in Attachment 1) and Sediment and Soil Core Processing Log forms (see example provided in Attachment 2)
- Tape measure
- Camera
- White board and pens
- Paper towels
- Duct tape
- Aluminum foil
- Core-cutting equipment
- Coolers with ice
- Sample containers and labels
- Clear plastic, resealable zippered bags (or equivalent)
- Computer with field application
- Plastic sheeting
- Foldable tables
- U.S. Department of Transportation (USDOT)-approved, 55-gallon, open-topped drums or Baker tank with lid for collection of solids
- USDOT-approved, 55-gallon, closed-top drums for collection of liquids

CORE PROCESSING PROCEDURES

1. Sediment and soil cores, once collected, will be stored upright to preserve core sediment or soil integrity and stored out of direct sunlight until processing. Sediment and soil cores will be stored on ice consistent with SOP 07 – Sample Handling, Packaging, and Shipping.

2. Sediment and soil core processing will be conducted at the processing area after being transported from the collection boat or field sampling crew location.
3. Core processing consists of removing the sediment and soils from the core or cutting the core open to access the materials.
4. All working surfaces and instruments will be thoroughly cleaned, decontaminated, and covered with plastic or aluminum foil to minimize outside contamination between sampling events. Aluminum foil will not be used during waste characterization sample processing.
5. Disposable gloves will be discarded after processing at each station and replaced prior to handling decontaminated instruments or work surfaces.
6. The length and weight of the core will be measured to calculate wet bulk density. Measurements will be recorded in the field logbook or field database. Prior to sample collection, the unit weight of the core tubes and core caps will be determined.
7. Prior to processing, the core caps will be removed, and each section of the core will be cut longitudinally using a circular saw or a cutting tool; care will be taken not to penetrate the sediment or soil while cutting.
8. Two longitudinal cuts will be made along the sides of the core so that the core can be opened to expose the sediment or soil.
9. The core will be split with decontaminated stainless-steel or new disposable plastic utensils to expose the center of the two halves for sampling. Only stainless steel or polypropylene-based plastic utensils will be used for waste characterization processing.
10. Prior to sampling, color photographs will be taken of the total core length.
11. A description of the core sample will be recorded on the Sediment and Soil Core Processing Log form (see example provided in Attachment 2) and field database for the following parameters, as appropriate:

    - Date and time of sample collection
    - Sample recovery (depth in feet of penetration compared to recovery)
    - Physical soil description along the entire length of the core (including lengths of each material type) in accordance with ASTM International (ASTM) procedures (ASTM D2488 – Standard Practice for Description and Identification of Soils [Visual-Manual Procedure] and ASTM D2487 – Standard Classification of Soils for

Engineering Purposes [Unified Soil Classification System]) will be recorded including soil type, moisture content, density/consistency of soil, color, and visual evidence of impacts (e.g., hydrocarbon-like sheens)

- Odors (e.g., hydrogen sulfide or petroleum)
- Visual stratification, structure, and texture, including measurement with tape measure as to where within the core they occur
- Vegetation and debris, including measurement with tape measure as to where within the core they occur
- Photoionization detector readings, including measurement with tape measure as to where within the core they occur
- Biological activity (e.g., detritus, shells, tubes, bioturbation, and live or dead organisms), including measurement with tape measure as to where within the core they occur
- Presence of sheen, including measurement with tape measure as to where within the core they occur
- Any other distinguishing characteristics or features
- Whether elevation of contamination (EOC) is apparent, and if so, the depth from top of sediment or soil to EOC

12. Sample material from a specific sample interval will be removed from the core using either decontaminated spoons or spatulas or new disposable plastic utensils (only stainless steel or polypropylene-based plastic utensils will be used for waste characterization processing), while taking care not to remove material that has come into contact with the sides of the core tube. Sample material from the specific sample interval will be placed into either a decontaminated stainless-steel or new disposable aluminum tray or bowl for homogenization. Aluminum trays or bowls will not be used for waste characterization sample processing. The waste characterization samples, as described in the Field Sampling Plan, will be composited into one sample. Compositing will include mixing the material associated with the three sample locations using a stainless steel trowel/shovel, or mixer. Additional methodology may be used with approval from Project Manager.
13. Following homogenization, the sample will be placed in appropriate laboratory-supplied jars. The bulk sediment sample for bench-scale studies and waste

characterization will be placed in a container made completely of perfluoroalkyl and polyfluoroalkyl substance-free (e.g., HDPE) material.

14. Core intervals to be removed for chemical analyses are described in the Field Sampling Plan and will be determined based on recovered measurements.

QUALITY ASSURANCE/QUALITY CONTROL

Entries in the field forms or field database will be double-checked by the field team staff to verify that the information is correct. It is the responsibility of the Field Lead to periodically check to ensure that the procedures are in conformance with those stated in this SOP.

LIST OF ATTACHMENTS

Attachment 1 – Physical Description of Sediment and Soil Key
Attachment 2 – Sediment and Soil Core Processing Log

Physical Description of Sediment/Soil Key

Visual sediment/soil descriptions consist of the following:

Moisture content, density/consistency, color, minor constituent, MAJOR CONSTITUENT/GROUP NAME; structure descriptions (as needed); amount and shape of minor constituents (e.g., organics and anthropogenics); biota; odor; sheen

Recovered and in situ depths

Recovered = measured in the lab, actual sediment depth from core tube

Sediment/Soil Description Terminology		
1. Moisture Content		
Dry	Little perceptible moisture (upland only)	
Damp	Some perceptible moisture, probably below optimum (clays, core intervals at depth)	
Moist	Probably near-optimum moisture content, no visible water (most sediment)	
Wet	Visible free water, probably above optimum	
2. Density (Core Drive Penetration and Finger Pressure)		
SAND or GRAVEL		
Density	**Visual**	**Notes**
Very loose	Freefall	May occur at the top of a core or grab
Loose	Easy penetration	
Medium dense	Moderate penetration	Typically down core due to compaction or compression
Dense	Hard penetration	Bottom of a core, typical to glacial deposits
Very dense	Refusal	
SILT or CLAY		
Consistency	**Visual**	**Notes**
Very soft	Freefall	Soupy, not cohesive
Soft	Easy penetration	Easily penetrated, just starting to be cohesive
Medium stiff	Moderate penetration	Cohesive, molded by finger pressure
Stiff	Hard penetration	Can indent and mold by stiff finger pressure
Very stiff/hard	Refusal	Modeling clay (rolls to a ball)
3. Color and Shading		
Example Colors		**Shades**
Black		Light
Browns (olive, yellow, red)		Dark
Grays (gray, olive, brown)		Very dark
Mottling: Streaks or spots of a minor color within the larger color unit		
4. Minor and MAJOR Group Name		
Gravel		Silt
Sand		Clay
* MAJOR is written in all CAPITAL LETTERS		
* Description of minor constituent precedes MAJOR constituent, except for trace		
Minor Constituents		**Percent**
Trace (clay, silt, sand, gravel)*		0 to 5
Slightly (clayey, silty, sandy, gravelly)		5-15
Clayey, silty, sandy, gravelly		15 to 30
Very (clayey, silty, sandy, gravelly)		30 to 50
GROUP NAME		Greater than 50
* For trace minor constituents, place after MAJOR constituent		

Sediment Description Terminology	
Descriptors	
Sand and Gravel	Rounding
	Sorting
	Grain color

5. Other Minor Constituents: % by volume (e.g., organics and anthropogenics)*	
Other Minor Constituents*	**Percent**
Trace	0 to 5
Occasional	5 to 10
Moderate	10 to 30
Substantial	30 to 50
*Separate major from other minor constituents with a period	

6. Biota
Beggiatoa - white/colorless, filamentous proteobacteria
Marsh grass, shells, worms, etc.

7. Odor Descriptions	
Amount	**Odor Types**
Trace	Petroleum-like
Slight	H_2S-like (Hydrogen sulfide-like)
Moderate	Septic-like
Strong	Solvent-like
	Metallic-like

8. Sheen (No odor or sheen observed unless noted)	
Amount	**Percent**
None, trace	Less than 2
Slight	2 to 15
Moderate	15 to 40
Moderate to heavy	40 to 70
Heavy	Greater than 70

Visual Description Terminology	
Rainbow	Multicolored
Metallic	Metallic gray-colored
Florets, streaks	Semi-circular and flat (two dimensional [2-D]) (florets = individual; streaks = lines)
Blebs	Semi-circular and spherical (3-D)

9. Product	
Oil stained	Visible brown or black stains on soil (fine-grained soil)
Oil coated	Visible brown or black coating on soil (coarse-grained soil)
Oil wetted	Visible brown or black oil wetting on soil. Oil appears as a liquid and is not held by soil grains (pools)

Nonaqueous phase liquid (NAPL): NAPL is generally classified as light NAPL (LNAPL) if the density is less than that of water (i.e., will float on water) and dense NAPL (DNAPL) if the density is greater than that of water (i.e., will sink in water).

Sediment Description Terminology	
10. Structure and Other Sediment Descriptions	
Hummocky	Cohesive soil that can be broken down into smaller lumps
Gummy	Cohesive, pliable soil with high percentage of clay
Bed	Greater than or equal to 0.5 inch thick
Thin bed	Less than 0.5 inch thick
Pockets	Semi-circular to circular inclusion/deposit
Laminated beds	Thin beds (less than 0.5 inch thick) lying between or alternating within a greater unit
Stratified beds	Beds (greater than 0.5 inch thick) lying between or alternating within a greater unit
Organic matter	Mass of leaves, twigs, wood, etc.
Anthropogenic material	Material originated from industrial activity such as coal fragments, slag, etc.
Aggregates	Industrial waste products
Anthropogenic debris	Debris originated from human activity such as trash, plastic, etc.
Decomposed	Visible sign of decomposition or discoloration
Fresh	No visible sign of decomposition or discoloration
Winnowed	Loss of material that occurred during coring, creating a washed-out void space
Contacts: For Core Processing Only	
@	Compositional change or presence of minor constituent
----------	Major unit change/non-discrete, gradational contact (dashed line)
————————	Major unit change/visually discrete, abrupt contact (solid line)
----------	Native major unit change/non-discrete, gradational contact (dash-dot line)
----------	Native major unit change/visually discrete, abrupt contact (dash-dot-dot line)
---------	Minor unit change (competency, color), not used in final core logs, used in field processing logs (half dashed line)

Notes:

*Classification of sediment on core logs is based on visual field observations, which include density/consistency, grain size, and plasticity estimates, and should not be construed to imply field nor laboratory testing unless presented herein.
Visual-manual classification method American Society for Testing and Materials (ASTM) D-2488 for the description and identification of soils was used as an identification guide.
"Grades to" indicates that all characteristics not called out stay the same as the unit above.
@ symbol indicates one single piece of the material (when not acompanied with a "grades to" or contact)
Chemistry: Cores analyzed for chemistry or select chemistry lists
Geotechnical: Cores analyzed for geotechnical analysis list
Geochronology: Cores analyzed for geochronology list
Station IDs: Multiple cores were taken at each subsurface sediment station to collect adequate volume for analysis. Co-located cores were labeled with sequential letters (A-E) within the station identification (ID) to differentiate each accepted attempt. Cores from each station were chosen for an analysis type (e.g., chemistry, geochronology, and archive) based on collection factors such as penetration, recovery, and observation of native material.
Acronyms/terms used in core logs:
NAD83 = North American Datum of 1983, Wisconsin State Plane, South Zone
NAVD88 = North American Vertical Datum of 1988
PID = Photo-ionization detector, measures volatile organic compounds (VOCs)
SC = sediment collection

Sediment/Soil Core Processing Log

Portage Canal - Segment 2

Job:	Station ID:
Job No.	Date/Time:
No. of Sections:	Core Logged By:
Drive Length:	Attempt #:
Recovery:	Type of Core ☐ Direct Push ☐ Vibracore ☐ Diver Core
% Recovery:	Diameter of Core (inches)
Notes:	Core Quality ☐ Good ☐ Fair ☐ Poor ☐ Disturbed

Recovered Length (cm)	Size % Gravel	Size % Sand	Size % Fines	**Classification and Remarks** (Density, Moisture, Color, Minor Constituent, MAJOR Constituent, with Additional Constituents, Sheen, Odor)	Recovered Length (cm)	PID	Sample	Summary Sketch

STANDARD OPERATING PROCEDURE
SOP 06 – SAMPLE CUSTODY

Prepared for

Wisconsin Department of Natural Resources

Prepared by

Anchor QEA, LLC

November 2018

STANDARD OPERATING PROCEDURE ACKNOWLEDGEMENT FORM

Project No. 181779-01.01 Project Name: Portage Canal – Segment 2

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) addresses the sampling program requirements for maintaining custody of samples throughout the sample collection and shipping process as part of the Pre-Design Investigation. The objective of chain-of-custody (COC) procedures is to provide sufficient evidence of sample integrity to satisfy data defensibility requirements.

Procedures for sample custody outlined in this SOP are expected to be followed. Deviations from the procedures detailed in the SOP will be described on the Daily Log and on a Field Deviation Form (see SOP 01 – Field Records).

HEALTH AND SAFETY WARNINGS

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the Site Safety Plan (SSP). The SSP will be followed during all activities conducted by all field personnel, including subcontractors.

PERSONNEL QUALIFICATIONS

Field personnel executing these procedures will have read, be familiar with, and comply with the requirements of this SOP, the Field Sampling Plan and the corresponding documents (i.e., SSP and Quality Assurance and Quality Control Plan [QA/QC Plan]). Specialized training is not required for COC procedures; however, field staff will be supervised by experienced staff when first performing COC procedures.

EQUIPMENT AND MATERIALS

The following is a list of equipment that may be necessary to carry out the procedures contained in this SOP. Additional equipment may be required, pending field conditions.

- Approved documents including the SSP, Field Sampling Plan, and QA/QC Plan
- Bound field logbooks
- Ballpoint black ink pens
- Custody tape or seals
- Sample labels
- COC forms (see example in Attachment 1)

- Re-sealable, zippered clear-plastic bags for COCs
- Clear-plastic sealing tape

CHAIN-OF-CUSTODY PROCEDURES

As few people as possible should handle the samples. Each sample generated in the field will be assigned a unique identification (refer to SOP 1 for the sample identification protocol). A label will be attached to each sampling container used for shipment to the laboratory. Labels will be applied to the container, not the lid, whenever possible. The lid will also be labeled with the sample identification written in indelible black ink as a backup for the container label.

When practical, the project identification, sample matrix, laboratory designation/analyses requested, field sample identification code, and preservation will be typed or printed onto the label before sampling. Completion of the sample labels (including the field team staff's initials and the date and time of sample collection) will occur prior to filling the sample bottles. Labels will be completed in indelible black ink. Individual sample bottles will be properly labeled and securely sealed before being placed in the container for shipment to the laboratory (see SOP 07 – Sample Handling, Packaging, and Shipping).

Samples are considered to be in one's possession if the samples are: 1) in the custodian's possession or view; 2) in a secured location (under lock) with restricted access; or 3) in a container that is secured with an official seal(s) such that the sample cannot be reached without breaking the seal(s). Field COC procedures shall be followed from the time a sample is collected until it is relinquished to the analytical laboratory (either in person or to a shipper). The principal document used to track possession and transfer of samples is the COC form. A COC form shall be filled out in duplicate and initiated when the first sample is collected and updated continuously through the sampling event. A new COC form shall be prepared for each day of field sampling. Information to be entered on the COC form includes the following:

- Project identification (project and task number)
- Sample identification
- Time and date of sampling
- Sample matrix (e.g., sediment, water, and air)

- Number of containers for each sample
- Analyses requested
- Preservative, if applicable
- Grab or composite sample designation, if applicable
- Signatures of field team staff/sample custodian
- Field team staff's remarks
- Destination (e.g., laboratory name and location)
- Page number (e.g., 1 of 2, 2 of 2)
- Air bill or other shipping number, if applicable
- Any special instructions

All data entries will be made using an indelible ink pen. Corrections will be made by drawing a single line through the error, writing in the correct information, and then dating and initialing the change. Blank lines and spaces on the COC form will be lined-out, dated, and initialed by the individual maintaining custody. A COC form will accompany each cooler of samples to the analytical laboratories. Each person who has custody of the samples will sign the COC form and ensure that the samples are not left unattended unless properly secured. One copy of the COC form should be placed in a bag and attached to the inside of each sample cooler. In the event that sediment subsamples are being sent to different laboratories, separate COC forms should be prepared for each laboratory and each sample cooler. A custody seal should be placed on the sample cooler when it is not in the custody of a member of the sampling team.

When samples are relinquished, either to the laboratory or for shipment, the COC form must be completed by the sample deliverer (except in the case of a commercial carrier such as FedEx). It should include the printed and signed name of the deliverer, the organization that person represents, date and time of sample relinquishment, and method of shipment, if appropriate. A completed copy of the laboratory-verified COC form will be distributed via email or fax to the Project Chemist within 24 hours of sample receipt at the laboratory. The original will be retained by the laboratory.

QUALITY ASSURANCE/QUALITY CONTROL

Completed COC forms will be reviewed by the individuals preparing the samples for shipment for completeness, accuracy, and legibility. Specifically, the sample labels and COC record will be compared to ensure agreement between the samples and the COC and to verify the number of sample containers.

It is the responsibility of the Field Lead to periodically check to ensure that the procedures are in conformance with those stated in this SOP.

LIST OF ATTACHMENTS

Attachment 1 – Chain-of-Custody Form

ANCHOR QEA

ENVIRONMENTAL SAMPLE CHAIN OF CUSTODY

COC ID:

Sample Custodian:

Client: **Project:** **Lab:**

COC Sample Number	Field Sample ID	Matrix	Collected		# Containers	Analytical Program	Lab QC*
			Date	Time			☐

Comment:

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature	Signature	Signature	Signature	Signature	Signature
Print Name	Print Name	Print Name	Print Name	Print Name	Print Name
Company	Company	Company	Company	Company	Company
Date/Time	Date/Time	Date/Time	Date/Time	Date/Time	Date/Time

* Lab QC Requested for sample when box checked

STANDARD OPERATING PROCEDURE SOP 07 – SAMPLE HANDLING, PACKAGING, AND SHIPPING

Prepared for

Wisconsin Department of Natural Resources

Prepared by

Anchor QEA, LLC

November 2018

STANDARD OPERATING PROCEDURE ACKNOWLEDGEMENT FORM

Project No. 181779-01.01 Project Name: Portage Canal – Segment 2

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes procedures for packaging and shipping samples collected as part of the Pre-Design Investigation. Sample packaging and shipping generally involves the placement of individual sample containers into a cooler with packing material and coolant in a manner that isolates the samples to prevent breakage, maintains required temperature, and limits the potential for damage to sample containers when the cooler is transported.

Procedures for sample packaging and shipping outlined in this SOP are expected to be followed. Deviations from the procedures detailed in the SOP will be described on the Daily Log and recorded on a Field Deviation Form (see SOP 01 – Field Records).

HEALTH AND SAFETY WARNINGS

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the Site Safety Plan (SSP). The SSP will be followed during all activities conducted by all field personnel, including subcontractors.

PERSONNEL QUALIFICATIONS

Field personnel executing these procedures will have read, be familiar with, and comply with the requirements of this SOP, the draft Field Sampling Plan, and the corresponding documents (i.e., SSP, Quality Assurance and Quality Control Plan [QA/QC Plan]). Additionally, field personnel will be under the direct supervision of qualified professionals who are experienced in performing the tasks required for sample handling, packaging, and shipping.

EQUIPMENT AND MATERIALS

The following is a list of equipment that may be necessary to carry out the procedures contained in this SOP. Additional equipment may be required, pending field conditions.

- Approved documents including SSP, Field Sampling Plan, and QA/QC Plan
- Ballpoint black ink pens
- Personal protective equipment as required by the SSP
- Inert packing material (e.g., cardboard and bubble wrap)

- Pre-preserved sample containers as specified in the QA/QC Plan
- Sample labels
- Insulated coolers
- Custody seals
- Shipping tape
- Re-sealable, zippered clear-plastic bags
- Temperature blanks (if not provided by the laboratory)
- Ice
- Overnight courier airbills or shipping forms
- Clear-plastic sealing tape
- Wax sealant and/or stretch tape for sealing undisturbed core samples

PROCEDURES

Observance of proper holding times and conditions during sample storage and shipment prior to laboratory analysis is critical to obtaining quality data from a sampling effort. Immediately after collection, samples (sediment and soil) should be stored in refrigerators (if available) or ice-filled, insulated coolers with sufficient ice to maintain an ambient temperature of approximately 4°C until received by the analytical laboratory. Specific sample holding times and conditions for specific matrices and analyses are listed in the QA/QC Plan.

Individual sample containers (or groups of sample containers) should be stored in the coolers and packed in re-sealable, zippered, clear-plastic bags to prevent labels from smearing and falling off. Ice should be placed on top of samples inside the coolers.

SAMPLE SHIPPING

All samples should be shipped or hand-delivered to the analytical laboratory as soon as possible after completion of sampling to minimize the number of people handling samples and protect sample quality and security. The following guidelines apply to soil and sediment samples that will be shipped by courier to the laboratory:

1. Shipping containers should be in good shape and capable of withstanding rough treatment during shipping.

2. Samples should be packed tightly with dividers (e.g., bubble wrap and cardboard) separating all glass containers and empty space within shipping containers filled so the jars are held securely.
3. Sample coolers should be packed with ice to maintain an ambient sample temperature of approximately 4°C until delivery to the analytical laboratory. Wet ice (no synthetic ice) can be used, and should be packed in a manner that will preclude leaking inside the sample cooler. A temperature blank (supplied by the laboratory) can be placed in the sample cooler along with analytical samples.
4. All coolers must be leak-proof or lined with a leak-proof plastic liner. Leaking coolers will not be delivered by some couriers.
5. A chain-of-custody (COC) form for each shipping container should be filled out completely (see SOP 06 – Sample Custody).
6. The original COC form and analysis request should be protected from damage by sealing in a re-sealable, zippered, clear-plastic bag, and taped to the underside of the cover inside the shipping container.
7. A custody seal should be attached to the outside of the shipping container lid so that the shipping container cannot be opened without breaking the seal.
8. Shipping containers carrying glass sample containers should have a "this side up" label to ensure that jars are transported in an upright position, and a "fragile – glass" label should be attached to the top of the container to minimize agitation of the samples.
9. Shipping containers should be sent by a carrier that will provide a delivery receipt (such as FedEx) to confirm that the contract laboratory received the samples and to serve as a backup to the COC form.

Undisturbed samples to be analyzed by a geotechnical laboratory will be hand-delivered (i.e., couriered) to the project laboratory as soon as possible after completion of sampling. This will minimize the number of people handling samples and protect sample quality and security. The following guidelines apply to undisturbed sediment and soil samples that will be shipped by courier to the geotechnical laboratory:

1. Once the undisturbed sample has been collected, it will be stored upright and secured to minimize disturbance of the sediment or soil.

2. The undisturbed sample will be sealed with caps on the ends of the collection tube so that there is minimal void space and sediment or soil is not allowed to move during shipment.
3. The ends of the collection tube will be capped and further secured in place with a wax seal or using stretch tape (various types available).
4. The collection tube will be marked to indicate the "top" of the undisturbed sample.
5. During storage, transfer, and shipping, the sample will remain upright and be secured so that the chance for unnecessary movement and disturbance of the sample is minimized.

QUALITY ASSURANCE/QUALITY CONTROL

It is the responsibility of the Field Lead to periodically check to ensure that the procedures are in conformance with those stated in this SOP.

STANDARD OPERATING PROCEDURE SOP 08 – EQUIPMENT CLEANING/DECONTAMINATION

Prepared for

Wisconsin Department of Natural Resources

Prepared by

Anchor QEA, LLC

November 2018

STANDARD OPERATING PROCEDURE ACKNOWLEDGEMENT FORM

Project No. 181779-01.01 Project Name: Portage Canal – Segment 2

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes the decontamination of sampling equipment, instruments, and other materials used during implementation of field tasks for the Pre-Design Investigation. Decontamination is the process of neutralizing, washing, and rinsing field sampling equipment to clean field equipment and minimize the potential for sample cross-contamination.

Procedures for equipment decontamination outlined in this SOP are expected to be followed. Deviations from the procedures detailed in this SOP will be described on the Daily Log and on a Field Deviation Form (see SOP 01 – Field Records).

HEALTH AND SAFETY WARNINGS

Health and safety issues for work associated with this SOP, including physical and chemical hazards, are addressed in the Site Safety Plan (SSP). The SSP will be followed during all activities conducted by all field personnel, including subcontractors.

PERSONNEL QUALIFICATIONS

Field personnel executing these procedures will have read, be familiar with, and comply with the requirements of this SOP, the Field Sampling Plan, and the corresponding documents (i.e., SSP and Quality Assurance and Quality Control Plan [QA/QC Plan]). Specialized training is not required for decontamination of equipment; however, field staff will be supervised by experienced staff.

EQUIPMENT AND SUPPLIES

The following is a list of equipment that may be necessary to carry out the procedures contained in this SOP. Additional equipment may be required, pending field conditions.

- Personal protective equipment, as required by the SSP
- Scrub brushes
- Plastic wash and rinse buckets or tubs
- Phosphate-free biodegradable detergent (e.g., Liquinox® or Alconox®)
- Hexane

- Deionized (DI) water (or distilled water)
- Spray bottles
- Aluminum foil or plastic (aluminum foil will not be used during waste characterization sample processing)
- Tap water source (any treated municipal water supply)
- Investigation-derived waste (IDW) storage containers (refer to SOP 11 – Investigation-Derived Waste Handling and Disposal)

PROCEDURES FOR DECONTAMINATION OF SAMPLING EQUIPMENT

Sample containers, instruments, working surfaces, technician protective gear, and other items that may come into contact with sample media must meet high standards of cleanliness. All equipment and instruments that are in direct contact with the sample medium will be decontaminated prior to use in the field.

The following steps will be used to decontaminate supporting equipment such as boats, lines, and ropes that are not in direct contact with samples or sediment:

1. Equipment will be rinsed with ambient water onboard the boat.
2. Rinse water will not be contained.
3. All sediment spilled on the decks will be contained and disposed of as IDW.
4. Ongoing decontamination of the decks of the boats will continue throughout the day to keep the decks clean.

The following steps will be used to decontaminate in-water vessels to prevent the spread of invasive species consistent with Wisconsin general boating law (DNR 2002):

1. Drain water from live wells, bilges, and other containers before leaving launch area.
2. Remove plant parts and animals from vessel, trailer, and accessory equipment. Dispose of material in garbage.
3. Wash boat and trailer thoroughly with tap water. High temperature and pressure water is preferred. Wash can be performed at the existing ramp on site.

To the extent practical disposable equipment will be used to avoid the need for decontamination. However, the following decontamination steps will be used to

decontaminate sampling equipment that comes into contact with sample media and is intended for reuse. The decontamination procedure is as follows:

1. Residual sample media on equipment will be rinsed, scrubbed off, and collected according to the procedures outlined in SOP 11.
2. Pre-wash rinse with tap water.
3. Wash with solution of tap water and soap (use scrub brush).
4. Wash with hexane if residual oily sheen is present.
5. Rinse with tap water.
6. Rinse with DI water.
7. Use immediately or cover all decontaminated items with aluminum foil or plastic (aluminum foil will not be used during waste characterization sample processing).

All used decontamination fluids will be collected and placed in labeled, designated containers suitable for disposal in accordance with IDW procedures outlined in SOP 11.

Sensitive field instruments, such as water quality meters, will be rinsed daily during field operations at the end of each workday, or as needed, with DI water at a minimum, or more rigorously according to the manufacturer's instruction.

QUALITY ASSURANCE/QUALITY CONTROL

It is the responsibility of the Field Lead to periodically check to ensure that the procedures are in conformance with those stated in this SOP. As described in the QA/QC Plan, equipment blanks will be collected periodically to validate the effectiveness of decontamination procedures.

REFERENCES

DNR (Wisconsin Department of Natural Resources), 2002. *Hazardous hitchhikers. Battling aquatic invasive species.* August 2002.

STANDARD OPERATING PROCEDURE
SOP 09 – SOIL SAMPLING

Prepared for

Wisconsin Department of Natural Resources

Prepared by

Anchor QEA, LLC

November 2018

STANDARD OPERATING PROCEDURE ACKNOWLEDGEMENT FORM

Project No. 181779-01.01 Project Name: Portage Canal – Segment 2

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) is applicable to the collection of soil samples for the Pre-Design Investigation. Although Wisconsin statutes define soil spatially as above the ordinary high water mark, this SOP is intended for sampling upland materials that are not submerged, which will include sediments on the banks of Portage Canal. Soil for chemistry and geotechnical testing will be collected using either a hand auger or Macrocore sampler (or equivalent), either by hand or mechanically driven. Core processing and sample collection procedures are described in SOP 05 – Sediment and Soil Core Processing.

Procedures for sediment sampling outlined in this SOP are expected to be followed. Deviations from the procedures detailed in this SOP will be described on the Daily Log and in a Field Deviation Form (see SOP 01 – Field Records).

HEALTH AND SAFETY WARNINGS

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the Site Safety Plan (SSP). The SSP will be followed during all activities conducted by all field personnel, including subcontractors. Utility clearance will be performed prior to any intrusive work.

PERSONNEL QUALIFICATIONS

Field personnel executing these procedures will have read, be familiar with, and comply with the requirements of this SOP, the Field Sampling Plan, and the corresponding documents (i.e., SSP and Quality Assurance and Quality Control [QA/QC Plan]). All field personnel are required to take a 40-hour Occupational Safety and Health Administration Hazardous Waste Operations and Emergency Response training course and annual refresher courses, as well as participate in a medical monitoring program prior to engaging in core collection activities. Additionally, field personnel will be under the direct supervision of qualified professionals who are experienced in performing the tasks required for sample collection.

EQUIPMENT AND SUPPLIES

The following is a list of equipment that may be necessary to carry out the procedures contained in this SOP. Additional equipment may be required, pending field conditions.

- Approved documents including Field Sampling Plan, SSP, and QA/QC Plan
- Sample coordinates
- Survey stake or pin flags
- Soil sampling equipment (hand auger, Macrocore sampler that is either hand or mechanically driven)
- Slide hammer
- Split-spoon sampler
- Acetate liners and caps
- Tubing cutters
- Core collection field forms or field database
- Duct tape
- Aluminum foil
- Decontamination materials as described in SOP 08 – Equipment Cleaning/Decontamination
- Appropriate personal protective equipment and clothing as defined in the project SSP
- Tape measure
- Digital camera
- Real-time kinematic (RTK) global positioning system (GPS) equipment or total station

SAMPLING PROCEDURE USING SURFACE SOILS

Soil samples will be collected using a hand-driven, split-spoon sampler, a stainless-steel bucket auger, or Macrocore device. Manual methodologies will be the primary collection method. Use of mechanized means (e.g., Geoprobe) will require discussion with the Field Lead and Project Manager, and acceptance by the property owner. Use of the Macrocore sampler will allow soil samples to be collected at discrete depth intervals and processed at an alternate location.

Surface and subsurface soil collection will be performed using the following procedures:

1. Confirm utility locate has been performed and that any existing utilities have been clearly marked or confirmation that no existence of utilities is present. Utilities will be cleared before sampling is commenced. This may be accomplished through notifying Diggers Hotline (800-242-8511).
2. Identify proposed sample location in the Field Sampling Plan.
3. Record the location using a differential global positioning system (RTK GPS) unit or total station and mark each individual sample location with a survey stake or pin flag. In addition, provide written descriptions of sample locations with approximate distances to prominent landmarks. Observations relative to the nature and condition of the ground surface at each soil sampling location will be recorded on the Core Collection Field Form or field database. Entries may include but are not limited to the following: disturbed soils, undisturbed soils, evidence of erosion or deposition, evidence of burrowing, evidence of cultivation, riparian vegetation, and grassland. Photograph the sample location and surrounding area prior to collection of the core.
4. If the sample location is in a vegetated area, the leafy vegetation should be removed prior to collecting the soil sample(s).
5. Using the Macrocore sampler (with a new inner acetate liner) and a slide hammer, advance with a straight, vertical entry into the soil (plumb with the soil surface), so as to secure a reasonably representative sample to the target penetration depth.
6. Measure and record the depth of soil penetrated.
7. Fill the remaining void with hand-compacted soil. Replace displaced vegetation, if possible and seed remaining disturbed area.

Acceptance criteria for soil core samples are as follows:

- The core tube appears intact without obstruction or blocking.
- Recovery is greater than 70% of the drive length.

If sample acceptance criteria are not achieved, the sample is rejected unless modified acceptance criteria are approved by the Field Lead and/or multiple attempts (three or more) have been made at the sampling location. In cases where three attempts are unsuccessful, the Field Lead will contact the Project Manager, and field conditions (e.g., bedrock) will be

considered and best professional judgment will be used to determine if additional cores should be attempted.

Sampling personnel will record field conditions and drive notes in the field database or on a Soil Core Collection Log (an example is provided in Attachment 1). The logs will include the following information:

- The sample station identification
- Geographic position of the actual coring location as determined by RTK GPS or total station
- Date and time of collection of each soil core sample
- Names of field personnel collecting and handling the samples
- Observations made during sample collection, including weather conditions, complications, and other details associated with the sampling effort
- Length of drive penetration and estimated recovery measurements
- Qualitative notation of apparent resistance of soil to coring (how the core drove)

Once the core samples are deemed acceptable, the following procedures will be followed:

1. The cutterhead will be removed, and a cap will be placed over the end of the tube and secured firmly in place with duct tape.
2. The core tube will then be removed from the sampler, and the other end of the core will be capped and taped.
3. The core tube will be labeled with the sample station number and an arrow pointing to the top of the core.
4. The cores will be sealed tightly enough to prevent leakage or disturbance during transport to the processing station.

QUALITY ASSURANCE/QUALITY CONTROL

Entries in the field forms will be double-checked by the field team staff to verify that the information is correct. It is the responsibility of the Field Lead to periodically check to ensure that the procedures are in conformance with those stated in this SOP.

LIST OF ATTACHMENTS

Attachment 1 – Soil Core Collection Log

ANCHOR QEA

Soil Core Collection Log

Job: Portage Canal - Segment 2

	Station ID:
Job No:	**Attempt No.**
Field Staff:	**Date:**
Contractor:	**Logged By:**
Vertical Datum:	**Horizontal Datum:**

Field Collection Coordinates:

Lat/Northing:	Long/Easting:

A. Soil Surface Elevation

Core Collection Recovery Details:

Core Accepted: Yes / No

Core Tube Length:

Drive Penetration:

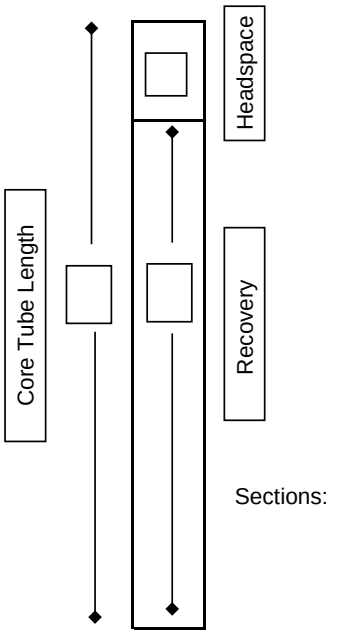
Headspace Measurement:

Recovery Measurement:

Recovery Percentage:

Total Length of Core To Process:

Is the EOC apparent? (If yes, record depth from top of core to EOC)



Drive Notes:

Core Field Observations and Description: Sediment type, moisture, color, minor modifier, MAJOR modifier, other constituents, odor, sheen, layering, anoxic layer, debris, plant matter, shells, biota

Notes:

STANDARD OPERATING PROCEDURE
SOP 10 – VANE SHEAR TESTING

Prepared for

Wisconsin Department of Natural Resources

Prepared by

Anchor QEA, LLC

November 2018

STANDARD OPERATING PROCEDURE ACKNOWLEDGEMENT FORM

Project No. 181779-01.01 Project Name: Portage Canal – Segment 2

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) defines the procedures for conducting vane shear tests in sediments for the Pre-Design Investigation (PDI). Vane shear testing will be conducted to determine the in situ undrained shear strength of the sediments (ASTM D2573-01). This method is appropriate for clay and silt and other fine materials. It is not appropriate for sand, gravel, or other highly permeable materials that may partially drain during the tests. The locations and depth intervals of testing are specified in the Field Sampling Plan. The vane shear tests will be conducted with a RocTest Model M-3 Field Inspection Vane Tester or equivalent. The vane shear tests will be conducted from a stabilized flat-bottom vessel or on foot. Vessel positioning will be conducted as described in SOP 3 – Navigation and Boat Positioning.

This SOP describes the equipment, field procedures, materials, and documentation procedures needed during the vane shear tests. Procedures for vane shear testing outlined in this SOP are expected to be followed. Deviations from the procedures detailed in this SOP will be described on the Daily Log and in a Field Deviation Form (see SOP 01 – Field Records).

HEALTH AND SAFETY WARNINGS

Health and safety issues for the work associated with this SOP, including physical and chemical hazards, are addressed in the Site Safety Plan (SSP). The SSP will be followed during all activities conducted by all field personnel, including subcontractors. Utility clearance will be performed prior to any intrusive work.

PERSONNEL QUALIFICATIONS

Field personnel executing these procedures will have read, be familiar with, and comply with the requirements of this SOP, the Field Sampling Plan, and the corresponding documents (i.e., SSP and Quality Assurance and Quality Control Plan [QA/QC Plan]). All field personnel are required to take a 40-hour Occupational Safety and Health Administration Hazardous Waste Operations and Emergency Response training course and annual refresher courses, as well as participate in a medical monitoring program prior to engaging in vane shear testing activities. Additionally, field personnel will be under the direct supervision of

qualified professionals who are experienced in performing the tasks required for vane shear testing.

EQUIPMENT AND SUPPLIES

The following is a list of equipment that may be necessary to carry out the procedures contained in this SOP. Additional equipment may be required, pending field conditions.

- Sampling vessel equipped with necessary real time kinematic (RTK) global positioning system (GPS) navigation and communication equipment
- Approved documents including Field Sampling Plan, SSP, and QA/QC Plan
- Testing coordinates
- Vane shear apparatus (RocTest Model M-3 Field Inspection Vane Tester, or equivalent, with torque reading head, extension rods, four blade vanes of varying size, and slip coupling)
- Hand tools and supplies (e.g., rubber mallet, hammer, pipe wrenches, clamps, weighted measuring tape)
- Field logbook and digital or disposable camera to document field activities
- Decontamination materials as described in SOP-08 – Equipment Cleaning/Decontamination
- Appropriate personal protective equipment (PPE) and clothing as defined in the SSP

VANE SHEAR TESTING METHOD

Vane shear tests will be conducted from a flat-bottomed vessel, by wading, or by walking along the canal bank. The following methods will be used to conduct the vane shear tests:

- Confirm utility locate has been performed and that any existing utilities have been clearly marked or confirmation that no existence of utilities is present. Utilities will be cleared before testing is commenced. This may be accomplished through notifying Diggers Hotline (800-242-8511).
- A two-person crew will operate the vane shear test apparatus. These two people will likely also operate the vessel from which the tests will be conducted, if necessary. A third person will be present to direct the vane shear testing operations and to document the tests.

- All personnel working on or near the water will follow the SSP requirements for PPE and personal flotation devices.
- The vessel will be navigated to the testing location following SOP 3 – Navigation and Boat Positioning, if on the water.
- Equipment will be decontaminated before the commencement of work and between samples or locations to remove gross contamination and visible sediment to avoid cross-contamination between locations.
- The Model M-3 Field Inspection Vane Tester or equivalent will be assembled. The vane shear apparatus consists of a torque recording head, boring rods, slip coupling, and a vane. The vane will be selected based on the type of sediment expected (large vane for soft sediment ranging to small vane for dense clay). The largest vane that can be advanced based on site conditions should be the one selected.
- The depth from the vessel to the top of sediment will be measured using a weighted tape.
- The vane shear test apparatus will be inserted/pushed into the sediment to the depth to be tested. Do not rotate the apparatus during insertion. Blows, vibration, and rotation used to advance the vane may affect the measurements. Avoid pounding or vibrating in the vane. Use a direct push.
- Verify the recording head is set to zero.
- Rotate the vane shear apparatus clockwise.
- Note any resistance during the initial rotation until the slip coupling engages. This value is the resistance of rods.
- Continue rotating the vane shear torque head until the sediment in the formation fails. Failure is indicted when the rods and vane turn at the same rate as the head or resistance decreases. Continue to hold the head steady and allow the torque in the tool to be dissipated at the vane end of the apparatus.
- Record the maximum torque by observing the position of the second needle on the torque gauge. This is the resistance of the rods and the vane. The difference between the rod resistance and the rod and vane resistance is the shear strength of the sediment.
- Determine the remolded strength by quickly rotating the vane and rods (five to ten times) using the wrenches provided. Record the number of rotations. Begin the remolded strength test within 1 minute but not more than 5 minutes from the

completion of the quick rotations. Be consistent (number of rotations and time between rotations and measurement) during the tests at different depths and different locations.

- Rezero the scale needles on the measuring head.
- Slowly rotate the vane assembly until failure is noted. Read the maximum torque on the gauge. This measurement is the remolded shear strength.
- Rotate the measuring head counter-clockwise until the slip coupling engages.
- Advance the vane to the next test depth.
- Repeat the test steps to test the next depth zone until all zones specified in the Field Sampling Plan have been tested.
- Stiffer zones may be encountered with depth. If the larger vane cannot be advanced to the proposed depth, withdraw the test apparatus and replace the vane with a smaller vane. Reinsert the apparatus and advance the new vane to the proposed test depth. Conduct the vane shear test as described above.
- Decontaminate the vane shear test apparatus to remove gross contamination and visible sediment following SOP-08.
- Pull up the anchor and move the vessel or wade/walk to the next test location.

QUALITY ASSURANCE/QUALITY CONTROL

Accurate and repeatable undrained shear strength data are needed throughout the site. This will be accomplished through consistent application of the vane shear test methods. The Field Sampling Plan and QA/QC Plan will be followed. Entries in the field forms will be double-checked by the field team staff to verify that the information is correct. It is the responsibility of the Field Lead to periodically check to ensure that the procedures are in conformance with those stated in this SOP.

DATA PROCESSING AND MANAGEMENT

Each vane shear test will be documented by the observer and team including geographic location, depth below sediment surface, water depth, rod friction, shear test failure pressure, pre-remolded test rotation count, wait time, and remolded shear test value. Field test observations will be recorded in the field logbook. This information may also be recorded electronically using a laptop computer. Any electronic data will be backed up daily or more

frequently as needed. Backup data will be stored separately from the field computer to protect the data from corruption, physical damage, loss, or theft. Electronic field notes must also be backed up daily.

REFERENCES

ASTM (ASTM International), 2004, Standard Test Method for Field Vane Shear Test in Cohesive Soil, D2573-01, Annual Book of ASTM Standards 2004, Section 4, Construction Vol. 04.09. Soil and Rock (II).

RocTest, 2005. Instruction Manual Field Inspection Vane Tester, Model H-60.

STANDARD OPERATING PROCEDURE SOP 11 – INVESTIGATION-DERIVED WASTE HANDLING AND DISPOSAL

Prepared for

Wisconsin Department of Natural Resources

Prepared by

Anchor QEA, LLC

November 2018

STANDARD OPERATING PROCEDURE ACKNOWLEDGEMENT FORM

Project No. 181779-01.01 Project Name: Portage Canal – Segment 2

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes the instructions for proper handling and disposal of investigation-derived waste (IDW; i.e., sediment, water, personal protective equipment [PPE], and other potentially contaminated materials) generated during field work for the Pre-Design Investigation.

Procedures for IDW handling and disposal outlined in this SOP are expected to be followed. Deviations from the procedures detailed in the SOP will be described on the Daily Log and on a Field Deviation Form (see SOP 01 – Field Records).

HEALTH AND SAFETY WARNINGS

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the Site Safety Plan (SSP). The SSP will be followed during all activities conducted by all field personnel, including subcontractors.

PERSONNEL QUALIFICATIONS

Field personnel executing these procedures will have read, be familiar with, and comply with the requirements of this SOP, the Field Sampling Plan, and the corresponding documents (i.e., SSP and Quality Assurance and Quality Control Plan [QA/QC Plan]). Additionally, field personnel will be under the direct supervision of qualified professionals who are experienced in performing the tasks required for sample collection and processing.

EQUIPMENT AND MATERIALS

The following is a list of equipment that may be necessary to carry out the procedures contained in this SOP. Additional equipment may be required, pending field conditions.

- Approved documents including SSP, Field Sampling Plan, and QA/QC Plan
- PPE as required by the SSP
- U.S. Department of Transportation (USDOT)-approved, 55-gallon, open-topped drums or Baker tank with lid for collection of solids
- USDOT-approved, 55-gallon, closed-top drums for collection of liquids

- 30-gallon garbage bags
- 5- to 10-gallon buckets or carboys to be used as satellite waste-collection containers
- Chemical drums
- Pallets
- Drum pad
- Drum cart
- Bung tool to open closed-top drums
- Drum wrenches to tighten open-top drum lids
- Acid and solvent spill kits
- Labels and tags
- Duct tape
- IDW Drum Log forms (see Attachment 1)
- Drum marking crayons
- Hazardous waste manifest forms

WASTE DISPOSAL PROCEDURES

Materials that are known or suspected to be contaminated with hazardous substances through the actions of sample collection or personnel and equipment decontamination are said to be IDW. These wastes are classified into the following three categories:

1. Solid materials consisting of sediments, soils, used core tubes, used PPE, and other materials used in the handling, processing, and storage of sediment and soil
2. Liquid wastes, such as waste decontamination water
3. Spent and residual chemicals (liquids) from decontamination

Each type of material will be handled in a manner described in this SOP.

SOLID WASTE

Solid residual wastes generated during field activities will consist of two types of materials: sediment/soil and non-sediment/soil solids. Sediment/soil wastes will include discarded core or grab samples and leftover sediment from core and grab samples not used for sample analyses. Non-sediment/soil wastes include items such as used core tubes and caps, aluminum foil, and PPE (e.g., gloves and plastic sheeting). Non-sediment/soil and

sediment/soil wastes will be segregated and stored in separate containers pending disposal. Loose sediment/soil will be removed from non-sediment/soil waste items prior to disposal, to the extent practical.

Sediment/soil residuals will be placed in 55-gallon drums, labeled, and stored temporarily pending characterization and transfer to an approved disposal facility. Non-sediment/soil solid material will be placed in 30-gallon plastic bags and temporarily stored pending disposal.

WASTE WATER

Waste water will be generated during sediment processing and decontamination activities. Sediments recovered during this process will be handled as solid waste as described previously. Waste water will be collected in 55-gallon, closed-top drums or in a larger, contaminated-liquid waste tank until the material is characterized and transferred off site for disposal.

CHEMICAL LIQUID WASTE

Chemical liquid wastes may include spent solvents generated during the decontamination process (refer to SOP 8). Waste solvents (e.g., ethyl acetate) will be collected in jacketed-glass solvent bottles and labeled with a Class 3 flammable liquid label. Waste containers will be stored in a secure location at the field facility until pickup by an authorized waste handler.

Both solid and liquid IDW will be generated at each sampling station. These materials will be segregated and containerized in closed 5-gallon buckets or trash bags, as appropriate, on the boat and secured for transport. Sediment generated at each sampling station will be containerized in 5-gallon buckets on the boat and secured for transport. The containers will be transported to the processing area for consolidation in 55-gallon drums (or other acceptable container) for subsequent disposal. A composite sample will be collected and analyzed for compounds specific to the potential disposal facility as described in the field sampling plan and SOP 05 – Sediment and Soil Core Processing.

Placement of sediment/soil or liquid waste into sequentially numbered disposal drums will be documented on IDW Drum Logs (see example in Attachment 1) listing the sample identification (ID) from which waste material originated. Information recorded on the IDW Drum Logs will include the following:

- Sequential drum number
- Type of waste stored in drum (e.g., wet sediment or water)
- Accumulation start and end dates
- Hazardous waste manifest number and date
- Transport contractor name and date of pickup
- Laboratory ID number associated with drum characterization testing

HAZARDOUS WASTE MANIFEST FORMS

Hazardous waste manifest forms will be completed for pick-up of IDW designated for off-site disposal as hazardous waste. The following information should be recorded on the manifests:

- Generator ID number
- Generator's name and mailing address
- Generator's phone
- Generator's site address
- Waste tracking number
- Designated disposal facility name and address
- Transporter's name and U.S. Environmental Protection Agency ID number
- Waste shipping name and description:
  - Description of waste
  - Number and type of containers and total quantity of waste
- Generator's/offeror's printed name and signature
- Transporter's printed name and signature
- Disposal facility owner's or operator's printed name and signature

Following delivery of drums to the waste disposal facility, a copy of the fully executed hazardous waste manifest will be delivered to the hazardous waste generator and retained in the project file.

QUALITY ASSURANCE/QUALITY CONTROL

It is the responsibility of the Field Lead to periodically check and ensure that IDW handling and disposal procedures are in conformance with those stated in this SOP.

LIST OF ATTACHMENTS

Attachment 1 – Investigation-Derived Waste Drum Log

ANCHOR QEA

Portage Canal Investigation-derived Waste Drum Log

Drum Number:	Investigation-derived Waste (IDW) Medium:
Accumulation Start Date:	Manifest Number:
Accumulation End Date:	Manifest Date:
Transport Contractor:	Lab ID Number:
Transport Pick-up Date:	Haz Characterization Date:
Manifest Copy Received from Waste Facility: _____	Date:

Samples placed in Drum	Date of Placement	Comment	Initials

IDW Medium:

Wet Sediment

Liquid Waste

Soiled PPE

STANDARD OPERATING PROCEDURE SOP 12 – DYNAMIC CONE PENETROMETER

Prepared for

Wisconsin Department of Natural Resources

Prepared by

Anchor QEA, LLC

November 2018

STANDARD OPERATING PROCEDURE ACKNOWLEDGEMENT FORM

Project Number: 181779-01.01 Project Name: Portage Canal – Segment 2

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

INTRODUCTION

Subsurface conditions are traditionally investigated through soil borings, electronic cone penetration testing (CPT), sonic coring, direct push probing, excavation of a test pit, or a combination thereof. Alternatively, hand-operated equipment that offers fast and inexpensive mobilization to limited access areas can provide means for obtaining critical subsurface data that can be used to estimate geotechnical engineering properties. One way is through the dynamic cone penetrometer (DCP).

The use of the DCP is a hybrid of standard penetration testing (SPT) and a CPT. A 10-square-centimeter field point is fixed to the end of a drive rod and advanced continuously through a series of blows. The blows are delivered to the top of the 1-meter-long drive rod through the raising and dropping of a 35-pound weight at a consistent fall height of 15 inches. The number of blows are recorded for each 10-centimeter interval for the full drive length. Additional 1-meter drive rods are added as needed until refusal or the desired investigation depth is reached. The blow count data obtained are then correlated to an equivalent SPT N-value for each 10-centimeter interval. The SPT N-values are then used to estimate the geotechnical engineering properties of interest.

HEALTH AND SAFETY WARNINGS

Health and safety issues for the work associated with this Standard Operating Procedure (SOP), including physical, chemical, and biological hazards, are addressed in the Site Safety Plan (SSP). The SSP will be followed during all activities conducted by all field personnel, including subcontractors. Utility clearance will be performed prior to any intrusive work.

PERSONNEL QUALIFICATIONS

Field personnel executing these procedures will have read, be familiar with, and comply with the requirements of this SOP, the Field Sampling Plan (FSP), and the corresponding documents (i.e., SSP and Quality Assurance and Quality Control [QA/QC] Plan). All field personnel are required to take a 40-hour Occupational Safety and Health Administration Hazardous Waste Operations and Emergency Response training course and annual refresher courses as well as participate in a medical monitoring program prior to engaging in dynamic cone penetrometer activities. Additionally, field personnel will be under the direct

supervision of qualified professionals who are experienced in performing the tasks required for sample collection.

EQUIPMENT AND SUPPLIES

- 10-square-centimeter field points (sacrificial)
- 1-meter drive rods with marks at 10-centimeter intervals and thread connections
- Driver hammer attachment with 35-pound weight with minimum 15 inches of throw
- Driving head (threaded connection)
- Mechanical drive rod extractor
- Base plate for drive rod extractor
- Equipment carrying case
- Field logbook, surface soil field collection form, and pens
- FSP and SSP
- Personal protective equipment (safety glasses, steel-toed boots, work gloves, and any other items required by the SSP)
- Decontamination equipment
- Real-time kinematic (RTK) global positioning system (GPS) or total station

PROCEDURES

Performing the Exploration

- Confirm utility locate has been performed and that any existing utilities have been clearly marked or confirmation that no existence of utilities is present. Utilities will be cleared before testing is commenced. This may be accomplished through notifying Diggers Hotline (800-242-8511). Locate the sample station as directed in the FSP using either a total station or RTK GPS. The vessel (as needed) will be navigated to the testing location following SOP 3 – Navigation and Boat Positioning, if on the water.
- Record project information on the field data collection form.
- Expose the soil surface by clearing an approximately 1-square-foot area at the sampling site of any surficial detritus that may otherwise create an obstruction.
- Ensure the driving head is threaded onto a 1-meter drive rod
- Fix the field point to the driving head.

- Place drive rod and field point unit on the ground with field point resting on the desired location of the exploration.
- Connect the driver attachment with the 35-pound hammer.
- Seat the field point by raising and dropping the driver until the field point is fully embedded in the subsurface.
- Begin raising and dropping the driver and count the number of blows required for 10 centimeters of advancement. Record the blows for each 10-centimeter drive interval. Manual adjustments may be needed to maintain verticality of the drive rods. Record any obstructions/zones of difficult driving or apparent changes in substrate that occur within the 10-centimeter interval, if applicable, on the field data collection form.
- Keep hands clear of hammer.
- Connect additional drive rods as needed until refusal or the desired drive depth is achieved. A refusal condition is assumed to be 50 blows per 10 centimeters or less. Leave approximately 0.5 meters of stickup of the last rod for extraction.
- After the desired depth or refusal is reached, place the base plate near the rod and fix the extractor and begin retrieving the rods. The drive hammer may need to be removed to allow for extraction of drive rods. Care must be applied when extracting the rod so as to not drop loose rods back down the hole.
- Decontaminate equipment, if necessary following SOP 08 – Equipment Cleaning/Decontamination.

Data Processing

1. Input the data obtained for each exploration into the data processing spreadsheet. The spreadsheet correlates an equivalent SPT N-value for each drive interval.
2. Report the depth, field recorded blow count, and equivalent SPT N-value.

Quality Assurance and Quality Control

1. Complete all pertinent field QA/QC documentation, logbooks, sample labels, and field data sheets. Record any deviations from the specified sampling procedures or any obstacles encountered.

2. Record actual exploration locations with field measurements from landmarks and a RTK GPS recording device (or total station).
3. Photograph the sample location and document it in the logbook.
4. Decontaminate all sampling equipment in accordance with SOP 08.

STANDARD OPERATING PROCEDURE SOP 13 – ASBESTOS AND LEAD-BASED PAINT SAMPLING AND AIR MONITORING

Prepared for

Wisconsin Department of Natural Resources

Prepared by

The Sigma Group, Incorporated and Anchor QEA, LLC

November 2018

STANDARD OPERATING PROCEDURE ACKNOWLEDGEMENT FORM

Project No. 181779-01.01 Project Name: Portage Canal – Segment 2

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

STANDARD OPERATING PROCEDURES:
ASBESTOS
FIELD INSPECTION
AND
AIR SAMPLING

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SECTION I: GENERAL INFORMATION

1. INTRODUCTION

The Sigma Group, Inc. (Sigma) Asbestos Standard Operating Procedures (SOP) have been developed in order to document procedures and tasks associated with managing asbestos-related projects and to assist Sigma personnel with complying with asbestos-related rules and regulations. Specific procedures have been developed and implemented and must be followed in order to comply with local, state, and federal requirements. Where appropriate, explanations are provided to better explain the purpose for the procedure or activity. Unique situations requiring further definition or actions may be encountered which are not discussed in the Asbestos SOP. In these cases, discuss the specific situation with the project manager and Asbestos QA/QC personnel to determine the appropriate course of action.

The Asbestos SOP includes the following sections:

- General Information;
- Background;
- Asbestos Inspector; and
- Asbestos Supervisor.

2. BACKGROUND

Asbestos is a naturally occurring mineral which is mined from the earth's crust. It can be distinguished from other minerals by its morphology, typically long, thin fibers. Asbestos minerals are divided into two categories: Serpentine and Amphibole. Serpentine asbestos has a sheet or layered structure while amphibole asbestos has a chain-like crystal structure. Serpentine asbestos consists of Chrysotile and is the most commonly found asbestos is the United States.

Asbestos has been used in a wide variety of products, in part, because asbestos fibers are readily available, easily mined, inexpensive, fire-resistant, chemically inert, poor conductors of heat and electricity (good insulator),and have high tensile strength. Commonly found asbestos-containing materials include spray-on insulation, floor tiles and mastic, gaskets and packing, pipe insulation, cement, mortar, electrical insulation, and various surfacing materials.

Because asbestos fibers are small, easily airborne, and chemically inert, they can be hazardous to human health. Microscopic fibers have the potential to travel deep into the lungs. Once in the lung air sacs, also known as alveoli, the asbestos fibers cannot be removed or digested by the body's natural defense mechanisms. Long-term exposure to asbestos can result in asbestosis, lung cancer, and mesothelioma.

Asbestos use became a regulatory issue in the 1970's. Numerous federal, state and local regulations and guidance documents pertaining to asbestos-containing materials (ACMs) have been developed.

Sigma conducts asbestos inspections as part of pre-demolition and pre-renovation activities. Sigma also performs observation, documentation, and air monitoring associated with asbestos removal activities performed by others. The remainder of this document establishes the Asbestos SOP for asbestos inspections, observation, documentation, and air monitoring activities.

3. GUIDANCE AND REGULATORY DOCUMENTS

Guidance and regulatory documents are maintained in the Asbestos QA/QC personnel office area. Additionally, current federal and state as well as select local regulations are available on the internet. Further discussions of some of the more critical regulations pertaining to inspection and ACM removal are provided in Sections II and III, respectively.

SECTION II: ASBESTOS INSPECTOR

1. INTRODUCTION

The role of the Asbestos Inspector is to conduct material and building assessments to determine the presence of asbestos-containing materials. The goal of the asbestos inspection is to comply with the United States Environmental Protection Agency (USEPA) National Emission Standards for Hazardous Air Pollutants (NESHAP), state and local regulations. Results of the inspection may be used to prepare asbestos abatement bid specifications for an abatement associated with a facility demolition or renovation or to document the presence of asbestos as part of an asbestos management program. The assessment may involve sampling a single suspect material or an entire multi-acre, multi-building facility.

2. EQUIPMENT

Various tools and equipment are required to properly conduct an asbestos inspection. The following list provides the most common tools required for an asbestos inspection. Site conditions, scope of work, and other considerations may require additional tools and equipment not listed below.

- Cellular telephone;
- Chisels;
- Digital camera;
- Drill, batteries, cord, and coring bits;
- Duct tape;
- Flashlight;
- Fluorescent spray paint;
- Hammer;
- HEPA vacuum;
- Inspection logsheets;
- Knife with extra blades;
- Ladder;
- Paint pens;
- Permanent markers;
- PDA, tablet or paper logsheets;
- Pliers;
- Respirator;
- Roof patch;
- Sample bags;
- Screw drivers;
- Tape measure, laser range finder, or other measuring device;
- Tool box;
- Water spray bottle;
- Wire cutters;
- Whirl Packs; and
- Zip Lock Bags.

3. BULK SAMPLE ASBESTOS ANALYTICAL METHODOLOGY

Bulk material samples are collected and analyzed to determine asbestos content. Four of the most common methods for determining asbestos content in bulk samples are polarized light microscopy, point count, gravimetric point count, and transmission electron microscopy.

3.1 PLM

Polarized light microscopy (PLM) is similar to phase contract microscopy (PCM) discussed in Section III. The polarized light is used to illuminate fibers in the bulk material. PLM is able to distinguish between asbestos and non-asbestos fibers as well as determine the specific asbestos type.

3.2 Point Count

The National Emissions Standards for Hazardous Air Pollutants (NESHAP), under the definition of friable asbestos-containing material (ACM), states that bulk samples that are determined to contain less than 10% asbestos using the polarized light microscopy (PLM) method should be analyzed by point count or assumed to contain asbestos.

Point count analysis is a method by which particles are identified as asbestos or non-asbestos fibers. A graticule with crosshairs is used to define a 'point' within the field of view. Fiber counting is conducted until 400 to 1,000 asbestos or non-asbestos fibers are counted. The percent asbestos in a sample is determined by dividing the total number of asbestos points by the number of non-asbestos fibers. The asbestos percent of the sample is reported as a range which is dependent upon the number of points counted and the number of asbestos fibers detected[1].

3.3 Gravimetry

Gravimetry is a technique used to enhance PLM in the quantification of asbestos in bulk samples. The sample is dried, weighed, and heated to 300 to 500 degrees Celsius for approximately six hours. Organic material in the sample is oxidized and off-gassed. The remaining sample is weighed after cooling and treated with hydrochloric acid to dissolve carbonates and other acid-soluble materials. The remaining material is rinsed with water, dried, weighed, and examined using PLM for the presence of asbestos fibers. Gravimetry improves the detection and quantification of asbestos fibers in a sample.[2]

3.4 TEM

Transmission electron microscopy (TEM) is an analytical technique available for characterizing asbestos minerals. TEM is capable of magnifying a sample to 20,000X and can differentiate between asbestos and non-asbestos materials as well as distinguish the different types of asbestos minerals. TEM can be used to analyze air and bulk samples.

---

[1] Richards, Jim, "Asbestos Quantification Using Point Counting and Other Methods" MACS Lab, Inc, Santa Clara, CA.

[2] Ibid.

4. ASBESTOS BULK SAMPLING PROCEDURES

Bulk sampling is conducted in order to determine if materials contain asbestos. Some examples of typical materials suspected of containing asbestos include the following: acoustical spray-on, caulking materials, drywall and joint compound, floor tile and mastic, pipe and boiler insulation, plaster, roofing and flashing materials, spray-on fireproofing, and window glazing.

Bulk sampling of material for asbestos analysis requires an Asbestos Inspector certification. Similar to the Asbestos Supervisor certification, a State-approved training program must be taken and passed in order to earn the Asbestos Inspector certification. The certification is valid for one year and must be renewed by taking an annual Asbestos Inspector refresher course.

4.1 Asbestos Sampling Procedures

The purpose of the asbestos inspection is to identify and quantify asbestos-containing materials (ACMs). It is important to follow established procedures when conducting an asbestos inspection. Documenting, mapping, labeling, sample collection, and competent project management are required to ensure a thorough and complete inspection. Appendix A provides Sigma's Asbestos Project Management Flow Chart. The following provides specific procedures for conducting an asbestos inspection.

4.1.1 Document Review and Project Kickoff Meeting

Important to the success of a project is a thorough review of the available project information and documents. Before the inspection process is initiated, the project manager must complete all appropriate sections of the Project Sheet. An example of a Project Sheet is provided in Appendix B.

The inspection process cannot be initiated until the Project Sheet is completed and the project manager meets with the inspectors. A project kickoff meeting attended by the field inspectors, QA/QC personnel, and project manager(s) will cover the proposed scope of work in order to clearly define the boundaries of the inspection, budget, project roles and responsibilities, deliverables, deadlines, and other information pertinent to the successful completion of the asbestos inspection. Maps may be available for identifying building age, presence of confirmed ACM, and structure layout. Before conducting activities at the site, a completed Site Health and Safety Plan must be reviewed and signed by all personnel working at the site. See Section Y of Sigma's Health and Safety Program for more information on preparing a Site Health and Safety Plan.

4.1.2 Facility Walk Through and Mapping

Upon arriving at the project site and if a prior site visit has not been conducted, the inspectors will conduct a facility walk through in order to visually assess the facility for homogeneous materials, potential health and safety hazards, and gather additional information useful for evaluating environmental risks or hazards. During the facility walkthrough, the inspector will document materials present and material quantities and conditions. Appendix E provides example homogenous material codes.

During the walk through, the inspector should observe the general layout of the building. If a detailed facility map is not available, the inspector will sketch the floor plan indicating room numbers or names and approximate dimensions. Rooms will be assigned a unique room number. In general, a room consists of any distinct area with a door or entry threshold. Larger areas may be broken down into more discrete sections depending upon the purpose of the inspection. Alternatively, a smaller room (i.e. closet, small bathroom, etc.) may be included within a larger room. The inspector must clearly indicate room numbers on figures or field sketches. First floor room number designations will begin with 100 and continue until every room on the first floor has been assigned a number. Second floor room designations will begin with 200 and continue until each room has been assigned a number. Basement room numbering will begin with B001. Subsequent floors will follow the same pattern. For buildings with greater than 99 rooms per floor, the inspector will assign room numbers starting with 1000, 2000, 3000, etc.

The objective for creating a floor plan is to clearly indicate room numbers, sample locations, and estimate quantity of ACBMs. The floor plan indicating sample locations may be submitted to the CAD Department for creation of an electronic map to be included as part of the inspection report. The floor plan should be sufficient to allow the CAD Department personnel to create a digital replica of the hard copy. Room and material sample numbers should be clearly represented on the floor plans.

4.1.3 Project Documentation

Observations made during the facility walk through should be documented in the inspector's field notes. Appendix C provides an example Field Observations logsheet which may be completed for each individual room. Information to be provided on the logsheet includes the following:

- Building name or number as appropriate;
- Room/Area number;
- Material descriptions (flooring, wall, ceiling, and other materials);
- Material category and condition
- Quantity estimates for each material;
- Inaccessible areas;
- General site condition (material storage, water damage, material damage, etc.); and
- Other observations (occupancy, energized utilities, etc.)

Sigma maintains tablets and a personal digital assistant (PDA) unit for use during field activities. The database template inspection files are downloaded to the tablet or PDA prior to starting the inspection activities. The field inspector enters the information listed above in each data collection cell. Following completion of the walkthrough, the inspector generates a material sample list from the available suspect materials. Once the list is generated, the inspector collects the samples and indicates the location of sample collection in the tablet. Upon completion of the site walkthrough and sampling

activities, the data is uploaded to the project file folder on the network drive for further analysis and reporting.

A copy of the field notes should be scanned and saved electronically in the project file and provided to the project manager on a daily basis. The asbestos inspector should maintain the original field inspection documentation.

The goal of the field notes is to enable the inspection process and sample collection activities to be recreated by a third-party at a later date. The field observations are an important tool when preparing the asbestos inspection report. Any unusual observations or general site conditions should be included in the report.

4.1.4 Sample Quantity and Location Determination

The sample quantity and collection location will depend on the purpose of the inspection, project scope of work, number of samples to be collected and site-specific conditions including accessibility, occupancy and amount of material present. The goal of the sampling is to determine the presence/absence of ACMs. Local requirements may require that a certain number of samples be collected based upon volume or surface area of homogenous materials.

The actual sampling locations should be selected to represent the homogenous material. Samples should be collected randomly, i.e. from different rooms, locations within a floor or wall, and different floors. The goal is to get representative samples from all homogenous materials.

A homogeneous area is defined by City of Milwaukee Department of Neighborhood Services as, "an area of surfacing material, thermal system insulation or miscellaneous material that is uniform in color and texture. Plaster and drywall systems may be considered homogeneous if surface color (paint) is the only discernable variable." Samples are not required to be collected from homogeneous materials which the certified inspector has determined to be non-asbestos-containing material, such as metal, glass, fiberglass, or wood.

4.1.5 Sample Collection

After determining the number and location of samples to collect, the asbestos inspector will wet the material to be sampled using a spray bottle containing amended water. The asbestos inspector will wear a half-face respirator when sampling friable materials. The inspector will use a clean sampling instrument which may include a utility knife, hammer and chisel, or other appropriate tool to collect a representative sample of the homogeneous material. A nickel to quarter coin size of the material will be collected and placed inside a clean sample container or Whirl-Pak plastic bag. A HEPA filter-equipped vacuum and/or wet wipes will be used to collect any dust and debris created by the sampling activities.

A photograph of each sample location will be taken to document the sample collection and material characteristics. The photo number generated by the camera may be

recorded on the Sigma Sample Material List which will be submitted to the laboratory. If a PDA or tablet is used during the inspection, table 5 will be printed for submittal to the laboratory. A minimum of one picture will be taken for each sample collected.

4.1.6 Sample Identification/Labeling

Concurrently with sample collection, the inspector will mark the sample location on the facility map. Depending on the scope of work, the inspector may also label the actual sample location next to the point of sample collection using a permanent marker, paint pen, or spray paint. Roofing sample locations may be indicated using fluorescent spray paint by marking the area with a filled-in circle and sample number.

The samples will be labeled using a standard format. The sample container will be labeled with the sample number, date, and the word "Sigma" or its symbol designation.

4.1.7 Visual Assessment

A visual assessment of the homogeneous material will be conducted during the walkthrough and sampling activities. The general condition of the material, approximate quantity, and any other unusual observations will be documented in the field notes.

Sigma uses the following definitions to assess material conditions as defined by the USEPA December 1990 document, "Asbestos NESHAP Regulated Asbestos-Containing Materials Guidance".

Category I Nonfriable Regulated ACM
"Poor Condition" – the binding of the ACM has lost its integrity, the ACM is peeling, cracking, or crumbling.

Category II Nonfriable Regulated ACM
"Poor Condition" – the material has been or will be crumbled, pulverized, or reduced to powder by demolition or renovation forces.

Materials not meeting the definitions above are considered to be in good condition.

When performing asbestos inspections and material assessments in schools covered by the Asbestos Hazard Emergency Response Act (AHERA), Sigma uses the following definitions for assessing material condition as defined by the AHERA requirements in 40 CFR 763:

"Damaged Friable Miscellaneous ACM: Friable Miscellaneous ACM which has deteriorated or sustained physical injury such that the internal structure (cohesion) of the material is inadequate, or, if applicable, which has delaminated such that its bond to the substrate (adhesion) is inadequate for any other reason, lacks fiber cohesion or adhesion qualities. Such damage or deterioration may be illustrated by separation of ACM into layers; separation for ACM from the substrate; flaking, blistering, or crumbling of the ACM surface; water damage; significant or repeated water stains, scrapes, gouges, mars or other signs of physical injury on the ACM."

"Damaged Friable Surfacing ACM: Friable Surfacing ACM which has deteriorated or sustained physical injury such that the internal structure (cohesion) of the material is inadequate, or which has delaminated such that its bond to the substrate (adhesion) is inadequate, or which, for any other reason, lacks fiber cohesion or adhesion qualities. This includes damage or significantly damaged thermal system insulation. Such damage or deterioration may be illustrated by separation of ACM into layers; separation for ACM from the substrate; flaking, blistering, or crumbling of the ACM surface; water damage; significant or repeated water stains, scrapes, gouges, mars or other signs of physical injury on the ACM."

"Damaged or Significantly Damaged Thermal System Insulation: Thermal system insulation (TSI) on pipes, boilers, tanks, ducts, and other thermal system insulation equipment where the insulation has lost its structural integrity, or its covering, in whole or part, is crushed, water stained, gouged, punctured, missing, or not intact such that it is not able to contain fibers. Damage may be further illustrated by occasional punctures, gouges or other signs of physical injury to ACM; occasional water damage on the protective coverings/jackets; or exposed ACM ends or joints."

"Significantly Damaged Friable Miscellaneous ACM: Damaged friable miscellaneous ACM where the damage is extensive and severe."

"Significantly Damaged Friable Surfacing ACM: Damaged friable surfacing ACM in a functional space where the damage is extensive and severe."

4.1.8 Substrate Patching

The project scope of work should indicate whether substrate patching is required. Under certain conditions, it may be necessary to patch the substrate from which a sample was collected. **Sigma will use only non-asbestos-containing materials for any field patching**. Thermal system pipe insulation and roofing sample locations should always be patched after collecting a sample. **The inspector will photo-document all roof patches**. Duct tape will be used to seal holes left by sampling thermal system pipe insulation. Membrane patch and/or roofing tar will be used to field patch holes left during roof sampling activities. Depending on building use, occupancy, and scope of work, it may also be necessary to patch holes created during sampling of walls, floors, and ceilings.

4.1.9 Post-Field Inspection

Prior to leaving the site, the field inspectors will summarize the daily activities in a field notebook. A field inspector will call the project manager indicating the inspection progress, any unusual field observations, number of samples collected if any, and sample submittal timeline. The project manager may provide additional instructions regarding inspection and sampling activities.

Contacting the project manager prior to leaving the site will provide the inspectors with an opportunity to verbally communicate field activities to the project manager. Problems encountered during the inspection process, inaccessible areas, and other items can be discussed. The project manager may also communicate additional instructions or changes in the scope of work.

4.1.10 Chain of Custody

The laboratory conducting the asbestos analysis will supply the chain of custody. Each laboratory chain of custody is different. See the project manager with questions on how to complete the chain of custody. In general, the chain of custody will include the following information:

- Client name and address (The Sigma Group, 1300 West Canal Street, Milwaukee, WI 53233);
- Project number;
- Date of sample collection;
- Analysis method requested;
- Signature of the person releasing the samples for shipment and analysis;
- Turnaround time;
- Billing information; and
- Sample description and location (provided on Sigma's Sample Material List).

The inspector is responsible for ensuring that each sample container is appropriately labeled with the sample number, the word "Sigma" or symbol designation and the sampling date. Prior to sending the samples to the laboratory, the project manager will verify the material sample descriptions, number of samples collected of each homogenous material, and the chain of custody. Sigma will submit the following documents along with the bulk material samples:

- Laboratory chain of custody;
- Supplemental Asbestos Chain of Custody (provided in Appendix F); and
- Sigma Sample Material List.

4.1.11 Sample Shipment

Sigma uses UPS, Federal Express, USPS, and any other valid carrier to ship samples to laboratories for analysis. When shipping material samples, provide the person completing the shipping papers with the project name and number, laboratory mailing address, and copy of the chain of custody. Include an original signed chain of custody inside the shipping container. Use appropriate packing materials to make sure the samples are not damaged during shipment.

4.1.12 Post Inspection Meeting

Following completion of the field inspection, the project manager will schedule a meeting with the inspectors to review the field notes, inspection logsheets, sample chain of custody, and maps.

4.2 NESHAP Requirements

The U.S. Environmental Protection Agency (EPA) issued rules concerning the application, removal and disposal of ACMs under the National Emission Standards for Hazardous Air Pollutants (NESHAP). The asbestos NESHAP regulations are provided in 40 Code of Federal Regulations (CFR) 61, Subpart M. Specifically, 40 CFR 61.145 states, "To determine which requirements of paragraphs (a), (b), and (c) of this section apply to the owner or operator of a demolition or renovation activity and prior to the commencement of the demolition or renovation, **thoroughly inspect the affected facility or part of the facility where the demolition or renovation operation will occur for the presence of asbestos, including Category I and Category II non-friable ACM**".

A NESHAP-consistent inspection requires destructive sampling which may include localized damage to floors, walls, roofs, and other building systems. It is important to review the scope of work and verify approval for destructive sampling and inspection from the client prior to implementing destructive sampling and inspection techniques.

During abatement, demolition and/or renovation, a potential exists for encountering asbestos and/or other hazardous materials not previously identified which have become exposed by way of abatement and/or demolition activities. In such cases, an asbestos inspector may be called in to sample the material if site conditions are safe for inspection and material sampling.

4.3 AHERA Requirements

The Asbestos Hazard Emergency Response Act (AHERA) went into law in 1986 and required the EPA to establish rules and regulations addressing ACMs in schools. The AHERA regulations are provided in 40 CFR 763 Subpart E Ss763.80 – Ss763.99 under the Toxic Substance Control Act (TSCA) and address the issues of identifying, evaluating, and controlling ACMs in schools. Schools K through 12 must inspect for friable and non-friable asbestos, implement response actions, and submit management plans to the State Governor or designated agency. Surveillance inspections are required every six months in order to reassess the condition of ACMs. An accredited inspector is required to reassess the condition of ACMs every three years and determine the response actions required.

4.4 City of Milwaukee Requirements

The City of Milwaukee has established minimum sampling requirements for suspect ACMs. The number of samples required to be collected depend on the material type and size of homogeneous area. In general, the City of Milwaukee requires the following:

Surfacing Materials

- At least three samples from homogeneous areas less than 1,000 square feet (sf) of material;
- At least five samples from homogeneous areas greater than 1,000 sf but less than 5,000 sf; and

- At least seven samples from homogeneous areas greater than 5,000 sf of material.

Thermal System Insulation

- At least three samples from each homogeneous area of thermal system insulation;
- At least one sample from each patched thermal system insulation that is less than six sf; and
- For pipe fittings, in a manner sufficient to determine if the material is asbestos-containing.

Miscellaneous Materials

- For each homogeneous area of material, a sufficient number of samples to determine if the material is asbestos-containing.

The project manager should check with the City of Milwaukee to determine if there are any additional requirements which apply to the inspection.

4.5 Other Municipal Requirements

Additional local regulations may apply to asbestos inspections. Contact the local authority to determine if there are any local-specific asbestos inspection requirements.

5. ANALYTICAL LABORATORY SELECTION

Sigma uses only certified laboratories to conduct sample analysis for asbestos. Laboratories are certified through the American Industrial Hygiene Association (AIHA) and the National Institute of Standards and Technology (NIST) through the National Voluntary Laboratory Accreditation Program (NVLAP). The AIHA and NVLAP provide proficiency testing through the Proficiency Analytical Testing Program (PAT).

6. REPORT FORMAT

Sigma uses a standard report format to ensure accuracy and consistent quality. The project scope of work and project manager may require variations to the report format. See the Asbestos QA/QC personnel for the most current asbestos inspection report. At a minimum, the report format will include the following topics:

- Introduction
- Background
- Asbestos Sample Collection and Analysis Procedures
- Summary of Results
- Recommendations
- Qualifications of Report
- State and Local Reporting Requirements
- Tables
    - Asbestos Analysis Results

    - Summary of Asbestos-Containing Materials
- Figures
    - Site Plan
    - Sample Location Map
- Appendices
    - Credentials – Wisconsin Certified Asbestos Inspector
    - Laboratory Analytical Results
    - Photo-documentation

SECTION III: ASBESTOS SUPERVISOR

1. INTRODUCTION

The role of the Sigma Asbestos Supervisor is primarily to conduct asbestos air monitoring before, during and after completion of abatement projects. The Asbestos Supervisor may also be required to provide quality assurance and quality control (QA/QC) observation and documentation during asbestos removal performed by others. Topics presented in this section include:

- Equipment;
- Air Sample Asbestos Analytical Methodology (PCM and TEM);
- Asbestos Air Sampling Procedures;
- Observation and Documentation Procedures; and
- Report Format

2. EQUIPMENT

2.1 Inventory

Various tools and equipment are required to properly conduct asbestos air sampling. The following list provides the most common tools required for asbestos air sampling. Site conditions, scope of work, and other considerations may require additional tools and equipment not listed below.

- Air sampling pumps (high and/or low flow);
- Extension cords;
- Field notebook;
- Laboratory chain of custody;
- Permanent marker;
- Rotameter;
- Sample cassettes;
- Sampling stands; and
- Watch.

2.2 Calibration

Calibration of sampling and analytical equipment is critical for ensuring reliable service and accurate data. Air sampling pumps (personal and area pumps), rotameters, and the phase contrast microscope require periodic calibration to ensure accurate and reliable data. Procedures for calibrating the air pump equipment and rotameter are briefly described below.

Equipment calibration activities will be documented and maintained in the **Equipment Calibration Logbook**. The logbook will contain the calibration records for each piece of equipment used to sample and analyze asbestos samples. Guidelines for type and frequency of calibration are provided below.

2.2.1 Phase Contrast Microscope

The phase contrast microscope (PCM) is serviced every six months by a qualified instrument technician. The six month service includes equipment inspection, cleaning, and lubrication. Documentation of the service will be maintained in the **Equipment Calibration Logbook** located on the Field Room microscope table.

Calibration of the PCM will be conducted **before** air monitoring samples are analyzed and consist of phase ring alignment and test slide verification. Appendix G provides the phase ring alignment and test slide calibration procedure. Records of scope calibrations are maintained in the Phase Contrast Microscope section of the **Equipment Calibration Logbook** and on each PCM Fiber Count Sheet. The PCM Fiber Count Sheets are the project forms completed in the field and are used during analysis of air samples.

2.2.2 Rotameter Calibration

Rotameters measure the airflow rate of a sampling pump and are considered secondary calibration devices. Secondary calibration devices provide indirect measurements of airflow and must be periodically calibrated with a primary calibration device. The rotameter manufacturer, Key Instruments, Inc., recommends calibration be performed annually. However, for rotameters used on a regular basis, more frequent calibrations are recommended[3]. Sigma will calibrate each rotameter with a Gilian Gilibrator 2 calibration system on a monthly basis. Records of the rotameter calibration will be maintained in the **Equipment Calibration Logbook** located in the field room on the microscope table. The Gilian Gilibrator 2 calibration system procedure is provided in Appendix H. Three cells are available to calibrate the rotameters:

- Low Flow (1 to 250 ccm)
- Standard Flow (20 ccm to 6 lpm)
- High Flow (2 to 30 lpm)

2.2.3 Air Sampling Pumps

Air sampling pumps require calibration **before and after** samples are collected[4]. Built-in rotameters attached to the air sampling pumps will not be used to calibrate the airflow rates. A standalone rotameter will be used to field calibrate each pump before and after samples are collected. The rotameter must be placed in line between the air sampling pump and the air cassette. The air cassette should be from the same lot of cassettes used for sampling. Records of the air sampling pump calibration will be provided on the **PCM Fiber Count Sheet** maintained in the project files. The air sampling pump and rotameter calibration procedure is provided in Appendix I.

[3] Barbara Plog, Jill Niland, Patricia Quinlan, Fundamentals of Industrial Hygiene (Itasca, IL: National Safety Council, 1996) 499.

[4] OSHA, Sampling and Analytical Methods, Method Number ID-160.

3. ASBESTOS ANALYTICAL METHODOLOGY

Many analytical methods are available for determining the amount of airborne asbestos and asbestos content in bulk samples. The required analytical method for analyzing samples for asbestos may be specified in regulations or defined in a project specification. The following discusses the most commonly used methods for air sample asbestos analysis.

3.1 Phase Contrast Microscopy

Phase contrast microscopy (PCM) is a technique used to enhance the contrast between fibers and the filter material. PCM analysis is used to determine the amount of fibers present in the air. A mixed cellulose ester (MCE) filter with a pore size between 0.8 and 1.2 microns is used in either a 25 mm or 37 mm cartridge to collect airborne fibers. Acetone is used to render the filter material optically transparent which allows the fibers to be counted. PCM analysis does not distinguish between asbestos and non-asbestos materials and counts only fibers longer than 5 microns and wider than 0.25 microns.

3.2 Transmission Electron Microscopy

Transmission electron microscopy (TEM) is a technique which uses an electron beam to penetrate a sample resulting in an image displaying various densities of the sample. TEM air samples can be collected using either MCE or polycarbonate filters. TEM analysis counts only asbestos fibers and is required for all air sampling conducted in accordance with the Asbestos Hazard Emergency Response Act (AHERA).

4. ASBESTOS AIR SAMPLING PROCEDURES

Section 4 provides information necessary for conducting air and bulk sampling for asbestos. Air sampling for asbestos requires an Asbestos Supervisor certification. In order to become a certified Asbestos Supervisor, a State approved training program must be taken and passed. The Asbestos Supervisor certification is valid for one year and must be renewed annually by taking an annual Asbestos Supervisor refresher course. Only certified personnel are allowed to conduct air and bulk sampling for asbestos. Copies of certifications are maintained in the Sigma personnel files and are updated as necessary.

Air sampling is conducted in order to assess environmental conditions (before, during, and after abatement activities), determine employee exposure, and verify proper cleanup after an asbestos abatement project has been completed. Air samples are typically analyzed using PCM and TEM analysis methods. PCM sample analysis is completed by in-house personnel or an approved laboratory. The PCM analytical procedure is provided in Appendix J. Samples requiring TEM analysis are sent to an approved laboratory.

Air sampling requires drawing in a known volume of air through a filter and analyzing the filter for the presence of asbestos. The filter is usually housed inside a plastic cassette which is connected to the sampling pump with a flexible tube. The sampling pump can be either AC electric or battery operated.

Two basic sampling pumps are available for area and personal monitoring. Area monitoring can be conducted using a low (<5 lpm) or high (5 to 30 lpm) flow pump. High flow pumps are commonly used because of the high sample volume of air required. The filter cassette is positioned at a 45° angle angling down and is placed in the breathing zone for both area and personal sampling. Personal samples are collected with a low flow pump worn by the worker with the intent of being representative of the actual exposure to airborne asbestos.

4.1 General Air Sampling Requirements

The airflow rate and sampling volume depends on the type of sample analysis, the intended purpose, and the general conditions of the area being sampled. The following table provides general sampling guidelines.

Table 1 – Air Sampling Guidelines

Type of Sample	Type of Analysis	Airflow Rate Range (liters per minute)	Sample Volume (liters)
Area	PCM	0.5 to 16.0[1.]	1,200 < x < 3,000
	TEM	< 10.0 (typically 9.5 to 9.9)	> 1,200
Personal	PCM	1.5 to 2.5	60 STEL Monitoring[1.] >60 PEL Monitoring[2.]
	TEM[3.]		
Clearance	PCM	0.5 to 16.0[4.]	1,200 < x < 3,000[5.]
	PCM - AHERA	1 to 10 (typically 9.5)	Minimum of 1,200 (target 1,500 to 2,000 liters)[6.]
	TEM	< 10.0 (typically 9.5)	> 1,200

Note:

1. NIOSH Method 7400 requires a minimum of 400 liters with an allowable flowrate of between 0.5 and 16 liters per minute. Sigma will collect a minimum of 1,200 liters using an airflow rate of between 1 and 15 liters per minute. The target volume is 1,500 liters with a flowrate of 5 to 15 liters per minute.
2. The OSHA STEL limit for asbestos is 1.0 f/cc and is determined by monitoring over a 30 minute time period expected to have the highest exposure level.
3. The OSHA PEL 8-hour time weighted average limit for exposure to asbestos is 0.1 f/cc.
4. TEM analysis is typically not used for personal exposure monitoring.
5. NIOSH Method 7400 requires a minimum of 400 liters with an allowable flowrate of between 0.5 and 16 liters per minute. Sigma will collect a minimum of 1,200 liters using an airflow rate of between 1 and 15 liters per minute. The target volume is 1,500 liters with a flowrate of 14 to 15 liters per minute.
6. Air clearance PCM sampling volume should be between 1,200 and 3,000 liters. Sampling volumes greater than 3,000 liters have the potential to overload the filter.
7. Appendix A of 40 CFR 763 requires that the sampling flowrate be between 1 and 10 liters per minute. NIOSH Method 7400 requires a minimum of 400 liters with an allowable flowrate of between 0.5 and 16 liters per minute. Sigma will collect a minimum of 1,200 liters using an airflow rate of between 1 and 10 liters per minute. The target volume is 1,500 liters with a flowrate of 9.5 liters per minute.

Field blanks are taken during area, personal, and clearance air sampling by opening a sample cassette and holding it upright for 30 seconds. A minimum of two field blanks or 10% of the total samples collected, whichever yields a greater number of field blanks, will be collected and analyzed. Any samples represented by a field blank having a fiber count in excess of the detection limit of the method being used may be rejected.[5] The PCM limit of detection changes based upon the volume of air sampled. Appendix L provides the PCM limit of detection for a wide range of air volumes sampled.

Sampling cassette labels will be completed by the sampler and will contain the following information:

- project reference number;
- date;
- sample identification or number;
- initials of sampler;
- time pump turned on;
- time pump turned off;
- airflow rate; and
- pump number.

4.2 Environmental Air Sampling

It may be necessary to assess the environmental conditions prior to, during, or after completion of an asbestos abatement project. Results from prevalent (background) level sampling conducted inside and outside the abatement area are used to estimate the existing airborne fiber concentrations before an asbestos abatement project begins. The results may be used as a control for comparing sample concentrations detected during and after abatement activities. Environmental sampling can be conducted during the asbestos abatement process to assess the impact of the abatement activities. Finally, environmental sampling can be conducted after the abatement process is completed to demonstrate that the asbestos abatement project did not adversely impact air quality of the building or adjacent areas.

Environmental air samples should be collected inside and outside of the building. Sigma will generally collect three samples, one inside and two outside. In general, Sigma will collect at least one inside air sample for every 50,000 cubic feet of building space. All three samples should be collected simultaneously in order to ensure identical environmental conditions.

4.3 Personal Air Sampling

Personal air sampling is conducted during an abatement project to determine employee exposure to airborne fibers. The information is used to determine the need for personal protective equipment including the use of respirators. Unless specifically requested by a

[5] OSHA 29 CFR 1926.1101 Appendix A.

client, Sigma does not conduct personal air monitoring during asbestos abatement projects.

4.4 Clearance Air Sampling

Sigma requires the use of a N99 or equivalent air purifying respirator and disposable coveralls to be worn during air clearance monitoring. Use of a tight-fitting respirator requires medical surveillance as specified in OSHA 29 CFR 1910.1001. Records of medical surveillance documents are maintained in the employee file in the Human Resources Department.

Clearance air sampling is conducted after the asbestos abatement activities are complete. The asbestos abatement area must pass a thorough visual inspection before the final clearance sampling is conducted. Clearance sampling will not be conducted if dust, debris, or other material suspected to contain asbestos is observed in the containment area after post-abatement cleanup activities have been performed. When project or site specific conditions warrant, aggressive clearance air sampling will be conducted by physically blowing air within the containment area using a leaf blower or similar device. Sampling under aggressive conditions provides a 'worst-case' scenario.

If AHERA regulations apply and the total asbestos abatement project includes the removal of greater than or equal to 160 square feet or 260 linear feet of ACM, five TEM samples are collected inside the containment area under turbulent conditions. If less than 160 square feet or 260 linear feet of ACM was removed, a minimum of five PCM air clearance samples are collected. An area passes clearance requirements if all of the TEM samples are all less than 70 structures per square millimeter or all of the PCM samples are less than 0.01 fibers per cubic centimeter (f/cc).

5. OBSERVATION AND DOCUMENTATION PROCEDURES

Observation and documentation is critical to the success of the asbestos abatement project. The project scope of work and project manager will specify the level of observation and documentation necessary to complete the project. The objective of documenting activities performed and observations is to ensure that Sigma completes the project in accordance with the project scope of work or contract.

Project-specific requirements may require the Asbestos Supervisor to conduct some level of observation and documentation of the site and project activities. The project scope of work and project manager will indicate the requirements for observation and documentation which may include observing the installation of the containment barriers, asbestos abatement activities, post-abatement cleanup activities, and removal of the containment barriers. Appendix M provides a sample observation logsheet which can be used to document asbestos removal activities. At a minimum, the following information will be entered into a field notebook:

- Project name and number;
- Sigma and client personnel onsite;

- Date;
- Time of arrival and departure;
- Activities performed;
- Observations; and
- Signature.

Corrections made to the field notes made in the field or office will be completed by drawing a single line through the word, sentence, or paragraph and initialing the correction. Additionally, spaces not used or required should have a single line drawn through in order to document that the information is not required or not collected.

The Asbestos Supervisor will make two copies of the field observations. One copy will be provided to the project manager and the other copy will be filed in the Master File. The Asbestos Supervisor will maintain the original field notes in the field notebook.

6. REPORT FORMAT

Sigma uses a standard report format to ensure accuracy and consistent quality. The project scope of work and project manager may require variations to the report format. See the Asbestos QA/QC personnel for the most current asbestos inspection report. At a minimum, the report format will include the following topics:

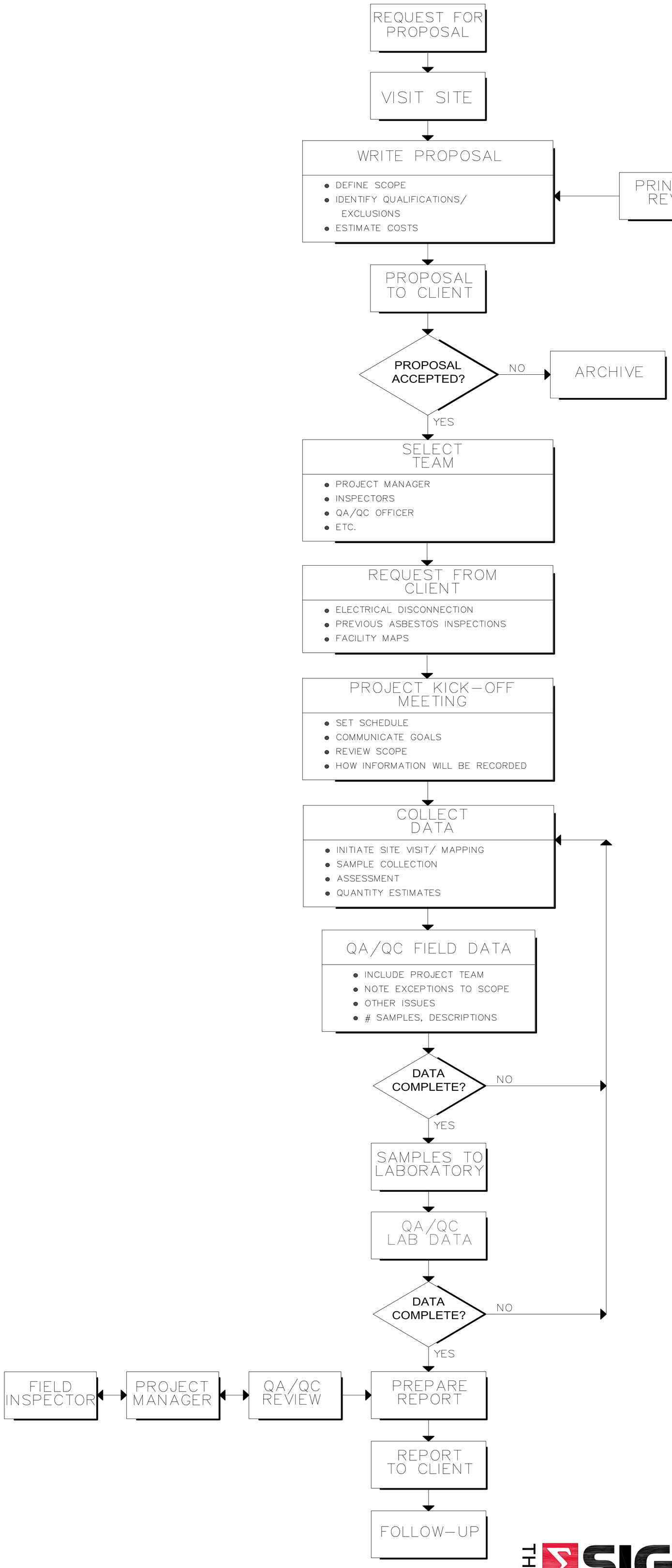
- Introduction
- Background
- Asbestos Air Sample Collection
- Summary of Results
- Recommendations
- Table
- Figures (if applicable)
  - Site Plan
  - Sample Collection Map
- Appendices
  - Credentials – Wisconsin Certified Asbestos Supervisor
  - Laboratory Analytical Results

Appendix A

Sigma's Asbestos Project Management Flow Chart

ASBESTOS PROJECT MANAGEMENT FLOW CHART

The Sigma Group



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Appendix B

Example Project Sheet

SIGMA ENVIRONMENTAL SERVICES, INC.

ASBESTOS / LEAD / HAZARDOUS MATERIAL ASSESSMENT PROJECT FORM

Project #		Date:	
Project Location:			

Inspection Type:		**Purpose:**	
	Asbestos		Demolition
	Lead-Based Paint		Renovation
	Supplemental Environmental Assessment		Other

Laboratory Analytical:					
	IATL		EMSL	Turnaround Time	
	Micro-Analytical		Other		

		Name	Responsibility
Project Team:	Client Manager		facility walkthrough, final report review, client contact
	Project Manager		facility walkthrough, fld notes QA/QC, coordinate completion of report
	QA/QC		review final report prior to issuance
	Primary Field Inspector		field documentation, sample collection, drawing review
	Ass. Field Inspector		field documentation, sample collection, write report
Budget:	Field Inspection		hours per Field Inspector (includes prep, travel onsite)
	Report		total hours
	Project Management		hrs (includes report writing time)

			Date			Date
Project Schedule:	Project Kickoff Meeting			Field Inspection		
	Post Field Work Meeting			Analytical		
	Draft Report:	Asbestos		Final Report:	Asbestos	
		Lead			Lead	
		SEA			SEA	
Site Safety Plan:	Review and Signatures					

Other:		YES	NO
1.	Read proposed scope of work		
2.	Floor plans **ARE** available		
3.	Map area according to functional spaces. Document presence and quantity of ASB, LBP and SEA (as appropriate) according to functional spaces		
4.	Photo-document all sampled locations		
5.	Inspect all outside structures		
6.	Provide project manager with field notes each day		
7.	Destructive sampling **WILL** be conducted		
8.	Positive stop for asbestos analysis.		
9.	Paint samples **ARE** to be sampled for asbestos content		
10.	Electrical system **IS** included in scope of inspection		
11.	Boiler/furnace system **IS** included in scope of inspection		
12.	Sample locations **ARE** to be marked with paint and marker		
13.	Route all field notes, forms and maps to project manager		

Routing:	Dave Scherzer (mandatory)	X		Gary Schultz	
	Randy Boness			Steve Marcinkowski	
	Mark Krueger			Project Manager	
	Jeff Senn			Master File	

Appendix C

Field Observation Logsheet

SIGMA ENVIRONMENTAL SERVICES, INC.

FIELD OBSERVATIONS

Project # _____ Project Name: _____ Date: _____

Project Location: _____ Field Personnel: _____

_____

_____ Field Book # _____

Functional Area / Room Number _____

Occupied? _____

Inaccessible areas? If so, why? _____

Rechecked? Result: _____

Utilities (e, heat, water) _____

General area condition: _____

Summary of materials per functional area/room:

Flooring	Qty	Wall	Qty	Ceiling	Qty

Other	Qty	Other	Qty	Other	Qty

Functional Area / Room Number _____

Occupied? _____

Inaccessible areas? If so, why? _____

Rechecked? Result: _____

Utilities (e, heat, water) _____

General area condition: _____

Summary of materials per functional area/room:

Flooring	Qty	Wall	Qty	Ceiling	Qty

Other	Qty	Other	Qty	Other	Qty

Appendix D

Sigma Sample Material List

SIGMA ENVIRONMENTAL SERVICES, INC.

SAMPLE MATERIAL LIST

Project # _____ Project Name: _____ Date: _____

Project Location: _____ Field Personnel: _____

_____

_____ Field Book # _____

Sample Number	Picture Number	Homogenous Material Code	Homogeneous Material Description (size, color, layered?)	Functional Area/ Room Number	Location within Room
01					
02					
03					
04					
05					
06					
07					
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50					

Appendix E

Homogeneous Material Codes

HOMOGENOUS MATERIAL CODES

Revision Date: 12/06/06

CODE	DESCRIPTION
GENERAL	
NSM	NO SUSPECT MATERIAL
INA	INACCESSIBLE
THERMAL	
TA#	AIRCELL - Size
TA#F	FITTINGS ON AIRCELL - Size
TC#	CARDBOARD - Size
TC#F	FITTINGS ON CARDBOARD - Size
TM#	MAGNESIA - Size
TW#	WOOL WRAP - Size
TW#F	FITTINGS ON WOOL WRAP - Size
TF#	FIBERGLASS SUSPECT SUB LAYER - Size
TF#F	FITTINGS ON FIBERGLASS - Size
TTW	TAPE WRAP ON PIPE
TBI	BOILER INSULATION INTERIOR
TBE	BOILER INSULATION EXTERIOR
TWT	WATER TANK INSULATION
TWM	WATER METER INSULATION
TGV	GANG VALVE INSULATION
TXB	EXHAUST BREECHING
TDI	DUCT INSULATION INTERIOR
TDE	DUCT INSULATION EXTERIOR
TDJ	DUCT JOINT SEALANT
TDW	PAPER DUCT WRAP
TIL	INCINERATOR LINER
TIX	INCINERATOR BREECHING
SURFACING	
SSF	SPRAYED ON FIREPROOFING
SSA	SPRAYED ON ACCOUSTICAL
STF	TROWELED ON FIREPROOFING
STA	TROWELED ON ACCOUSTICAL
SPI	PLASTER (BASE AND SKIM COAT)

City of Milwaukee / AHERA
3 samples for 0-1000 square feet
5 samples for 1000-5000 square feet
7 samples +5000 square feet

Where # further defines the specific material by size, color, or other

CODE	DESCRIPTION
MISCELLANEOUS	
MB8	8" BRICK
MBI	BLOWN IN INSULATION
MBM	BRICK MORTAR
MC-#	CAULK - Color
MCB	CINDER BLOCK
MCC	CONCRETE
MCDCx	CLOTH DUCT CONNECTOR
MCM	CARPET MASTIC
MCP	CEMENTATIOUS PANELS
MCTM-#	CERAMIC TILE SYSTEMS - Size followed by color
MCT-#	CEILING TILE AND MASTIC - Size followed by description
MDC	DUCT CLOTH
MDW	DRYWALL
MDWC	DRYWALL AND JOINT COMPOUND
MECTM	EXPOSED CEILING TILE MASTIC
MEJ	EXPANSION JOINT
MEM	EXPOSED FLOORING MASTIC
MF12-#	12" FLOOR TILE AND MASTIC - Color(s)
MF36-#	36" FLOOR TILE AND MASTIC - Color(s)
MF6-#	6" FLOOR TILE AND MASTIC - Color(s)
MF9-#	9" FLOOR TILE AND MASTIC - Color(s)
MFB	FIRE BRICK
MFC	FIRE CURTAIN
MFD	FIRE DOOR
MFG	FLOOR GROUT
MFL-#	LINEOLIUM AND MASTIC - Color(s)
MFP	FLUE PACKING
MGK	GASKETS
MJC	JOINT COMPOUND
MJP	JOINT PUTTY
MLI	LIGHT INSULATION (REFLECTIVE PAPER)
MPG	WINDOW GLAZING
MPI	PAPER INSULATION
MPM	PANELING MASTIC
MPT	TAR PAPER INSULATION
MPW	PIPE WRAP
MRB	BUILT UP ROOF
MRF	ROOF FLASHING
MRM	ROCK MORTAR
MRM	ROOF MEMBRANE
MRS-#	ROOF SHINGLE - Color
MSC-#	SINK COATING - Color
MSCT-#	SUSPENDED CEILING TILE - Size followed by description
MSM	SERPANTINE MARBLE
MSTD	STAIR TREAD
MTF	TERRAZO FLOOR
MTL	TRANSITE TABLE TOP
MTP	TRANSITE PANELS
MTS	TRANSITE SINK
MV4-#	4" VINYL BASEBOARD AND MASTIC - Color
MV6-#	6" VINYL BASEBOARD AND MASTIC - Color
MVDC-#	VINYL DUCT CONNECTOR - Color
MVF-#	VINYL FLOORING AND MASTIC - Color
MWC-#	WINDOW CAULK - Color
MWG	WALL GROUT
MWI	WIRE INSULATION
MWR	WINDOW ROPE
MWS	WALL SHINGLE

Appendix F

Supplemental Asbestos Chain of Custody

Supplemental Asbestos Chain of Custody

Project Number: _____

Number of Samples: _____

In addition to the information provided on the laboratory chain of custody, Sigma requires the following (checked items only):

☐ When the laboratory observes an apparent discrepancy between Sigma's material description and the sample received by the laboratory, the laboratory shall flag the material description on the laboratory report and define on the laboratory report the specific discrepancy(s) noted.

☐ **With the exception of drywall and joint compound samples**, analyze and report each distinct and separable material layer unless otherwise instructed on the attached "Sigma Sample Material List" sheet(s). Laboratory to determine distinct and separable layers and provide layer descriptions for each individual layer.

☐ Analyze and report each distinct and separable material layer unless otherwise instructed on the attached "Sigma Sample Material List" sheet(s). Laboratory to determine distinct and separable layers and provide layer descriptions for each individual layer.

☐ Discontinue analysis of homogenous material upon determining that the material contains greater than one percent asbestos content. If the homogeneous material contains multiple layers, continue analysis of each layer until all samples have been analyzed or until it has been determined that the layer contains greater than one percent asbestos content. See item #4 for flooring system Positive Stop instructions.

For example, if Sigma submitted three roofing system samples and the top layer sample analysis revealed asbestos is present at greater than one percent, the top layer analysis would be discontinued but the underlying layer(s) analysis would continue until greater than one percent asbestos is detected or until all three underlying sample layers have been analyzed. This assumes, however, that the materials are in fact homogenous. Through microscopic examination, it may be determined by the analyst that there are additional layers not present in each sample. In that case, the individual sample layer should also be analyzed.

☐ **Flooring Systems (including floor tile systems, vinyl flooring systems, vinyl laminate systems, and stair tread systems): Conduct analysis of the mastic layer(s) first. If analysis reveals greater than one percent asbestos content, discontinue analysis of the mastic layers and do not analyze the flooring material (tile, vinyl, laminate, etc.) Call Jeff Senn at (414) 643-4151 with specific questions.**

Appendix G

PCM Phase Contrast and Test Slide Calibration Procedure

Note: At the present time, Sigma does not conduct in-house PCM analysis of air samples. The applicable sections have been retained in this Asbestos SOP in the event that Sigma reinstates in-house analysis of air samples.

PCM Phase Contrast and Test Slide Calibration Procedure

The phase shift detection limit of the microscope shall be about three degrees measured using the HSE phase shift test slide. The following provides the phase contrast calibration procedure:

1. Place the test slide on the microscope stage and center it under the phase objective.

2. Bring the blocks of grooved lines into focus
   Note: The slide consists of seven sets of grooved lines in descending order of visibility from sets one to seven, seven being the least visible. The requirements for asbestos counting are that the microscope optics enable the analyst to resolve the grooved lines in set three completely, although the lines may appear somewhat faint and the grooved lines in sets six and seven must be invisible. Sets four and five must be at least partially visible but may vary slightly in visibility between microscopes. A microscope that fails these requirements has either a too low or high resolution to be used for asbestos counting.

3. If the image deteriorates, clean and adjust the microscope. If the problem persists, consult the microscope manufacturer.

Appendix H

Gilian Gilibrator 2 Calibration System Procedure

Gilian Gilibrator 2 Calibration System Procedure

Introduction:
The standard operating procedures for the Gilian Gilibrator 2 calibration unit is to provide Sigma personnel with the proper steps to calibrate the asbestos air monitoring equipment. Proper calibration of the asbestos air monitoring equipment assures the most true and accurate data to our clients.

Operation:
Step #1: Remove base unit, nine pin adapter, proper wet cell, rubber tubing and bubble generator soap dispenser (red cap) from carrying case. Place equipment and supplies on level surface.

Step #2: Select proper wet cell for calibration test:
Rotameter #1 uses wet cell P/N800286
Rotameter #2 uses wet cell P/N800285
Rotameter #3 uses wet cell P/N800285

Step #3: Attach proper wet cell to the control unit base by grasping lower portion of wet cell. Be sure front of wet cell is facing to the right. Align the two (2) metal pins located on the bottom of the wet cell with the two (2) slots on the control unit base monitoring plate. Grasp lower portion of wet cell and turn wet cell clockwise until it clicks.

Step #4: Connect the 9-pin plug from the base unit to the connecting jack on the back of the wet cell.

Step #5: Disconnect rubber tube from top portion of wet cell.

Step #6: Fill the base unit bubble cell generator with soap using the rubber tube as a funnel. Depress the black bubble initiate button while filling until the angled edge at the bottom of the bubble generator ring is immersed in the soap solution.

Step #7: Remove rubber tube from the bottom portion of wet cell and set aside.

Step #8: Connect rubber hose from bottom of rotameter to air outlet fitting located on upper portion of wet cell.

Step #9: Connect rubber hose from top of rotameter to air sampler intake fitting.

Step #10: Turn the air sampler unit. **NOTE: DO NOT TURN ON GILIBRATOR.**

Step #11: Depress the black bubble initiate button on the wet cell several times to wet the inner walls of the base unit flow tube. **NOTE: THIS MUST BE DONE IN ORDER TO INITIATE A TIMING BUBBLE.**

Step #12: Push the on button of the control base unit. Wait ten (10) seconds while control base unit conducts self test.

Step #13: Depress the black bubble initiate button and hold to initiate the first bubble to travel up the base unit flow tube. (This will give you your first reading.) Release the button to initiate a second bubble. (This will give you your second reading.) Repeat for additional readings.

Step #14: Document base unit readings, rotameter and air sample unit onto calibration log sheet.

Disassemble:

Step #1: Press delete on base unit for three (3) seconds to zero (0) out base unit.

Step #2: Press off on base unit and disconnect 9-pin plug from wet cell.

Step #3: Disconnect rubber hose from rotameter to wet cell.

Step #4: Remove wet cell by grasping lower portion of cell and turn counter-clockwise to release.

Step #5: Empty unused soap into soap dispenser by tilting wet cell at 45 degree angle. Allow soap solution to empty out of wet cell lower portion fitting into dispenser.

Step #6: Replace wet cell rubber hose you set aside in step #7 in operations.

Step #7: Return all components to carrying case for future use.

Appendix I

Air Sampling Pump Calibration

Air Sampling Pump Calibration

Each air sampling pump will be calibrated in the field **before and after** sampling activities using a rotameter. A rotameter consists of a plastic housing with a tapered tube which allows a float or ball to travel up and down. Air is pulled through the rotameter causing the float to rise until the gravitational force and the force of the air lifting the float upward are in equilibrium. The backside of the rotameter is graduated to indicate the airflow rate. The airflow rate is determined by comparing the center of the ball to the number indicated on the graduated lines.

The following procedure must be followed in order to calibrate an air sampling pump:

1. Verify rotameter calibration against the primary calibration device has been conducted within the past 30 days. If not, calibrate the rotameter with the Gilian Gilibrator 2 calibration system as described in Appendix H.

2. Connect the air sampling pump to the calibration sample cassette using the tygon or similar tubing. Connect the inlet side of the sample cassette to the outlet of the rotameter.

3. Turn on the air sampling pump.

4. Using the calibration curve generated during the rotameter calibration process, adjust the airflow to the desired rate.

Appendix J

In-House PCM Analysis Method

Note: At the present time, Sigma does not conduct in-house PCM analysis of air samples. The applicable sections have been retained in this Asbestos SOP in the event that Sigma reinstates in-house analysis of air samples.

In-House PCM Analysis Method

Sigma follows the PCM analytical procedures as specified in the OSHA 29 CFR 1926.1101 Appendix A. Only analysts who have completed the NIOSH 582 Fiber Counting training program are authorized to analyze air samples for asbestos. Additionally, Sigma requires all PCM analysts to participate in the Proficiency Analytical Testing (PAT) program. Every three months, PAT samples must be analyzed. The results of the PAT analysis are sent for verification. A certification is awarded if the results are within acceptable limits.

The following sample preparation and analysis procedures are followed each time PCM air samples are analyzed for asbestos.

Sample Preparation

The objective of the sample preparation is to produce a sample with a smooth (non-grainy) background in a medium with a refractive index of approximately 1.46. The following technique is designed to compress the filter for easier focusing and produces permanent mounts which are useful for quality control and inter-laboratory comparison purposes.

1. Heat an aluminum block or similar device to about 70 ºC. Do not place the hot block on any surface which can be damaged by heat or exposure to acetone.
2. Ensure that the glass slides and cover slips are free from dust and fibers. Use Kimwipes or equivalent to clean any dust from the slides or cover slides.
3. Remove the top plug to prevent a vacuum condition when the cassette is opened. Clean the outside of the cassette prior to opening if necessary. Cut the seal and/or tape on the cassette with a razor blade. Carefully separate the base from the extension cowl, leaving the filter and backup pad in the base.
4. With a rocking motion, cut a triangular wedge from the filter using a scalpel. The wedge should be between 1/6 and 1/4 of the filter. Grasp the filter wedge with the forceps on the perimeter of the filter which was clamped between the cassette pieces. NEVER TOUCH the filter with your fingers. Place the filter on the glass slide sample side up. Static electricity will usually keep the filter on the slide.
5. Place the tip of the micropipette containing about 200 μL of acetone into the aluminum block. Insert the glass slide into the receiving slot in the aluminum block. Inject the acetone into the block with slow, steady pressure on the plunger while holding the pipette firmly in place. Wait three to five seconds for the filter to clean, and then remove the pipette and slide from the aluminum block.
6. Immediately (less than 30 seconds) place between 2.5 and 3.5 μL of triacetin on the filter.

   Note: Waiting longer than 30 seconds will result in increased index of refraction and decreased contrast between the fibers and the preparation. This may also lead to separation of the cover slip from the slide.

7. Lower the cover slip gently onto the filter at a slight angle to reduce the potential for forming bubbles. If more than 30 seconds have elapsed between the acetone exposure and triacetin application, glue the edges of the cover slip to the slide with lacquer or nail polish.
8. If the clearing of the filter is slow, warm the slide for 15 minutes on a warm hot plate (50 ºC). The top of the aluminum block can be used but caution must be exercised in order to prevent the slide from overheating.
9. Fiber counting may begin after clearing and mounting are completed.

Sample Analysis

Fiber counting may begin after the samples have been prepared and the phase ring and test slide calibration activities have been completed. Make sure the optical surfaces are free from dust and debris. The following provides the PCM sample analysis procedure[6, 7]:

1. Place the prepared slide on the mechanical stage of the microscope. Position the center of the wedge under the objective lens and focus upon the sample using the coarse and fine adjustment knobs.
2. Start counting from one end of the wedge and progress along a radial line to the other end (count in either direction from perimeter to wedge tip). Select fields randomly, without looking into the eyepieces, by slightly advancing the slide in one direction with the mechanical stage control.
3. Continually scan over a range of focal planes (generally the upper 10 to 15 μm of the filter surface) with the fine focus control during each field count. Spend at least 5 to 15 seconds per field.
4. Most samples will contain asbestos fibers with fiber diameters less than 1 μm. Look carefully for faint fiber images. The small diameter fibers will be very hard to see. However, they are an important contribution to the total count.
5. Count only fibers equal to or longer than 5 μm. Measure the length of the curved fibers along the curve.
6. Count fibers which have a length to width ratio of 3:1 or greater.
7. Count all the fibers in at least 20 fields. Continue counting until either 100 fibers are counted or until 100 fields have been viewed, whichever comes first. Count all the fibers in the final field.
8. Fibers lying entirely within the boundary of the Walton-Beckett graticule field shall be counted as 1 fiber. Fibers crossing the boundary once and having one end within the circle shall be counted as ½ of a fiber. Do not count any fiber that crosses the graticule boundary more than once. Reject and do not count any other fibers even though they may be visible outside the graticule area. If a fiber touches the circle, it is considered to cross the line.
9. Count bundles of fibers as one fiber unless individual fibers can be clearly identified and each individual fiber is clearly not connected to another counted fiber.

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[6] OSHA 29 CFR 1926.1101 Appendix B.

[7] NIOSH Manual of Analytical Methods, Fourth Edition, 8/15/1994.

10. Record the number of fibers in each field in a consistent way such that fiber concentration non-uniformity can be assessed.
11. Regularly check phase ring alignment during the analysis.
12. When an agglomerate (mass of material) covers more than 25% of the field of view, reject the field and select another. Do not include it in the number of fields counted.
13. Perform a "blind recount" of at least one in every ten filter wedges (slides).
14. Calculate the airborne fiber concentration using the following equation:

$$AC = \frac{\left[\left(\frac{FB}{FL}\right) - \left(\frac{BFB}{BFL}\right)\right] \times ECA}{1{,}000 \times FR \times T \times MFA} \qquad \text{(Equation 1)}$$

where AC = Airborne fiber concentration (f/cc)
FB = Total number of fibers greater than 5 μm counted
FL = Total number of fields counted on the filter
BFB = Total number of fibers greater than 5 μm counted in the blank
BFL = Total number of fields counted on the blank filter
ECA = Effective collecting area of filter (385 mm^2 nominal for a 25 mm filter)
FR = Pump flow rate (liters per minute)
MFA = Microscope count field area (mm^2) (0.00785 mm^2 for a Walton-Beckett Graticule)
T = Sample collection time (min)
1,000 = Conversion of L to cc

Since a given analyst always has the same interpupillary distance, the number of fields per filter for a particular analyst will remain constant for a given size filter. The field size for that analysis is also constant because the microscope and reticule are not changed. As a result, equation 1 can be simplified. Assuming that ECA and MFA are constant (values provided above), equation 1 can be simplified to:

$$AC = \frac{\left[\left(\frac{FB}{FL}\right) - \left(\frac{BFB}{BFL}\right)\right] \times 49}{FR \times T} \qquad \text{(Equation 2)}$$

Recount Calculations

As required in step 13 of the sample analysis procedure (Section 5.2), a "blind recount" of 10% of the slides is performed. In all cases, differences will be observed between the first and second counts of the same filter wedge due to chance or analysis biases. Statistical recount criteria enables the analyst to decide whether the differences can be explained due to chance or systematic differences between analysts, microscopes, or other biasing factors. Use the following test to determine whether a pair of counts by the sample counter on the same filter should be rejected because of possible bias:

Reject the sample if:

$$\left|\sqrt{AC_2} - \sqrt{AC_1}\right| > 2.77x\sqrt{AC_{avg}}\,xCV_{FB}$$

where: AC_1 = lower estimated airborne fiber concentration
AC_2 = higher estimated airborne fiber concentration
AC_{avg} = average of the two concentration estimates
CV_{FB} = coefficient of variation (CV) of the two concentration estimates, $\text{CV} = \frac{\text{standard deviation}}{\text{mean}}$

$$\text{standard deviation} = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}},$$

x = measurement
$\bar{x}$ = mean
n = total number of measurements

If a pair of counts is rejected by this criterion, recount the rest of the filters in the set. Apply the test and reject any other pairs which fail the test. A rejection memorandum should be issued to the client stating that the sample failed a statistical test for homogeneity and the true air concentration may be significantly different than the reported value.

Reporting Results
Results should be reported as fibers per cubic centimeter (fibers/cc or f/cc). Use two significant figures when reporting the values. If multiple analyses are performed on the same sample, report the average of the results unless any of the results can be rejected for cause.

Quality Assurance and Quality Control
Sigma has implemented the following quality control program in order to ensure accurate and reliable results.

1. All personnel responsible for analyzing air samples for asbestos must be certified. PCM air sample analysts must have taken the NIOSH 582 course or equivalent for sampling and evaluating airborne asbestos.
2. Sigma sends out samples to at least two other laboratories in order to compare performance and eliminate error on a semiannual basis. The results of the analysis will be compared to the in-house analysis and displayed for all analysts to see.
3. Each airborne asbestos analyst will participate in the Proficiency Analytical Testing (PAT) Program, the Asbestos Analyst Registry or equivalent.
4. Each analyst shall select and count prepared slides from a “slide bank”. These are quality assurance counts. The slide bank shall be prepared using uniformly distributed samples taken from the workload. Fiber densities should cover the expected range routinely encountered. The slides are counted blind by all counters to establish an original standard deviation. This historical distribution is compared with the quality assurance counts. A counter must

have 95% of all quality control samples counted within three standard deviations of the historical mean. This count is then integrated into a new historical mean and standard deviation for the slide.

The slide bank will be developed over the next two months and will include samples having various fiber counts. To begin the process, three slides will be created for each sample. The slides will be individually labeled and read in-house. Two of each sample will be sent offsite to two separate laboratories for analysis. Results from the in-house and offsite analysis will be compared and recorded in the **Slide Bank** logsheet provided in Appendix K. The standard deviation and historic mean values will be determined. The in-house value determined during project sample analysis will be included in all future standard deviation and historic mean values.

Slide and Cassette Retention

Sigma maintains slides analyzed in-house for a minimum of three years. Slides are inventoried based upon project number and sample date. The slides are labeled with the project number, date, and sample number and placed in a microscope slide box. The microscope slide box is numbered in sequential order. A slide inventory sheet is completed which indicates the project number, date, sample numbers, and microscope slide box. The sample slide inventory sheets are maintained in the **Equipment Calibration Logbook**. The microscope slide boxes are archived in a storage box which is maintained in the Field Room.

Appendix K

Slide Bank Logsheet

Note: At the present time, Sigma does not conduct in-house PCM analysis of air samples. The applicable sections have been retained in this Asbestos SOP in the event that Sigma will resume in-house analysis of air samples. Sigma will develop and maintain a slide blank logsheet prior to resuming in-house analysis of air samples.

Appendix L

PCM Limit of Detection

Sigma Environmental Services, Inc.
PCM Limit of Detection

Volume of Air Sampled (L)	LOD (f/cc)	Volume of Air Sampled (L)	LOD (f/cc)	Volume of Air Sampled (L)	LOD (f/cc)	Volume of Air Sampled (L)	LOD (f/cc)	Volume of Air Sampled (L)	LOD (f/cc)
400	0.0067	1025	0.0026	1650	0.0016	2275	0.0012	2900	0.0009
425	0.0063	1050	0.0026	1675	0.0016	2300	0.0012	2925	0.0009
450	0.0060	1075	0.0025	1700	0.0016	2325	0.0012	2950	0.0009
475	0.0057	1100	0.0025	1725	0.0016	2350	0.0011	2975	0.0009
500	0.0054	1125	0.0024	1750	0.0015	2375	0.0011	3000	0.0009
525	0.0051	1150	0.0023	1775	0.0015	2400	0.0011	3025	0.0009
550	0.0049	1175	0.0023	1800	0.0015	2425	0.0011	3050	0.0009
575	0.0047	1200	0.0022	1825	0.0015	2450	0.0011	3075	0.0009
600	0.0045	1225	0.0022	1850	0.0015	2475	0.0011	3100	0.0009
625	0.0043	1250	0.0022	1875	0.0014	2500	0.0011	3125	0.0009
650	0.0041	1275	0.0021	1900	0.0014	2525	0.0011	3150	0.0009
675	0.0040	1300	0.0021	1925	0.0014	2550	0.0011	3175	0.0008
700	0.0039	1325	0.0020	1950	0.0014	2575	0.0010	3200	0.0008
725	0.0037	1350	0.0020	1975	0.0014	2600	0.0010	3225	0.0008
750	0.0036	1375	0.0020	2000	0.0013	2625	0.0010	3250	0.0008
775	0.0035	1400	0.0019	2025	0.0013	2650	0.0010	3275	0.0008
800	0.0034	1425	0.0019	2050	0.0013	2675	0.0010	3300	0.0008
825	0.0033	1450	0.0019	2075	0.0013	2700	0.0010	3325	0.0008
850	0.0032	1475	0.0018	2100	0.0013	2725	0.0010	3350	0.0008
875	0.0031	1500	0.0018	2125	0.0013	2750	0.0010	3375	0.0008
900	0.0030	1525	0.0018	2150	0.0013	2775	0.0010	3400	0.0008
925	0.0029	1550	0.0017	2175	0.0012	2800	0.0010	3425	0.0008
950	0.0028	1575	0.0017	2200	0.0012	2825	0.0010	3450	0.0008
975	0.0028	1600	0.0017	2225	0.0012	2850	0.0009	3475	0.0008
1000	0.0027	1625	0.0017	2250	0.0012	2875	0.0009	3500	0.0008

LOD = 5.5 fibers per 100 fields or 7 fibers per $mm^{2.}$

LOD = [5.5\100\0.00785 x 385] / [Volume (L) x 1,000]

Appendix M

Field Inspection Report

FIELD INSPECTION REPORT

Asbestos Removal Activities

THE SIGMA GROUP
SIGMA ENVIRONMENTAL SERVICES, INC.
SIGMA DEVELOPMENT, INC.
SIGMA LEASING, INC.

Project Name: _____
Project Number: _____
Client: _____
Date: _____
Time: _____
Person Completing this Report: _____

Name of Asbestos Removal Contractor: _____

Names and License Numbers of Asbestos Contractor Employees
Observed Working On-Site During Site Visit:

Employee Name State License Number

Who is the Contractor's Asbestos Supervisor? _____

Describe Observed Work Activities:

Include location and type of ACM being removed.
Describe Equipment Being Used for Wetting.
Describe any other pertinent observations or discussions that took place during site visit.

Check appropirate box for questions below. If ☐ Explain further on pg 1.

	Yes	No	N/A
Is the Contractor's Asbestos Supervisor Present On-Site?	☐	☐	☐
Is wetting taking place during ACM removal?	☐	☐	☐
Containerized ACM appears to be wetted with plenty of water?	☐	☐	☐
Was temperature below 32 degrees F?	☐	☐	☐
Were damaged or ripped containers observed?	☐	☐	☐
Is there any suspect ACM on ground adjacent to waste containers?	☐	☐	☐
Are waste containers for transport marked with			
Generator Name and Location	☐	☐	☐
Asbestos Hazard Warning	☐	☐	☐
DOT Waste Classification	☐	☐	☐
Is waste being accumulated in a secure location to limit potential visible emissions, load loss and spills or leakages of liquids?	☐	☐	☐

Is work under containment?

___ Full ___ Glove Bag

___ Critical Barriers ___ None

Regulated areas marked?	☐	☐	☐
Ventilation Machines in Use? Number of machines_____	☐	☐	☐
Is negative pressure apparent with positive airflow from clean room into work area?	☐	☐	☐
Were uncontrolled openings observed in containment?	☐	☐	☐
Respitory Protection being used by Employees?	☐	☐	☐
Asbestos Removal Contractor Conducting Personnel Air Monitoring?	☐	☐	☐
Decontamination Facilities Available?	☐	☐	☐

Decontamination Methods Being Used

___ Double Suit ___ HEPA vac. ___ Other

___ Shower ___ None

Recommendations to Client:

Signature of Person Completing Form: _____

Routing: Project Manager, Field File, Masterfile, Other_____

Field Book:_____. Attach for any additional observations, work conducted.

STANDARD OPERATING PROCEDURES:
LEAD-BASED-PAINT SURVEY

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1300 West Canal Street
Milwaukee, WI 53233
414-643-4200

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LEAD-BASED-PAINT SURVEY
STANDARD OPERATING PROCEDURES

1. INTRODUCTION

The Sigma Group, Inc. (Sigma) Lead-Based-Paint Survey Standard Operating Procedures (SOP) have been developed to document procedures and tasks associated with paint assessments and in certain instances, to assist Sigma personnel with complying with lead-based paint (LBP) related rules and regulations. Unique situations requiring further definition or actions may be encountered which are not discussed in this SOP. In these instances, discuss the specific situation with the project manager to determine the appropriate course of action.

The LBP Survey SOP includes the following sections:

- Introduction;
- Background;
- Regulatory Discussion;
- Equipment;
- Methodology;
- Inspection Procedures; and
- Report Format.

2. BACKGROUND

In Wisconsin, LBP is defined as paint containing greater than 0.06% lead by weight or greater than 1.0 milligrams of lead per square centimeter (mg/cm^2). Lead is a heavy metal and is used as pigment, with lead(II) chromate (PbCrO4, "chrome yellow") and lead(II) carbonate (PbCO3, "white lead") being the most common. Lead is added to paint to speed drying, increase durability, retain a fresh appearance, and resist moisture which causes corrosion. Paint with significant lead content is still used in industry, especially in applications where paint adhesion and corrosion are a problem. For example, LBP is sometimes used to paint roadways, parking lot lines, and in military and heavy equipment applications.

The year of building construction can provide information as to the likelihood that LBP will be present in the building. Facilities older than 1940 will likely have LBP, facilities constructed between 1940 and 1978 may contain LBP, while facilities constructed after 1978 are less likely to contain LBP. However, it should be noted that LBP and other lead-bearing materials (LBM) might be present in facilities of all ages.

Exposure to lead can lead to pregnancy complications, high blood pressure, nervous system disorders, and memory and concentration problems. Lead

exposure for children under age six whose bodies are still developing can lead to nervous system damage, hearing loss, stunted growth, hyperactivity, and delayed development.

A common misconception related to lead exposure is that the cause of lead exposure/poisoning is the ingestion of paint chips containing lead. In fact, the most common route of childhood lead exposure is through ingestion of lead dust through normal hand-to-mouth contact during which children swallow lead dust dislodged from deteriorated paint or leaded dust generated during remodeling or painting.

3. REGULATORY DISCUSSION

Paint containing greater than 0.06% (600 ppm) lead was banned for residential use in the United States in 1978 by the U.S. Consumer Product Safety Commission (16 Code of Federal Regulations CFR 1303). The Wisconsin Administrative Code HFS 163 defines LBP as paint or any other surface coating material containing more than 1% lead by weight or more than 0.7 milligrams lead per square centimeter. The threshold for paint to be considered LBP in Wisconsin is lower than the US Environmental Protection Agency (USEPA) and the US Housing and Urban Development (USHUD) definitions of LBP. The USHUD, Wisconsin Department of Natural Resources (WDNR), and the Wisconsin Department of Health Services (WDHS) regulate activities involving LBP including but not limited to inspection and assessment, renovation, abatement, and disposal.

According to the WDNR, contractors may demolish structures coated with LBP or remove their architectural components without actually removing the paint from the substrate. The WDNR does not typically consider it necessary to make a hazardous waste determination on these structural materials if the paint is not separated from the structural materials. The generator of these wastes must, however, follow the State's solid waste regulations and dispose of debris in a WDNR approved disposal facility. Loose paint chips or dust generated during demolition must be managed as if they had been mechanically removed by blasting or other means.

Additionally, the Occupational Safety and Health Administration (OSHA) regulations provided in 29 CFR 1926 require specific work practices, personal protective equipment, monitoring, and jobsite engineering controls to reduce lead exposure when conducting activities including but not limited to cutting, grinding, scraping, welding, and shot blasting of LBP and/or LBM. Federal, state, and local agencies may also regulate the presence of LBP within occupied spaces. As required by the OSHA regulations, renovation and/or demolition of a structure or portions of a structure which contains LBP and/or LBM must be conducted in a manner consistent with the requirements provided in 29 CFR 1926.

Finally, the WDHS regulates activities involving “Target Housing” and “Child-Occupied Facilities.” Target Housing is defined as a dwelling constructed prior to 1978. Chapter HFS 163 requires that lead abatement and/or lead hazard reduction activities involving LBP in target housing be conducted by certified individuals.

4. EQUIPMENT

Various tools and equipment are required to properly conduct a paint assessment. The following list provides the most common tools required in an assessment. Site conditions, scope of work, or other considerations may require additional tools and equipment to complete the survey.

- XRF instrument
- Calibration paint samples/Lead Paint Standard
- Sharp chisel
- Sample bags
- Paint pen or permanent marker
- Camera
- Flashlight
- Ladder

5. METHODOLOGY

Sigma routinely conducts paint surveys using a Thermo Scientific Niton X-Ray fluorescence (XRF) instrument. XRF analysis is nondestructive and provides a field determination of lead content within five to fifteen seconds. Only those trained in the safe use of the XRF instrument by the equipment manufacturer and licensed by the State of Wisconsin are allowed to conduct paint surveys using an XRF.

In some cases, it may be necessary to collect a paint chip for laboratory analysis. A sharp chisel shall be used to remove approximately 1 square inch of paint. Care must be taken to exclude the substrate as this will impact the results when the lead is reported in percent by the weight of sample. It may also be possible to collect a known area of paint to submit to the laboratory. When the area of paint collected is known, the results may be reported in mg/cm^2. Samples are to be sent to the laboratory under chain-of-custody for lead analysis following ASTM or other appropriate analytical methods. Sigma uses only American Industrial Hygiene Association (AIHA) National Lead Laboratory Accreditation Program (NLLAP) accredited laboratories.

6. INSPECTION PROCEDURES

The purpose of the paint assessment is to identify the presence of LBP and LBM. It is important to follow established procedures when conducting a lead survey. Documenting, mapping, labeling, sample collection, and competent project management are required to ensure a thorough and complete assessment.

In general for a pre-renovation and/or pre-demolition paint assessment, Sigma will assess concrete and masonry painted surfaces for lead content. As discussed above, concrete and masonry materials coated with LBP may require special approval for crushing and recycling. It may also be necessary to assess other painted surfaces for lead content. For project specific information, consult the project manager regarding scope of materials to assess.

6.1. Document Review and Project Kickoff Meeting

Important to the success of a project is a thorough review of the available project information and documents. Before the inspection process is initiated, the project manager must complete all appropriate sections of the Project Sheet. An example of a Project Sheet is provided in Appendix A.

The inspection process cannot be initiated until the Project Sheet is completed and the project manager meets with the inspectors. A project kickoff meeting attended by the field inspector(s), project manager and potentially the QA/QC manager, will cover the proposed scope of work in order to clearly define the boundaries of the inspection, budget, project roles and responsibilities, deliverables, deadlines, and other information pertinent to the successful completion of the paint assessment. Maps may be available for identifying building age, and structure layout.

A Site Health and Safety Plan may be required depending on the project, setting, and site-specific conditions. In general, paint assessment in an industrial or large commercial facility will likely require an SHSP while a limited paint assessment of a residential structure will not likely require an SHSP. Please consult with the project manager and/or field supervisor to see if an SHSP is required. See Section Y of Sigma's Health and Safety Program for more information on preparing a Site Health and Safety Plan.

6.2. Facility Walk Through and Mapping

Upon arriving at the project site and if a prior site visit has not been conducted, the inspectors will conduct a facility walk through in order to visually assess the facility for painted surfaces, potential health and safety hazards, and gather additional information useful for evaluating environmental risks or hazards.

During the walk through, the inspector should observe the general layout of the building. If a detailed facility map is not available, the inspector will sketch the floor plan indicating room numbers or names and approximate dimensions. Rooms will be assigned a room number. In general, a room consists of any

distinct area with a door or entry threshold. Larger areas may be broken down into more discrete sections depending upon the purpose of the inspection. First floor room number designations will begin with 100 and continue until every room on the first floor has been assigned a number. Second floor room designations will begin with 200 and continue until each room has been assigned a number. Basement room numbering will begin with B01. Subsequent floors will follow the same pattern.

The objective of creating a floor plan is to clearly indicate room numbers and sample locations. The floor plan indicating sample locations may be submitted to the CAD Department for creation of an electronic map to be included as part of the inspection report. The floor plan should be sufficient to allow the CAD Department personnel to create a digital replica of the hard copy.

6.3. Project Documentation

Observations made during the facility walk through should be documented in the inspector's field notes. Appendix B provides the Paint Sample Logsheet which must be completed during the paint assessment. Information to be provided on the logsheet includes the following:

- Sample number;
- Substrate
- Color
- Condition
- Functional area/room number;
- Location in room (floor, wall, ceiling, window frame, door frame, etc.); and
- Lead content.

A copy of the field notes should be provided to the project manager, filed in the master file, and scanned and saved in the project file on the I-drive. The inspector should maintain the original field inspection documentation.

The goal of the field notes is to enable the inspection process and sample collection activities to be recreated if necessary, by a third-party at a later date. The field observations are an important tool when preparing the asbestos inspection report. Any unusual observations or general site conditions should be included in the report.

6.4. Sample Quantity and Location Determination

The number of samples evaluated using field XRF evaluation or laboratory analysis will depend on the purpose of the inspection, project scope of work, and site-specific conditions including accessibility and painted materials present. In general, the goal of the paint assessment is to determine the presence or absence of LBP and LBM.

The actual sampling locations should be selected to represent the painted surfaces. Samples should be collected randomly, i.e. from different rooms, locations within a room, and different floors. The goal is to get a representative assessment of painted surfaces.

6.5. Paint Assessment

During the walk through, the inspector will make a field determination necessary to identify painted surfaces requiring assessment. Painted surfaces may be evaluated for lead content by using an XRF instrument or by collecting and submitting paint chip samples to a laboratory.

6.5.1. Assessment Using XRF

If the paint assessment will be conducted using an XRF instrument, the inspector will complete an internal calibration of the instrument following the manufacturer recommendations. After completing the internal instrument calibration, the inspector will verify the calibration by conducting an external calibration check using the Lead Paint Standard provided by Niton. The inspector will verify the calibration by measuring the lead concentration on the sample identified as SRM 2573 which should produce a measurement value between 0.8 and 1.2 mg/cm^2. If the XRF produces a measurement outside the acceptable range, the inspector will reboot the instrument and follow the internal calibration and external calibration verification steps. If the external calibration verification still results in a lead concentration outside the acceptable range, the inspector should call the project manager and the Radiation Safety Officer to communicate the XRF instrument status.

Once the initial calibration and external calibration verification has been successfully completed, the inspector will conduct a paint assessment as indicated by the project manager. Excerpts of the XRF instrument operating instructions are provided in Appendix C. The complete operating instructions are provided in the Niton XLp 300 Series Analyzer User Manual version 5.2/P/N 500-926 Chapter 4.

6.5.2. Paint Chip Assessment

Paint samples collected for laboratory analysis will be collected using a sharp utility knife, hammer and chisel, or other appropriate tool to collect a representative sample of the paint. If the desired analytical output is mg of lead per square centimeter (mg/cm^2), the inspector must measure the surface area of paint collected and report the value on the sample chain of custody. If the desired analytical output is percent asbestos by weight, care must be taken to minimize any collection of substrate as the addition of substrate in the sample will affect the analytical output. A representative sample will be collected and placed inside a clean sample container or plastic bag. Any dust or debris created inside an occupied facility during paint sample collection will be cleaned using either a HEPA filter-equipped vacuum or damp wipe towel.

6.6. Sample Identification/Labeling

Concurrently with sample collection, the inspector will mark the sample location on the facility map. Depending on the scope of work, the inspector may also label the actual sample location next to the point of sample collection using a

permanent marker, paint pen, or spray paint. The samples will be labeled using a standard format. The sample container will be labeled with the sample number, date, and the word “Sigma” or its symbol designation.

6.7. Visual Assessment

A visual assessment of the paint will be conducted during the sampling activities. The general condition of the material, approximate quantity, and any other unusual observations will be documented in the field notes.

6.8. Substrate Patching

The project scope of work should indicate whether substrate patching is required. Depending on building use, occupancy, and scope of work, it may also be necessary to patch holes created during paint sampling of walls, floors, and ceilings. Sigma will use only non-asbestos-containing materials for any field patching.

6.9. Post-Field Inspection

Prior to leaving the site, the field inspectors will summarize the daily activities in a field notebook. A field inspector will call the project manager indicating the inspection progress, any unusual field observations, number of samples analyzed and/or collected if any, and sample submittal timeline as appropriate. The project manager may provide additional instructions regarding inspection and sampling activities.

Contacting the project manager prior to leaving the site will provide the inspectors with an opportunity to verbally communicate field activities to the project manager. Problems encountered during the inspection process, inaccessible areas, and other items can be discussed. The project manager may also communicate additional instructions or changes in the scope of work.

6.10. Chain of Custody

The laboratory conducting the lead analysis will supply the chain of custody. Each laboratory chain of custody is different. See the project manager with questions on how to complete the chain of custody. In general, the chain of custody will include the following information:

- Client name and address (The Sigma Group, 1300 West Canal Street, Milwaukee, WI 53233);
- Project number;
- Date of sample collection;
- Analysis method requested;
- Signature of the person releasing the samples for shipment and analysis;
- Turn around time;
- Billing information; and
- Sample description and location (provided on Paint Sample Logsheet).

The inspector is responsible for ensuring that each sample container is appropriately labeled with the sample number, the word “Sigma” or symbol designation and the sampling date. Prior to sending the samples to the laboratory, the project manager will verify the material sample descriptions, number of samples collected of each homogenous material, and the chain of custody. Sigma will submit the following documents along with the bulk material samples:

- Laboratory chain of custody; and
- Sigma Paint Sample Logsheet.

6.11. Sample Shipment

Sigma uses UPS, Federal Express, USPS, and any other valid carrier to ship samples to laboratories for analysis. When shipping material samples, provide the person completing the shipping papers with the project name and number, laboratory mailing address, and copy of the chain of custody. Include an original signed chain of custody inside the shipping container. Use appropriate packing materials to make sure the samples are not damaged during shipment.

6.12. Post Inspection Meeting

Following completion of the field inspection, the project manager will schedule a meeting with the inspectors to review the field notes, inspection logsheets, sample chain of custody, and maps.

7. REPORT FORMAT

Sigma uses a standard report format to ensure accuracy and consistent quality. The project scope of work and the project manager may require variations to the report format. See QA/QC personnel for the most current LBP assessment report format. At a minimum, the report will include the following topics:

- Introduction
- Background
- Methodology
- Summary of Results
- Recommendations
- Qualifications of Report
- Table(s)
- Figure(s)

Appendix A
Example Project Sheet

SIGMA ENVIRONMENTAL SERVICES, INC.

ASBESTOS / LEAD / HAZARDOUS MATERIAL ASSESSMENT PROJECT FORM

Project # _____ Date: _____

Client Name: _____

Project Location: _____

Inspection Type:

- ☐ Asbestos
- ☐ Lead-Based Paint
- ☐ Supplemental Environmental Assessment

Purpose:

- ☐ Demolition
- ☐ Renovation
- ☐ Other _____

Laboratory Analytical:

- ☐ IATL ☐ EMSL Turnaround Time 1 Day, 3 Day, 5 Day, 7 Day
- ☐ Micro-Analytical ☐ Other _____

		Name	Responsibility
Project Team:	Client Manager		facility walkthrough, final report review, client contact
	Project Manager		facility walkthrough, fld notes QA/QC, coordinate completion of report
	QA/QC		review final report prior to issuance
	Field Inspector		field documentation, sample collection, drawing review
	Field Inspector		field documentation, write report
Budget:	Field Inspection		hours per Field Inspector (includes prep, travel onsite)
	Report		total hours
	Project Management		hrs (includes report writing time)

		Date		Date
Project Schedule:	Project Kickoff Meeting		Field Inspection	
	Post Field Work Meeting		Analytical	
	Draft Report: Asbestos		Final Report: Asbestos	
	Lead		Lead	
	SEA		SEA	
Site Safety Plan:	Review and Signatures			

Other:

	YES	NO
1. Read proposed scope of work	☐	☐
2. Floor plans available	☐	☐
3. Map area according to functional spaces. Document presence and quantity of ASB, LBP and SEA (as appropriate) according to functional spaces	☐	☐
4. Employ destructive investigation methods to identify hidden materials	☐	☐
5. Collect at least 3 samples of each material and 3, 5, or 7 samples of surfacing if project is located in the City of Milwaukee	☐	☐
6. Inspect all outside structures	☐	☐
7. Collect paint samples for asbestos content - **only textured or heat resistant paints**	☐	☐
8. Layer drywall and joint compound when performing PLM analysis	☐	☐
9. Include electrical and/or boiler system(s) in scope of inspection	☐	☐
10. Positive stop for asbestos analysis.	☐	☐
11. Mark sample locations with paint and marker **(Tape and Marker)**	☐	☐
12. Photo-document all sampled locations	☐	☐
13. Provide project manager with field notes each day and scan all field notes, forms and maps	☐	☐

Routing:

Dave Scherzer (mandatory)	X		
Randy Boness	X	Steve Marcinkowski	
Mark Krueger	X	Project Manager	
Jeff Senn (mandatory)	X	Master File	X

Appendix B
Paint Sample Logsheet

SIGMA ENVIRONMENTAL SERVICES, INC.

PAINT SAMPLE LOGSHEET

Project #
Project Name:
Project Location:
Circle method: XRF CHIP

Date:
Field Personnel:
Field Book #

Page: of

Sample Number	Substrate	Color	Condition	Functional Area/Room Number	Location in Room	Lead Content/ Area (cm^2)
Calibration	Standard	Opening Calibration	---	Time:	---	
Calibration	Standard		---	Time:	---	
Calibration	Standard		---	Time:	---	
Calibration	Standard	Closing Calibration	---	Time:	---	
01						
02						
03						
04						
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25						

Appendix C
XRF Operating Instructions

Chapter 4 Pb Paint Mode

Using Pb Paint Mode

Your NITON XLp-300 Series Lead-in-Paint Analyzer is designed to detect and quantify the amount of lead present in painted surfaces. Your analyzer also tracks important information about your site readings using the integrated bar-code scanner or the analyzer's control panel.

Lead Paint inspection guidelines and protocols are specific to the country and state in which the testing is being performed. For the HUD testing guidelines and the NITON Analyzer Performance Characteristic Sheet (PCS), please go to www.hud.gov

The Pb Paint Mode Menu

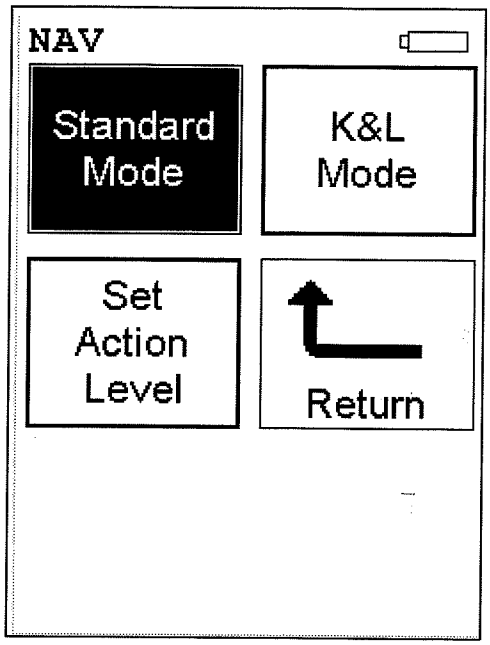
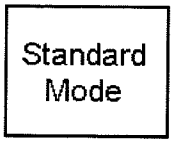
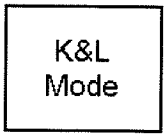


Figure 4-1. The Pb Paint Mode Menu

All NITON XLp-300 Series Lead-in-Paint Analyzer Mode functions are accessible from the Pb Paint Mode Menu and subsidiary menus. Each of the instrument functions represented by an icon on the **Pb Paint Mode Menu** screen may be selected by choosing the appropriate icon. When one of these **Pb Paint Mode Menu** icons is selected, the function specific sub-menu appropriate to that icon will be displayed.



The **Standard Mode** icon allows you to select the Lead-in-Paint **Standard Mode**. **Standard Mode** is the default mode selection, and uses only L-shell fluorescence for very fast readings.



The **K+L Mode** icon allows you to select the Lead-in-Paint K+L Mode. K+L Mode uses both the K and L-shell fluorescence for readings, and is better at detecting deeply buried lead paint layers.

The Set Action Level icon allows you to set the action level for Lead-in-Paint to match the official action level of your locality.

The Standard Mode Menu

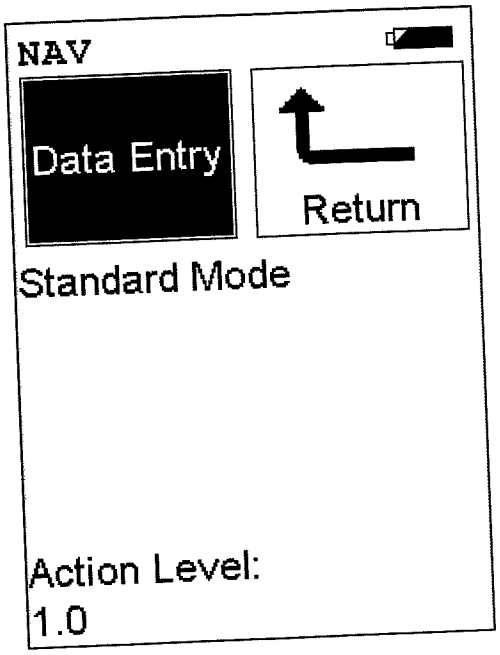


Figure 4-2. The Standard Mode Menu

All NITON XLp Standard Mode functions are accessible from the Standard Mode Menu and subsidiary sub-menus. From the **Standard Mode Menu**, you can immediately initiate a sample test using the proper preconditions for operation, enter data about your sample using the **Data Entry** icon, or return to the **Main Menu**.

Select the **Data Entry** icon from the **Standard Mode Menu**to go to the "The Data Entry Screens" on page 4-10, to input data about the sample which you are testing. The data you enter will be associated with the next sample you test.

The K+L Mode Menu

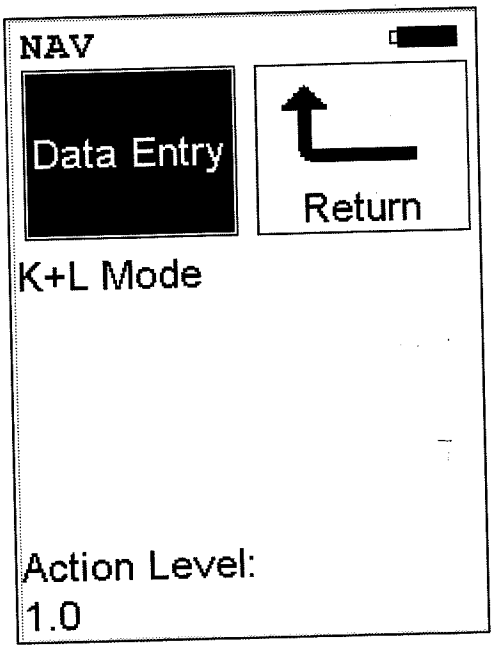


Figure 4-3. The K+L Mode menu

All NITON XLp K+L Mode functions are accessible from the K+L Mode Menu and subsidiary sub-menus. From the **K+L Mode Menu**, you can immediately initiate a sample test using the proper preconditions for operation, enter data about your sample using the **Data Entry** icon, or return to the **Main Menu**.

Select the **Data Entry** icon from the **K+L Mode Menu**to go to the "The Data Entry Screens" on page 4-10, to input data about the sample which you are testing. The data you enter will be associated with the next sample you test.

The Set Action Level Screen

The Set Action Level Screen is accessible from the Paint Mode Menu. When the Set Action Level icon is selected, the Set Action Level Screen will be displayed.

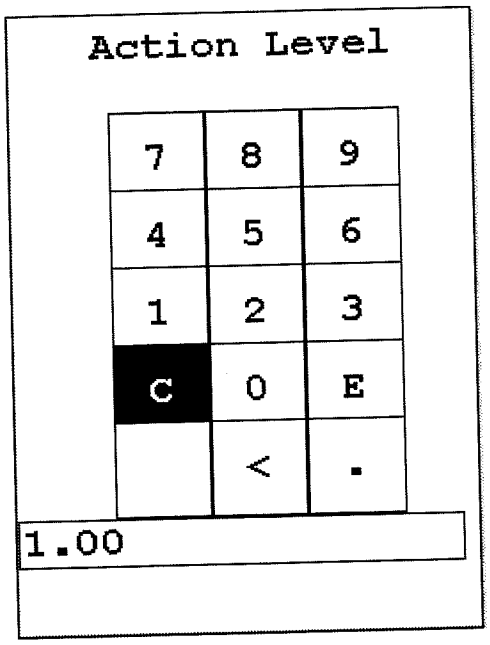


Figure 4-4. The Set Action Level Screen

To change the preset Action Level to match the Action Level set by your locality, select the "C" key from the Virtual Numeric Keypad to clear the current Action Level value, select the new Action Level value using the numeric keys, then select "E" to enter the new Action Level value. The Action Level will be changed to the new value.

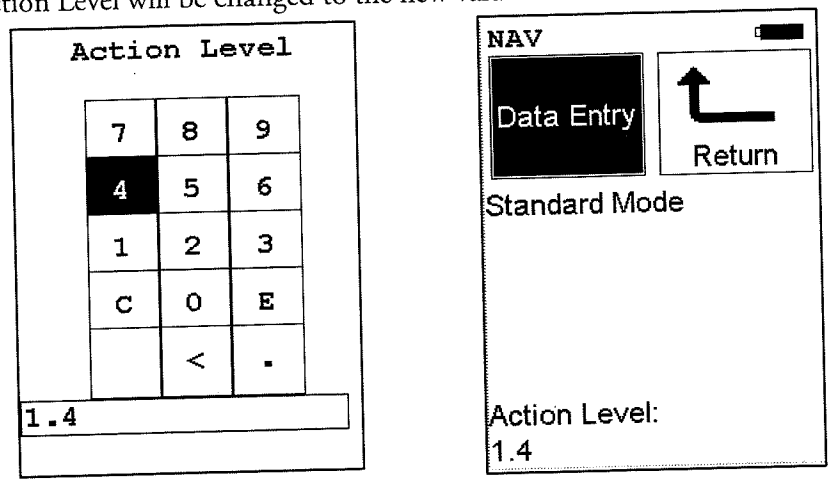


Figure 4-5. Changing the Action Level

Taking a Reading

CAUTION After being powered on, the NITON 300 Series Analyzer will perform an internal re-calibration before an analysis is initiated. It is recommended that you let your instrument warm up for ten minutes after start up, before testing is begun. ♦

There are five different methods of operation for taking a sample measurement, and your analyzer will be configured to use one of those methods, depending on the regulatory requirements of your locality. These methods are:

- Trigger-Only method. With the Trigger-Only method, you only need to place the measurement window close to the sample to be analyzed and pull the trigger for sample analysis to be initiated.

- Trigger-and-Proximity-Sensor method. With the Trigger-and-Proximity-Sensor method, you must place the measurement window against the sample to be analyzed to engage the proximity sensor on the front of the instrument, then pull the trigger for sample analysis to be initiated.

- Momentary-Trigger-Touch-and-Proximity-Sensor method. With the Momentary-Trigger-Touch-and-Proximity-Sensor method, you must place the measurement window against the surface to be analyzed to engage the proximity sensor on the front of the instrument, then pull the trigger.

- The trigger may be released and the reading will continue until you release the proximity button, or other criteria (such as Max Time) are reached.

- Trigger-and-Interlock method. With the Trigger-and-Interlock method, you need to place the measurement window close to the sample to be analyzed, press and keep pressing the interlock button at the rear of the instrument with your free hand, then pull the trigger for sample analysis to be initiated.

- Trigger-Interlock-and-Proximity-Sensor method. With the Trigger-Interlock-and-Proximity-Sensor method, you must place the measurement window against the sample to be analyzed to engage the proximity sensor on the front of the instrument, press and keep pressing the interlock button at the rear of the instrument with your free hand, then pull the trigger for sample analysis to be initiated.

With any of these methods, analysis will stop if any one of the preconditions are violated. For example, with the Trigger-Interlock-and-Proximity-Sensor method, if the trigger or the Proximity Sensor or the Interlock is released, the reading will stop immediately, and the shutters will close.

After your NITON XLp analyzer is calibrated, initiate a sample reading using the appropriate method. If you attempt to initiate a sample reading using a different method, the analyzer will inform you that one or more of the preconditions need to be met in order for sample analysis to begin.

Note The three LED lights will blink during calibration or whenever there is a shutter open. ♦

WARNING! The preconditions for operation must be continued for the duration of the reading. If the preconditions are violated, all the shutters will close, and the measurement will end. The three LED lights will stop blinking, the shutters will close, and the measurement will end. The flashing of the LED lights is not synchronized to minimize power consumption. ♦

WARNING! The three LED warning lights are designed to blink only during a measurement, where one or more of the shutters are open and the trigger depressed. If the LED lights blink at any other time, disconnect the battery pack immediately, place the instrument in its shielded holster, place the holster in the shielded carrying case, and call Thermo Electron Corporation's Service Department in the United States, toll free, at (800) 875-1578, or outside the United States, at +1-978-670-7460, or your local Authorized NITON Analyzers Service Center. ♦

Your NITON Analyzer will display the Results Screen throughout the duration of each reading, The Results Screen is updated regularly throughout the reading. When the reading is complete, a final screen update will appear, and your NITON analyzer will display the final results of the measurement which has just been completed.

Standard Mode Results Screen

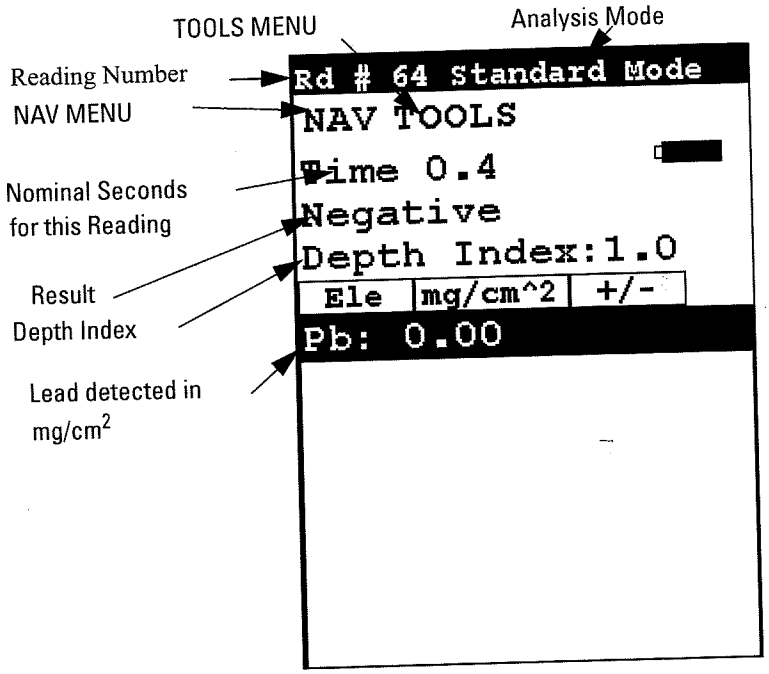


Figure 4-6. Standard Mode Results Screen

Before the analyzer has reached a determination, the result will be shown as "Inconclusive". Your analyzer will beep twice when a result is reached then terminate the reading. The display will change from "Inconclusive" to show the result, either "Positive" for lead detected above the action level, or "Negative" for no lead or lead below the action level. It will also display the amount of lead detected in mg/cm^2.

The Depth Index is a numerical value indicating the amount of non-leaded paint covering the lead (if any) detected by the analyzer.

- A Depth Index of less than 1.5 indicates a reading very near the surface.
- A Depth Index between 1.6 and 4.0 indicates a moderate depth.
- A Depth Index of greater than 4.0 indicates a deeply buried reading.

K+L Mode Results Screen

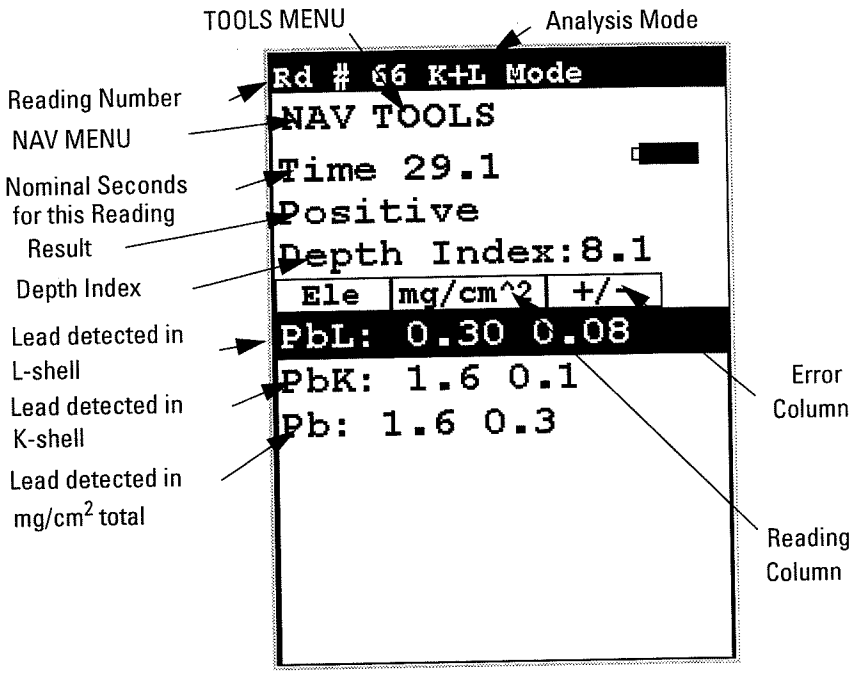


Figure 4-7. K+L Mode Results Screen

The K+L Mode Results Screen will show the same basic display throughout the reading. Your analyzer will beep twice to indicate it has reached a conclusion, and the Result field will change from "Inconclusive" to "Positive" or "Negative", but the reading will continue for as long as you continue to hold down the trigger and depress the Proximity Sensor.

The K+L Results Screen shows the reading results and error for both K and L-shell readings. The "Lead Detected in mg/cm^2 total" field is the result of the judgement of your analyzer as to which reading, K or L-shell, best represents the true condition.

The **Depth Index** is a numerical value indicating the amount of non-leaded paint covering the lead (if any) detected by the analyzer.

- A Depth Index of less than 1.5 indicates a reading very near the surface.
- A Depth Index between 1.6 and 4.0 indicates a moderate depth.
- A Depth Index of greater than 4.0 indicates a deeply buried reading.

The Data Entry Screens

The Data Entry Screens allow you to set the values for various parameters tracked by the system along with the actual analysis results. This screen allows you to input data in several different fields, or categories, concerning your sample, in several different ways:

- By selecting the Virtual Keyboard button and typing the parameter in using the **Virtual Keyboard**.
- By scanning in the parameter name using the integrated bar code scanner.
- By creating a new, or editing your analyzer's existing, '.ndf' file through the NDT program. You can then select from the various custom options you have created using the Drop-down List button.

These fields are saved along with the subsequent reading, and allow you to associate important information about the sample directly with the reading, so that you have a full description of the sample tied into the reading itself.

These parameters all describe the particular test target to be analyzed. The location of the target in the site, the type of target, the surface and substrate, the condition of the surface, and the inspector performing the test are some of the parameters tracked by the analyser.

Navigating the Data Entry Screen

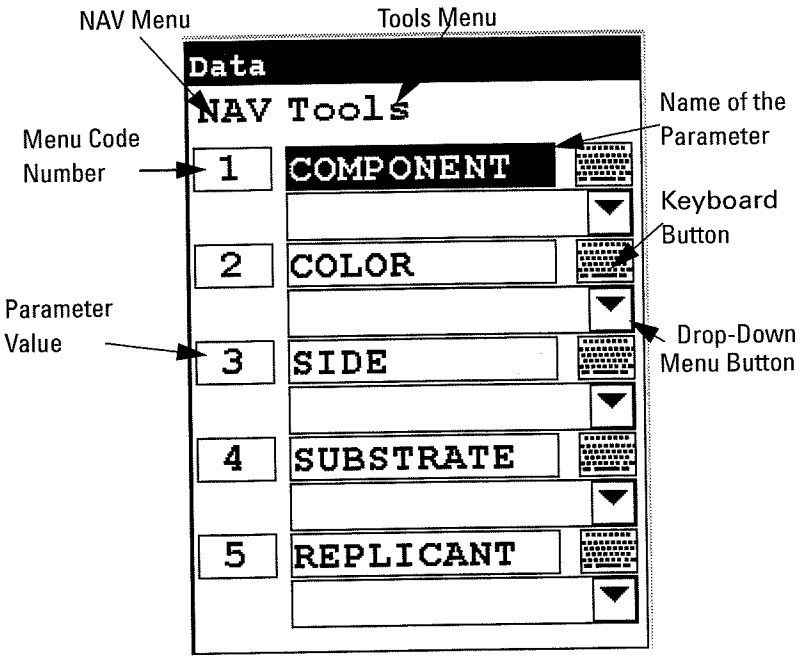


Figure 4-8. Navigating the Data Entry Screen

Above is a sample of the Data Entry Screen. To navigate through the Data Entry Screen and select your parameter settings, you can use the touch screen display or 4-way touch pad and control panel buttons.

Navigating the Data Entry Screen

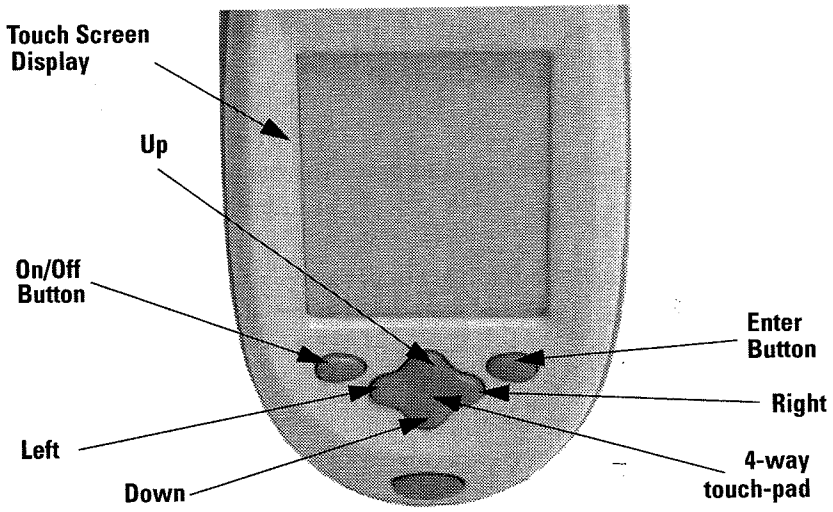


Figure 4-9. The Control Panel

The following description of screen navigation using the control panel assumes that the analyzer is held so that the display is held upright as in Figure 4-9.

- To move from column to column, use the Right and Left portion of the 4-way touch pad.
- To move from row to row, use the Up and Down portions of the 4-way touch pad.
- To select the highlighted option, press the Enter button on the control panel.

The *Data Entry* Screen is divided into sections of 5 setting parameters. By using the Down portion of the 4-way touch pad when you are on the last row of a section, the display will change to the next section. By using the Up portion of the 4-way touch pad when you are on the first row of a section, the display will change to the previous section.

By selecting the *On/Off* button, you can exit the *Data Entry* Screen.

Using The Data Entry Screen

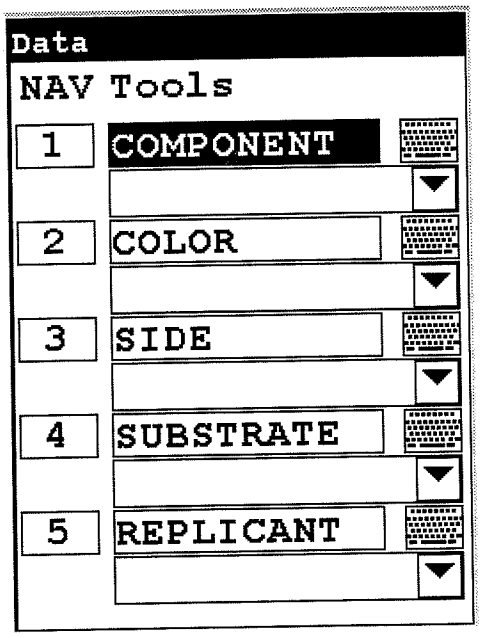


Figure 4-10. The Data Entry Screen - First Section

This is the first section of the Data Entry Screen. There are five parameters in this section.

- Selecting Component allows you to input the reading location Component parameter.
- Selecting Color allows you to input the reading location Color parameter.
- Selecting Side allows you to input the reading location Side parameter.
- Selecting Substrate allows you to input the reading Substrate parameter.
- Selecting Replicant allows you to input the reading Replicant parameter.

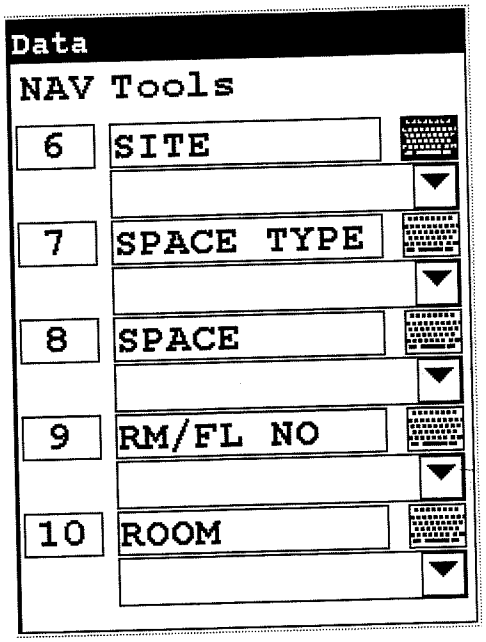


Figure 4-11. The Data Entry Screen - Second Section

This is the second section of the Data Entry Screen. There are five parameters in this section.

- Selecting Site allows you to input the reading Site parameter.
- Selecting Space Type allows you to input reading the reading location Space Type parameter.
- Selecting Space allows you to input the reading location Space parameter.
- Selecting Rm/Fl No allows you to input the reading location Rm/Fl No parameter.
- Selecting Room allows you to input the reading Room parameter.

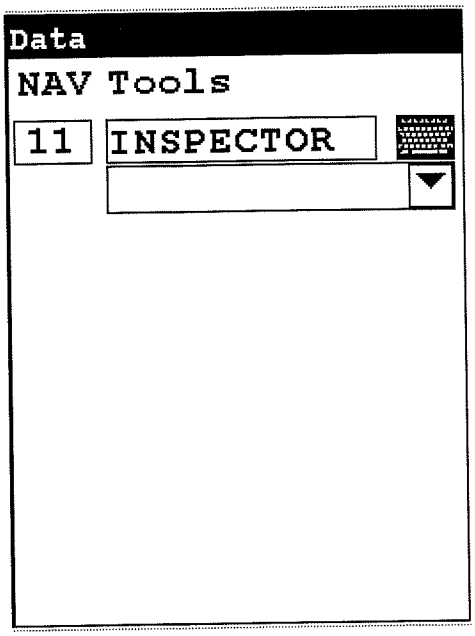


Figure 4-12. The Data Entry Screen - Third Section

This is the third section of the Data Entry Screen. There is one parameter in this section.

- Selecting Inspector allows you to input the reading Inspector parameter.

- Selecting the Menu Code Number will initiate a bar code scan to input pre-printed bar code parameter values

- Selecting the Drop-Down Menu Button will access the particular Drop-Down Menu for that parameter, allowing you to select the parameter value from a pre-determined list.

- Selecting the Keyboard button allows you to input a parameter value as required using the Virtual Keyboard.

Appendix B
Quality Assurance/Quality Control Plan

November 2018
Portage Canal – Segment 2 Remedial Design

ANCHOR QEA

Quality Assurance and Quality Control Plan

Portage, Wisconsin
BRRTS No.: 02-11-577055

Prepared for Wisconsin Department of Natural Resources

November 2018
Portage Canal – Segment 2 Remedial Design

Quality Assurance and Quality Control Plan

Portage, Wisconsin
BRRTS No.: 02-11-577055

Prepared for
Wisconsin Department of Natural Resources
3911 Fish Hatchery Road
Fitchburg, Wisconsin 53711

Prepared by
Anchor QEA, LLC
290 Elwood Davis Road, Suite 340
Liverpool, New York 13088

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Quality Assurance and Quality Control Plan
Pre-Design Investigation
Portage Canal – Segment 2
Portage, Wisconsin

Prepared By:
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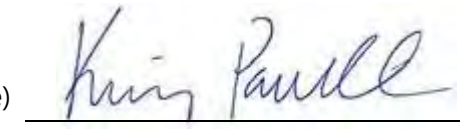
Project Manager (Signature) 

Kim Powell
Name/Date November 7, 2018

Project QA/QC Manager (Signature)

Delaney Peterson
Name/Date November 7, 2018

1 Introduction

This QA/QC Plan establishes the quality assurance objectives for conducting sampling and evaluation activities described in the Field Sampling Plan (FSP). The analytical methods and quality assurance procedures described here will be followed by the Wisconsin Department of Natural Resources (DNR) and its contractors during sample collection activities described in the FSP.

The goal of the QA/QC Plan is to ensure that data of sufficiently high quality are generated to support the project data quality objectives (DQOs). The QA/QC Plan will address project management responsibilities, sampling and analytical procedures, assessment and oversight, and data reduction, validation, and reporting.

The QA/QC Plan was prepared following U.S. Environmental Protection Agency's *Guidance for Quality Assurance Project Plans* (USEPA 2002). Analytical quality assurance/quality control (QA/QC) procedures were also developed based on the analytical protocols and QA guidance of USEPA's *Test Methods for the Evaluation of Solid Waste: Physical/Chemical Methods, 3rd Edition* (USEPA 1986), and the *U.S. EPA Contract Laboratory Program National Functional Guidelines for Data Review* (USEPA 2014a, 2014b, 2016).

1.1 Document Organization

USEPA guidance (USEPA 2002) specifies four groups of information that must be included in a QA/QC Plan (Project Management, Data Generation and Acquisition, Assessment and Oversight, and Data Validation and Usability). Each group comprises several QA/QC Plan elements. USEPA's guidance provides a suggested outline for the QA/QC Plan elements. However, the guidance indicates that certain elements may not be applicable to a given project, and that the elements need not be presented in the order presented in the guidance.

The remainder of this QA/QC Plan is organized into the following sections:

- Section 2 – Project Management
- Section 3 – Data Generation and Acquisition
- Section 4 – Assessment and Oversight
- Section 5 – Data Validation and Usability
- Section 6 – References

2 Project Management

This section identifies key project personnel, describes the rationale for conducting the investigation studies, identifies the studies to be performed and their respective schedules, outlines project DQOs and criteria, lists training and certification requirements for sampling personnel, and describes documentation and record keeping procedures.

2.1 Project Organization

Responsibilities of the team members, as well as laboratory project managers, are described in the following sections. The project organization and the key personnel are shown schematically in Figure 1. Contact information for each member of the project is provided in Table 1.

Figure 1
Organizational Chart

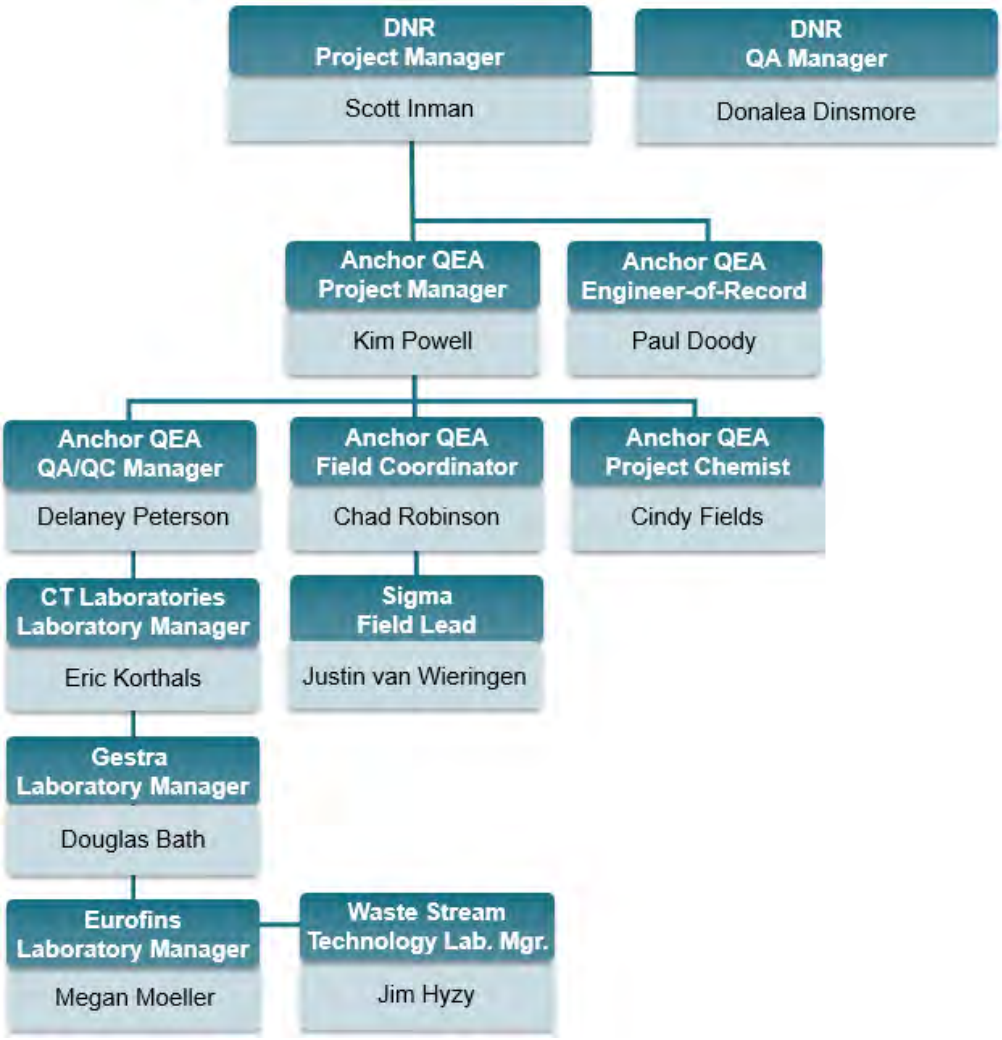


Table 1
Key Project Management Personnel Contact Information

Affiliation	Title	Name	Phone Number
Wisconsin Department of Natural Resources	Project Manager	Scott Inman	(608) 273-5613
	QA Manager	Donalea Dinsmore	(608) 266-1926
Anchor QEA, LLC	Project Manager	Kim Powell	(315) 414-2014
	Engineer-of-Record	Paul Doody	(315) 414-2044
	Field Coordinator	Chad Robinson	(231) 742-2735
	QA/QC Manager	Delaney Peterson	(360) 715-2707
	Project Chemist	Cindy Fields	(206) 903-3394
The Sigma Group	Project Manager	Kristin Kurzka	(414) 643-4127
	Field Lead	Justin van Wieringen	(414) 643-4128
CT Laboratories	Laboratory Project Manager	Eric T. Korthals	(608) 356-2760 ext. 19
Eurofins Lancaster Laboratories Environmental (ELLE)	Laboratory Project Manager	Megan Moeller	(717) 556-7261
Gestra	Laboratory Project Manager	Douglas Bath	(414) 933-7444
Waste Stream Technology, Inc	Laboratory Project Manager	Jim Hyzy	(716) 284-0431

2.1.1 Project Planning and Coordination

The Project Manager, Kimberly Powell of Anchor QEA, will act as the direct line of communication between contractors and the DNR and is responsible for implementing activities described in this QA/QC Plan. The Project Manager will also be responsible for production of project deliverables, and performing the administrative tasks needed to ensure timely and successful completion of the investigation. The Project Manager will also be responsible for resolving project concerns or conflicts related to technical matters.

2.1.2 Field Activities

Chad Robinson of Anchor QEA, or his designee, will serve as the Field Coordinator (FC). He will provide direction on field sampling logistics, personnel assignments, and field operations and will work closely with Justin van Wieringen of Sigma (Field Lead) on these tasks. The FC will supervise the field collection of samples and will be responsible for ensuring accurate positioning and recording of sample locations, depths, and identification; ensuring conformity to sampling and handling requirements, including field decontamination procedures; physical evaluation and documentation of the samples; and delivery of the samples to the laboratory. He will ensure that the samples are stored under proper conditions while in its custody until delivery to the laboratory. The FC will be

responsible for summarizing field sampling activities. This summary will include details of the sampling effort, sample preparation, sample storage and transport procedures, field quality assurance, and documentation of any deviation from this QA/QC Plan.

The sampling will be completed by Anchor QEA and its subconsultants as described in the FSP. Subconsultants will follow the QA/QC and analytical protocols established in this QA/QC Plan.

2.1.3 Quality Assurance/Quality Control Management

Delaney Peterson of Anchor QEA, or her designee, will serve as QA/QC Manager for this project and will be responsible for the coordination with the analytical laboratories and field team. She will perform oversight for both the field sampling and laboratory programs. She will be kept fully informed of field program procedures and progress during sample collection and laboratory activities during sample preparation. She will record and correct any activities that vary from this QA/QC Plan. Upon completion of the sampling and analytical program, she will review the laboratory QA/QC results and incorporate the findings into a data summary report.

2.1.4 Laboratory Preparation and Analyses

Cindy Fields of Anchor QEA, or her designee, will serve as the Project Chemist (PC) for the project and will be responsible for review of laboratory reports and case narratives describing any anomalies and exceptions that occurred during analysis. Any QA/QC problems will be brought to the attention of the Anchor QEA QA/QC Manager as soon as possible, to discuss issues related to the problem and to evaluate potential solutions. The PC will be responsible for performing or overseeing the validation of the data according to the requirements of the QA/QC Plan and incorporating the results of the validation into the final project database.

Each analytical laboratory will be responsible for physical and chemical analyses of sediment samples and will ensure that the submitted samples are handled and analyzed in accordance with the selected analytical testing protocols and QA/QC requirements, as well as the requirements specified in this QA/QC Plan. The laboratories will provide certified, pre-cleaned sample containers and sample preservatives, as appropriate, and prepare a data package containing the analytical and QA/QC results.

The Laboratory Project Managers will oversee laboratory operations associated with the receipt of the environmental samples, chemical/physical analyses, and laboratory report preparation for this project. The Laboratory Project Managers will review the laboratory reports and prepare case narratives describing any anomalies and exceptions that occurred during analysis. The laboratory managers will also notify the project QA/QC manager of any QA/QC problems when they are identified to allow for quick resolution.

2.2 Problem Definition/Background

The FSP describes the investigations that will be performed to evaluate Portage Canal. A detailed project overview, site description, project figures, and supporting field sampling details are provided in the FSP. The data being acquired for these investigations will be used to address the Data Quality Objectives as detailed in the FSP.

2.3 Project/Task Description and Schedule

Sampling activities described in the FSP will be initiated following DNR approval of the FSP and this QA/QC Plan. The anticipated schedule for the field investigation activities is described in calendar days as follows:

- Implementation of FSP and QA/QC Plan: Initiate field work within 3 weeks from Notice to Proceed
- Field Sampling: 4 weeks
- Laboratory data analysis and data validation: 21 days (standard turnaround time) from completion of the field sampling

2.4 Data Quality Objectives and Criteria

The DQOs for this project are to develop and implement procedures that will ensure the collection of representative data of known, acceptable, and defensible quality to achieve the project objectives described in the FSP. The quality of the laboratory data is assessed by precision, accuracy, representativeness, comparability, and completeness (the "PARCC" parameters; see Section 3.4.2).

2.5 Special Training Requirements/Certifications

For sample preparation tasks, it is important that field personnel are trained in standardized data collection requirements, so that the data collected are consistent among the field crew. Field personnel must be fully trained in the collection and processing of surface sediment and subsurface sediment core samples; conducting in situ geotechnical tests; decontamination protocols; visual inspections; and chain-of-custody (COC) procedures. Training for staff will be provided through on-the-job training and attendance at internal and external seminars and workshops on relevant subject matter. The Anchor QEA FC will be responsible for ensuring that staff and any contractors have the necessary training required to conduct the field investigation procedures described in the FSP and this QA/QC Plan.

In addition, the 29 Code of Federal Regulations (CFR) 1910.120 Occupational Safety and Health Administration (OSHA) regulations require training to provide employees with the knowledge and skills enabling them to perform their jobs safely and with minimum risk to their personal health. Sampling personnel will have completed the 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training course and 8-hour refresher courses, as necessary, to meet the

OSHA regulations. Anchor QEA's project Health and Safety Officer, Chris Torell, is responsible for the completion and retention of HAZWOPER certification. Certifications will be maintained in Anchor QEA's project files.

2.6 Documentation and Records

This project will require central project files to be maintained at Anchor QEA. Project records will be stored and maintained in a secure manner. Each project team member is responsible for filing necessary project information or providing it to the person responsible for the filing system. Individual team members may maintain files for individual tasks, but must provide such files to the central project files upon completion of each task. Hard copy documents will be kept on file at Anchor QEA or at a document storage facility throughout the duration of the project, and electronic data will be maintained in the database at Anchor QEA and backed up regularly as part of routine file maintenance.

2.6.1 Field Sampling Plan and Quality Assurance and Quality Control Plan Updates

Revisions or updates to the FSP or QA/QC Plan will be provided to personnel listed on the distribution list on the QA/QC Plan. The Anchor QEA PM will be responsible for sending revisions or updates in a timely manner.

2.6.2 Field Records

Documents generated during the field effort are controlled documents that become part of the project file. Field team members will keep a daily record of significant events, observations, and measurements on field logs developed specifically for each activity. The field logs will be the main source of documentation for field activities and will be maintained by the FC.

2.6.3 Sample Collection Records

The sampling documentation will contain information on each sample collected and will include, at a minimum, the following information:

- Project name
- Field personnel on-site
- Facility visitors
- Weather conditions
- Field observations
- Maps and/or drawings
- Date and time sample collected
- Sampling method and description of activities

- Identification or serial numbers of instruments or equipment used
- Deviations from the QA/QC Plan and FSP
- Conferences associated with field sampling activities

Entries for each day will begin on a new form. The person recording information must enter the date and time and initial each entry. Additional specific field reporting requirements and checklists for each study are defined in the SAP. In general, sufficient information will be recorded during sampling so that reconstruction of the event can occur without relying on the memory of the field personnel.

The field forms will be on water-resistant, durable paper to prevent deterioration of the project record due to adverse field conditions, taking into consideration specific requirements during sampling[1]. Notes will be taken in indelible, waterproof blue or black ink. Errors will be corrected by crossing out with a single line, dating, and initialing. Each form will be marked with the project name, number, and date. The field forms will be scanned into Anchor QEA's project file directory as is convenient during the sampling event or upon completion of each sampling event.

Sample collection tables will be prepared prior to each sampling program. The checklist will include proposed coordinates of each location, the sampling scheme, and whether any QC samples are to be collected.

2.6.4 Analytical and Chemistry Records

The laboratory will retain analytical data records. Additionally, Anchor QEA will retain them in central project files. For chemical analyses, the data reporting requirements will include those items necessary to complete data validation, including copies of raw data. The laboratories will prepare a detailed laboratory data package documenting the activities associated with the sample analyses. Laboratory data packages will contain information necessary to perform a Stage 4 data validation per USEPA guidelines (USEPA 2009), however, Stage 4 validations will not be conducted unless the Stage 2B validations reveal errors or issues that would warrant a higher level of validation. The report includes, but is not limited to, the following information:

- **Project Narrative.** This summary, in the form of a cover letter, will discuss problems, if any, encountered during any aspect of sample preparation analyses. This summary will discuss, but not be limited to, quality control, sample shipment, sample storage, and analytical difficulties. Problems encountered, actual or perceived, and their resolutions will be documented in as much detail as appropriate.
- **Chain-of-Custody Records.** Legible copies of the COC forms will be provided as part of the data package. This documentation will include the time of receipt and condition of each sample received by the laboratory. Additional internal tracking of sample custody by the

[1] When sampling per- and polyfluoroalkyl substances (PFAS), water-resistant paper (e.g., Rite in the Rain) should not be used.

laboratory will also be documented on a sample receipt form. The form must include sample shipping container temperatures measured at the time of sample receipt.

- **Sample Results.** The data package will summarize the results for each sample analyzed. The summary will include the following information when applicable:
  - Field sample identification code and the corresponding laboratory identification code
  - Sample matrix
  - Date of sample extraction
  - Date and time of analysis
  - Weight and/or volume used for analysis
  - Final dilution volumes or concentration factor for the sample
  - Identification of the instrument used for analysis
  - Method detection and reporting limits accounting for sample-specific factors (e.g., dilution and total solids)
  - Analytical results with reporting units identified
  - Data qualifiers and their definitions
- **QA/QC Summaries.** This section contains the results of the laboratory QA/QC procedures. Each QA/QC sample analysis will be documented with the same information required for the sample results. No recovery or blank corrections will be made by the laboratory. The required summaries include, but are not limited to:
  - **Calibration Data Summary.** This summary will report the concentrations of the initial calibration and daily calibration standards, and the date and time of analysis. The response factor, percent relative standard deviation, percent difference, and retention time for each analyte will be listed, as appropriate. Results for standards used to quantify instrument sensitivity will be documented.
  - **Internal Standard Area Summary**. The stability of internal standard areas will be reported.
  - **Method Blank Analysis**. The method blank analyses associated with each sample and the concentration of compounds of interest identified in these blanks will be reported.
  - **Surrogate Spike Recovery**. This will include surrogate spike recovery data for organic analyses. The names and concentrations of the compounds added, percent recoveries (%R), and range of acceptable recoveries will be reported.
  - **Matrix Spike Recovery.** The name and concentrations of analytes added, %R, and range of acceptable recoveries will be listed. The relative percent difference (RPD) for matrix spike duplicate analyses will be included.
  - **Matrix Duplicate.** This summary will include the RPD value for matrix duplicate analyses.

  - **Laboratory Control Sample.** The name and concentration of analytes added, %R, and range of acceptable recoveries will be listed. The RPD value for laboratory control sample duplicate analyses will be included.
  - **Relative Retention Time.** This summary will include a report of the relative retention time of each analyte detected in the samples for both primary and conformational analyses.
- **Original Data.** Legible copies of the original data generated by the laboratory will include the following:
  - Sample extraction, preparation, identification of extraction method used, and cleanup logs
  - Instrument specifications and analysis logs for instruments used on days of calibration and analysis
  - Calculation worksheets
  - Reconstructed ion chromatograms for samples, standards, blanks, calibrations, spikes, replicates, and reference materials
  - Original printouts of full scan chromatograms and quantitation reports for gas chromatography (GC) and/or gas chromatography/mass spectrometry (GC/MS) samples, standards, blanks, calibrations, spikes, replicates, and reference materials
  - Enhanced spectra of detected compounds with associated best-match spectra for each sample

Instrument data shall be fully restorable at the laboratory from electronic backup. The laboratory will be required to maintain records relevant to project analyses for a minimum of 5 years. Data validation reports will be maintained in the central project files with the analytical data reports.

2.6.5 Data Reduction

Data reduction is the process by which original data (analytical measurements) are converted or reduced to a specified format or unit to facilitate analysis of the data. Data reduction requires that aspects of sample preparation that could affect the test result, such as sample volume analyzed or dilutions required, be taken into account in the final result. It is the laboratory analyst's responsibility to reduce the data, which are subjected to further review by the Laboratory Manager, the Project Chemist, the Project Manager, the QA/QC Manager, and independent reviewers. Data reduction may be performed manually or electronically. If performed electronically, software used must be demonstrated to be true and free from error.

3 Data Generation and Acquisition

Data generation and acquisition begins with the development of the rationale for locating and selecting environmental samples for analysis and ends with the generation and reporting of analytical data for those samples by the analytical laboratories.

3.1 Sampling Design

The sampling design including the rationale for locating and selecting environmental samples for analyses is detailed in the FSP.

3.2 Sampling Methods and Sample Handling Requirements

Standard operating procedures for collection of field samples are included in the Field Sampling Plan. Sampling procedures are generally consistent with USEPA protocols or other approved sample collection standards established for the site.

3.3 Analytical Methods

Analytical methods for chemical and physical analyses are listed in Tables 2 through 4. In completing analyses for this project, the laboratory is expected to meet the following minimum requirements:

- Adhere to the methods outlined in this QA/QC Plan, including methods referenced for each analytical procedure
- Follow documentation, custody, and sample tracking procedures
- Notify the project QA/QC manager of any QA/QC problems when they are identified
- Provide a detailed discussion of any modifications made to approved analytical methods
- Deliver Adobe PDF and electronic data as specified
- Meet reporting requirements for deliverables
- Meet turnaround times for deliverables
- Implement QA/QC procedures, including the DQOs, laboratory QA requirements, and performance evaluation testing requirements
- Allow laboratory and data audits to be performed, if deemed necessary

Analytical methods and RLs for proposed sample media are presented in Tables 2 through 4. Table 5 presents the field and lab QA/QC sample frequency requirements (e.g., field duplicates, matrix spikes, and laboratory control samples).

3.4 Quality Assurance and Quality Control

Field and laboratory activities must be conducted in such a manner that the results meet specified quality objectives and are fully defensible. Guidance for QA/QC is derived from the protocols

developed for USEPA SW 846 (USEPA 1986), the USEPA Contract Laboratory Program (USEPA 2014a, 2014b, and 2016), and the cited methods.

3.4.1 Field Quality Control

Anchor QEA personnel and their subcontractors will identify and label samples in a consistent manner to ensure that field samples are traceable and that labels provide the information necessary for the laboratory to properly conduct the required analyses. Samples will be placed in appropriate containers and preserved for shipment to the laboratory.

3.4.1.1 Sample Containers

The analytical lab will provide certified, pre-cleaned, USEPA approved containers for the samples (Table 7). The laboratory will maintain documentation certifying the cleanliness of bottles and the purity of preservatives provided.

3.4.1.2 Location and Sample Identification and Labels

Each sample will have an adhesive plastic or waterproof paper label affixed to the container and will be labeled at the time of collection. The following information will be recorded on the container label at the time of collection:

- Project name
- Sample identification
- Date and time of sample collection
- Preservative type (if applicable)
- Required analyses
- Sampler's name or initials

Samples will be uniquely identified with a sample identification that, at a minimum, specifies the sample matrix, sample number, sample location, and type of sample. Specific sample nomenclature will be as presented in Standard Operating Procedure (SOP) 1 – Field Records.

3.4.1.3 Sample Custody and Shipping Requirements

Samples are considered to be in one's custody if at least one of the following conditions applies:

- They are in the custodian's possession or view.
- They are in a secured location (under lock) with restricted access.
- They are in a container that is secured with official seals such that the sample cannot be reached without breaking the seals.

COC procedures will be followed for the samples throughout the collection, handling, and analysis process. The principal document used to track possession and transfer of samples is the COC form. Each sample will be represented on a COC form the day it is collected. Data entries will be made

using indelible ink pen. Corrections will be made by drawing a single line through the error, writing in the correct information, then dating and initialing the change. Blank lines or spaces on the COC form will be lined-out, dated, and initialed by the individual maintaining custody.

A COC form will accompany each cooler of samples to the analytical laboratories. Each person who has custody of the samples will sign the COC form and establish that the samples were not left unattended unless properly secured. Copies of COC forms will be retained in the project files.

Filled sample containers for chemistry and physical analyses will be stored in coolers containing ice to maintain the samples at 4°C until delivery to the analytical laboratory.

Samples will be shipped to the analytical laboratory no later than the day after collection. Samples collected on Friday may be held until the following Monday for shipment provided that this does not jeopardize any hold time requirements (Table 7). Specific sample shipping procedures are as follows:

- Each cooler or container with the samples for analysis will be hand-delivered the day of sample collection, couriered, or shipped via overnight delivery to the appropriate analytical laboratory. In the event that Saturday delivery is required, the FC will contact the analytical laboratory before 3 p.m. on Friday to ensure that the laboratory will be staffed to receive samples on a Saturday and is aware of the number of containers shipped and the airbill tracking numbers for those containers. Following shipment, the FC will confirm the samples have been received and are in good condition.
- Coolant ice will be sealed in separate plastic bags and placed in the shipping containers. Plastic bags will be doubled for overnight shipping.
- Individual sample containers will be placed in a sealable plastic bag, packed to prevent breakage, and transported in a sealed ice chest or other suitable container.
- Glass bottles and jars will be separated in the shipping container by shock-absorbent material (e.g., bubble wrap) to prevent breakage.
- The shipping containers will be clearly labeled with sufficient information (name of project, time and date container was sealed, person sealing the container, and consultant's office name and address) to enable positive identification.
- COC forms will be enclosed in a plastic bag and placed inside of the cooler.
- A minimum of two signed and dated COC seals will be placed on adjacent sides of each cooler prior to shipping.
- Each cooler will be wrapped securely with strapping tape, labeled "Glass – Fragile" and "This End Up," and will be clearly labeled with the laboratory's shipping address and the consultant's return address.

Upon transfer of sample possession to the analytical laboratory, the person transferring custody of the sample container will sign the COC form. Upon receipt of samples at the laboratory, the shipping

container seal will be broken and the receiver will sign the COC and record the condition of the samples on a sample receipt form. COC forms will be used internally in the laboratory to track sample handling and final disposition.

3.4.1.4 Field Quality Assurance Sampling

Field QA procedures will consist of following procedures for acceptable practices for collecting and handling of samples. Adherence to these procedures will be complemented by periodic and routine equipment inspection.

Field QA samples will be collected along with the environmental samples. Field QA samples are useful in identifying possible problems resulting from sample collection or sample processing in the field. The collection of field QA samples includes equipment rinsates/field blanks, and field duplicates as specified in Table 5. Field QA samples will be collected at a frequency of one per sampling event or 1 in 20 sample locations processed, whichever is more frequent.

Field QA samples will also include the collection of additional sample volume or mass to ensure that the laboratory has sufficient sample volume to run the program-required analytical QA/QC (matrix duplicate [MD]/MS/MS duplicate [MSD]) samples for analysis as specified in Table 5. Additional sample volume or mass to meet this requirement will be collected at a frequency of one per sampling event or 1 in 20 samples processed, whichever is more frequent. The sample collection team will confirm with the laboratory the appropriate extra volume or mass required for these analyses. The samples designated for MD/MS/MSD analyses should be clearly marked on the COC.

Field QA samples will be documented on the field forms and verified by the QA/QC Manager or designee.

3.4.2 Laboratory Quality Control

Laboratory QC procedures, where applicable, include initial and continuing instrument calibrations, standard reference materials, laboratory control samples, matrix replicates, MSs, surrogate spikes (for organic analyses), and method blanks. Table 5 lists the frequency of analysis for laboratory QA/QC samples, and Table 6 summarizes the DQOs for precision, accuracy, and completeness.

An analyst will review the results of the QC samples from each analytical batch immediately after a sample group has been analyzed. The QC sample results will then be evaluated to determine if control limits have been exceeded. If control limits are exceeded in the batch and reanalysis or re-extraction does not correct the exceedance, the QA/QC Manager will be contacted and alternative corrective action (e.g., method modifications followed by reprocessing the affected samples) will be explored prior to processing a subsequent group of samples.

3.4.2.1 Laboratory Instrument Calibration and Frequency

An initial calibration will be performed on each laboratory instrument to be used prior to analyses, after each major interruption to the analytical instrument, and when any ongoing calibration does not meet method control criteria. A calibration verification sample will be analyzed following each initial calibration and will meet method criteria prior to analysis of samples. Continuing calibration verifications (CCV) will be analyzed at required frequencies to track instrument performance. The frequency of CCVs varies with method. For GC/MS methods, one will be analyzed every 12 hours. For GC, metals, and inorganic methods, one will be analyzed for every ten field samples analyzed and at the end of each run. If the ongoing continuing calibration is out of control, the analysis must come to a halt until the source of the control failure is eliminated or reduced enough to meet control specifications. Project samples analyzed while instrument calibration was out of control will be reanalyzed.

Instrument blanks or continuing calibration blanks provide information on the stability of the baseline established. Continuing calibration blanks will be analyzed immediately prior to or right after the CCV as applicable to the method.

3.4.2.2 Laboratory Duplicates/Replicates

Analytical duplicates provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Analytical duplicates and replicates are subsamples of the original sample that are prepared and analyzed as a separate sample.

3.4.2.3 Matrix Spikes and Matrix Spike Duplicates

Analyses of MS samples provide information on the extraction efficiency of the method on the sample matrix, as well as any interferences introduced by the sample matrix. By performing duplicate MS analyses, information on the precision of the method is also provided for organic analyses.

3.4.2.4 Method Blanks

Method blanks are analyzed to assess possible laboratory contamination at every stage of sample preparation and analysis. The method blank results must be less than the reporting limit of any single target analyte or compound. If a laboratory method blank exceeds this criterion for any analyte or compound, and the concentration of the analyte or compound in any of the samples is less than five times the concentration found in the blank (ten times for common contaminants), analyses must stop and the source of contamination must be eliminated or reduced.

3.4.2.5 Laboratory Control Samples

Laboratory control samples are analyzed to assess possible laboratory bias at the stages of sample preparation and analysis. The laboratory control sample is a matrix-dependent spiked sample prepared at the time of sample extraction along with the preparation of the sample and MS. The

laboratory control sample will provide information on the accuracy of the analytical process and, when analyzed in duplicate, will provide precision information as well.

3.4.2.6 Laboratory Deliverables

Data packages will be checked for completeness immediately upon receipt from the laboratory to ensure that data and QA/QC information requested in Section 2.6.2 are present.

3.5 Data Quality Objectives

The parameters used to assess data quality are precision, accuracy, representativeness, comparability, completeness, and sensitivity. These parameters are presented on Table 6 and discussed in greater detail in the following sections.

3.5.1 Precision

Precision is the ability of an analytical method or instrument to reproduce its own measurement. It is a measure of the variability, or random error in sample collection and laboratory analyses. The American Society for Testing and Materials (ASTM) recognizes two levels of precision:
1) repeatability—the random error associated with measurements made by a single test operator on identical aliquots of test material in a given laboratory, with the same apparatus, under constant operating conditions; and 2) reproducibility—the random error associated with measurements made by different test operators, in different laboratories, using the same method but different equipment to analyze identical samples of test material (ASTM 2002).

In the laboratory, "within-batch" precision is measured using replicate sample or QC analyses and is expressed as the RPD between the measurements. The "batch-to-batch" precision is determined from the variance observed in the analysis of standard solutions or laboratory control samples from multiple analytical batches.

Field precision will be evaluated by the collection of field duplicates analyses at a frequency of 1 per 20 samples collected. Field chemistry duplicate precision will be screened against an RPD of 50%. However, no data will be qualified based solely on field duplicate precision.

Precision measurements can be affected by the nearness of a chemical concentration to the method detection limit (MDL), where the percent error (expressed as RPD) increases. The equation used to express precision is as follows:

Equation #1

$$\mathrm{RPD} = \frac{(\mathrm{C}_1 - \mathrm{C}_2) \times 100\%}{(\mathrm{C}_1 + \mathrm{C}_2) / 2}$$

where:

RPD	=	relative percent difference
C_1	=	larger of the two observed values
C_2	=	smaller of the two observed values

3.5.2 Accuracy

Accuracy is a measure of the closeness of an individual measurement (or an average of multiple measurements) to the true or expected value. Accuracy is determined by calculating the mean value of results from ongoing analyses of laboratory control samples, standard reference materials, and standard solutions. In addition, matrix-spiked samples are also measured; this indicates the accuracy or bias in the actual sample matrix. Accuracy is expressed as %R of the measured value, relative to the true or expected value. If a measurement process produces results for which the mean is not the true or expected value, the process is said to be biased. Bias is the systematic error either inherent in a method of analysis (e.g., extraction efficiency) or caused by an artifact of the measurement system (e.g., contamination). Analytical laboratories utilize several quality control measures to eliminate analytical bias, including systematic analyses of method blanks, laboratory control samples, and independent calibration verification standards. Because bias can be positive or negative, and because several types of bias can occur simultaneously, only the net, or total, bias can be evaluated in a measurement.

Laboratory accuracy will be evaluated against quantitative spike recovery performance criteria provided by the laboratory and in Table 6. Accuracy can be expressed as a percentage of the true or reference value, or as a %R in those analyses where reference materials are not available and spiked samples are analyzed. The equation used to express accuracy is as follows:

Equation #2

$$\%\mathrm{R} = 100\% \times (\mathrm{S} - \mathrm{U}) \,/\, \mathrm{C_{sa}}$$

where:

$\%R$	=	percent recovery
S	=	measured concentration in the spiked aliquot
U	=	measured concentration in the unspiked aliquot
$\mathrm{C_{sa}}$	=	actual concentration of spike added

Field accuracy will be controlled by adherence to sample collection procedures outlined in the FSP.

3.5.3 Bias

Bias is the systematic or persistent distortion of a measurement process that causes errors in one direction. Bias assessments for environmental measurements are made using personnel, equipment, and spiking materials or reference materials as independent as possible from those used in the calibration of the measurement system. When possible, bias assessments should be based on analysis of spiked samples or matrix-matched reference samples rather than spiked blanks so that the effect of the matrix on recovery is incorporated into the assessment. A documented spiking protocol and consistency in following that protocol are important to obtaining meaningful data quality estimates.

3.5.4 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent an environmental condition. For the site, the list of analytes has been identified to provide a comprehensive assessment of the known and potential contaminants.

3.5.5 Comparability

Comparability expresses the confidence with which one dataset can be evaluated in relation to another dataset. For this program, comparability of data will be established using standard analytical methodologies and reporting formats, and of common traceable calibration and spike materials.

3.5.6 Completeness

Completeness is a measure of the amount of data that is determined to be valid in proportion to the amount of data collected. Completeness will be calculated as follows:

Equation #3

$$C = \frac{(\text{Number of acceptable data points}) \times 100}{(\text{Total number of data points})}$$

The DQO for completeness for components of this project is 95%. Data that have been qualified as estimated because the QC criteria were not met will be considered valid for the purpose of assessing completeness. Data that have been qualified as rejected will not be considered valid for the purpose of assessing completeness.

3.5.7 Sensitivity

Analytical sensitivities must be consistent with or lower than the target limits listed in Tables 2 through 4 to demonstrate compliance with this QA/QC Plan.

The MDL is defined as the minimum concentration at which a given target analyte can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The Limit of Detection (LOD) is the smallest amount or concentration of a substance that must be present in a sample to be detected at a 99% confidence level. Laboratory practical quantitation limits (PQLs), limits of quantitation (LOQ), or reporting limits (RLs) are defined as the lowest level that produces a quantitative result within specified limits of precision and accuracy during routine laboratory operating conditions. Laboratory MDLs and RLs (Tables 2 through 4) will be used to evaluate the method sensitivity and/or applicability prior to the acceptance of a method for this program.

The sample-specific MDLs and RLs will be reported by the laboratory and will take into account factors relating to the sample analysis that might decrease or increase the MDLs and RLs (e.g., dilution factor, percent moisture, and sample volume). If the MDL and RL are elevated for a sample due to matrix interferences and subsequent dilution or reduction in the sample aliquot, the data will be evaluated by Anchor QEA and the laboratory to determine if an alternative course of action is required or possible. The sample-specific MDL and RL will be the value provided in the project database.

3.6 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

Testing, inspection, and maintenance of field and laboratory equipment are important determinants of the quality of sampling and analysis results.

3.6.1 Field Instruments/Equipment

In accordance with the QA program, Anchor QEA shall maintain an inventory of field instruments and equipment. The frequency and types of maintenance will be based on the manufacturer's recommendations and/or previous experience with the equipment.

The Anchor QEA FC will be responsible for the preparation, documentation, and implementation of the preventative maintenance program. The equipment maintenance information will be documented in the instrument's calibration log. The frequency of maintenance is dependent on the type and stability of the equipment, the methods used, the intended use of the equipment, and the recommendations of the manufacturer. Detailed information regarding the maintenance procedures and frequency of equipment maintenance is provided in specific manufacturer's instruction manuals.

Maintenance records will be verified prior to each sampling event. The FC will be responsible for verifying that required maintenance has been performed prior to using the equipment in the field.

The worker or subcontractor responsible for navigation will confirm proper operation of the navigation equipment daily. This verification may consist of internal diagnostics or visiting a location with known coordinates to confirm the coordinates indicated by the navigation system. The winch line and grab sampler will be inspected daily for fraying, misalignment of jaws, loose connections, and any other applicable mechanical problems. All equipment will be operated and maintained according to manufacturer specifications. Any problems will be noted in the field logbook and corrected prior to continuing sampling operations.

3.6.2 Laboratory Instruments/Equipment

In accordance with the QA program, the laboratory shall maintain an inventory of instruments and equipment and the frequency of maintenance will be based on the manufacturer's recommendations and previous experience with the equipment.

The laboratory preventative maintenance program, as detailed in the laboratory QA Manual, is organized to maintain proper instrument and equipment performance, and to prevent instrument and equipment failure during use. The program considers instrumentation, equipment, and parts that are subject to wear, deterioration, or other changes in operational characteristics; the availability of spare parts; and the frequency at which maintenance is required. Any equipment that has been overloaded, mishandled, gives suspect results, or has been determined to be defective will be taken out of service, tagged with the discrepancy noted, and stored in a designated area until the equipment has been repaired. After repair, the equipment will be tested to ensure that it is in proper operational condition. The client will be promptly notified in writing if defective equipment casts doubt on the validity of analytical data. The client will also be notified immediately regarding any delays due to instrument malfunctions that could impact holding times.

Laboratories will be responsible for the preparation, documentation, and implementation of the preventative maintenance program. Maintenance records will be checked according to the schedule on an annual basis and recorded by the responsible individual. The Laboratory Manager, or designee, shall be responsible for verifying compliance with the preventative maintenance program.

3.7 Instrument Calibration

Proper calibration of equipment and instrumentation is an integral part of the process that provides quality data. Instrumentation and equipment used to generate data must be calibrated at a frequency that ensures sufficient and consistent accuracy and reproducibility.

3.7.1 Field Instrument/Equipment Calibration

Field equipment will be calibrated prior to each sampling event according to manufacturer's recommendations using manufacturer's calibration standards. The equipment, calibration, and maintenance information will be documented in the instrument calibration log. The frequency of calibration is dependent on the type and stability of the equipment, the methods used, the intended use of the equipment, and the recommendations of the manufacturer. Detailed information regarding the calibration and frequency of equipment calibration is provided in specific manufacturer's instruction manuals.

Equipment that fails calibration or becomes inoperable during use will be removed from service and tagged (time and date of action) to prevent inadvertent use. Such equipment will be satisfactorily recalibrated or repaired and tagged (date and time of return to service) prior to use.

A post-survey calibration check may be performed at the end of each day's activities to confirm that the instrument functioned properly throughout the day. The instrument will also be checked during the day if erratic or suspect readings are observed.

3.7.2 Laboratory Instrument/Equipment Calibration

As part of their QC program, laboratories perform two types of calibrations. A periodic calibration is performed at prescribed intervals (i.e., balances, drying ovens, refrigerators, and thermometers), and operational calibrations are performed daily, at a specified frequency, or prior to analysis (i.e., initial calibrations) according to method requirements. Calibration procedures and frequency are discussed in the laboratory QA Manual. Calibrations are discussed in the laboratory standard operating procedures (SOPs) for analyses.

The Laboratory Manager will be responsible for ensuring that the laboratory instrumentation is calibrated in accordance with specifications. Implementation of the calibration program shall be the responsibility of the respective laboratory Group Supervisors. Recognized procedures (USEPA, ASTM, or manufacturer's instructions) shall be used when available.

Physical standards (i.e., weights or certified thermometers) shall be traceable to nationally recognized standards such as the National Institute of Standards and Technology (NIST). Chemical reference standards shall be NIST standard reference materials or vendor-certified materials traceable to these standards.

The calibration requirements for each method and respective corrective actions shall be accessible, either in the laboratory SOPs or the laboratory's QA Manual, for each instrument or analytical method in use. Calibrations shall be preserved on electronic media.

3.8 Inspection/Acceptance Requirements for Supplies and Consumables

Inspection and acceptance of field supplies, including laboratory-prepared sampling bottles, will be the responsibility of the FC. Primary chemical standards and standard solutions will be used in this project, in the field and laboratory, and will be traceable to documented, reliable, commercial sources. Standards will be validated to determine their accuracy by comparison with an independent standard. Any impurities found in the standard will be documented.

3.9 Non-Direct Measurements

Historical data were used primarily during the planning phase of this investigation to develop the project approach. For use in decision making, historical data will be examined to determine how their representativeness, bias, and precision may affect any conclusions.

3.10 Data Management

Field data sheets will be checked for completeness and accuracy by the FC prior to delivery to the QA/QC Manager. Data generated in the field will be documented on electronically or on hard copy and provided to the QA/QC Manager, who is responsible for the data's entry into the database. Manually entered data will be checked by a second party. Field documentation will be filed in the main project file after data entry and checking are complete.

Laboratory data will be provided to the QA/QC Manager in the EQuIS electronic format. Laboratory data that is electronically provided and loaded into the database will undergo a check against the laboratory hard copy data. Data will be validated or reviewed manually, and qualifiers, if assigned, will be entered manually. The accuracy of manually entered data will be verified. Data tables and reports will be exported from EQuIS to MS Excel tables.

4 Assessment and Oversight

Once data are received from the laboratory, a number of QC procedures will be followed to provide an accurate evaluation of the data quality. Specific procedures will be followed to assess data precision, accuracy, and completeness.

4.1 Assessment and Oversight

Laboratory and field performance audits consist of on-site reviews of QA systems and equipment for sampling, calibration, and measurement. Laboratory audits will not be conducted as part of this study. However, laboratory audit reports will be made available to the project QA/QC Manager upon request. The laboratory is required to have written procedures addressing internal QA/QC. These procedures have been submitted and the project QA/QC Manager will review them to ensure compliance with the QA/QC Plan. The laboratory must ensure that personnel engaged in preparation and analysis tasks have appropriate training. As part of the audit process, the laboratory will provide written details of any method modifications planned for the consultant's review.

The following sections identify the responsibilities of key project team members and actions to be taken in the event of an error, problem, or non-conformance to protocols identified in this document.

4.1.1 Field Activities

The FC will be responsible for correcting equipment malfunctions during the field sampling effort. The project QA/QC Manager will be responsible for resolving situations identified by the FC that may result in non-compliance with this QA/QC Plan. Corrective measures will be immediately documented in the field logbook.

4.1.2 Laboratory Activities

The laboratory is required to comply with its SOPs. The Laboratory Project Manager will be responsible for ensuring that appropriate corrective actions are initiated as required for conformance with this QA/QC Plan. Laboratory personnel will be responsible for reporting problems that may compromise the quality of the data.

The Laboratory Project Manager will be notified if any QC sample result grossly exceeds the project-specified control limits. The analyst will identify and correct the anomaly before continuing with the sample analyses. If the anomaly cannot be corrected, the Laboratory Project Manager will document the corrective action taken and relay this to the QA/QC Manager in a timely manner. A narrative describing the anomaly, the steps taken to identify and correct the anomaly, and the treatment of the relevant sample batch (i.e., recalculation, reanalysis, and re-extraction) will be submitted with the data package.

4.2 Reports to Management

QA reports to management include verbal status reports, written reports on field sampling activities and laboratory processes, data validation reports, and final project reports. These reports shall be the responsibility of the QA/QC Manager.

The FC will prepare progress reports following the sampling event. The project QA/QC Manager also will prepare progress reports after the sampling is completed and samples have been submitted for analysis, when information is received from the laboratory, and when analysis is complete. The status of the samples and analysis will be indicated with emphasis on any deviations from the QA/QC Plan. A data report will be written after validated data are available. These reports will be delivered electronically to the Project Manager.

5 Data Validation and Usability

Laboratory data will be provided in both PDF and EQuIS electronic format. Once data are received from the laboratory, QC procedures will be followed to provide an accurate evaluation of the data quality. The data will be validated in accordance with the project specific DQOs (Table 6), analytical method criteria, and the laboratory's internal performance standards based on their Standard Operating Procedures.

5.1 Data Review, Validation, and Verification

During the validation process, analytical data will be evaluated for method and laboratory QC compliance, and their validity and applicability for program purposes will be determined. Based on the findings of the validation process, data validation qualifiers may be assigned. The validated project data, including qualifiers, will be entered into the project database, thus enabling this information to be retained or retrieved, as needed.

5.2 Validation and Verification Methods

Data validation includes signed entries by the field and laboratory technicians on field data sheets and laboratory datasheets, respectively; review for completeness and accuracy by the FC and Laboratory Project Manager; review by the QA/QC Manager for outliers and omissions; and the use of QC criteria to accept or reject specific data. Data will be entered into the EQuIS database and a raw data file generated. A verification of the database raw data file will be performed. One hundred percent of manually entered qualifiers will be verified. Any errors found will be corrected on the raw data file. Any errors in the raw data file will be corrected and the database established.

Laboratory data will be reviewed and verified to determine whether DQOs have been met, and that appropriate corrective actions have been taken, when necessary. The project QA/QC Manager or designee will be responsible for the final review of the data generated from analyses of samples.

The first level of review will take place in the laboratory as the data are generated. The laboratory department manager or designee will be responsible for ensuring that the data generated meet minimum QA/QC requirements and that the instruments were operating under acceptable conditions during data acquisition. DQOs will also be assessed at this point by comparing the results of QC measurements with pre-established criteria as a measure of data acceptability.

A Stage 2B validation will be performed by Anchor QEA, in accordance with USEPA National Functional Guidelines (USEPA 2014a, 2014b, 2016) and in accordance with this QA/QC Plan. If the Stage 2B validation reveals errors that effect the accuracy of results, a Stage 4 validation may be

conducted. Chemical data will be reviewed with regard to the following, as appropriate to the particular analysis:

- Data completeness
- Holding times
- Instrument performance checks
- Initial calibrations
- Continuing calibrations
- Column confirmation results
- Method blanks
- Surrogate recoveries
- Detection limits
- Reporting limits
- Laboratory control samples
- Field and laboratory duplicates
- MS/MSD samples
- Standard reference material results

The results of the data quality review, including text assigning qualifiers in accordance with the USEPA National Functional Guidelines (USEPA 2014a, 2014b, 2016) and a tabular summary of qualifiers, will be generated by the validator and submitted to the project QA/QC Manager for final review and confirmation of the validity of the data.

5.3 Reconciliation with User Requirements

The QA/QC Manager will review data after each survey to determine if DQOs have been met. If data do not meet the project's specifications, the QA/QC Manager will review the errors and determine if the problem is due to calibration/maintenance, sampling techniques, or other factors and will suggest corrective action. If problems cannot be corrected by retraining, revision of techniques, or replacement of supplies or equipment, the DQOs will be reviewed for feasibility. If specific DQOs are not achievable, the QA/QC Manager will recommend appropriate modifications.

6 References

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USEPA, 2009. Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. EPA 540-R-08-005. January 2009.

USEPA, 2014a. National Functional Guidelines for Inorganic Superfund Data Review. Office of Superfund Remediation and Technology Innovation (OSRTI). EPA 540-R-16-001. August.

USEPA, 2014b. National Functional Guidelines for Superfund Organic Methods Data Review. OSRTI. EPA-540-R-014-002. August.

USEPA, 2016. National Functional Guidelines for High Resolution Superfund Methods Data Review. OSRTI. EPA 542-B-16-001. April.

Tables

Table 2
Sediment Analyte List, Analytical Methods, and Reporting Limits

Analyte	Analytical Method	Method Detection Limit[a]	Target Reporting Limit[a]
Conventionals and Physical Tests			
pH (Corrosivity; SU)	EPA 9045D	NA	NA
Flashpoint (°)	SW 1010	NA	NA
Reactive Cyanide (mg/kg)	ASTM D5049	20	20
Total solids (%)	SM 2540G	NA	NA
Grain size (%)	ASTM D422	0.023	NA
Specific gravity	ASTM D854	0.07	NA
Atterberg limits	ASTM D4318	0.3	NA
Moisture content (%)	ASTM D2216	0.04	NA
Metals (mg/kg)			
Cadmium	EPA 6010C	0.006	0.04
Chromium	EPA 6010C	0.023	0.14
Copper	EPA 6010C	0.07	0.4
Iron	EPA 6010C	0.3	1.8
Lead	EPA 6010C	0.04	0.25
Mercury	EPA 7471A	0.0021	0.0083
Molybdenum	EPA 6010C	0.04	0.24
Nickel	EPA 6010C	0.021	0.12
Silver	EPA 6010C	0.017	0.1
Zinc	EPA 6010C	0.05	0.3
VOCs (µg/kg)			
1,1,1,2-Tetrachloroethane	EPA 8260C	9	50
1,1,1-Trichloroethane	EPA 8260C	10	50
1,1,2,2-Tetrachloroethane	EPA 8260C	6	50
1,1,2-Trichloroethane	EPA 8260C	8	50
1,1-Dichloroethane	EPA 8260C	11	50
1,1-Dichloroethene	EPA 8260C	16	50
1,1-Dichloropropene	EPA 8260C	14	50
1,2,3-Trichlorobenzene	EPA 8260C	8	50
1,2,3-Trichloropropane	EPA 8260C	13	50
1,2,4-Trichlorobenzene	EPA 8260C	9	50
1,2,4-Trimethylbenzene	EPA 8260C	9	50
1,2-Dibromo-3-chloropropane	EPA 8260C	12	50
1,2-Dibromoethane	EPA 8260C	10	50
1,2-Dichlorobenzene	EPA 8260C	9	50
1,2-Dichloroethane	EPA 8260C	12	50
1,2-Dichloropropane	EPA 8260C	7	50
1,3,5-Trimethylbenzene	EPA 8260C	6	50
1,3-Dichlorobenzene	EPA 8260C	8	50
1,3-Dichloropropane	EPA 8260C	7	50
1,4-Dichlorobenzene	EPA 8260C	8	50

Table 2
Sediment Analyte List, Analytical Methods, and Reporting Limits

Analyte	Analytical Method	Method Detection Limit[a]	Target Reporting Limit[a]
112Trichloro122trifluoroethane	EPA 8260C	20	100
2,2-Dichloropropane	EPA 8260C	9	50
2-Butanone	EPA 8260C	100	500
2-Chlorotoluene	EPA 8260C	9	50
2-Hexanone	EPA 8260C	68	500
4-Chlorotoluene	EPA 8260C	8	50
4-Methyl-2-pentanone	EPA 8260C	82	500
Acetone	EPA 8260C	63	500
Benzene	EPA 8260C	5	50
Bromobenzene	EPA 8260C	9	50
Bromochloromethane	EPA 8260C	8	50
Bromodichloromethane	EPA 8260C	9	50
Bromoform	EPA 8260C	6	50
Bromomethane	EPA 8260C	30	100
Carbon disulfide	EPA 8260C	15	100
Carbon tetrachloride	EPA 8260C	11	50
Chlorobenzene	EPA 8260C	8	50
Chloroethane	EPA 8260C	19	100
Chloroform	EPA 8260C	9	50
Chloromethane	EPA 8260C	25	100
cis-1,2-Dichloroethene	EPA 8260C	10	50
cis-1,3-Dichloropropene	EPA 8260C	10	50
Dibromochloromethane	EPA 8260C	8	50
Dibromomethane	EPA 8260C	10	50
Dichlorodifluoromethane	EPA 8260C	13	50
Dichlorofluoromethane	EPA 8260C	27	100
Diisopropyl ether	EPA 8260C	10	50
Ethylbenzene	EPA 8260C	8	50
Hexachlorobutadiene	EPA 8260C	13	50
Isopropylbenzene	EPA 8260C	8	50
m & p-Xylene	EPA 8260C	18	100
Methyl tert-butyl ether	EPA 8260C	28	100
Methylene chloride	EPA 8260C	40	100
n-Butylbenzene	EPA 8260C	9	50
n-Propylbenzene	EPA 8260C	8	50
Naphthalene	EPA 8260C	10	50
o-Xylene	EPA 8260C	8	50
p-Isopropyltoluene	EPA 8260C	9	50
sec-Butylbenzene	EPA 8260C	6	50
Styrene	EPA 8260C	6	50
tert-Butylbenzene	EPA 8260C	8	50

Table 2
Sediment Analyte List, Analytical Methods, and Reporting Limits

Analyte	Analytical Method	Method Detection Limit[a]	Target Reporting Limit[a]
Tetrachloroethene	EPA 8260C	8	50
Toluene	EPA 8260C	7	50
trans-1,2-Dichloroethene	EPA 8260C	11	50
trans-1,3-Dichloropropene	EPA 8260C	7	50
Trichloroethene	EPA 8260C	10	50
Trichlorofluoromethane	EPA 8260C	13	50
Vinyl chloride	EPA 8260C	14	50
PAHs (µg/kg)			
2-Methylnaphthylene	EPA 8270D/SIM	0.22	1.5
Acenaphthene	EPA 8270D/SIM	0.33	1.5
Acenaphthylene	EPA 8270D/SIM	0.24	1.5
Anthracene	EPA 8270D/SIM	0.31	1.5
Benzo(a)anthracene	EPA 8270D/SIM	0.32	1.5
Benzo(a)pyrene	EPA 8270D/SIM	0.28	1.5
Benzo(e)pyrene	EPA 8270D/SIM	TBD	TBD
Benzo(b)fluoranthene	EPA 8270D/SIM	0.4	1.5
Benzo(k)fluoranthene	EPA 8270D/SIM	0.37	1.5
Benzo(g,h,i)perylene	EPA 8270D/SIM	0.39	1.5
Chrysene	EPA 8270D/SIM	0.35	1.5
Dibenz(a,h)anthracene	EPA 8270D/SIM	0.35	1.5
Fluoranthene	EPA 8270D/SIM	0.36	1.5
Fluorene	EPA 8270D/SIM	0.36	1.5
Indeno(1,2,3-cd)pyrene	EPA 8270D/SIM	0.36	1.5
Naphthalene	EPA 8270D/SIM	0.27	1.5
Phenanthrene	EPA 8270D/SIM	0.45	3.0
Pyrene	EPA 8270D/SIM	0.41	1.5
PCBs (µg/kg)			
Aroclor 1016	EPA 8082A	5	30
Aroclor 1221	EPA 8082A	7	30
Aroclor 1232	EPA 8082A	9	30
Aroclor 1242	EPA 8082A	7	30
Aroclor 1248	EPA 8082A	7	30
Aroclor 1254	EPA 8082A	9	30
Aroclor 1260	EPA 8082A	6	30
Aroclor 1262	EPA 8082A	7	30
Aroclor 1268	EPA 8082A	5	30
PFAS (µg/kg)			
10:2-fluorotelomersulfonate	EPA 537 Mod	1	3
4:2 fluorotelomersulfonate	EPA 537 Mod	1	3
6:2 fluorotelomersulfonate	EPA 537 Mod	0.6	2
8:2 fluorotelomersulfonate	EPA 537 Mod	0.6	2

Table 2
Sediment Analyte List, Analytical Methods, and Reporting Limits

Analyte	Analytical Method	Method Detection Limit[a]	Target Reporting Limit[a]
NEtFOSAA	EPA 537 Mod	0.5	2
NEtPFOSA	EPA 537 Mod	0.5	2
NEtPFOSAE	EPA 537 Mod	0.5	2
NMeFOSAA	EPA 537 Mod	0.5	2
NMePFOSA	EPA 537 Mod	0.5	2
NMePFOSAE	EPA 537 Mod	0.5	2
Perfluoro-octanesulfonate	EPA 537 Mod	0.3	0.9
Perfluorobutanesulfonate	EPA 537 Mod	0.2	0.6
Perfluorobutanoic acid	EPA 537 Mod	0.2	0.6
Perfluorodecanesulfonate	EPA 537 Mod	0.3	1
Perfluorodecanoic acid	EPA 537 Mod	0.2	0.6
Perfluorododecanesulfonate	EPA 537 Mod	0.3	0.9
Perfluorododecanoic acid	EPA 537 Mod	0.2	0.6
Perfluoroheptanesulfonate	EPA 537 Mod	0.2	0.6
Perfluoroheptanoic acid	EPA 537 Mod	0.2	0.6
Perfluorohexadecanoic acid	EPA 537 Mod	0.2	0.6
Perfluorohexanesulfonate	EPA 537 Mod	0.2	0.6
Perfluorohexanoic acid	EPA 537 Mod	0.2	0.6
Perfluorononanesulfonate	EPA 537 Mod	0.2	0.6
Perfluorononanoic acid	EPA 537 Mod	0.2	0.6
Perfluorooctadecanoic acid	EPA 537 Mod	0.2	0.6
Perfluorooctanesulfonamide	EPA 537 Mod	0.2	0.6
Perfluorooctanoic acid	EPA 537 Mod	0.2	0.6
Perfluoropentanesulfonate	EPA 537 Mod	0.2	0.6
Perfluoropentanoic acid	EPA 537 Mod	0.2	0.6
Perfluorotetradecanoic acid	EPA 537 Mod	0.2	0.6
Perfluorotridecanoic acid	EPA 537 Mod	0.2	0.6
Perfluoroundecanoic acid	EPA 537 Mod	0.2	0.6

Notes:

[a] Achievable reporting limits may vary based on sample moisture content and dilution factor.

µg/kg: micrograms per kilogram

ASTM: ASTM International

EPA: U.S. Environmental Protection Agency

Mod:

mg/kg: milligrams per kilogram

NA: no value available for this analyte

PAH: polycyclic aromatic hydrocarbon

PCB: polychlorinated biphenyl

PFAS: per and polyfluoroalkyl substances

SIM:

SM: Standard Method

SU: Standard Unit

SW:

VOC: volatile organic compound

Table 3
Water Analyte List, Analytical Methods, and Reporting Limits

Analyte	Analytical Method	Method Detection Limit[a]	Target Reporting Limit[a]
Conventionals (mg/L)			
Total suspended solids (mg/L)	SM 2540D	2	2
Oil and Grease	EPA 1664A	1.4	10
Metals (µg/L)			
Mercury	EPA 1631E	0.0002	0.0005
PAHs (µg/L)			
2-Methylnaphthylene	EPA 8270D/SIM	0.015	0.075
Acenaphthene	EPA 8270D/SIM	0.014	0.075
Acenaphthylene	EPA 8270D/SIM	0.014	0.075
Anthracene	EPA 8270D/SIM	0.013	0.075
Benzo(a)anthracene	EPA 8270D/SIM	0.013	0.075
Benzo(a)pyrene	EPA 8270D/SIM	TBD	0.075
Benzo(e)pyrene	EPA 8270D/SIM	0.013	0.075
Benzo(b)fluoranthene	EPA 8270D/SIM	0.013	0.075
Benzo(k)fluoranthene	EPA 8270D/SIM	0.013	0.075
Benzo(g,h,i)perylene	EPA 8270D/SIM	0.012	0.075
Chrysene	EPA 8270D/SIM	0.015	0.075
Dibenz(a,h)anthracene	EPA 8270D/SIM	0.021	0.075
Fluoranthene	EPA 8270D/SIM	0.015	0.075
Fluorene	EPA 8270D/SIM	0.014	0.075
Indeno(1,2,3-cd)pyrene	EPA 8270D/SIM	0.018	0.075
Naphthalene	EPA 8270D/SIM	0.014	0.075
Phenanthrene	EPA 8270D/SIM	0.015	0.075
Pyrene	EPA 8270D/SIM	0.016	0.075

Notes:

[a] Achievable reporting limits may vary based on sample moisture content and dilution factor.

µg/L: micrograms per liter

EPA: U.S. Environmental Protection Agency

mg/L: milligrams per liter

NA: no value available for this analyte

PAH: polycyclic aromatic hydrocarbon

PFAS: per and polyfluoroalkyl substances

SIM:

SM: Standard Method

TBD:

Table 4
Elutriate Analyte List, Analytical Methods, and Reporting Limits

Analyte	Analytical Method[a]	Method Detection Limit[b]	Target Reporting Limit[b]
TCLP Metals (mg/L)			
Arsenic	EPA 6010C	0.004	0.024
Barium	EPA 6010C	0.00029	0.0018
Cadmium	EPA 6010C	0.0003	0.002
Chromium	EPA 6010C	0.0006	0.004
Lead	EPA 6010C	0.0014	0.004
Mercury	EPA 7470A	0.0003	0.00012
Selenium	EPA 6010C	0.0022	0.013
Silver	EPA 6010C	0.0007	0.001
TCLP VOCs (mg/L)			
Benzene	EPA 8260C	0.00019	0.001
Carbon tetrachloride	EPA 8260C	0.00023	0.001
Chlorobenzene	EPA 8260C	0.00024	0.001
Chloroform	EPA 8260C	0.00015	0.0005
1,2-Dichloroethane	EPA 8260C	0.0003	0.001
1,1-Dichloroethene	EPA 8260C	0.00024	0.001
2-Butanone	EPA 8260C	0.0024	0.001
Tetrachloroethene	EPA 8260C	0.0003	0.001
Trichloroethene	EPA 8260C	0.00021	0.001
Vinyl chloride	EPA 8260C	0.00015	0.001
TCLP SVOCs (mg/L)			
1,4-Dichlorobenzene	EPA 8270D	0.00019	0.001
2,4,5-Trichlorophenol	EPA 8270D	0.0011	0.005
2,4,6-Trichlorophenol	EPA 8270D	0.0010	0.005
2,4-Dinitrotoluene	EPA 8270D	0.00021	0.001
2-Methylphenol	EPA 8270D	0.00086	0.005
3- & 4-Methylphenol	EPA 8270D	0.0014	0.009
Hexachlorobenzene	EPA 8270D	0.00027	0.001
Hexachlorobutadiene	EPA 8270D	0.00018	0.001
Hexachloroethane	EPA 8270D	0.00022	0.001
Nitrobenzene	EPA 8270D	0.00016	0.001
Pentachlorophenol	EPA 8270D	0.0011	0.005
Pyridine	EPA 8270D	0.00062	0.004

Notes:

[a] Elutriate samples will be generated from solid samples using EPA method 1311.

[b] Achievable reporting limits may vary based on sample moisture content and dilution factor.

EPA: U.S. Environmental Protection Agency

mg/L: milligrams per liter

SVOC: semivolatile organic compound

TCLP:

VOC: volatile organic compound

Table 5
Field and Laboratory Quality Assurance/Quality Control Sample Analysis Summary

Analysis Type	Field Duplicate	Field/ Equipment Blank	Initial Calibration[a]	Ongoing Calibration	Matrix Duplicates	Matrix Spikes	Matrix Spike Duplicates	SRM or LCS	Method Blanks	Surrogate Spikes
Geotechnical	NA	NA	Each batch[b]	NA	NA	NA	NA	NA	NA	NA
pH, Flashpoint, Reactive cyanide	NA	NA	Daily or each batch	NA	NA	NA	NA	1 per 20 samples	NA	NA
TS	1 per 20 samples	NA	Each batch[b]	NA	1 per 20 samples	NA	NA	NA	NA	NA
Oil and grease	1 per 20 samples	NA	Each batch[b]	1 per 10 samples	1 per 20 samples	1 per 20 samples	NA	1 per 20 samples	1 per 20 samples	NA
Metals	1 per 20 samples	1 per sampling method per event	As needed[c]	1 per 10 samples	1 per 20 samples	1 per 20 samples	NA	1 per 20 samples	1 per 20 samples	NA
PAHs/SVOCs	1 per 20 samples	1 per sampling method per event	As needed[c]	Every 12 hours	NA	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample
VOCs	1 per 20 samples	1 per sampling method per event	As needed[c]	Every 12 hours	NA	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample
PCBs	1 per 20 samples	1 per sampling method per event	As needed[c]	1 per 10 samples	NA	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample
PFAS	NA	1 per sampling method per event	As needed[c]	1 per 10 samples	1 per 20 samples	NA[d]	NA[d]	1 per 20 samples	1 per 20 samples	Every sample

Notes:
[a] Initial calibration verification must be analyzed immediately following the initial calibration and prior to sample analyses.
[b] Temperature of drying ovens checked daily with a NIST thermometer. Weighing scales checked daily with NIST weights and recertified on annual basis.
[c] Initial calibrations are considered valid until the continuing calibration no longer meets method specifications. At that point, a new initial calibration is analyzed.
[d] Isotope dilution analyzed per method.
LCS: laboratory control sample
NA: not applicable
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
PFAS: per and polyfluoroalkyl substances
SRM: standard reference material
SVOCs: semivolatile organic compound
TS: total solids
VOC: volatile organic compound

Table 6
Data Quality Objectives

Parameter	Precision[a]	Accuracy[a]	Completeness
Sediment Samples			
Total solids	± 20% RPD	NA	95%
pH, flashpoint, reactive cyanide	± 20% RPD	70–130% R	95%
Metals	± 30% RPD	75–125% R	95%
VOCs	± 30% RPD	50–150% R	95%
PAHs	± 35% RPD	50–150% R	95%
PCBs	± 35% RPD	50–150% R	95%
PFAS	± 35% RPD	50–150% R	95%
Aqueous Samples			
Total suspended solids	± 50% RPD	NA	95%
Oil and grease	± 34% RPD	75–115% R	95%
Metals	± 25% RPD	80–120% R	95%
PAHs/SVOCs	± 30% RPD	60–140% R	95%
VOCs	± 30% RPD	60–140% R	95%

Notes:

[a] Precision and accuracy limits apply to laboratory control samples, laboratory duplicates, and matrix spike/matrix spike

NA:

PAH: polycyclic aromatic hydrocarbon

PCB: polychlorinated biphenyl

PFAS: per and polyfluoroalkyl substances

R: recovery

RPD: relative percent difference

SVOC: semivolatile organic compound

VOC: volatile organic compound

Table 7
Guidelines for Sample Handling and Storage

Analyte	Container	Holding Time	Preservative
Sediment Samples			
Grain size	Sealable plastic bags	None	Ambient
Specific gravity			
Atterberg limits			
Moisture content			
pH	4-oz plastic container	28 days	0–6°C
Flashpoint			
Reactive cyanide			
Mercury	4-oz plastic container	28 days	0–6°C
All metals except mercury		6 months	Ambient
		2 years	< 0°C
VOCs	2 x 40 mL VOA vials	14 days	Water; 0–6°C
	1 x 40 mL VOA vials		Methanol; 0–6°C
PAHs	4-oz glass jar	14 days until extraction	0–6°C
		1 year until extraction	< 0°C
		40 days after extraction	0–6°C
PCBs		None	< 6°C
PFAS	4.5-oz HDPE	14 days until extraction	< 6°C
		28 days after extraction	
Archive	4-oz glass jar	--	< 0°C
Aqueous Samples			
Total suspended solids	1 L HDPE	7 days	0–6°C
Oil and grease	1 L amber glass	28 days	0–6°C; HCl to pH < 2
Metals (methods 6010C, 7470A)	500 mL HDPE	6 months	0–6°C; HNO3 to pH < 2
Mercury (method 1631E)	250 mL FLPE	90 days	0–6°C; BrCl
VOCs	3 x 40 mL VOA vials	14 days	0–6°C; HCl to pH < 2
PAHs	1 L amber glass	7 days until extraction	0–6°C
		40 days after extraction	
SVOCs	1 L amber glass	7 days until extraction	0–6°C
		40 days after extraction	

Notes:
FLPE:
HDPE:
L: liter
mL: milliliter
oz: ounce
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
PFAS: per and polyfluoroalkyl substances
SVOC: semivolatile organic compound
VOA:
VOC: volatile organic compound

Appendix C
Site Safety Plan

November 2018
Portage Canal – Segment 2 Remedial Design

ANCHOR QEA

Site Safety Plan

Portage, Wisconsin
BRRTS No.: 02-11-577055

Prepared for Wisconsin Department of Natural Resources

PLAYING IT SAFE
Responsibility Is Taken, Not Given
Take Responsibility For Safety

November 2018
Portage Canal – Segment 2 Remedial Design

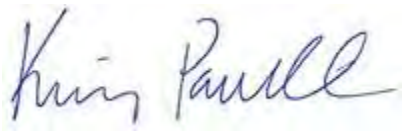
Site Safety Plan

Portage, Wisconsin
BRRTS No.: 02-11-577055

Prepared for
Wisconsin Department of Natural Resources
3911 Fish Hatchery Road
Fitchburg, WI 53711

Prepared by
Anchor QEA, LLC
290 Elwood Davis Road, Suite 340
Liverpool, NY 13088

Certification Page



Kimberly Powell

Project Manager

Anchor QEA, LLC

Date: November 9, 2018

Mike Conese

Field Lead

Anchor QEA, LLC

Date: November 9, 2018

The information in this Site Safety Plan has been designed for the Scope of Work pertaining to Segment 2 of the Portage Canal – BRRTS No. 02-11-5055 presently contemplated by Anchor QEA, LLC. Therefore, this document may not be appropriate if the work is not performed by or using the methods presently contemplated by Anchor QEA. In addition, as the work is performed, conditions different from those anticipated may be encountered and this document may have to be modified. Therefore, Anchor QEA only intends this plan to address currently anticipated activities and conditions and makes no representations or warranties as to the adequacy of the Site Safety Plan for all conditions encountered.

Site Safety Plan Acknowledgement Form

Project Number: 181779-02.01

Project Name: Portage Canal – Segment 2 Remedial Design

My signature below certifies that I have read and understand the policies and procedures specified in this Site Safety Plan (SSP). For non-Anchor QEA employees, this SSP may include company-specific appendices to this plan developed by entities other than Anchor QEA.

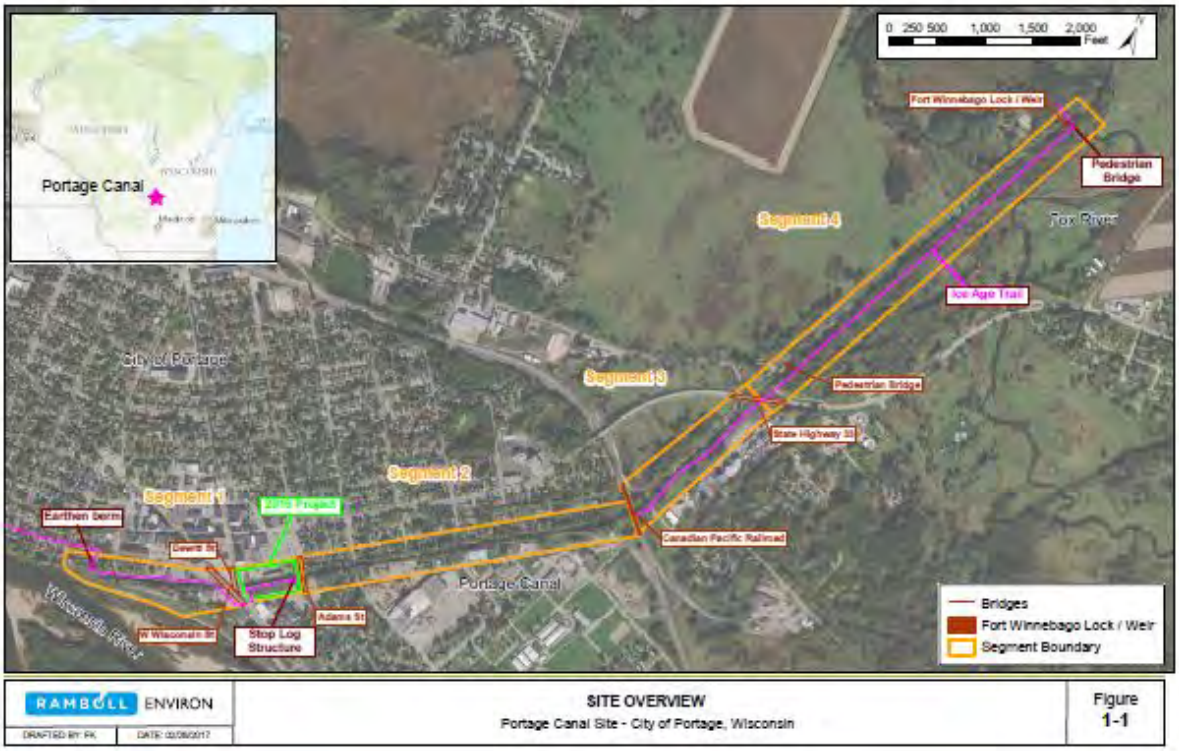
Date	Name (print)	Signature	Company

Date	Name (print)	Signature	Company

Site Emergency Procedures

Site Map

Figure A
General Site Location Overview



Emergency Contact Information

Table A
Site Emergency Form and Emergency Phone Numbers*

Category	Information
Possible Chemicals of Concern	Metals including lead and mercury Polycyclic aromatic hydrocarbons (PAHs) Volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) associated with petroleum products Polychlorinated biphenyls (PCBs) Non-aqueous phase liquid (NAPL) Per- and polyfluoroalkyl substances (PFAs)
Minimum Level of Protection	D
Site(s) Location Address	Adams St., Portage, Wisconsin

Category	Information	
Emergency Phone Numbers		
Ambulance	911	
Fire	911	
Police	911	
Poison Control	(800) 222-1222	
Client Contact	Scott Inman, PE	Office: (608) 273-5613 Cell: (608) 576-4912
Project Manager (PM)	Kimberly Powell	Office: (315) 414-2014 Cell: (315) 263-1811
Field Lead (FL)	Mike Conese	Office: (351) 569-5226 Cell: (351) 451-1211
Corporate Health and Safety Manager (CHSM)	David Templeton	Office: (206) 287-9130 Cell: (206) 910-4279
State Emergency Response System	(608) 242-3232	
EPA Emergency Response Team,[1] Region 5	(312) 353-2000 (800) 621-8431	

Notes:

* In the event of any emergency, contact the PM and FL.

1. For local resources, please visit: http://www2.epa.gov/emergency-response/emergency-response-my-community. The National Response Center hotline is 1-800-424-8802.

Table B
Hospital Information

Category	Information
Hospital Name	Divine Savior Healthcare Emergency Room
Address	2817 New Pinery Road
City, State	Portage, WI
Phone	(608) 742-4131
Emergency Phone	(608) 745-5604

Hospital Route Map and Driving Directions

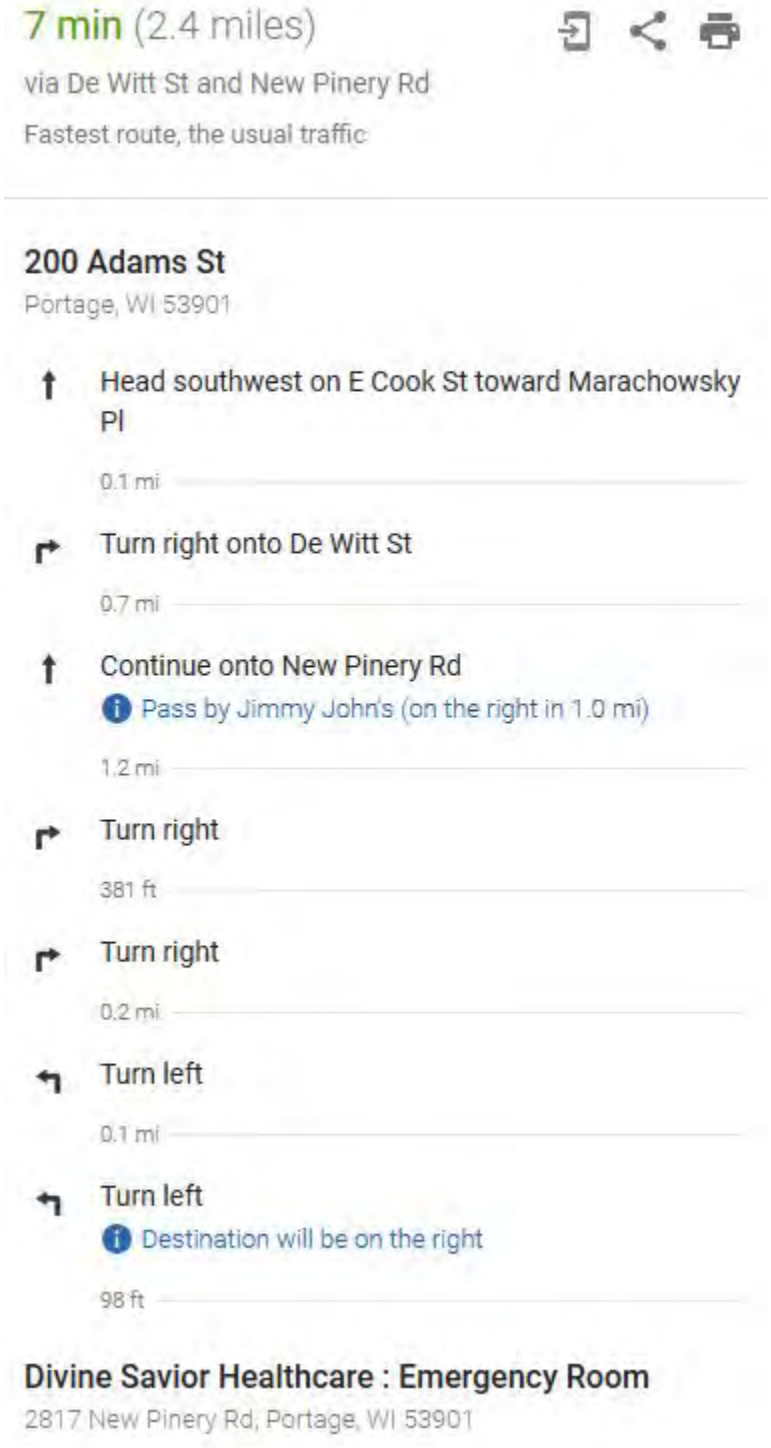
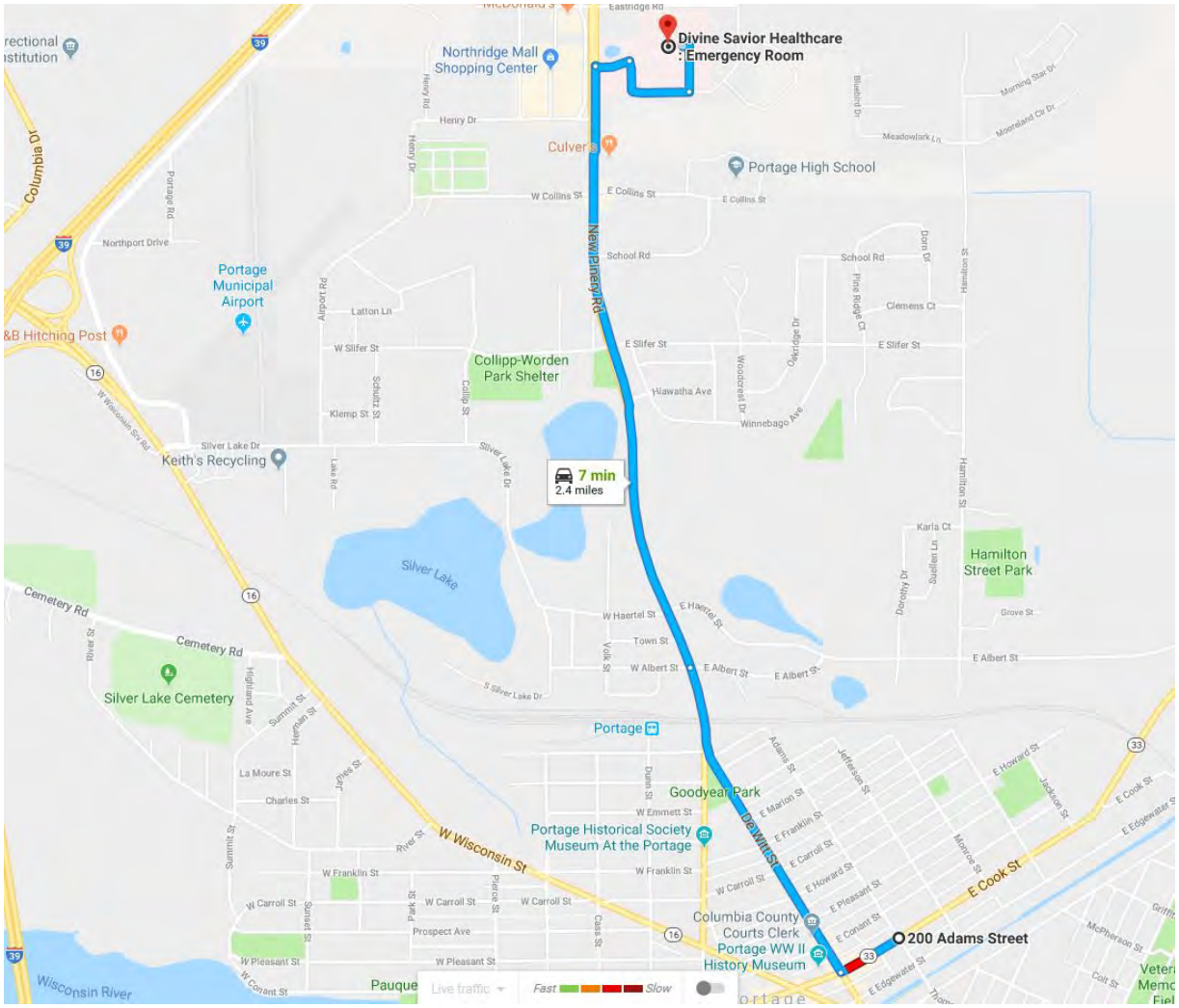


Figure B
Hospital Route Map



Care Management—WorkCare Incident Intervention

Anchor QEA has an additional Incident Intervention resource from WorkCare to help answer questions, alleviate uncertainty and stress in a potential injury situation, and maintain the health and safety of our employees. Incident Intervention is an injury and illness management tool that provides employees with 24 hours a day/7 days a week (24/7) immediate telephone access to a member of WorkCare's clinical staff of nurses and physicians who intervene at the time of a workplace injury or illness. Contact information is provided below:

- **Access WorkCare 24/7 from anywhere using the toll-free number: 1-888-449-7787**

At the time of a workplace injury or illness, the employee, manager, or another employee at the scene notifies WorkCare using the toll-free number listed above. The caller provides information on the type of incident, possible cause, and the scope of the situation. With the details of the incident recorded, an experienced nurse or physician provides the following:

- Responsive evaluation of the incident
- Direction on the appropriate course of action
- Consultation with the employee's treating physician to design a quality care treatment plan that meets the needs of the employee and Anchor QEA

All employees are encouraged to use this service should a workplace injury or illness occur.

Key Safety Personnel

The following people share responsibility for health and safety at the site. See Section 4 of this Site Safety Plan (SSP) for a description of the role and responsibility of each.

Client Contact: Scott Inman, PE	Office: (608) 273-5613 Cell: (608) 576-4912
Project Manager (PM): Kimberly Powell	Office: (315) 414-2014 Cell: (315) 263-1811
Field Lead (FL): Mike Conese	Office: (315) 569-5266 Cell: (315) 451-1211
Corporate Health and Safety Manager (CHSM): David Templeton	Office: (206) 287-9130 Cell: (206) 910-4279

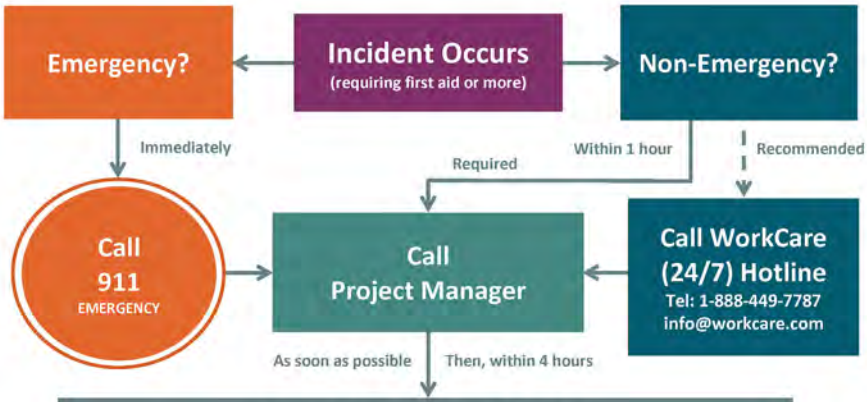
Personal Incident Response Procedures

In the event of an emergency, immediate action must be taken by the first person to recognize the event. Use the following steps as a guideline and refer to Figure C:

1. Survey the situation to verify that it is safe for you and the victim. Do not endanger your own life. Do not enter an area to rescue someone who has been overcome unless properly equipped and trained. Verify that all protocols are followed. If applicable, review Safety Data Sheets (SDS) to evaluate response actions for chemical exposures.
2. Call the appropriate emergency number (911, if available) or direct someone else to do this immediately (see Table A). Explain the physical injury, chemical exposure, fire, or release and location of the incident.
3. Have someone retrieve the nearest first aid kit (containing appropriate items for the particular work scope) and Automated External Defibrillator (AED), if available. Note: Only use an AED if you have been properly trained and are currently certified to do so.
4. Decontaminate the victim without delaying life-saving procedures (see Section 8).

5. Administer first aid and cardiopulmonary resuscitation (CPR), if properly trained, until emergency responders arrive.[1]
6. In the event that evacuation is required, the FL must perform a head count to verify that all Anchor QEA personnel are accounted for.
7. Notify the Field Lead (FL) and Project Manager (PM); the PM will notify the client contact. The PM will also contact the Corporate Health and Safety Manager (CHSM). The CHSM will facilitate the incident investigation. All client requirements pertinent to personal incident reporting will also be adhered to.
8. Complete the appropriate incident investigation reports.

Figure C
Incident Flowchart



Project Manager Calls H&S Representative Below Within 1 Hour (step through the list until a person is reached)	
Chris Torell Health and Safety Manager	**Cell (call or text):** (315) 254-4954 ctorell@anchorqea.com
David Templeton Health and Safety Director	**Cell (call or text):** (206) 910-4279 dtempleton@anchorqea.com
Gloria Palermo Health and Safety Coordinator	**Cell:** (315) 622-3723 gpalermo@anchorqea.com
Jessie LaHaie Human Resources	**Cell:** (206) 310-3053 jlahaie@anchorqea.com

[1] Personnel qualified and currently certified in basic first aid or CPR are protected under Good Samaritan policies as long as they only perform the basic tasks that they were taught. Do not perform first aid or CPR tasks if you have not been trained in first aid or CPR.

Non-Personal Incident Response Procedures

All incidents including, but not limited to, fire, explosion, property damage, or environmental release will be responded to in accordance with the site-specific SSP. In general, this includes securing the site appropriate to the incident, turning control over to the emergency responders, or securing the site and summoning appropriate remedial personnel or equipment. Anchor QEA will immediately notify the client of any major incident, fire, equipment or property damage, or environmental incident with a preliminary report. A full report will be provided within 72 hours.

Spills and Releases of Hazardous Materials

When required, notify the National Response Center and local state agencies. The following information should be provided to the National Response Center:

- Name and telephone number
- Name and address of incident location
- Time and type of incident
- Name and quantity of materials involved, if known
- Extent of injuries
- Possible hazards to human health or the environment outside of the facility

The emergency telephone number for the National Response Center is 1-800-424-8802. If hazardous waste is released or produced through control of the incident, verify that:

- Waste is collected and contained
- Containers of waste are removed or isolated from the immediate site of the emergency
- Treatment or storage of the recovered waste, contaminated soil or surface water, or any other material that results from the incident or its control is provided
- No waste that is incompatible with released material is treated or stored in the facility until cleanup procedures are completed

Verify that all emergency equipment used is decontaminated, recharged, and fit for its intended use before operations are resumed.

Near-Miss Reporting

All near-miss incidents (i.e., those that could have reasonably led to an injury, environmental release, or other incident) must be reported to the FL and PM immediately, so action can be taken to verify that such conditions that led to the near-miss incident are readily corrected to prevent future occurrences.

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1 Introduction

This Site Safety Plan (SSP) was prepared on behalf of Wisconsin Department of Natural Resources (WDNR) and presents health and safety requirements and procedures that will be followed by Anchor QEA, LLC, personnel and at a minimum by Anchor QEA subcontractors during work activities at Segment 2 of the Portage Canal – BRRTS No. 02-11-5055 (the site). This SSP was developed in accordance with Title 29 of the Code of Federal Regulations (CFR), Part 1910.120(b), and will be used in conjunction with Anchor QEA's Corporate Health and Safety Program. See Section 1.1 for SSP modification procedures.

The provisions of this SSP are mandatory for all Anchor QEA personnel assigned to the project. A copy of this SSP must be maintained on site and available for employee review at all times. Anchor QEA subcontractors are also expected to follow the provisions of this SSP unless they have their own SSP that covers their specific activities related to this project. Any subcontractor SSPs must include the requirements set forth in this SSP, at a minimum. All visitors to the work site must also abide by the requirements of this SSP and will attend a pre-work briefing where the contents of this SSP and Sigma's SSP (Appendix E) will be presented and discussed.

Personnel assigned to work at the project site will be required to read this plan and must sign the Site Safety Plan Acknowledgement Form to confirm that they understand and agree to abide by the provisions of this SSP.

Subcontractors are ultimately responsible for the health and safety of their employees. Subcontractors may mandate health and safety protection measures for their employees beyond the minimum requirements specified in this SSP.

The objectives of this SSP are to identify potential physical, chemical, and biological hazards associated with field activities; establish safe working conditions and protective measures to control those hazards; define emergency procedures; and describe the responsibilities, training requirements, and medical monitoring requirements for site personnel.

This SSP prescribes the procedures that must be followed during specific site activities. Significant operational changes that could affect the health and safety of personnel, the community, or the environment will not be made without the prior approval of the Project Manager (PM) and the Corporate Health and Safety Manager (CHSM).

Issuance of this approved SSP documents that the workplace has been evaluated for hazards. A hazard assessment was performed, and the adequacy of the personal protective equipment (PPE) selected was evaluated as required by 29 CFR 1910.132(d)—Personal Protective Equipment, General Requirements (General Industry); 29 CFR 1910.134—Respiratory Protection; 29 CFR 1926.28—Personal Protective Equipment (Construction Industry); and 29 CFR 1926.55—Gases, Vapors, Fumes,

Dusts and Mist, and is duly noted by the signature(s) and date appearing on the certification page of this document.

1.1 Site Safety Plan Modifications

This SSP will be modified by amendment, if necessary, to address changing field conditions or additional work tasks not already described in this document. Modifications will be proposed by the Field Lead (FL) using the Modification to Site Safety Plan form included in Appendix A. Modifications will be reviewed by the CHSM or authorized representative and approved by the PM.

2 Site Description and Background Information

This section provides information on the background of the Site, including a brief Site description and an overview of the Site history.

2.1 Site Description

The 2.5-mile long and 17-acre Canal is in the City of Portage in Columbia County, Wisconsin. The Canal begins at the Wisconsin River and flows northeast, through the City's downtown before emptying into the Upper Fox River. The Canal project corridor includes four segments based on major road and rail crossings as follows:

Table 1
General NR 700 Site Information

Segment	From	To	BRRTs No.	Length
1	WI River/Highway 51	Adams Street	02-11-543021[1]	700/2,100
2	Adams Street	CPR[2] crossing	02-11-577055	3,500
3	CPR	Highway 33	02-11-577056	1,800
4	Highway 33	Fox River	02-11-577057	4,700

Notes:

1. The transportation enhancement project refers to Segment 1 as including from the Wisconsin River to Adams Street. The BRRTs case for Segment 1 (02-11-543021) excludes the 1,400 ft section from the Wisconsin River to Hwy 51 because sampling showed it was not contaminated and the City dredged it in 2006.
2. Canadian Pacific Railway

The scope of this project includes 3,600 feet of the Canal, from Adams St. to a location approximately 100 ft downstream of the Canadian Pacific Railway (CPR) bridge near Center Street. This consists of all of Segment 2 and approximately 100 ft of Segment 3. Adjacent land use includes: North bank: 43 parcels of residential houses; South bank: 19 parcels including residential houses, two commercial businesses (Alter Trading corporation and Whaley Automotive) with parking lots, a County parking lot, and a DNR parcel with building, which serves as the Portage Levee maintenance facility.

2.2 Site History

The Canal is not a natural waterbody; private entities and United States Army Corps of Engineers (Corps) created the Canal from 1838 to 1876. The remains of navigation locks lie at either end of the Canal. Water flow through the Canal has been reduced since the Corps closed the locks and abandoned the Canal in 1959. In 1961, the Corps transferred ownership of the Canal to the State of Wisconsin by a quit claim deed.

Currently, water flow is largely from groundwater and stormwater during precipitation events. An intake structure in the Wisconsin River supplies a nominal amount of water to the canal beneath a levee constructed by the Corps in 1998. Portage Canal is in the Great Lakes Basin as a tributary to Lake Michigan. It is also listed on the National Register of Historic Places. Furthermore, the canal is considered a water of the state and a jurisdictional water under the Clean Water Act due to its history for navigation and interstate commerce.

2.3 Nature and Extent of Contamination

Mead and Hunt, working for the City as part of the Phase II for the transportation enhancement grant, discovered and reported contamination of Canal sediments to the DNR in 2002. The DNR and others performed sediment characterization in 2003, 2004, 2009, 2013, 2015, and 2016, collected samples and tested for a total of 121 chemical parameters. The characterization found elevated levels of heavy metals, polycyclic aromatic hydrocarbons (PAHs), petroleum, polychlorinated biphenyls (PCBs), and non-aqueous phase liquid (NAPL). Nine heavy metals exceed the DNR Consensus-Based Sediment Quality Guidelines (CBSQG) Interim Guidance WT-732 2003 threshold effect concentrations (TEC; DNR 2003), including cadmium, chromium, copper, iron, lead, mercury, nickel, silver, and zinc. Lead and mercury exceed the CBSQG most consistently, by the highest margin, and are considered the primary contaminants of concern (COC; Ramboll 2017). Lead (Pb) and mercury (Hg) concentrations within the Canal sediments are collocated and correlated. Therefore, Hg is used as the primary risk driver for the site. Hg impacts are confined to organic silt and silty sand sediment between the existing Canal banks and do not extend into the underlining native material.

Sediment consists primarily of dark brown to black silty sand containing variable amounts of organics, clay, and gravel. The sediment also contains various amounts of debris that includes an extensive range of urban garbage, such as plastics and cans, and large cobbles. Material under the soft sediment is a poorly graded fine sand and is visually distinct from the overlying sediment. Hg in sediment core samples ranges from non-detect to 11 milligrams per kilogram (mg/kg) and averages 2-3 mg/kg. The thickness of the soft sediment ranges from 0.4 to 5.0 feet. Normal water depths vary from 0 to 2.1 feet.

Exposure pathways are complete for both human and ecological receptors based on the Conceptual Site Model (CSM; Ramboll 2017). Exposure pathways for humans are complete for recreational activities such as paddle sports and fishing. Paddle sports pathways include dermal contact and incidental ingestion of sediment. Fishing pathways include the ingestion of fish tissue from fish caught from the Canal. The DNR has a posted a fish consumption advisory specific to the Canal for PCBs in common carp based on fish tissue testing. Exposure pathways for ecological receptors are complete for benthic invertebrates as well as fish and piscivores through the food chain. The Canal is on the impaired waters list because of the contaminated sediment.

The sediment remedial cleanup goal for the Canal is 0.36 milligrams per kilogram (mg/kg) total mercury, and the Remedial Actions Options Report (RAOR; Ramboll 2018) developed the following remedial objectives for the site:

- Remedial Objective 1: Reduce human exposures to COCs associated with incidental sediment ingestion and fish consumption from the Canal by reducing the bioavailability and concentration of COCs in sediments that are above protective levels.
- Remedial Objective 2: Reduce the exposure of the aquatic community and wildlife populations to sediment COCs at concentrations that are above protective levels.
- Remedial Objective 3: Minimize downstream transport of COCs during remedial action implementation.

As documented in the Segment 1 Construction Documentation Report (DNR 2017), sheen was apparent during sediment coring and also on geotextile tubes during remediation of Segment 1. Also documented in the Site Investigation Report (Ramboll 2017), Gruber Automotive is presumed to have been dumping petroleum substances into the Canal. The storm sewers from the former Gruber facility empty directly into the most upstream section of Segment 2. In addition, inspection of Sanborn maps identified a former Manufactured Gas Plant (MGP) along Segment 1 that operated from the 1890s to between 1910 and 1920. Note that only one core location (other than a composite in Segment 1) has been analyzed for PAHs. A sample maximum concentration of 68 mg/kg tPAH18 was reported for that core (PC13-56).

DNR previously identified the elevation of contamination (EOC) at sediment core locations by measurement of the elevation of the transition point from sediment to underlying native sand. DNR confirmed the validity of this approach through chemical analysis of the sediment and underlying native sand. The native sand bottom also represents the original dredging by the Corps when the canal was constructed. The EOC was apparent unless multi-depositional or intra bedded sand layers were present. Several observations and conclusions from previous investigations are as follows:

- The EOC was clear in 24 of the 28 cores collected in Segment 2 and the cores did not have multi-depositional layers.
- Multi-deposition layers existed at locations PC13-55, PC13-56, PC13-61S, and PC13-33. Except for PC13-33, all these locations are located in the delta area in the most upstream part of Segment 2.
- Peat was encountered below contaminated sediment at locations PC13-53, PC13-55, and PC-57S and in all cases, was native material and uncontaminated.

2.4 Selected Remedy

Remedial Action Option (RAO) 4 is the selected remedy from the RAOR (Ramboll 2017). RAO 4 includes the removal of contaminated sediment by dredging followed by placement of a sediment

cover. Removed material will be transported to a staging and processing area where they will be dewatered and processed to meet landfill requirements. The processed material will be transported to pre-approved licensed disposal facilities. Capping will be conducted where there are concerns for utilities and bank stabilization. The remedy underneath the railroad is under development.

3 Scope of Work

3.1 Project Scope of Work

This plan addresses health and safety issues associated with the following field tasks, which are described in more detail in the FSP:

- Non-intrusive field surveys (topographic, bathymetric, shoreline)
- Sediment poling
- Sediment sampling
- Soil sampling
- Geotechnical investigations including dynamic cone penetrometer tests and vane shear tests
- Motor vehicle use
- Work on or over water

4 Authority and Responsibilities of Key Personnel

This section describes the authority and responsibilities of key Anchor QEA project personnel. The names and contact information for the following key safety personnel are listed in the Site Emergency Procedures section at the beginning of this SSP. Should key site personnel change during the course of the project, a new list will be established and posted immediately at the site. The emergency phone number for the site is **911** and should be used for all medical, fire, and police emergencies.

4.1 Project Manager

The PM provides overall direction for the project. The PM is responsible for ensuring that the project meets the client's objectives in a safe and timely manner. The PM is responsible for providing qualified staff for the project and adequate resources and budget for the health and safety staff to carry out their responsibilities during the field work. The PM will be in regular contact with the FL and CHSM to verify that appropriate health and safety procedures are implemented into each project task.

The PM has authority to direct response operations; the PM assumes total control over project activities but may assign responsibility for aspects of the project to others. In addition, the PM performs the following tasks:

- Oversees the preparation and organization of background review of the project, the scope of work, and the field team
- Verifies that the team obtains permission for site access and coordinates activities with appropriate officials
- Briefs the FL and field personnel on specific assignments
- Together with the FL, sees that health and safety requirements are met
- Consults with the CHSM regarding unsafe conditions, incidents, or changes in site conditions or the scope of work

4.2 Field Lead

The FL reports to the PM, has authority to direct response operations, and assumes control over on-site activities. The FL will direct field activities, will coordinate the technical and health and safety components of the field program, and is responsible in general for enforcing this site-specific SSP and Corporate Health and Safety Program requirements. The FL will be the primary point of contact for all field personnel and visitors and has direct responsibility for implementation and administration of this SSP. The FL and any other member of the field team have **STOP WORK AUTHORITY**—the authority to stop or suspend work in the event of an emergency, if conditions arise that pose an unacceptable health and safety risk to the field team or environment, or if

conditions arise that warrant modifications to this SSP. It is critical that both the FL and PM communicate regularly to proactively identify and address any safety-related concerns that may arise. The following include, but are not necessarily limited to, the functions of the FL related to this SSP:

- Conduct and document daily safety meetings, or designate an alternate FL in his or her absence.
- Execute the scope of work and schedule.
- Conduct periodic field health and safety inspections to verify compliance with this SSP.
- Oversee implementation of safety procedures.
- Implement site personnel protection levels.
- Enforce site control measures to help verify that only authorized personnel are allowed on site.
- Notify, when necessary, local public emergency officials (all personnel on site may conduct this task as needed).
- Follow-up on incident reports to the PM.
- Periodically inspect protective clothing and equipment for adequacy and safety compliance.
- Verify that protective clothing and equipment are properly stored and maintained.
- Perform or oversee air monitoring (if required) in accordance with this SSP.
- Maintain and oversee operation of monitoring equipment and interpretation of data from the monitoring equipment.
- Monitor site personnel for signs of stress, including heat stress, overexertion, cold exposure, and fatigue.
- Require participants to use the "buddy" system in performing tasks.
- Provide (via implementation of this SSP) emergency procedures, evacuation routes, and telephone numbers for the local hospital, poison control center, fire department, and police department.
- Communicate incidents promptly to the PM.
- Maintain communication with the CHSM regarding on-site activities.
- If applicable, verify that decontamination and disposal procedures are followed.
- Maintain the availability of required safety equipment.
- Advise appropriate health services and medical personnel of potential exposures.
- Notify emergency response personnel in the event of an emergency and coordinate emergency medical care.

The FL will record health-and-safety-related details of the project in the field logbook. At a minimum, each day's entries must include the following information:

- Project name or location
- Names of all on-site personnel

- Level of PPE worn and any other specifics regarding PPE
- Weather conditions
- Type of field work being performed

The FL will have completed the required Occupational Safety and Health Administration (OSHA) 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training and annual updates, the 8-hour Supervisor training, medical monitoring clearance, and current first aid and cardiopulmonary resuscitation (CPR) training.

4.3 Corporate Health and Safety Manager

The CHSM (or designee) will be responsible for managing on-site health and safety activities and will provide support to the PM and FL on health and safety-related issues. The following are specific duties of the CHSM:

- Provide technical input into the design and implementation of this SSP.
- Advise on the potential for occupational exposure to project hazards, along with appropriate methods and/or controls to eliminate site hazards.
- Verify that a hazard assessment has been performed and that the adequacy of the PPE selected was evaluated as required by 29 CFR 1910.132(d), 29 CFR 1910.134, 29 CFR 1926.25, and 29 CFR 1926.55, and is duly noted by the signatures and date appearing on the Certification Page of this document.
- Consult with the FL on matters relating to suspending site activities in the event of an emergency.
- Verify that all on-site Anchor QEA personnel and subcontractors have read and signed the SSP Acknowledgement Form.
- Verify that corrective actions resulting from deficiencies identified by audit and observations are implemented and effective.

The CHSM or designee will have completed the required OSHA 40-hour HAZWOPER training and annual updates as well as the 8-hour Supervisor training (or a minimum of 5 years of supervisory experience).

4.4 Project Field Team

All project field team members will attend a project-specific meeting conducted by the FL concerning safety issues and project work task review before beginning work on site. All field team members, including subcontractors, must be familiar with and comply with this SSP. The field team has the responsibility to immediately report any potentially unsafe or hazardous conditions to the FL, and all members of the field team have **STOP WORK AUTHORITY**—the authority to stop or suspend work if conditions arise that pose an unacceptable health and safety risk to the field team or

environment, or if conditions arise that warrant modifications to this SSP. It is critical that all field team members proactively communicate with the FL to identify potential unsafe conditions. The field team reports to the FL for on-site activities and is responsible for the following:

- Reviewing and maintaining a working knowledge of this SSP
- Safe completion of on-site tasks required to fulfill the scope of work
- Compliance with the SSP
- Attendance and participation in daily safety meetings
- Notification to the FL of existing or potential safety conditions at the site
- Reporting all incidents to the FL
- Demonstrating safety and health-conscious conduct

Per OSHA 1910.120(e)(3)(i),[2] newly assigned HAZWOPER 40-hour trained field team members must have at least 3 days of field work supervised by an experienced FL (preferably an individual with HAZWOPER Supervisor training). It is the responsibility of the PM to identify such "short service" personnel and verify that their supervised field experience occurs (or has occurred) and is documented in the project field notes and on the Daily Safety Briefing form (Appendix A).

[2] "General site workers (such as equipment operators, general laborers and supervisory personnel) engaged in hazardous substance removal or other activities which expose or potentially expose workers to hazardous substances and health hazards shall receive a minimum of 40 hours of instruction off the site, and a minimum of three days actual field experience under the direct supervision of a trained experienced supervisor."

5 Project-Specific Requirements

This section provides activity-specific levels of protection and air monitoring requirements to be used on this site based on the scope of work and the chemicals of concern (COCs).

5.1 Activity-Specific Level of Protection Requirements

Refer to Section 10 for general requirements for PPE. Level D is the minimum acceptable level for most sites. An upgrade to Modified Level D occurs when there is a possibility that contaminated media can come in contact with the skin or work uniform. An upgrade to Level C occurs when there is a potential for exposure to airborne COCs (i.e., if the results of air monitoring reveal that action levels have been exceeded). Hearing protection must be worn when there are high noise levels. Site personnel must maintain proficiency in the use and care of PPE that is to be worn.

Table 5-1 describes the specific means of protection needed for each identified work activity.

5.2 Project Air Monitoring Requirements

Refer to Section 11 of this plan for general requirements for air monitoring at the project site, including information on air monitoring equipment. Upgrade from Level D and/or Modified Level D to Level C when the results of air monitoring reveals that action levels have been exceeded.

Table 5-2 describes the specific air monitoring required for each identified work activity.

Table 5-1
Project Job Tasks and Required PPE

Job Tasks		PPE Requirements
• Non-intrusive field activities, including site surveys and work on or over water, without the potential to contact contaminants of concern	☒	Standard work uniform/coveralls
	☒	Work boots with safety toe conforming to ASTM International (ASTM) F2412-05/ASTM F2413-05
	☒	High-visibility traffic safety vest
	☐	Chemical-resistant clothing <u>check appropriate garments</u>: ☐ One-piece coverall ☐ Hooded one- or two-piece chemical splash suit ☐ Disposable chemical coveralls ☐ Chemical-resistant hood and apron ☐ Bib-style overalls and jacket with hood **Fabric Type**: Tyvek NOTE: Thick rain pants and coveralls may be substituted for coated Tyvek if sediments are not obviously contaminated with polycyclic aromatic hydrocarbons (PAHs) or related petroleum products. Rain slickers cannot be effectively decontaminated of tar/petroleum contamination.
	☐	Disposable inner gloves (latex or equivalent "surgical")
	☒	Disposable chemical-resistant outer gloves **Material Type**: leather
	☐	Chemical-resistant boots with safety toe conforming to ASTM F2412-05/ASTM F2413-05 or disposable boot covers for safety toe/work boots **Material Type**: Rubber or leather
	☐	Puncture-resistant shanks in safety shoes conforming to ASTM F2412-05/ASTM F2413-05
	☐	Metatarsal guards conforming to ASTM F2412-05/ASTM F2413-05
	☐	Sleeves to be duct-taped over gloves and pants to be duct-taped over boots
	☐	Splash-proof safety goggles
	☒	Safety glasses
	☒	Hard hat
	☐	Hard hat with face shield
	☐	Hearing protectors (**REQUIRED** if site noise levels are greater than 85 decibels [dB] based on an 8-hour time-weighted average [TWA]). **Type**:
	☐	Two-way radio communication (intrinsically safe, if explosive atmosphere is a potential)
	☐	Long cotton underwear

Job Tasks		PPE Requirements
	☒	High-visibility, U.S. Coast Guard (USCG)-approved personal flotation device (PFD; if working on any water vessel or without fall protection within 10 feet of water)
	☒	USCG-approved float coat and bib-overalls (e.g., full two-piece "Mustang" survival suit or similar) or one-piece survival suit if combined air and water temperature is below 90°F
	☐	Half-face Air-Purifying Respirator (APR; OSHA/NIOSH-approved)
	☐	Full-face APR (OSHA/NIOSH-approved)
	☐	**Type of Cartridges to be Used**: ☐ **OV or** ☐ **OV/HEPA (if samples are dry)**
• Intrusive activities or general activities with the potential to contact contaminants of concern	☒	Standard work uniform/coveralls
	☒	Work boots with safety toe conforming to ASTM F2412-05/ASTM F2413-05
	☒	High-visibility traffic safety vest
	☒	Chemical-resistant clothing <u>check appropriate garments</u>: ☐ One-piece coverall ☐ Hooded one- or two-piece chemical splash suit ☒ Disposable chemical coveralls ☐ Chemical-resistant hood and apron ☐ Bib-style overalls and jacket with hood **Fabric Type**: Tyvek NOTE: Thick rain pants and coveralls may be substituted for coated Tyvek if sediments are not obviously contaminated with PAHs or related petroleum products. Rain slickers cannot be effectively decontaminated of tar/petroleum contamination.
	☒	Disposable inner gloves (latex or equivalent "surgical")
	☒	Disposable chemical-resistant outer gloves **Material Type**: Heavy nitrile
	☐	Chemical-resistant boots with safety toe and steel shank conforming to ASTM F2412-05/ASTM F2413-05 or disposable boot covers for safety toe/work boots **Material Type**: Rubber or leather
	☐	Puncture-resistant shanks in safety shoes conforming to ASTM F2412-05/ASTM F2413-05
	☐	Metatarsal guards conforming to ASTM F2412-05/ASTM F2413-05
	☐	Sleeves to be duct-taped over gloves and pants to be duct-taped over boots
	☐	Splash-proof safety goggles

Job Tasks		PPE Requirements
	☒	Safety glasses
	☒	Hard hat
	☐	Hard hat with face shield
	☐	Hearing protectors (**REQUIRED** if site noise levels are greater than 85 dB based on an 8-hour TWA). **Type:**
	☐	Two-way radio communication (intrinsically safe, if explosive atmosphere is a potential)
	☐	Long cotton underwear
	☒	High-visibility, USCG-approved PFD (if working on any water vessel or without fall protection within 10 feet of water)
	☒	USCG-approved float coat and bib-overalls (e.g., full two-piece "Mustang" survival suit or similar) or one-piece survival suit if combined air and water temperature is below 90°F
	☐	Half-face APR (OSHA/NIOSH-approved)
	☐	Full-face APR (OSHA/NIOSH-approved)
	☐	**Type of Cartridges to be Used:** ☐ **OV or** ☐ **OV/HEPA (if samples are dry)**

Table 5-2
Project Air Monitoring Requirements[3]

Instrument[1]	Job Tasks/Functions	Measurement	Monitoring Schedule[2]	Actions[3]
FID and/or PID (11.7 eV Lamp; Measures Total Organic Vapors)	Conduct air monitoring for VOCs during activities where contaminated media are present. Make sure that a background reading is taken before the start of activities and periodically thereafter.	0 to 1 ppm above background in breathing zone	Periodically (every 15 to 30 minutes)	Acceptable, continue work.
		> 1 ppm above background in breathing zone		Stop work required.[4] Leave work area and contact PM and CHSM for guidance.

Notes:

1. Instruments must be calibrated according to manufacturer's recommendations.
2. Monitoring frequency is from the beginning of each task and at specified intervals thereafter, or when detectable soil contamination is encountered (as indicated by strong, sustained odor, visual evidence of product, or petroleum-discolored soils).
3. For VOCs, a sustained reading for greater than 2 minutes in excess of the action level will trigger a protective measure.
4. Contact with the CHSM and PM must be made prior to continuance of work. A hazard review must be conducted before proceeding with work. Corrective actions may include temporary work stoppage to allow vapors to dissipate, and then returning to work if air monitoring data permits.

eV: electronvolt
FID: flame ionization detector
PID: photoionization detector
ppm: part per million
VOC: volatile organic compound

[3] This air monitoring stipulated for this project assumes all sample material will be wet and dust will not be negated/present. If dusty conditions arise, stop work and contact the CHSM.

6 Risk Analysis and Control

The following sections discuss the potential health and safety hazards associated with the field tasks described in the scope of work. Controls of these hazards are addressed through the mechanical and physical control measures, use of PPE, monitoring, training, decontamination, emergency response, and safety procedures.

Significant changes in the scope of work covered by this SSP must be communicated to the PM and CHSM, and a modification to this SSP must be created as needed (see Section 1.1). Any task conducted beyond those identified in the scope of work and this SSP must be evaluated using the Job Safety Analysis (JSA) process prior to conducting the work.

6.1 Job Safety Analysis

Anchor QEA work tasks have been evaluated for their hazards and JSA documents have been developed that detail the chemical, physical, and biological hazards associated with these tasks along with the control measures (e.g., engineering controls, administrative controls, and/or PPE) that will be used to conduct them in a safe manner.

The PM and FL are responsible for identifying work tasks and project site conditions that are beyond the previously developed JSA documents and for communicating such information to the CHSM. The CHSM will provide support, as needed, to the PM and the FL, who will have primary responsibility to develop project-specific JSAs.

The contents of the JSA documents shall be communicated to project personnel during the site orientation meeting and during daily safety meetings when conducting work where the specific JSAs are applicable.

JSA documents applicable to this project are located in Appendix B and include the following field tasks:

- Field Activities (JSA001)
- Sediment and Soil Sampling, (JSA002)
- General Boating Activities (JSA003)
- Decontamination Activities (JSA004)
- Motor Vehicle Operation (JSA005)
- Stream, Wetland, and Habitat Surveys (JSA006)
- Investigation-derived Waste Management (JSA007)
- Sample and Laboratory Glassware Handling (JSA008)

6.1.1 Augmented Job Safety Analysis Process

If significant work tasks are identified during the course of the project that were not previously addressed in the JSA documentation supplied in Appendix B, then a task-specific JSA document must be developed prior to conducting the work. The PM and FL shall develop this document(s) with input from the CHSM, as needed, and this SSP will be modified to include the JSA document (see Section 1.1 for SSP modification procedures). Project personnel shall be trained on the contents of the developed task-specific JSA prior to its implementation. A copy of the task-specific JSA form used in this process is supplied in Appendix B of this SSP.

6.2 Exposure Routes

Possible routes of exposure to the chemicals potentially encountered on this project include inhalation, dermal contact, and ingestion of dust, mist, gas, vapor, or liquid. Exposure will be minimized by using safe work practices and by wearing the appropriate PPE. A further discussion of PPE requirements is presented in Section 10.

6.2.1 Inhalation

Inhalation of particulates, dust, mist, gas, or vapor during field activities is possible. Whenever possible, work activities will be oriented so that personnel are upwind of the sampling location. An organic vapor monitor (OVM) may be used to monitor ambient air and the breathing zone within the work area for organic compounds.

6.2.2 Dermal Contact

Dermal contact with potentially contaminated soil, sediment, or surface water during field activities is possible. Direct contact will be minimized by using appropriate PPE and decontamination procedures.

6.2.3 Ingestion

Direct ingestion of contaminants can occur by inhaling airborne dust, mist, or vapors, or by swallowing contaminants trapped in the upper respiratory tract. Indirect ingestion can occur by introducing the contaminants into the mouth by way of food, tobacco, fingers, or other carriers. Although ingestion of contaminants can occur, proper hygiene, decontamination, and contamination reduction procedures should reduce the probability of this route of exposure.

6.3 Chemicals of Concern Profile

Table 6-1 provides a summary profile for the COCs for this project. As available, this profile is based on recent site history and site characterization information. For more detailed and specific

information, always refer to the Safety Data Sheet (SDS) or equivalent information for the chemical (see Appendix C).

Table 6-1
Chemicals of Concern Profile

Chemical	Exposure Routes	Symptoms	Target Organs	OSHA PEL	Odor Threshold (ppm)	LEL (%)	Ionization Potential (eV)
Metals (as mercury)	Inhalation, skin absorption, ingestion, skin and/or eye contact	Paresthesia; ataxia, dysarthria; vision and hearing disturbance; spasticity, jerking limbs; dizziness; salivation; lacrimation (discharge of tears); nausea, vomiting, diarrhea, and constipation; skin burns; emotional disturbance; kidney injury; and possible teratogenic effects	Eyes, skin, central nervous system, peripheral nervous system, kidneys	0.01 mg/m^3	NA	NA	NA
SVOCs and PAHs (as naphthalene)	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation of eyes; headache, confusion, excitement, and malaise (vague feeling of discomfort); nausea, vomiting, and abdominal pain; irritation of bladder; profuse sweating; jaundice; hematuria (blood in the urine) and renal shutdown; dermatitis, optical neuritis, and corneal damage	Eyes, skin, blood, liver, kidneys, central nervous system	10 ppm	0.084 ppm	0.9	8.12
VOCs (as benzene)	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation of eyes, skin, nose, and respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression; (potential occupational carcinogen)	Eyes, skin, respiratory system, blood, central nervous system, bone marrow	1 ppm	1.5 ppm	1.2	9.84
PCBs (as chlorodiphenyl 54% chlorine)	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation of eyes and chloracne; liver damage; reproductive effects (potential occupational carcinogen)	Skin, eyes, liver, reproductive system	0.5 mg/m^3	NA	NA	Unknown

Chemical	Exposure Routes	Symptoms	Target Organs	OSHA PEL	Odor Threshold (ppm)	LEL (%)	Ionization Potential (eV)
Perfluoroalkyls	Direct contact, inhalation, ingestion[1]	Irritation of eyes, dry skin, nasal discomfort and coughing, stomach pain, nausea, vomiting, diarrhea[2]	Eyes, skin, digestive system[3]	None[4]	Unknown[5]	NA[6]	Unknown

Notes:
Sources: https://www.cdc.gov/niosh/npg/default.html; https://www.epa.gov/sites/production/files/2016-09/documents/naphthalene.pdf; https://www.epa.gov/sites/production/files/2016-09/documents/benzene.pdf

1. http://grimsleysinc.com/page_images/1434040889.pdf
2. http://grimsleysinc.com/page_images/1434040889.pdf
3. http://grimsleysinc.com/page_images/1434040889.pdf
4. https://www.atsdr.cdc.gov/toxprofiles/tp200-c7.pdf
5. https://www.atsdr.cdc.gov/toxprofiles/tp200-c4.pdf
6. https://www.atsdr.cdc.gov/toxprofiles/tp200-c4.pdf

7 Site Control and Communications

The primary purposes for site controls are to establish the hazardous area perimeter, reduce migration of contaminants into clean areas, and prevent unauthorized access or exposure to hazardous materials by site personnel and the public. Site control is especially important in emergency situations.

7.1 General Site Control Safety Procedures

The following standard safe work practices apply to all Anchor QEA site personnel and subcontractors and shall be discussed in the safety briefing prior to initiating work on the site:

- Eating, drinking, chewing gum or tobacco, and smoking are prohibited on site except in designated areas.
- Hands and faces must be washed before entering and upon leaving the work area, as well as before eating, drinking, chewing gum or tobacco, and smoking.
- A buddy system will be used. Radio, cell phone, or hand signals will be established to maintain communication.
- During site operations, each worker will consider himself/herself as a safety backup to his/her partner.
- Visual contact will be maintained between buddies on site when performing potentially hazardous duties.
- No personnel will be admitted to the site without the proper safety equipment, training, and (if required) medical monitoring certification.
- All personnel must comply with established safety procedures. Any staff member who does not comply with safety policy as established in this SSP may be subject to corrective action, potentially including but not limited to, being reprimanded or immediate dismissal.
- Proper decontamination procedures must be followed before leaving a contaminated work area.

7.2 Work Area Access Control

If work is performed in public areas, the following precautions shall be taken to protect both the site personnel and the public. Access control to the work area will be accomplished using a combination of the following devices and/or methods:

- Fences and/or barricades
- Traffic control devices and/or use of flaggers
- Caution tape
- Other methods to keep the site secure and provide a visual barrier to help keep unauthorized personnel from entering the site and active work areas

7.3 Hazardous Waste Site Work Control Procedures

To prevent contamination from migrating from personnel and equipment, work areas will be clearly specified as an Exclusion Zone/Hot Zone (EZ), Contamination Reduction Zone (CRZ), or Support Zone/Clean Zone (SZ) prior to beginning operations. Each work area will be clearly identified using signs or physical barriers. At the end of each workday, the site should be secured and/or guarded to prevent unauthorized entry.

Site work zones will include:

- **Exclusion Zone/Hot Zone (EZ).** The EZ will be the "hot zone" or contaminated area inside the site perimeter (or sample collection area of boat). The EZ is the defined area where potential respiratory and/or health hazards exist. All personnel entering the EZ must use the required PPE, as set forth in this SSP, and meet the appropriate training and medical clearance. Entry to and exit from this zone will be made through a designated point. Appropriate warning signs to identify the EZ should be posted (e.g., DANGER, AUTHORIZED PERSONNEL ONLY, PROTECTIVE EQUIPMENT REQUIRED BEYOND THIS POINT). Personnel and equipment decontamination must be performed upon exiting the EZ.
- **Contamination Reduction Zone (CRZ).** The CRZ, also known as the "warm zone," is a transitional zone between the EZ and the SZ (also known as the "cold zone" or "clean zone"). The CRZ provides a location for removal and decontamination of PPE and tools leaving the EZ. A separate decontamination area will be established for heavy equipment. All personnel and equipment must exit via the CRZ. If the CRZ is compromised at any time, a new CRZ will be established.
- **Support Zone/Clean Zone (SZ).** This uncontaminated zone will be the area outside the EZ and CRZ and within the geographic perimeters of the site (including boat and processing areas). The SZ is used for support personnel; staging materials; parking vehicles; office, laboratory, and sanitation facilities; and receiving deliveries. Personnel entering this zone may include delivery personnel, visitors, security guards, and others who will not necessarily be permitted in the EZ or CRZ.

A log of all personnel visiting, entering, or working on the site shall be maintained by the FL. No visitor will be allowed in the EZ without showing proof of training and medical certification, per 29 CFR 1910.120(e),(f) (and 29 CFR 1926.1101(k)(9),(m) if appropriate). Visitors will attend a site orientation given by the FL and sign the SSP.

7.4 Site-Specific Work Zone Requirements

This section contains guidelines for maintaining safe conditions when working from land or from a boat.

7.4.1 Land-Based Soil or Sediment Sampling Work Zones

This subsection contains guidelines concerning health and safety during soil sampling activities on land, as well as land-based sediment sampling in the canal. These land locations may be on residential property in maintained areas, or overgrown locations. The FL will delineate the boundaries of the work zones at each sampling location and will inform the field crews of the arrangement. The purpose of the zones is to limit the migration of sample material out of the zones and to restrict access to active work areas, particularly regarding inadvertent entry into the zones by the public or property owner.

Two Exclusion Zones will be observed at each sampling location. One zone will include the area where the sampling apparatus will be deployed and recovered. The second work zone will be a sample processing area at the support vehicle, designated location near the Site, or as otherwise determined. Only Anchor QEA personnel and their subcontractors are permitted in these Exclusion Zones.

Both the collection and processing land-based areas will have an SZ outside the CRZ to stage clean equipment, don PPE, take rest breaks, or perform any other site activities that do not involve potentially contaminated materials.

7.4.1.1 Decontamination Area

A station will be set up for decontaminating sample processing equipment and personnel gear such as boots or PPE. The station will have the buckets, brushes, soapy water, rinse water, or wipes necessary to perform decontamination operations. Plastic bags will be provided for expendable and disposable materials. Decontamination fluids will be stored in sealable containers and will be properly disposed of.

7.4.1.2 Access Control

Security and control of access to the sampling onshore area will be the responsibility of FL.

7.4.2 Work Zones for Sediment Sampling from Vessels

This subsection contains guidelines concerning health and safety aboard marine sampling vessels. The vessel captain, onshore coring operator, and FL will delineate the boundaries of the work zones aboard the vessel and will inform the field crews of the arrangement. The purpose of the zones is to limit the migration of sample material out of the zones and to restrict access to active work areas.

Due to the size of the anticipated vessels (i.e., jon boat), one work zone will be observed aboard the vessel. It will encompass the location of the vessel where the samplers will be deployed and recovered. Only the coring crew may enter this zone unless assistance is required by other personnel. The coring crew will deliver sediment core tubes to the sample processing zone on shore.

The collection area on the vessel will have a SZ outside the CRZ to stage clean equipment, don PPE, take rest breaks, or perform any other site activities that do not involve potentially contaminated materials.

7.4.2.1 Vessel Decontamination Area

A station will be set up for decontaminating sample processing equipment and personnel gear such as boots or PPE. The station will have the buckets, brushes, soapy water, rinse water, or wipes necessary to perform decontamination operations. Plastic bags will be provided for expendable and disposable materials. The decontamination fluids will be stored in sealable containers and will be properly disposed of.

7.4.2.2 Access Control

Security and control of access to the sampling vessel and onshore area will be the responsibility of the captain and FL. Additional security measures may be placed into effect by the client, or as required by national security threat levels determined by the federal government. Access to the vessel and onshore areas will only be granted to necessary project personnel and authorized visitors. Any security or access control problems will be reported to the client or appropriate authorities.

7.4.2.3 Safety Equipment

In addition to PPE that will be worn by shipboard personnel, basic emergency and first aid equipment will also be provided. Equipment will include:

- U.S. Coast Guard (USCG)-approved personal flotation devices (PFDs)
- First aid kit adequate for the number of personnel
- Emergency eyewash

Anchor QEA and/or subconsultants will provide this equipment, which must be at the location(s) where field activities are being performed. Equipment will be checked daily to verify its readiness for use.

7.5 Field Communications

Communications between all Anchor QEA employees and subcontractors at the work site can be verbal and/or non-verbal. Verbal communication can be affected by the on-site background noise and various PPE. See Table 7-1 for a list of the types of communication methods and equipment to use, depending on site conditions. Communication equipment must be checked daily to verify proper operation. All project personnel must be initially briefed on the communication methods prior to starting work; communication methods should be reviewed in daily safety meetings.

Table 7-1
Field Communication Methods

Type of Communication	Communication Device	Signal
Emergency notification	On-site Telephone or Cellular Telephone	Initiate phone call using applicable emergency numbers
Emergency notification among site personnel	Two-way Radio	Initiate radio communication with Code Red message
Hailing site personnel for non-emergency	Compressed Air Horn	One long blast, one short blast
Hailing site personnel for emergency evacuation	Compressed Air Horn	Three long, continuous blasts
Hailing site personnel for distress, need help	Visual	Arms waved in circle over head
Hailing site personnel for emergency evacuation	Visual	Arms waved in criss-cross over head
Contaminated air/strong odor	Visual	Hands clutching throat
Break, lunch, end of day	Visual	Two hands together, break apart

8 Decontamination Procedures and Practices

8.1 Minimization of Contamination

The following measures will be observed to prevent or minimize exposure to potentially contaminated materials:

Personnel

- Do not walk through spilled materials.
- Do not handle, touch, or smell sample media directly.
- Make sure PPE has no cuts or tears prior to use.
- Protect and cover any skin injuries.
- Stay upwind of airborne dusts and vapors.
- Do not eat, drink, chew tobacco, or smoke in the work zones.

Sampling Equipment and Vehicles/Vessels

- Use care to avoid getting sampled media on the outside of sample containers.
- If necessary, bag sample containers before filling with sampled media.
- Place clean equipment on a plastic sheet to avoid direct contact with contaminated media.
- Keep contaminated equipment and tools separate from clean equipment and tools.
- Fill sample containers over a plastic tub to contain spillage.
- Clean up spilled material immediately to avoid tracking around the vehicle/vessel.

8.2 Decontamination Equipment

All vehicles, vessels, and equipment that have entered potentially contaminated areas will be visually inspected and, if necessary, decontaminated prior to leaving the area. Tools will be cleaned following Standard Operating Procedure 08 – Equipment Decontamination. Rinsate from all decontamination activities will be collected for proper disposal. Decontamination of equipment and tools will take place within the CRZ.

The following supplies will be available to perform decontamination activities:

- Wash and rinse buckets
- Tap water and phosphate-free detergent
- Scrub brushes
- Distilled/deionized water
- Pressure washer/steam cleaner, if appropriate
- Paper towels and plastic garbage bags

8.3 Personnel Decontamination

The FL will verify that all site personnel are familiar with personnel decontamination procedures as listed below. All personnel wearing PPE in a work area (EZ) must undergo decontamination prior to entering the SZ. Personnel will perform the following decontamination procedures:

- Wash and rinse outer gloves and boots in portable buckets to remove gross contamination.
- If suit is heavily soiled, rinse it off.
- Remove outer gloves; inspect and discard if damaged. Leave inner gloves on. Personnel will remove their outer garment and gloves, dispose of them, and properly label container or drum. Personnel will then decontaminate their hard hats and boots with an aqueous solution of detergent or other appropriate cleaning solution. These items then will be hand-carried to the next station. Remove inner gloves.
- Thoroughly wash hands and face before leaving CRZ.

8.4 Sampling and Processing Equipment Decontamination

To prevent sample cross-contamination, sampling and processing equipment in contact with soil, sediment, or water samples will undergo the following decontamination procedures when work is completed in the CRZ and prior to additional use:

1. Rinse with potable water and wash with scrub brush.
2. Wash with phosphate-free detergent (Alconox®).
3. Visually inspect the sampler and repeat the scrub and rinse step, if necessary. If scrubbing and rinsing with Alconox® is insufficient to remove visually observable tar-related contamination on equipment, the equipment will be scrubbed and rinsed using hexane (or similar type solution) until all visual signs of contamination are absent.
4. Rinse external sampling equipment with potable water three times prior to use. Rinse homogenizing equipment once with potable water and three times with distilled water prior to and between sample processing.

8.5 Handling of Investigation-Derived Waste

All remaining soil or sediment, fluids used for decontamination of sampling equipment, and sample collection disposable wastes (e.g., gloves, paper towels, foil, or others) will be placed into appropriate containers and staged on site for disposal.

8.5.1 Disposable Personal Protective Equipment

Disposable PPE may include Tyvek suits and inner latex gloves. Dispose of PPE according to the requirements of the client and state and federal agencies.

8.5.2 Non-Disposable Personal Protective Equipment

Non-disposable PPE may include boots and gloves.

When decontaminating boots and gloves, observe the following practices and procedures:

- Decontaminate the boots or gloves outside with a solution of detergent and water; rinse with water prior to leaving the site.
- Protect the boots or gloves from exposure by covering with disposable covers such as plastic to minimize required decontamination activities.

8.6 Sanitizing Personal Protective Equipment

Reusable protective clothing and other personal articles must not only be decontaminated before being reused, but also sanitized. Clothing may become soiled due to exhalation, body oils, and perspiration. If practical, reusable protective clothing should be machine-washed after a thorough decontamination; otherwise, it must be cleaned by hand.

8.7 Emergency Personnel Decontamination

Personnel with medical problems or injuries may also require decontamination. There is the possibility that the decontamination may aggravate or cause more serious health effects. If prompt lifesaving, first aid, and medical treatment are required, decontamination procedures will be omitted. In either case, a member of the site management team will accompany contaminated personnel to the medical facility to advise on matters involving decontamination.

8.8 Containment of Decontamination Fluids

As necessary, spill control measures will be used to contain contaminated runoff that may enter into clean areas. Use plastic sheeting, hay bales, or install a spill control system to prevent spills and contain contaminated water.

8.9 Pressure Washing

The following procedure is required when using high-pressure washing equipment for decontamination purposes:

- Wear modified Level D protection, including safety goggles.
- Verify that other personnel are out of the area prior to decontamination.
- Secure the area around the decontamination pad with cones, caution tape, or barricades.
- Verify that safe work practices and precautions are taken to minimize the potential for physical injury from high-pressure water spray. Follow the manufacturer's operating instructions.
- The pressure washer wand must be equipped with a safety release handle.

- Verify that the area is clean after equipment is decontaminated. Barricades, cones, or caution tape must be left in place and secured at all times.

9 Health and Safety Training and Informational Programs

This section describes the health and safety training and informational programs with which Anchor QEA project site personnel must comply. All certifications required in this section are provided in Appendix D and will be kept on internal file.

9.1 Initial Project Site Orientation

Work on all Anchor QEA project sites requires participation in an initial health and safety orientation presented by the PM or FL that will consist of, at a minimum, the following topics:

- A review of the contents of this SSP, including the scope of work and associated site hazards and control methods and procedures.
- Provisions of this plan are mandatory for all Anchor QEA personnel assigned to the project.
- Anchor QEA subcontractors are also expected to follow the provisions of this plan unless they have their own SSP that covers their specific activities related to this project and includes the minimum requirements of this SSP.
- All visitors to the work site will also be required to abide by the requirements of this plan.
- Personnel assigned to perform work at the project site, working under the provisions of this SSP, will be required to read the plan and must sign the Site Safety Plan Acknowledgement Form to confirm that they understand and agree to abide by the provisions of this plan. Personnel not directly affiliated with the project (i.e., visitors) may also be required to sign the Liability Waiver.

9.2 Daily Safety Meetings

Daily safety meetings ("tailgate meetings") make accident prevention a top priority for everyone and reinforce awareness of important accident-prevention techniques. The following daily safety meeting procedures and practices are required:

- Daily safety meetings will be held each morning prior to conducting site activities.
- The Daily Safety Briefing form in Appendix A will be used to document each meeting.
- Copies of the completed Daily Safety Briefing forms will be maintained on site during the course of the project.

9.3 End-of-Day Wellness Checks

Similar to the daily safety meetings, field staff will gather at the end of the day to verify group health and wellness and discuss any near misses that occurred that day. The wellness checks will be recorded on that day's Daily Safety Briefing form.

9.4 Hazardous Waste Operations Training

Personnel working on project sites that present a potential exposure to hazardous wastes or other hazardous substances shall be trained in accordance with the requirements of the 29 CFR 1910.120 (HAZWOPER) regulation. Training requirements will consist of the following:

- Field personnel must complete a minimum of 40 hours of hazardous waste activity instruction.
- Field personnel must complete a minimum of 3 days of supervised field instruction.
- Field personnel assigned to the site will also have received 8 hours of refresher training if the time lapse since their previous training has exceeded 1 year.
- On-site managers and supervisors directly responsible for employees engaged in hazardous waste operations will receive an additional 8 hours of supervisory training.
- Field personnel shall be current in first aid/CPR training offered by the American Red Cross or equivalent.
- Other training may be required depending on the task to be performed (e.g., confined space, excavation/trenching, underground storage tank removal, fall protection, respiratory protection, and hazard communication).

9.5 Hazard Communication Program

The purpose of hazard communication (Employee Right-to-Know) is to verify that the hazards of all chemicals located at the field project site are communicated to all Anchor QEA personnel and subcontractors according to 29 CFR 1926.59. Refer to the Anchor QEA Hazard Communication Program document for additional information.

Every container of hazardous materials must be labeled by the manufacturer, who must also provide a SDS upon initial order of the product and upon request thereafter. The actual format may differ from company to company (e.g., National Fire Protection Association [NFPA], Hazardous Material Information System [HMIS], or other), but the labels must contain similar types of information. Maintain manufacturer labels if possible. The label may use words or symbols to communicate the following:

- Introduction
- Hazard(s) identification
- Composition/information on ingredients
- First-aid measures
- Fire-fighting measures
- Accidental release response measures
- Handling and storage
- Exposure controls/personal protection
- Physical and chemical properties

- Stability and reactivity properties
- Toxicological properties
- Ecological properties
- Disposal considerations
- Transport considerations
- Regulatory information
- Other information, including at a minimum, label preparation or last revision date

SDS for all chemicals brought onto the site or anticipated to be used on site shall be provided in Appendix C of this SSP. These SDS shall be readily available for reference by site personnel and emergency response personnel.

Hazardous materials received without proper labels shall be set aside and not distributed for use until properly labeled.

If a hazardous chemical is transferred into a portable container (approved safety can), even if for immediate use only, the contents (e.g., acetone or gasoline) of the portable container must be identified.

10 General PPE Requirements

The minimum level of PPE should be selected according to the hazards that may be encountered during site activities in accordance with established U.S. Environmental Protection Agency (EPA) levels of protection (D and C). Only PPE that meets American National Standards Institute (ANSI) standards shall be worn. Site personnel must maintain proficiency in the use and care of PPE. Damaged or defective PPE must be replaced and may not be used. Anchor QEA will provide all necessary PPE for its employees as described in this SSP.

Refer to Section 5 for site-specific job task and level-of-protection requirements.

10.1 Minimum Requirements: Level D Protection

The minimum level of protection on project sites will be Level D protection, which consists of the following equipment:

- Standard work uniform/coveralls
- Work boots with safety toe conforming to ASTM International (ASTM) F2412-05/ASTM F2413-05
- Approved safety glasses or goggles (meets ANSI Z87.1—2010 requirements for eye protection)
- Hard hat (meets ANSI Z89.1—1986 requirements for head protection)
- High-visibility traffic safety vest
- Hearing protection when there are high noise levels

Level D protection will be used only when:

- The atmosphere contains no known hazards
- Work functions preclude splashes, immersions, or the potential for unexpected inhalation of, or contact with, hazardous concentrations of chemicals
- Atmospheric concentrations of contaminants are less than the Permissible Exposure Limit (PEL) and/or Threshold Limit Value (TLV)

10.1.1 Modified Level D Protection Requirements

Depending on the scope of work and the potential hazards to be encountered, Level D protection shall be modified to include additional protective equipment such as USCG-approved PFDs, face shields/goggles, chemical-resistant clothing, and disposable gloves of varying materials depending on the chemical substances involved. An upgrade to Modified Level D occurs when there is a possibility that contaminated media can contact the skin or work uniform, or if unique, site-specific hazards exist.

11 General Air Monitoring Requirements

11.1 General Requirements

In general, air monitoring shall be conducted when the possibility of hazardous atmospheres, chemical volatilization, or contaminated airborne dust exists (e.g., from intrusive activities involving contaminated soils or groundwater, developing new monitoring wells, working with wells containing known COCs, confined space entry, or others).

Air movers or other engineering controls shall be used to exhaust or dilute solvent vapors emanating from monitoring wells or hazardous atmospheres in confined spaces prior to the use of respiratory protection devices.

Site-specific air monitoring action levels are provided in Section 5.2.

11.2 Real-Time Air Monitoring Equipment

As applicable, organic vapor concentrations shall be monitored in the field with either a photoionization detector (PID) or flame ionization detector (FID). Flammable vapors and/or gasses are monitored with an oxygen/lower-explosive limit (O_2/LEL) real-time instrument. Organic vapor measurements are usually taken in the breathing zone of the worker while O_2/LEL measurements are taken at the point of operation (e.g., monitoring well head or auger point).

As applicable, airborne dust/particulate concentrations shall be measured using a real-time aerosol monitor (using a scattered light photometric sensing cell) when there are visible signs of potentially contaminated airborne dust. Both area and personal air monitoring readings are to be taken to characterize site activities.

As applicable, colorimetric detector tubes shall be used to monitor specific COCs such as benzene or vinyl chloride if there is a possibility that they may be present in elevated concentrations based upon the background of the project site, the scope of work, and conditions discovered at the site.

As applicable, other real-time air monitoring equipment, such as hydrogen cyanide meters, may be utilized depending upon the scope of work and COCs.

Air monitoring results shall be documented on the Daily Air Monitoring Record form (see Appendix A) or in the field logbook.

11.3 Time-Integrated Air Monitoring Equipment

Some Anchor QEA projects may require the use of time-integrated air monitoring equipment to determine employee exposures to COCs. Time-integrated air monitoring would be required if there

is the possibility that employees would be exposed to concentrations of a COC that approach or exceed an established exposure limit.

Typical time-integrated sampling methods will usually involve the use of personal sampling pumps and associated filter and/or charcoal sampling media, or the use of diffusion-based sampling media. Exposed sampling media is normally sent to an accredited laboratory for analysis.

Contact the CHSM for consultation and assistance with the performance of time-integrated air monitoring activities.

11.4 Equipment Calibration and Maintenance

Calibration and maintenance of air monitoring equipment shall follow manufacturer specifications and must be documented. Recalibration and adjustment of air monitoring equipment shall be completed as site conditions and equipment operation warrant. Record all air monitoring equipment calibration and adjustment information on the Daily Air Monitoring Record form (see Appendix A) and in the field logbook.

11.5 Air Monitoring Action Levels

Air monitoring action levels have been developed that stipulate the chemical concentrations in the breathing zone that require an upgrade in level of PPE.

Air monitoring action levels are typically set at one-half of the OSHA PEL, NIOSH Recommended Exposure Limit (REL), or the American Conference of Governmental Industrial Hygienists (ACGIH) TLVs. The rationale for establishing action levels is based on the available data that characterize COCs in site media.

Air monitoring measurements shall generally be taken in the breathing zone of the worker most likely to have the highest exposure. Transient peaks will not automatically trigger action. Action will be taken when levels are consistently exceeded in a 2-minute period. Similarly, if chemical odors are detected that are a nuisance, bothersome, or irritating, an upgrade in respiratory protection can provide an extra level of comfort or protection when conducting site activities.

11.6 Air Monitoring Frequency Guidelines

In general, conduct periodic air monitoring when:

- It is possible that an immediately dangerous to life or health (IDLH) condition or a flammable atmosphere has developed (e.g., confined space entry or intrusive activities).
- There is an indication that exposures may have risen over established action levels, PELs, or published exposure levels since the last monitoring. Look for a possible rise in exposures associated with the following situations:

- Change in site area (e.g., work begins on a different section of the site).
- Change in on-site activity (e.g., one operation ends and another begins).
- Change in contaminants (e.g., handling contaminants other than those first identified).
- Visible signs of particulate exposure from intrusive activities such as drilling, boring, or excavation.
- Perceptible chemical odors or symptoms of exposure.
- Handling leaking drums or containers.
- Working with obvious liquid contamination (e.g., a spill or lagoon).
- Conduct air monitoring when the possibility of volatilization exists (such as with a new monitoring well or a well containing known COCs).

12 Health and Safety Procedures and Practices

In addition to the task-specific JSAs listed in Section 6.1 and presented in Appendix B, this section lists the health and safety procedures and practices applicable to this project. For additional information, consult with the PM.

12.1 Physical Hazards and Controls

12.1.1 General Site Activities

Observe the following general procedures and practices to prevent physical hazards:

- Legible and understandable precautionary labels shall be affixed prominently to containers of potentially contaminated soil, sediment, water, and clothing.
- No food or beverages shall be present or consumed in areas that have the potential to contain COCs and/or contaminated materials or equipment.
- No tobacco products or cosmetics shall be present or used in areas that have the potential to contain COCs and/or contaminated materials or equipment.
- An emergency eyewash unit shall be located immediately adjacent to employees who handle hazardous or corrosive materials, including decontamination fluids. All operations involving the potential for eye injury or splash must have approved eyewash units locally available capable of delivering at least 0.4 gallons per minute for at least 15 minutes.
- Personnel working within 10 feet of bodies of water shall wear USCG-approved PFDs.
- Certain project sites may have newly finished work (e.g., concrete, paving, framing, habitat reconstruction, or sediment caps) that may be damaged by unnecessary contact, or that could cause dangerous conditions for personnel (e.g., slipping, sinking, or tripping). Personnel working in or around these areas shall communicate with the PM, FL, and client contact as needed to prevent damaging new work or entering dangerous conditions.
- Generally, all on-site activities will be conducted during daylight hours. If work after dusk is planned or becomes necessary due to an emergency, adequate lighting must be provided.
- Hazardous work, such as handling hazardous materials and heavy loads and operating equipment, should not be conducted during severe storms.
- All temporary electrical power must have a ground-fault circuit interrupter (GFCI) as part of its circuit if the circuit is not part of permanent wiring. All equipment must be suitable and approved for the class of hazard present.

12.1.2 Slips, Trips, and Falls

Observe the following procedures and practices to prevent slips, trips, and falls:

- Inspect each work area for slip, trip, and fall potential prior to each work task.

- Slip, trip, and fall hazards identified must be communicated to all personnel. Hazards identified shall be corrected or labeled with warning signs to be avoided.
- All personnel must be aware of their surroundings and maintain constant communication with each other at all times.

12.1.3 Ergonomic Considerations

Certain field tasks may involve workers in fixed positions (e.g., observing subcontractor work) or performing repetitive motions over a period of time (e.g., sediment sample processing). It is important that workers self-monitor for ergonomic fatigue (e.g., soreness, tightness, stiffness, or pain in muscles) and make adjustments to work tasks, body positions, or work areas so that ergonomic stressors are minimized. Suggestions for decreasing the likelihood of ergonomic stress include the following:

- Limit fixed positions. Periodically vary standing and sitting positions, take frequent short walks, and modify observation locations when possible.
- Minimize extreme postures. Conduct work tasks using comfortable postures (particularly if the tasks are repetitive), and use tools or structures to minimize the need to hold or work with materials or access the work area.
- Limit contact stress. Be aware of soft tissue resting on hard surfaces, and limit these occurrences (e.g., use comfortable footwear, and use tools to hold materials).
- Contact the Field Mobilization Team in advance for prolonged field efforts that involve a field trailer. This group can set up field staff with a monitor, mouse, and keyboard so they are not working solely on laptops.
- Take breaks from work tasks, particularly repetitive ones.
- Consider performing stretching exercises before and during work activities, if those tasks are anticipated to be long in duration and/or strenuous.

12.1.4 Sediment Core Sampling and Geotechnical Data Collection

Sediment/soil samples will be collected using manual direct push coring or ponar grab samples. Rules specific to manual direct push coring include the following:

- Use care when applying body weight to advance corer.
- Extract the corer with assistance from crew members, and using proper lifting techniques.
- Be aware of the potential to encounter subsurface materials of differing densities and the effects these may have on corer advancement and retrieval.
- If the manual corer requires torque to advance or retrieve, use care to turn the corer in a controlled manner.

Please see Sections 12.1.10 and 12.1.11 for additional safety information regarding working on or near the water.

12.1.5 Underground or Overhead Utility Line Contact Prevention

Observe the following underground/overhead utility line contact prevention procedures and practices:

- Prior to conducting work, the PM or FL shall verify that all existing underground or overhead utilities in the work area are located per the state or local mark-out methods and subcontract. Documentation of utility mark-out shall be completed using the Utility Contact Prevention Checklist form (see Appendix A). No excavation work is to be performed until all utility mark-outs are verified.
- The PM or FL shall conduct a site survey to search for signs of other buried or overhead utilities. The results of such surveys shall be documented on the Utility Mark-out documentation form.
- The property owner or facility operator shall be consulted on the issue of underground utilities. As-built drawings shall be reviewed, when available, to verify that underground utility locations are consistent with the utility location mark-outs. All knowledge of past and present utilities must be evaluated prior to conducting work.
- If on-site subsurface utility locations are in question, a private locating service shall be contacted to verify locations. If the investigation calls for boreholes in an area not covered by the municipal One-Call system, then a private utility locate firm shall be contacted to determine the location of other underground utilities.
- The PM shall have documented verbal contact and an agreement with the fiber optic company for all work within 50 feet of any fiber optic cables.
- **Only non-destructive excavation, such as hand digging or hydro excavation, is permitted within 3 feet of underground high voltage, product, or gas lines.** Once the line is exposed, heavy equipment can be used, but must remain at least 3 feet from the exposed line.
- Elevated superstructures (e.g., drill rig, backhoe, scaffolding, ladders, and cranes) shall remain a distance of 10 feet away from utility lines and 20 feet away from power lines. Distance from utility lines may be adjusted by the FL depending on actual voltage of the lines.
- Overhead utility locations shall be marked with warning tape or flags where equipment has the potential for contacting overhead utilities.

Table 12-1 shows the minimum clearances required for energized overhead electrical lines.

Table 12-1
Overhead Utility Clearance Requirements

Minimum Clearance from Energized Overhead Electric Lines	
Nominal System Voltage	**Minimum Required Clearance**
0 to 50 kV	10 feet
51 to 100 kV	12 feet

Minimum Clearance from Energized Overhead Electric Lines	
Nominal System Voltage	**Minimum Required Clearance**
101 to 200 kV	15 feet
201 to 300 kV	20 feet
301 to 500 kV	25 feet
501 to 750 kV	35 feet
751 to 1,000 kV	45 feet

Notes:
Whenever equipment operations must be performed closer than 20 feet from overhead power lines, the FL must be notified. When clearance to proceed is received from the FL, the electric utility company must be contacted to turn the power off or physically insulate (protect) the lines if the operation must be performed closer to the power line than is allowed in this table. For voltages not listed on this table, add 0.4 inches per kilovolt (kV) to obtain the safe distance between equipment and power lines.

12.1.6 Electric Safety

Observe the following procedures and practices to prevent electric shock:

- General
  - Use only appropriately trained and certified electricians to perform tasks related to electrical equipment. A good rule of thumb is to defer any task that would not normally and reasonably be completed by the average public consumer.
  - Each circuit encountered will be considered live until proven otherwise.
  - Only proper tools will be used to test circuits.
  - No wire will be touched until the circuit is determined to be de-energized.
- Extension Cords
  - All extension cords used on any project will be three-pronged.
  - All extension cords will be in good working order.
  - Each extension cord ground will be tested for continuity on at least a quarterly basis and marked to indicate when the inspection occurred.
  - Each extension cord will be visually inspected before each use.
  - If any extension cord is found in disrepair or fails the continuity test, it will be taken out of service.
  - Any extension cord that does not have the grounding pin will be taken out of service and not used.
  - Extension cords will not be used in place of fixed wiring.
  - Extension cords will not be run through holes in walls, ceilings, or floors.
  - Extension cords will not be attached to the surface of any building.
  - No extension cord will be of the "flat wire" type. Every extension cord will have each individual wire insulated and further protected by an outside cover.

  - Be sure to locate extension cords out of traffic areas or, if this is unavoidable, flag cords and protect workers from tripping over them (i.e., use barricades and tape the cord down).
  - Do not stage extension cords or powered equipment in wet areas, to the degree possible. Elevate cords, connections, and equipment out of puddles.
- Power Tools/Plug and Cord Sets
  - Any cord that is cut in a way that exposes insulation will be removed from service.
  - All tools and plug and cord sets will be tested for continuity.
  - If grounding pins are missing, the plug and cord will be removed from service.
  - Any tool or plug and cord set failing the continuity test will be removed from service.
  - All power tools will have three-pronged plugs unless double insulated.
- Ground-fault Circuit Interrupters
  - Each 120-volt electrical wall receptacle providing power to the job site will be protected by a portable GFCI.
  - Each GFCI will be tested quarterly and marked to indicate when the inspection occurred.
  - Each 120-volt, single-phase, 15- and 20-ampere receptacle outlet, including those on generators, will have an approved GFCI.
  - GFCIs will be located in line as close to the piece of equipment as possible.

12.1.7 Hand and Power Tools

Observe the following procedures and practices when working with hand and power tools:

- Keep hand tools sharp, clean, oiled, dressed, and not abused.
- Worn tools are dangerous. For example, the "teeth" in a pipe wrench can slip if worn smooth, an adjustable wrench will slip if the jaws are sprung, and hammerheads can fly off loose handles.
- Tools subject to impact (e.g., chisels, star drills, and caulking irons) tend to "mushroom." Keep them dressed to avoid flying spalls, and use tool holders.
- Do not force tools beyond their capacity.
- Flying objects can result from operating almost any power tool, so always warn people in the vicinity and use proper eye protection.
- Each power tool should be examined before use for damaged parts, loose fittings, and frayed or cut electric cords. Tag and return defective tools for repairs. Verify that there is adequate lighting, inspect tools for proper lubrication, and relocate tools or material that could "vibrate into trouble."
- Compressed air must be shut off or the electric cord unplugged before making tool adjustments. Air must be "bled down" before replacement or disconnection.
- Proper guards or shields must be installed on all power tools before issue. Do not use improper tools or tools without guards in place.

- Replace all guards before startup. Remove cranks, keys, or wrenches used in service work.

12.1.8 Motor Vehicle Operation

All drivers are required to have a valid driver's license, and all vehicles must have appropriate state vehicle registration and inspection stickers. **Anchor QEA prohibits the use of hand-held wireless devices while driving any vehicle for business use at any time, for personal use during business hours, and as defined by law**. Additionally, site-specific motor vehicle requirements must be followed, if any.

When driving to, from, and within the job site, be aware of potential hazards including:

- Vehicle accidents
- Distractions
- Fatigue
- Weather and road conditions

To mitigate these hazards, observe the following procedures and practices regarding motor vehicle operation:

- Before leaving, inspect fuel and fluid levels and air pressure in tires, and adjust mirrors and seat positions appropriately.
- Wear a seat belt at all times and make sure that clothing will not interfere with driving.
- Plan your travel route and check maps for directions or discuss with colleagues.
- Clean windows and mirrors as needed throughout the trip.
- Wear sunglasses as needed.
- Fill up when the fuel level is low (not near empty).
- Follow a vehicle maintenance schedule to reduce the possibility of a breakdown while driving.
- Stop driving the vehicle, regardless of the speed (e.g., even 5 miles per hour) or location (e.g., a private road), when the potential of being distracted by conversation exists.
- Using hand-held communication devices (e.g., cell phones) while operating any motor vehicle is prohibited.
- Get adequate rest prior to driving.
- Periodically change your seat position, stretch, open the window, or turn on the radio to stay alert.
- Pull over and rest if you are experiencing drowsiness.
- Check road and weather conditions prior to driving.
- Be prepared to adjust your driving plans if conditions change.
- Travel in daylight hours, if possible.
- Give yourself plenty of time to allow for slowdowns due to construction, accidents, or other unforeseen circumstances.

- Use lights at night and lights and wipers during inclement weather.

12.1.9 Vehicular Traffic

Observe the following procedures and practices regarding vehicular traffic:

- Wear a high-visibility traffic safety vest when vehicle hazards exist.
- Use cones, flags, barricades, and caution tape to define the work area.
- Use a vehicle to block the work area (if conditions allow).
- Engage a police detail for high-traffic situations.
- Always use a spotter in tight or congested areas for material deliveries.
- As necessary, develop traffic control plans and train personnel as flaggers in accordance with the DOT MUTCD and/or local requirements.

12.1.10 Boating Operations

The following precautions shall be followed when conducting boating trailer and launch activities:

- Follow the trailer and boat manufacturers' instructions for securing the boat to the trailer.
- Follow the trailer manufacturer's instructions for securing the trailer to the towing vehicle.
- Prohibit site personnel from moving into trailer/vehicle pinch points without advising the vehicle operator.
- Use experienced operators when backing trailers on boat ramps.
- Wear proper work gloves when the possibility of pinching or other injury may be caused by moving or handling large or heavy objects.
- Maintain all equipment in a safe condition.
- Launch boats one at a time to avoid collisions.
- Use a spotter for vehicles backing boats to the launch area.
- Understand and review hand signals.
- Wear boots with non-slip soles when launching boats.
- Wear USCG-approved PFDs when working within 10 feet of the water.
- Keep ropes and lines coiled and stowed to eliminate trip hazards.
- Maintain three-point contact on dock/pier or boat ladders.
- Verify that drain plugs are in place, as present.

The following precautions shall be followed when conducting boating operations:

- Maintain a current boater's license(s) as required.
- Wear USCG-approved PFDs for work activities within 10 feet of the water.
- Obtain and review information regarding dams that may be present in work areas, particularly with regard to "no boating" zones and safety buoys, cables, and warning signage.

- Maintain boat anchorage devices commensurate with anticipate currents, distance to shore, and water depths.
- Provide a floating ring buoy in the immediate boat launch/landing areas with at least 60 feet (18.3 meters) of line for a vessel less than 65 feet (19.8 meters) in length, or 90 feet (27.4 meters) of line for a vessel 65 feet (19.8 meters) or greater in length (see http://www.uscg.mil/d13/cfvs/CheckLists/Regs/28.115.pdf for more information).
- Step into the center of the boat.
- Keep your weight low when moving on the boat.
- Move slowly and deliberately.
- Steer directly across other boat wakes at a 90-degree angle to avoid capsizing.
- Steer the boat facing forward.
- Watch for floating objects in the water.
- Right-of-way is yielded to vessels on your boat's right, or starboard, and vessels with limited ability to maneuver such as any wind-propelled vessel.

The following precautions shall be followed when working on a boat:

- Observe proper lifting techniques.
- Obey lifting limits (see Section 12.1.13)
- Use mechanical lifting equipment (i.e., pulleys or winches) to move large or awkward loads.
- Wear USCG-approved PFDs for work activities within 10 feet of the water.

The safety-related items listed in Table 12-2 shall be available when conducting boating operations.

Table 12-2
Safety Equipment Specific to In-Water Work

Additional Safety Equipment for Sampling Vessel per U.S. Coast Guard Requirements:	
• Proper vessel registration, numbering, and documentation (registered with state, certificate of vessel registration number displayed, and carrying a valid certificate of number) • USCG-approved personal flotation devices (PFDs; or life jackets) for every person on the sampling vessel (Type III or Type IV are common; Type I, II, III, or V are required). High-visibility required by Anchor QEA. • Appropriate, non-expired, visual distress devices for day and night use from the following: – Three hand-held red flares (day and night), or – One hand-held red flare and two parachute flares (day and night), or – One hand-held orange smoke signal, two floating orange smoke signals (day), and one electric distress light (night only) • Alternate means of propulsion (oars or paddles) • Dewatering device (pump or bailer) • Properly maintained and inspected USCG-approved fire extinguishers (no fixed system = (2) B-1 or (1) B-2 type extinguishers; fixed system = (1) B-1 type extinguisher) • Proper ventilation of gasoline-powered vessels • Sound-producing device (whistle, bell, or horn) • VHF 2-way radio • Proper navigational light display • Throwable life ring with attached line (any vessel larger than 16 feet is required to carry one Type IV [throwable] PFD)	
Additional USCG Recommended Equipment Includes:	
• Extra visual distress signals • Primary and spare anchor • Heaving line • Fenders • First aid kit • Flashlight • Mirror • Searchlight • Sunburn lotion • Tool kit • Spare fuel	• Boat hook • Spare propeller • Mooring line • Food and water • Binoculars • Spare batteries • Sunglasses • Marine hardware • Extra clothing • Spare parts • Pertinent navigational chart(s) and compass

12.1.11 Working Over or Near Water

12.1.11.1 Personal Flotation Devices

PFDs are not required where employees are continuously protected from the hazard of drowning by railings, nets, safety belts, or other applicable provisions.

Type I, II, III or V USCG-approved, high-visibility PFD shall be provided and properly worn by all personnel in the following circumstances:

- On or within 10 feet of water
- On floating pipelines, pontoons, rafts, or stages
- On structures extending over or next to the water, except where guard rails or safety nets are provided for employees
- Working alone at night where there are drowning hazards, regardless of other safeguards provided
- In skiffs, small boats, or launches, unless in an enclosed cabin or cockpit
- Whenever there is a drowning hazard

The following precautions shall be followed when using PFDs:

- Prior to and after each use, the buoyant work vests or life preservers shall be inspected for defects that would alter their strength or buoyancy. Defective devices or devices with less than 13 pounds buoyancy shall be removed from service.
- All PFDs shall be equipped with reflective tape as specified in 46 CFR 25.25-15.
- Thirty-inch USCG-approved ring buoys with at least 150 feet of 600-pound capacity line shall be provided and readily available for emergency rescue operations. The distance between ring buoys shall not exceed 200 feet.
- PFD lights conforming to 46 CFR 161.012 shall be required whenever there is a potential need for life rings to be used after dark. Onshore installations, at least one life ring, and every third one thereafter, shall have a PFD light attached. PFD lights on life rings are required only in locations where adequate general lighting (e.g., floodlights or light stanchions) is not provided.

12.1.11.2 Cold Water Work

When the combined air and water temperature is below 80°F, field personnel working on or near water shall wear either a float coat or a one-piece survival suit. Suits or float coats shall be USCG approved. If extremely cold or severe weather conditions are forecast, work activities should be postponed. Work activities will be continually reviewed and adjustments made if wearing a survival suit during work activities potentially poses a hazard due to warm air temperatures, or limited mobility or agility. In addition, proximity of water work to shore and scope/duration/timing of work activities will be considered when stipulating the above requirement. Overall, if water craft will be used during work, or work will be conducted near water, it is imperative that site-specific conditions are considered and evaluated so that proper safeguards and procedures are in place prior to beginning work.

In addition to considering the use of apparel appropriate for anticipated air, weather, and water conditions, field teams shall identify any procedures necessary for cold-water "man-overboard" scenarios. These procedures should be identified in the site-specific SSP, described in the JSA used for boating activities and, if prudent, practiced before work.

12.1.12 Noise

Excessive noise is hazardous not only because of its potential to damage hearing, but also because of its potential to disrupt communications and instructions. The following procedures and practices shall be followed to prevent noise-related hazards:

- All employees will have access to ear protection with a Noise Reduction Rating of not less than 30.
- Ear protection must be worn in any environment where site personnel must raise their voices to be heard while standing at a distance of 3 feet or less.
- Ear protection must be worn by any personnel observing or operating concrete cutting or sawing equipment, pile driving, or other loud noise-generating activities.

Hearing protection is required for site personnel operating or working near noisy equipment or operations, where the noise level is greater than 85 A-weighted decibels (dbA; time-weighted average [TWA]), as well as personnel working around heavy equipment. The FL will determine the need and appropriate testing procedures, (i.e., sound level meter and/or dosimeter) for noise measurement.

When needed, a sound level meter will be used to measure noise levels at selected locations in the work area and on the site perimeter. When used, noise monitoring equipment must be calibrated before and after each shift.

If continuous noise levels are found to exceed 85 dbA at any location within the work area, warning signs will be posted. Site personnel and visitors will be notified that hearing protection is required. Appropriate hearing protection (i.e., ear plugs or ear muffs) will be worn whenever personnel or visitors are working in that location. A supply of ear plugs will be maintained on site.

Action levels in Table 12-3 will trigger the use of appropriate hearing protection (plugs or muffs). Hearing protection must be able to attenuate noise below 90 dbA (8-hour TWA). Each hearing protection or device has a Noise Reduction Rating (NRR) assigned by EPA. The calculation for a hearing protection device's effectiveness is:

Equation 1

Noise reading $dbA - (NNR - 7db) < 90dbA$

where:

dbA = A-weighted decibel

NRR = Noise Reduction Rating

Table 12-3
Noise Exposure Action Levels

Instrument	Measurement	Action
Type I or Type II Sound Level Meter or Dosimeter	> 80 dbA to 85 dbA	Hearing protection recommended. Limit work duration to 8-hour shifts.
	> 85 dbA to 90 dbA	Hearing protection required. Limit work duration to 8-hour shifts.
	> 90 dbA to 115 dbA	Hearing protection required. Investigate use of engineering controls. Limit work duration to 8-hour shifts.
	> 115 dbA	Stop work. Consult CHSM.

12.1.13 Lifting and Material Handling

Observe the following procedures and practices for lifting and material handling:

- Use leather gloves when handling metal, wire rope, sharp debris, or transporting materials (e.g., wood, piping, or drums).
- The size, shape, and weight of the object to be lifted must first be considered. No individual employee is permitted to lift any object that weighs more than 60 pounds. Multiple employees or mechanical lifting devices are required for objects heavier than the 60-pound limit.
- Plan a lift before doing it. Bend at the knees and lift with the legs; maintain the natural curves of the back; do not use back muscles.
- Check the planned route for clearance.
- Use the buddy system when lifting heavy or awkward objects.
- Do not twist your body while lifting.
- Know the capacity of any handling device (e.g., crane, forklift, chain fall, or come-along) that you intend to use.
- Use tag lines to control loads.
- Verify that your body, material, tools, and equipment are safe from such unexpected movement as falling, slipping, rolling, tripping, bowing, or any other uncontrolled motion.
- Trucks (i.e., flat beds) hauling equipment or materials must not be moved once rigging has been released.

- Chock all material and equipment (such as pipe, drums, tanks, reels, trailers, and wagons) as necessary to prevent rolling.
- Tie down all light, large-surface-area material that might be moved by the wind.
- When working at heights, secure tools, equipment, and wrenches against falling.
- Do not store materials or tools on ducts, lighting fixtures, beam flanges, hung ceilings, or similar elevated locations.
- Fuel-powered tools used inside buildings or enclosures shall be vented and checked for excessive noise.

12.1.14 Fire Control

Observe the following fire control procedures and practices:

- Smoke only in designated areas.
- Keep flammable liquids in closed containers.
- Keep the work site clean; avoid accumulating combustible debris such as paper.
- Obtain and follow property owner hot work safety procedures when welding or performing other activities requiring an open flame.
- Isolate flammable and combustible materials from ignition sources.
- Verify fire safety integrity of equipment installations according to National Electrical Code (NEC) specifications.

12.1.15 Static Electricity and Transfer of Flammable Liquids

Observe the following procedures and practices regarding static electricity when transferring flammable liquids:

- Electrically bond and ground pumps, transfer vessels, tanks, drums, bailers, and probes when moving flammable liquids.
- Electrically bond and ground vacuum trucks and the tanks they are emptying.
- Do not splash fill containers with flammable liquids.
- Pour flammable liquids slowly and carefully.
- Two fire extinguishers (2A20:BC) must be available, charged, inspected, and readily accessible.

12.1.16 Cleaning Equipment

Observe the following procedures and practices when cleaning equipment:

- Wear appropriate PPE to avoid skin and eye contact with isopropyl alcohol, Alconox®, or other cleaning materials.
- Stand upwind to minimize any potential inhalation exposure.
- Dispose of spent cleaning solutions and rinses accordingly.

12.2 Environmental Hazards and Controls

12.2.1 Fatigue Management

Because Anchor QEA personnel may be working during both daytime and nighttime hours several days per week, depending on the activity, it is important that all personnel are aware of the hazards related to fatigue. Fatigue can be defined as an increasing difficulty in performing physical or mental activities. Signs of fatigue may include tiredness, changes in behavior, loss of energy, and reduced ability to concentrate. Fatigued site personnel may have a reduced ability to recognize or avoid risks on the work site, which may lead to an increase in the number and severity of injuries and other incidents. Fatigue can occur at any time when working and may cause safety concerns due to decreased manual dexterity, reaction time, and alertness.

Fatigue results from insufficient rest and sleep between activities. Contributing factors to fatigue may include the following:

- The time of day that work takes place
- The length of time spent at work and in work-related duties
- The type and duration of a work task and the environment (e.g., weather conditions and ambient noise) in which it is performed
- The quantity and quality of rest obtained prior to, during, and after a work period
- Non-work activities
- Individual factors such as sleeping disorders, medications, or emotional state

Personnel suffering from fatigue may exhibit both physical and mental effects, such as the following:

- Slower movements
- Poor coordination
- Slower response time to interaction
- Bloodshot eyes
- Slumped or weary appearance
- Nodding off
- Distractedness or poor concentration
- Inability to complete tasks
- Fixed gaze
- Appearing depressed, irritable, frustrated, or disinterested

Employees are strongly encouraged to get sufficient pre-work rest, maintain sufficient nutritional intake during work (i.e., eat and drink at regular intervals), and communicate with team members and leaders if their level of fatigue elevates.

Use the following procedures to help detect and address fatigue-related issues:

- Periodically observe and query coworkers for signs or symptoms of fatigue.
- Site personnel that express concern over their level of fatigue, or that are observed to be fatigued such that elevated worker risk is evident, will be relieved or their work tasks adjusted so that they may rest sufficiently.
- Work schedules will consider fatigue factors and optimize continuous periods available for uninterrupted sleep. The employee is responsible for reporting to work properly rested and fit for duty. In case of an emergency or operational difficulties (e.g., limited access due to water levels or boat repairs), work hours may require adjustment.
- Maintain a routine exercise program and regular sleep schedule as much as possible over the course of the work.
- Avoid heavy meals or caffeine and minimize or eliminate the consumption of alcohol and nicotine before sleeping.

12.2.2 Heat Stress

Observe the following general procedures and practices regarding heat stress:

- Increase the number of rest breaks and/or rotate site personnel in shorter work shifts.
- Watch for signs and symptoms of heat stress and fatigue (see Section 12.2.2.1).
- During hot months, plan work for early morning or evening.
- Use ice vests when necessary.
- Rest in cool, dry areas.
- Verify that employees have access to potable drinking water and shade.
- During conditions exceeding 95°F, verify that the following additional procedures are adhered to:
  - Establish effective communication by voice, observation, or electronic means.
  - Observe employees for alertness and signs or symptoms of heat illness.
  - Designate one or more employees on each work site as authorized to call for emergency medical services.
  - Remind employees to drink water throughout the shift.
  - Conduct pre-shift meetings before beginning work to review the high heat procedures, encourage drinking water, and remind employees of their right to take a cool-down rest when necessary.

12.2.2.1 Signs, Symptoms, and Treatment

The FL will be trained in heat stress prevention, including the following, prior to supervising employees:

- Procedures to prevent heat illness.
- Procedures to follow when an employee exhibits symptoms consistent with possible heat illness, including emergency response procedures.

The information provided below addresses these training requirements.

Adverse climatic conditions are important considerations in planning and conducting site operations. High ambient temperature can result in health effects ranging from transient heat fatigue, physical discomfort, reduced efficiency, personal illness, and increased accident probability to serious illness or death. Heat stress is of particular concern when chemical protective garments are worn because they prevent evaporative body cooling. Wearing PPE places employees at considerable risk of developing heat stress.

Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, and the individual characteristics of the worker. Because heat stress is probably one of the most common (and potentially serious) illnesses, regular monitoring and other preventive precautions are vital.

Heat Rash. Heat rash can be caused by continuous exposure to hot and humid air and skin abrasion from sweat-soaked clothing, rubber boots, or impermeable waders. The condition is characterized by a localized red skin rash and reduced sweating. Heat rash reduces the ability to tolerate heat. To treat, keep skin hygienically clean and allow it to dry thoroughly after using chemical protective clothing. Take measures to prevent heat rash by changing clothes often to maximize use of dry garments, or taking frequent breaks to allow doffing of equipment and drying of skin.

Heat Cramps. Heat cramps are caused by profuse perspiration with inadequate electrolytic fluid replacement. This often robs the larger muscle groups (stomach and quadriceps) of blood, which can cause painful muscle spasms and pain in the extremities and abdomen. To treat, move the employee to a cool place and give sips of water or an electrolytic drink. Watch for signs of heat exhaustion or heat stroke.

Heat Exhaustion. Heat exhaustion is a mild form of shock caused by increased stress on various organs to meet increased demand to cool the body. Onset is gradual and symptoms should subside within 1 hour. Symptoms include a weak pulse; shallow breathing; pale, cool, moist skin; profuse sweating; dizziness; and fatigue. To treat, move the employee to a cool place and remove as much clothing as possible. Give sips of water or electrolytic solution and fan the person continuously to remove heat by convection. Do not allow the affected person to become chilled. Treat for shock if necessary.

Heat Stroke. Heat stroke is the most severe form of heat stress; the body must be cooled immediately to prevent severe injury and/or death. ***This is a medical emergency!*** Symptoms include red, hot, dry skin; a body temperature of 105°F or higher; no perspiration; nausea; dizziness and confusion; and a strong, rapid pulse. Because heat stroke is a true medical emergency, transport the individual to a medical facility immediately. Prior to transport, remove as much clothing as possible

and wrap the individual in a sheet soaked with water. Fan the individual vigorously while transporting to help reduce body temperature. If available, apply cold packs under the arms, around the neck, or any other place where they can cool large surface blood vessels. If transportation to a medical facility is delayed, reduce body temperature by immersing the individual in a cool-water bath (however, be careful not to over-chill the individual once body temperature is reduced below 102°F). If this is not possible, keep the individual wrapped in a sheet and continuously douse with water and fan.

12.2.2.2 Prevention

The implementation of preventative measures is the most effective way to limit the effects of heat-related illnesses. During periods of high heat, adequate liquids must be provided to replace lost body fluids. Replacement fluids can be a 0.1% saltwater solution, a commercial mix such as Gatorade, or a combination of these with fresh water. The replacement fluid temperature should be kept cool, 50°F to 60°F, and should be placed close to the work area. Employees must be encouraged to drink more than the amount required to satisfy thirst. Employees should also be encouraged to salt their foods more heavily during hot times of the year.

Cooling devices such as vortex tubes or cooling vests can be worn beneath impermeable clothing. If cooling devices are worn, only physiological monitoring will be used to determine work activity.

All site personnel are to rest when any symptoms of heat stress are noticed. Rest breaks are to be taken in a cool, shaded rest area. Employees shall remove chemical protective garments during rest periods and will not be assigned other tasks.

All employees shall be informed of the importance of adequate rest and proper diet, including the harmful effects of excessive alcohol and caffeine consumption.

12.2.2.3 Monitoring

Heat stress monitoring should be performed when employees are working in environments exceeding 90°F ambient air temperature. If employees are wearing impermeable clothing, this monitoring should begin at 77°F. There are two general types of monitoring that the health and safety representative can designate to be used: wet bulb globe temperature (WBGT), and physiological. The Heat Stress Monitoring Record form (see Appendix A) will be used to record the results of heat stress monitoring.

Note that some states such as Washington and California have specific regulatory standards for protection of employees from heat stress-related injuries.

Wet Bulb Globe Temperature (WBGT). The WBGT index is the simplest and most suitable technique to measure the environmental factors that most nearly correlate with core body

temperature and other physiological responses to heat. When WBGT exceeds 25°C (77°F), the work regiment in Table 12-4 should be followed.

Table 12-4
Permissible Heat Exposure Threshold Limit Values

Work/Rest Regimen	Workload		
	Light	Moderate	Heavy
Continuous work	86°F (30.0°C)	80°F (26.7°C)	77°F (25.0°C)
75% work, 25% rest each hour	87°F (30.6°C)	82°F (28.0°C)	78°F (25.9°C)
50% work, 50% rest, each hour	89°F (31.4°C)	85°F (29.4°C)	82°F (27.9°C)
25% work, 75% rest, each hour	90°F (32.2°C)	88°F (31.1°C)	86°F (30.0°C)
These TLVs assume that nearly all acclimated, fully-clothed site personnel with adequate water and salt intake should be able to function effectively under the given working conditions without exceeding a deep body temperature of 100.4°F (38°C).			

(From OSHA Technical Manual, Section III: Chapter 4 – Heat Stress)

The TLVs denoted in Table 12-4 apply to physically fit and acclimatized individuals wearing light, summer clothing. If heavier clothing that impedes sweat or has a higher insulation value is required, the permissible heat exposure TLVs should be adjusted based on the WBGT Correction Factors in Table 12-5.

Table 12-5
WBGT Correction Factors

Clothing Type	WBGT Correction
Summer lightweight working clothing	0°F (0°C)
Cotton coveralls	-3.6°F (-2°C)
Winter work clothing	-7.2°F (-4°C)
Water barrier, permeable	-10.8°F (-6°C)
Fully encapsulating	-14.4°F (-10°C)

Physiological. Physiological monitoring can be used in lieu of, or in addition to, WBGT. This monitoring can be self-performed once the health and safety representative demonstrates appropriate techniques to affected employees. Because individuals vary in their susceptibility to heat, this type of monitoring has its advantages. The following two parameters are to be monitored at the beginning of each rest period:

- **Heart Rate:** The maximum heart rate (MHR) is the amount of work (beats) per minute a healthy person's heart can be expected to safely deliver. Each individual will count his/her

radial (wrist) pulse for 1 minute as early as possible during each rest period. If the heart rate of any individual exceeds 75% of his/her calculated MHR (MHR = 200 – age) at the beginning of the rest period, then the work cycle will be decreased by one-third. The rest period will remain the same. An individual is not permitted to return to work until his/her sustained heart rate is below 75% of his/her calculated MHR.

- **Temperature:** Each individual will measure his/her temperature with a thermometer for 1 minute as early as possible in the first rest period. If the temperature exceeds 99.6°F at the beginning of the rest period, then the work cycle will be decreased by one-third. The rest period will remain the same. An individual is not permitted to return to work if his/her temperature exceeds 100.4°F.

12.2.2.4 Training

Employees potentially exposed to heat stress conditions will be instructed on the contents of this procedure. This training can be conducted during daily tailgate safety meetings.

12.2.3 Cold Stress

Observe the following procedures and practices regarding cold stress:

- Take breaks in heated shelters when working in extremely cold temperatures.
- Upon entering the shelter, remove the outer layer of clothing and loosen other layers to promote evaporation of perspiration.
- Drink warm liquids to reduce the susceptibility to cold stress.
- Be aware of cold stress symptoms, including shivering, numbness in the extremities, and sluggishness.
- Provide adequate insulating dry clothing to maintain warmth if work is performed in air temperature below 40°F. Wind chill cooling rates and the cooling power of air are critical factors. The higher the wind speed and the lower the temperature in the work area, the greater the insulation value of the protective clothing required.
- If the air temperature is 32°F or less, hands should be protected.
- If only light work is involved and if the clothing on the worker may become wet on the job site, the outer layer of the clothing in use should be impermeable to water. With more severe work under such conditions, the outer layer should be water repellent, and the outer wear should be changed as it becomes wetted. The outer garments should include provisions for easy ventilation in order to prevent wetting of the inner layer by sweat.
- If available clothing does not give adequate protection to prevent cold injury, work should be modified or suspended until adequate clothing is made available, or until weather conditions improve.
- Implement a buddy system in which site personnel are responsible for observing fellow workers for early signs and symptoms of cold stress.

12.2.3.1 Signs, Symptoms, and Treatment

Cold stress can range from frostbite to hypothermia. The signs and symptoms of cold stress are listed below. The appropriate guidelines should be followed if any personnel exhibit these symptoms:

Frostbite. Frostbite is characterized by pain in the extremities and loss of manual dexterity. "Frostnip," or reddening of the tissue, is accompanied by a tingling or loss of sensation in the extremities and continuous shivering.

Hypothermia. Hypothermia is characterized by pain in the extremities and loss of manual dexterity, with severe, uncontrollable shivering, and an inability to maintain the level of activity. Symptoms include excessive fatigue, drowsiness, irritability, or euphoria. Severe hypothermia includes clouded consciousness, low blood pressure, pupil dilation, cessation of shivering, unconsciousness, and possible death.

Move the individual to a warm, dry place. If the individual's clothing is wet, remove it and replace it with dry clothing. Keep the individual warm. Re-warming of the individual should be gradual to avoid stroke symptoms. Dehydration, or the loss of body fluids, may result in a cold injury due to a significant change in blood flow to the extremities. If the individual is conscious and alert, warm sweet liquids should be provided. Coffee and other caffeinated liquids should be avoided because of diuretic and circulatory effects. Extremities affected by frostbite should be gradually warmed up and returned to normal temperature. Moist compresses should be applied; begin with lukewarm compresses and slowly increase the temperature as changes in skin temperature are detected. Keep the individual warm and calm and move them to a medical facility as soon as possible.

12.2.4 Sunlight and Ultraviolet Exposure

Observe the following procedures and practices regarding ultraviolet (UV) exposure:

- Protect against extended exposure to sunlight with shade, long clothing, sunscreen, and high-SPF, broad-spectrum sunscreen applied frequently.
- Plan work to avoid unnecessary UV exposure (see Section 12.2.4.2).
- During peak daylight months, plan work for early morning or evening.
- Many factors affect the hazards associated with UV exposure, including the following:
  - **Time of day:** UV rays are strongest between 10:00 a.m. and 4:00 p.m.
  - **Season of the year:** UV rays are stronger during spring and summer months. This is less of a factor near the equator.
  - **Distance from the equator (latitude):** UV exposure goes down as you get farther from the equator.
  - **Altitude:** More UV rays reach the ground at higher elevations.
  - **Cloud cover:** The effect of clouds can vary. Sometimes cloud cover blocks some UV from the sun and lowers UV exposure, while some types of clouds can reflect UV and

increase UV exposure. What is important to know is that UV rays can get through, even on a cloudy day.

  - **Reflection off surfaces:** UV rays can bounce off surfaces like water, sand, snow, pavement, or grass, leading to an increase in UV exposure.
- Cloud cover does not necessarily protect from UV exposure. Consider monitoring the UV index for your work area: http://www2.epa.gov/sunwise/uv-index.
- Evaluate site-specific factors affecting UV exposure and address work practices as appropriate.

12.2.4.1 Signs, Symptoms, and Treatment

The best way to treat sunburn is to prevent it using the guidelines listed in the bullets above and in Section 12.2.4.2. Signs of sunburn include the following:

- Pinkness or redness
- Skin that feels warm or hot to the touch
- Pain, tenderness, or itching
- Swelling
- Small, fluid-filled blisters, which may break
- Headache, fever, chills, and fatigue if the sunburn is severe

If signs of sunburn are noticed, avoid further exposure and immediately implement treatment. If the sunburn is blistering *and* covers 15% or more of the body, seek medical attention.

12.2.4.2 Prevention

UV exposure hazards and their impacts on each worksite should be evaluated to determine the best practices for risk mitigation. The most effective way to prevent skin damage from UV exposure is to protect bare skin from the exposure. This can be accomplished with shade, clothing (e.g., pants, long sleeves, or hats), sunscreen, and sunglasses. Plan work to either create shade or take advantage of natural shade, and avoid peak UV times during the day when possible.

12.2.5 Inclement Weather

Observe the following procedures and practices regarding inclement weather:

- Evaluate the worksite for hazards that may be amplified during inclement weather, such as traction issues, ingress and egress, slope stability, or wind-driven hazards (e.g., dust, debris, or falling trees).
- Stop outdoor work during electrical storms (lightning strikes), hailstorms, high winds, and other extreme weather conditions such as extreme heat or cold.
- Take cover indoors or in a vehicle that will provide adequate protection. In some cases, this may require exiting the worksite, such as during windstorms in areas with overhead hazards (e.g., trees or power lines).

- Listen to local forecasts for warnings about specific weather hazards such as tornadoes, hurricanes, and flash floods.
- Verify that on-site equipment and resources are adequately protected from inclement weather.
- If working in an unfamiliar geographic location, consult with local resources for unique weather hazards.

12.2.6 Insects and Spiders

Observe the following general procedures and practices regarding insects/spiders:

- Tuck pants into socks.
- Wear long sleeves.
- Use insect repellent.
- Avoid contact by always looking ahead to where you will be walking, standing, sitting, leaning, grabbing, lifting, or reaching.
- Check for signs of insect/spider bites, such as redness, swelling, and flu-like symptoms.

The most dangerous spiders to humans in North America are black widows and brown spiders (also known as brown recluse or fiddleback spiders). A guide to identifying these spiders is presented in Table 12-6.

Table 12-6
North American Hazardous Spider Identification Guide

Hazardous Spider Identification Guide	
Black Widow Spider • Abdomen usually shows hourglass marking • Female is 3 to 4 centimeters in diameter • Have been found in well casings and flush-mount covers • Not aggressive, but more likely to bite if guarding eggs • Light, local swelling and reddening are early signs of a bite, followed by intense muscular pain, rigidity of the abdomen and legs, difficulty breathing, and nausea • If bitten, see a physician as soon as possible	
Brown Spiders (aka Brown Recluse or Fiddleback) • Found in the central and southern United States, although in some other areas, as well • 1/4-to-1/2-inch-long body, and size of a silver dollar • Hide in baseboards, ceiling cracks, and undisturbed piles of material • Bite may either go unnoticed or may be followed by a severe localized reaction, including scabbing, necrosis of the affected tissue, and very slow healing • If bitten, see a physician as soon as possible	

12.2.7 Bees and Wasps

Many encounters with bees and wasps occur when nests built in well casings or excavation areas are disturbed. Before opening a well casing, take a few moments to observe whether or not insects are entering or exiting. If they are flying to and from the casing, avoid it if possible. If you must be in an area where disturbing a nest is likely, be sure to wear long pants and a long-sleeved shirt. Stinging insects fly around the top of their target, so if you get into trouble, pull a portion of your shirt over your head and run away.

If you get stung, look for a stinger and, if present, remove it as soon as possible. Several over-the-counter products or a simple cold compress can be used to alleviate the pain of the sting. If the sting is followed by severe symptoms, or if it occurs in the neck or the mouth, seek medical attention immediately because swelling could cause suffocation.

If you need to destroy a nest, consult with the PM and project FL first. Commercially available stinging insect control aerosols are very effective, but could potentially contaminate the well. Once the nest is destroyed, fine mesh may be applied over the exit and entry points of a well casing to prevent re-infestation.

12.2.8 Ticks

Ticks in North America can be carriers of several diseases, including Lyme's Disease, Rocky Mountain Spotted Fever, and ehrlichiosis.

Limiting exposure to ticks reduces the likelihood of infection when exposed to tick-infested habitats. Measures to prevent tick exposure include the following:

- Remove leaf litter and brush in areas where you will be working prior to tick season.
- Wear light-colored clothing so that ticks are visible.
- Tuck your pant legs into your socks.
- Apply repellents to discourage tick attachment.
- Promptly inspect your body and remove crawling or attached ticks when you leave a tick-infested area.
- Conduct tick checks on buddies upon exiting any suspect area (may be needed multiple times per work day).
- Be aware of seasonal activity; ticks are often most active in the spring.

Observe the following procedures and practices if you are bitten by a tick:

- Use fine-tipped tweezers or shield your fingers with tissue, paper towel, or rubber gloves.

- Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause mouthparts to break off and remain in the skin.
- Do not squeeze, crush, or puncture the body of the tick because its fluids may contain infectious organisms.
- Do not handle the tick with bare hands because infectious agents may enter through mucous membranes or breaks in the skin.
- After removing the tick, thoroughly disinfect the bite site and wash your hands with soap and water.
- You may wish to save the tick for identification in case you become ill within 2 to 3 weeks. Place the tick in a sealed plastic bag in the freezer, and mark the bag with the date of the bite.

12.2.9 Mosquitoes

Mosquitoes in the United States have been known to carry West Nile virus, Zika virus, St. Louis encephalitis, and Dengue fever. Avoid mosquito bites by doing the following:

- Apply insect repellent containing DEET (N,N-diethyl-meta-toluamide) when outdoors. DEET is very effective, but could potentially contaminate samples.
- Read and follow the product directions whenever you use insect repellent.
- Wear long-sleeved clothes and long pants treated with repellent to further reduce your risk, or stay indoors during peak mosquito feeding hours (dusk until dawn).
- Limit the number of places available for mosquitoes to lay their eggs by eliminating standing water sources from around the work area.
- If you need to destroy a nest, consult with the PM and project FL first.
- Check to see if there is an organized mosquito control program near the project site. If no program exists, work with the local government officials to establish a program.

12.2.10 Poisonous Plants

Poisonous plants include poison ivy, poison oak, and poison sumac as shown in Table 12-10. Observe the following procedures and practices regarding poisonous plants:

- Avoid entering areas infested with poisonous plants.
- Immediately wash any areas that come into contact with poisonous plants.
- Use PPE when there is a possibility of contact with poisonous plants.

Table 12-10
North American Hazardous Plant Identification Guide

Hazardous Plant Identification Guide		
Poison Ivy • Grows in the West, Midwest, Texas, and the East Coast • Several forms—vine, trailing shrub, or shrub • Three leaflets (can vary from three to nine) • Leaves are green in summer and red in fall • Yellow or green flowers • White berries		
Poison Oak • Grows in the East (New Jersey to Texas) and Pacific Coast • 6-foot tall shrubs or long vines • Oak-like leaves in clusters of three • Yellow berries		
Poison Sumac • Grows in boggy areas, especially in the Southwest and Northern United States • Shrub up to 15 feet tall • Seven to 13 smooth-edged leaflets • Glossy pale yellow or cream-colored berries		

If you have been exposed to poison ivy, oak, or sumac, act quickly because the toxin in the plants penetrates the skin within minutes. If possible, stay outdoors until you complete the first two steps:

1. Cleanse the exposed skin with generous amounts of isopropyl alcohol.
2. Wash the skin with water.
3. Take a regular shower with soap and warm water. Do not use soap until this point because it will pick up the toxin from the surface and move it around.
4. Wash clothes, tools, and anything else that may have been in contact with the toxin with alcohol and water. Be sure to wear hand protection during that process.

Signs and symptoms of exposure include redness and swelling that appears 12 to 48 hours after exposure. Blistering and itching will follow. If you have had a severe reaction in the past, you should see a physician right away. Over-the-counter products that are available to alleviate symptoms include Cortaid®, Lanacort®, baking soda, Aveeno® oatmeal baths, and calamine lotion.

12.2.11 The Public at Large

The community residents around worksites may pose their own specific hazards. These conditions may include the following:

- Unintentional disruption of work
- Benign or malicious trespass
- Criminal intent

Scenarios may include the following:

- Pedestrians, cyclists, or motorists disregarding site boundaries due to distraction or willful disobedience.
- Public use of private site facilities for shelter, relief, and other reasons with no ill-intention.
- Public use of private site facilities for mischievous or criminal activity, such as loitering, vandalism, or theft.
- Encounters with community members who are disgruntled with the project activity.
- Encounters with criminal activities on or near a project site.

If any of the above are anticipated to be likely, take the following precautions as appropriate:

- Verify that the site is adequately marked and barricaded to limit unintentional disruptions of the work by the public.
- Review the site for attractive nuisances (e.g., hazards or conditions that are likely to attract children), and mitigate those.
- Secure all equipment and site facilities to prevent unauthorized access or use.
- Remove valuable items from the site or adequately secure them on site to limit the temptation for potential criminals.
- Have contact information for the client's or owner's public relations office while on site, and direct disgruntled community members to that office. If necessary, vacate the site to relieve the situation and notify the PM or FL.
- Work in pairs when uncertain of the public safety situation at a site. In questionable situations, postpone work as necessary until a plan of action can be developed to verify a safe working environment.

12.2.12 Personal Health and Safety

In addition to hazards associated with chemicals of concern, equipment, operations or site conditions discussed above, there may be additional personal safety issues to consider at a site, including those related to one or multiple protected classes, such as race, gender, religion, ability, sexual orientation,

or gender identity. These conditions may involve the following, perpetrated by the public or those associated with the work:

- Malicious disruption of work
- Harassment, including unwanted comments, gestures, or actions
- Threats of violence, either implied (using derogatory language) or explicit
- Assault

It is critical that the work environment be discussed within the project team to evaluate risks, ways to avoid those risks, and communication protocols. Anchor QEA requires that work be performed in teams.

Specifically, if any of the above are anticipated, take the following precautions as appropriate:

- Alert the PM, FL, CHSM, and Human Resources Department of potential issue(s).
- Formulate a plan of action to verify and maintain a safe working environment prior to field work, which may include the following:
  - Working in pairs and/or within a certain physical distance of other work groups.
  - Coordinated check-ins (calls to or from the office or visual check-ins with other field members).
- Whenever possible, schedule work only within daylight hours (which fluctuate seasonally) or on weekends when questionable scenarios may be more minimal.
  - If night work is required, maintain a minimum of two field personnel at all times, and potentially increase the total number of personnel.
  - If working in high-risk areas, discuss the possibility of hiring security if work needs to be performed at night, in low light, or near potentially dangerous areas (e.g., abandoned buildings, public displays of hostility, discrimination, or gang-related activity).
- Maintain a field phone with active GPS and non-locking 911 capability at all times while out in the field.
- If a need arises for a change in field work (e.g., additional sampling or moving to an area that was not planned) or travel plans (e.g., dead battery or flat tire), immediately alert the FL and PM as to the event.

In addition, practice active awareness of your environment. Discuss personal health and safety concerns at the daily tailgate meeting. If you feel unsafe based on the potential behavior of others, immediately bring it up to field team coworkers. If the issue is not resolved to your satisfaction, alert the PM, FL, CHSM, and Human Resources Department to assist in resolving any potential issue(s).

13 Medical Monitoring Program

This section describes the medical monitoring program that Anchor QEA field personnel must comply with when working on sites where there is a potential for exposure to hazardous wastes or other hazardous substances.

13.1 General Requirements

Anchor QEA employees shall be enrolled in a medical monitoring program in compliance with OSHA standards (29 CFR 1910.120(f)) under the following circumstances.

If they are involved with any of the following operations:

- *Cleanup operations* required by a governmental body, whether federal, state, local, or other involving hazardous substances that are conducted at uncontrolled hazardous waste sites (including, but not limited to, the EPA's National Priority List [NPL] sites, state priority list sites, sites recommended for the EPA NPL, and initial investigation of government-identified sites that are conducted before the presence or absence of hazardous substances has been ascertained)
- *Corrective actions* involving cleanup operations at sites covered by the Resource Conservation and Recovery Act of 1976 (RCRA) as amended (42 United States Code 6901 et seq)
- *Voluntary cleanup operations* at sites recognized by federal, state, local, or other governmental bodies as uncontrolled hazardous waste sites
- *Operations involving hazardous wastes* that are conducted at treatment, storage, and disposal (TSD) facilities regulated by 40 CFR 264 and 40 CFR 265 pursuant to RCRA or by agencies under agreement with the EPA to implement RCRA regulations
- *Emergency response operations* for releases of, or substantial threats of releases of, hazardous substances without regard to the location of the hazard

And, if they meet the following criteria:

- Are or may be exposed to hazardous substances or health hazards at or above the established PEL, above the published exposure levels for these substances, without regard to the use of respirators, for 30 days or more per year

In addition, employees are required to be enrolled in the medical monitoring program if they meet any of the following conditions:

- Wear a respirator for 30 days or more per year
- Are injured, become ill, or develop signs or symptoms due to possible overexposure involving hazardous substances or health hazards from an emergency response or hazardous waste operations
- Are members of a Hazardous Materials (HAZMAT) team

Anchor QEA employees required to be enrolled in a medical monitoring program under 29 CFR 1910.120(f) shall have medical examinations and consultations made available to them by Anchor QEA on the following schedule:

- Prior to assignment
- At least once every 12 months unless the attending physician believes a longer interval (not greater than biennially) is appropriate
- At termination of employment or reassignment to an area where the employee would not be covered if the employee has not had an examination within the last 6 months
- As soon as possible upon notification that the employee has developed signs or symptoms indicating possible overexposure to hazardous substances or health hazards, or that the employee has been injured or exposed above the PEL or published exposure levels in an emergency situation
- At more frequent times, if the examining physician determines that an increased frequency of examination is medically necessary

The content of medical examinations or consultations made available to employees shall be determined by the attending physician but shall include, at a minimum, a medical and work history with special emphasis on symptoms related to the handling of hazardous substances and health hazards, and to fitness for duty including the ability to wear any required PPE under conditions (i.e., temperature extremes) that may be expected at the work site.

The attending physician shall provide Anchor QEA with a written opinion for each examined employee that contains the following information:

- Whether the employee has any detected medical conditions that would place the employee at an increased risk of impairment of the employee's health from hazardous waste operations work, emergency response, or respirator use
- Any recommended limitations on the employee's assigned work
- A statement that the employee has been informed of the results of the medical examination and any medical conditions that require further examination or treatment

The written opinion obtained by Anchor QEA shall not reveal specific findings or diagnoses unrelated to occupational exposures. Medical monitoring and other employee-related medical records shall be retained for at least the duration of employment plus 30 years.

13.2 Team Self-Monitoring

All personnel will be instructed to look for and inform each other of any deleterious changes in their physical or mental condition during the performance of all field activities. Examples of such changes are as follows:

- Headaches
- Dizziness
- Nausea
- Blurred vision
- Cramps
- Irritation of eyes, skin, or respiratory system
- Skin chafing from damp or wet clothing
- Changes in complexion or skin color
- Changes in apparent motor coordination
- Increased frequency of minor mistakes
- Excessive salivation or changes in papillary response
- Changes in speech ability or speech pattern
- Symptoms of heat stress or heat exhaustion
- Symptoms of hypothermia

If any of these conditions develop, the affected person will be moved from the immediate work location and evaluated. If further assistance is needed, personnel at the local hospital will be notified, and an ambulance will be summoned if the condition is thought to be serious. If the condition is the result of sample collection or processing activities, procedures and/or PPE will be modified to address the problem.

14 References

DNR (Wisconsin Department of Natural Resources), 2003. *Consensus-Based Sediment Quality Guidelines, Recommendation for Use and Application, Interim Guidance*. Publication WT-732. December 2003.

DNR, 2017. *Portage Canal – Segment 1 Remediation Construction Documentation Report*. November 2017.

Ramboll (Ramboll Environ US Corporation), 2017. *NR 716 Site Investigation Report. Portage Canal (Segments 2, 3, and 4)*. Prepared for the Wisconsin Department of Natural Resources. March 2017.

Ramboll, 2018. *Remedial Action Options Report Revision 1. Portage Canal (Segments 2, 3, and 4)*. Prepared for the Wisconsin Department of Natural Resources. January 2018.

Appendix A
Health and Safety Logs and Forms

Daily Air Monitoring Record

Project Name: _____ **Date:** _____

Project Number: _____ **Location:** _____

Temperature: _____

Conditions: _____

_____

_____

_____

COC	Instrument	S/N	Calibration Date	Calibration Gas/Method	Calibration by
Organic vapors					
Particulates					
O_2					
Other:					
Other:					
Other:					

Time	Location/Description	Organic Vapor (ppm)	O2%	CG %LEL	Other	Other

Notes:

Completed by:

Printed Name _____ Signature _____ Date _____

Daily Safety Briefing Form

Date: _____

Project No: _____

Project Name: _____

Person Conducting Meeting: _____ **Health & Safety Officer:** _____ **Project Manager:** _____

TOPICS COVERED:

- ☐ Emergency Procedures and Evacuation Route
- ☐ Directions to Hospital
- ☐ HASP Review and Location
- ☐ Safety Equipment Location
- ☐ Proper Safety Equipment Use
- ☐ Employee Right-to-Know/ SDS Location
- ☐ Fire Extinguisher Location
- ☐ Eye Wash Station Location
- ☐ Buddy System
- ☐ Self and Coworker Monitoring
- ☐ Lines of Authority
- ☐ Communication
- ☐ Site Security
- ☐ Vessel Safety Protocols
- ☐ Work Zones
- ☐ Vehicle Safety and Driving/ Road Conditions
- ☐ Equipment Safety and Operation
- ☐ Proper Use of PPE
- ☐ Decontamination Procedures
- ☐ Near Miss Reporting Procedures
- ☐ Lifting Techniques
- ☐ Slips, Trips, and Falls
- ☐ Hazard Exposure Routes
- ☐ Heat and Cold Stress
- ☐ Overhead and Underfoot Hazards
- ☐ Chemical Hazards
- ☐ Flammable Hazards
- ☐ Biological Hazards
- ☐ Eating/Drinking/Smoking
- ☐ Reviewed Prior Lessons Learned
- ☐ Field Team Medical Conditions for Emergency Purposes (Confidential): _____
- ☐ Other: _____

Weather Conditions: _____

Daily Work Scope: _____

Site-specific Hazards: _____

Safety Comments: _____

Attendees

Printed Name	Signature

End of Day Wellness Check

Employee Exposure/Injury Incident/Spill Report

Employee Name: _____ **Date:** _____

Project Name/No: _____ **Time:** _____

Type of Occurrence: ☐ employee exposure ☐ injury incident ☐ spill

Site Name and Location: _____

Site Weather: *(clear, rain, snow, etc.)* _____

Nature of Illness/Injury: _____

Symptoms: _____

Action Taken: ☐ rest ☐ first aid ☐ medical

Transported By: _____ **Witnessed By:** _____

Hospital Name: _____

Treatment: _____

Describe in detail how this exposure/injury incident/spill occurred: *(if a spill, list the name of the compounds, quantities, and method of cleanup/containment)* _____

_____

_____

_____

_____

_____

What was the person doing at the time of the accident/incident?: _____

_____

List personal protective equipment worn: _____

_____

What immediate action was taken to prevent recurrence?: _____

_____

Employee:

Printed Name	Signature	Date

Supervisor:

Printed Name	Signature	Date

Site Safety Representative:

Printed Name	Signature	Date

NOTE: Use additional page(s) if necessary.

Field Safety Equipment Checklist

The following is a list of safety-related gear that may be appropriate depending on the type of work being conducted. The purpose of this checklist is twofold: 1) ensure that all field crew members think about appropriate safety gear needs before heading to the worksite; and 2) provide an extensive list of gear to consider in order to serve as a reminder of potential safety gear needs during a field effort.

☐ **Safety Briefing Log or Notebook**

Personal Protective Gear

- ☐ Rain pants and jacket
- ☐ Hard hats
- ☐ Boots (steel-toed, if appropriate)
- ☐ Safety glasses
- ☐ Ear protection
- ☐ Nitrile gloves (inner and outer pair)
- ☐ Tyvek overalls
- ☐ H_2S sensor
- ☐ Flashlight
- ☐ EpiPen (inquire if any field staff use one)
- ☐ Other:

Warm Weather Safety Gear

- ☐ Sunscreen
- ☐ Water
- ☐ Hat
- ☐ Light clothes

Cold Weather Safety Gear

- ☐ Warm clothes (preferably synthetics)
- ☐ Hat
- ☐ Gloves
- ☐ Boot warmers
- ☐ Thermos of warm drink/soup

Communications

- ☐ Notify office staff of day's field plan
- ☐ Walkie Talkies
- ☐ Cell phones
- ☐ Satellite phone (if appropriate)
- ☐ Contact numbers (e.g., for other field crew members, the PM, or others to notify that you are accessing site)

General Gear for Work Near Water

- ☐ Life jacket
- ☐ Boots or waders (hip or chest)
- ☐ Throwline

Boat Safety Gear

U.S. Coast Guard Required Gear:

- ☐ 1. Personal flotation device (PFD), preferably life jacket, for each occupant
- ☐ 2. Fire extinguisher (filled to operable range)
- ☐ 3. Flares (unexpired)
- ☐ 4. Horn
- ☐ 5. Navigation lights

- ☐ First aid kit
- ☐ Bowline and stern line
- ☐ Anchor and anchor line
- ☐ Paddle
- ☐ Spare propeller and linchpin
- ☐ Appropriate personal protective gear (boots or waders) to step onto shore if necessary
- ☐ Drain plug (and spare)
- ☐ Boat fuel and oil
- ☐ Weather radio (if appropriate)
- ☐ Weather, tides, and currents forecasts
- ☐ Warm clothes/blanket in dry bag

Modification to Health and Safety Plan

Date: _____

Project No: _____

Project Name: _____

Modification: _____

_____

_____

_____

_____

Reason for Modification: _____

_____

_____

_____

_____

_____

Site Personnel Briefed

Name: _____ **Date:** _____

Name: _____ **Date:** _____

Name: _____ **Date:** _____

Name: _____ **Date:** _____

Name: _____ **Date:** _____

Name: _____ **Date:** _____

Name: _____ **Date:** _____

Name: _____ **Date:** _____

Name: _____ **Date:** _____

Name: _____ **Date:** _____

Approvals

Field Lead: _____ _____ _____
Printed Name | Signature | Date

Project Manager: _____ _____ _____
Printed Name | Signature | Date

Heat Stress Monitoring Record

Date: _____

Project No: _____

Project Name: _____

Location: _____

Employee Name	Monitoring Results												
	Initial Reading Time:	First Work Period Time:		Second Work Period Time:		Third Work Period Time:		Fourth Work Period Time:		Fifth Work Period Time:		Sixth Work Period Time:	
	WBGT (°F):	WBGT (°F):		WBGT (°F):		WBGT (°F):		WBGT (°F):		WBGT (°F):		WBGT (°F):	
	Air Temp (°F):	Air Temp (°F):		Air Temp (°F):		Air Temp (°F):		Air Temp (°F):		Air Temp (°F):		Air Temp (°F):	
	Initial Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:
	Initial H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:
	Initial Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:
	Initial H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:
	Initial Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:
	Initial H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:
	Initial Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:
	Initial H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:
	Initial Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:
	Initial H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:

Notes:

Completed by:

Printed Name _____ Signature _____ Date _____

PLAYING IT SAFE

Utility Contact Prevention Checklist

NOTE: Utility mark-out requirements vary from state to state; consult state authorities before beginning work.

Purpose: This form is intended to help the Field Lead confirm that underground or overhead utilities are identified to the extent practicable and consistent with applicable regulations **PRIOR** to site work.

INVESTIGATIONS MUST NOT OCCUR UNTIL MULTIPLE LINES OF EVIDENCE INDICATE THAT SUBSURFACE OR OVERHEAD UTILITIES ARE NOT PRESENT IN THE WORK AREA

Project Name/No: _____ **Date:** _____

Field Lead: _____ **Project Address:** _____

Project Manager: _____ **Health & Safety Officer:** _____

Emergency Contact Information for One Call: _____

Duration/Summary of Work to be Performed: _____

_____

_____

Consideration	Check		Explanation	Initial
Has the state One Call been contacted?	☐ Yes	☐ No		
Has the property owner or client been contacted for local knowledge of utilities, as applicable?	☐ Yes	☐ No		
Does the property owner or client have specific utility contact prevention procedures and, if so, have they been completed?	☐ Yes	☐ No		
Are any as-built drawings available? If so, do they show any utilities?	☐ Yes	☐ No		
Has a visual inspection of the work area(s) been completed?	☐ Yes	☐ No		
Has the potential presence of in-water utilities been assessed (shore markers, streets dead-ending at water's edge, etc.)	☐ Yes	☐ No		
Is evidence of electrical utilities present? (electric meters on structures, conduits, overhead lines, light poles, etc.)	☐ Yes	☐ No		
Is evidence of water/sewer utilities present? (water meter, hydrants, restrooms, grates in ground, etc.)	☐ Yes	☐ No		
Is evidence of telecommunications utilities present? (fiber optic warning signs, conduits from utility poles, wall-mounted boxes, etc.)	☐ Yes	☐ No		
Is other evidence of utilities present? (unknown ground markings, manholes or valve covers, "Call Before You Dig" signs, linear asphalt or concrete repair characteristics, liner subsidence of ground surface, pin flags or stakes, etc.)	☐ Yes	☐ No		

Utility Contact Prevention Checklist

NOTE: Utility mark-out requirements vary from state to state; consult state authorities before beginning work.

Consideration	Check		Explanation	Initial
Has a private locating service been contacted?	☐ Yes	☐ No		
Were any utilities identified and marked out through a private locating service? If so, duplicate mark-outs on site drawings.	☐ Yes	☐ No		
Are there any fiber optic cables, fuel lines, or high-pressure lines within 50 feet of work locations?	☐ Yes	☐ No		
If fiber optic cables, fuel lines, or high-pressure lines are within 50 feet, has an agreement with the utility owner been established?	☐ Yes	☐ No		
Can a test borehole be advanced by hand digging, probing, post-hole digging, and/or air knifing to 5 feet below ground surface (bgs)?	☐ Yes	☐ No		
If hand digging, probing, post-hole digging, and/or air knifing to 5 feet bgs is not possible, can a non-invasive geophysical investigation be conducted? If not, why?	☐ Yes	☐ No		
Other considerations:				

NOTE: Please fill in second page and attach additional reports, drawings, or other information, as necessary.

Confirmation Number: _____

Contact Name: _____ **Organization:** _____

Contact Date: _____ **Contact Time:** _____

Response: _____

_____

_____

_____

Completed by:

_____ _____ _____

Printed Name Signature Date

Contractor:

_____ _____ _____

Printed Name Signature Date

PLAYING IT SAFE

Appendix B
Job Safety Analysis (JSA) Documents

Job Safety Analysis

Field Activities

Project Name: Portage Canal – Segment 2	**Project Number:** 181779-02.01	**JSA Number:** 001	**Issue Date:**
Location: Portage, Wisconsin	**Contractor:** Anchor QEA, LLC	**Analysis by:** Mike Conese	**Analysis Date:** 10/27/2018
Work Operation: Field activities	**Superintendent/Competent Person:** Mike Conese	**Revised by:**	**Revised Date:**
Required Personal Protective Equipment (PPE): • Modified Level D—Long pants and/or Tyvek coveralls if handling potentially contaminated media and steel-toed footwear conforming to ASTM International (ASTM) F2412-05/ASTM F2413-05 • Depending on activity, the following PPE may also be required: safety glasses/splash goggles, hard hat, nitrile outer gloves and latex inner gloves, and, if boating, U.S. Coast Guard-approved personal flotation device (PFD; see cold stress section for cold-weather PFD information)		**Reviewed by:** Christopher R. Torell, PG, CSP	**Reviewed Date:** 10/30/2018
		Approved by:	**Approved Date:**

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
If boating		• Follow the Job Safety Analysis (JSA) for boating activities.	
Outdoor, physical activity	Slips, trips, and falls	• Avoid walking while writing or texting—maintain a heads-up posture. • Be aware of potentially slippery surfaces and tripping hazards. Use handrails where available. Wear footwear that has sufficient traction. • Maintain good housekeeping practices. Clean up all spills immediately. • Be aware of weather effects on the work area, including wet and/or frozen ground. • Jumping, running, and horseplay are prohibited. • Keep all areas clean and free of debris to prevent any trips and falls. • Be aware of and limit loose clothing or untied shoelaces that may contribute to slips, trip, and falls. • Notify the field team members of any unsafe conditions. • Use the buddy system.	• Routinely inspect work area for unsafe conditions.

Job Safety Analysis

Field Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Outdoor, physical activity (continued)	Heat stress	• Adjust work schedules, as necessary, to avoid the hottest part of the day. • Take rest breaks as warranted. • Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods. • Maintain body fluids at normal levels. • Train workers to recognize the symptoms of heat-related illness.	• Review weather forecast prior to field work. • Monitor workers' physical conditions. • Monitor outside temperature versus worker activity.
	Cold stress	• Provide shelter (enclosed, heated environment) to protect personnel during rest periods. • Educate workers to recognize the symptoms of frostbite and hypothermia. • Use appropriate cold-weather gear, up to and including Mustang-type bib coveralls or jacket/bib combinations. • Consider additional precautions if working near water in cold weather. • Have a dry change of clothing available. • Train workers to recognize the symptoms of cold-related illness.	• Review weather forecast prior to field work. • Monitor workers' physical conditions and PPE. • Monitor outside and water temperature versus worker activity and PPE.
	Rain/snow	• Wear appropriate PPE (rain gear). • Be aware of slip hazards, puddles, and electrical hazards when working in wet conditions. • If extremely cold conditions are forecast, consider additional precautions or postponing work activity.	• Review weather forecast prior to field work. • Inspect PPE daily prior to use. • Routinely inspect work area for deteriorating conditions.
	Sunshine	• Have site-appropriate sunscreen available for ultraviolet protection. • Have abundant water available to prevent dehydration. • Consider wearing wide-brimmed headwear and light-colored, lightweight, sun-blocking clothing.	• Ensure that sunscreen and water are available.
	Lightning	• Do not begin or continue work until lightning subsides for at least 30 minutes. Disconnect and do not use or touch electronic equipment. • Immediately head for shore if on the water and lightning is observed. If not able to get to shore, disconnect and do not use or touch the major electronic equipment, including the radio, throughout the duration of the storm.	• Obtain weather forecast and updates as needed.

Job Safety Analysis

Field Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Outdoor, physical activity (continued)	High winds	• Wear goggles or safety glasses if dust or debris are visible.	• Review weather forecast prior to field work. • Ensure that goggles or safety glasses are available.
	Biological hazards (flora [e.g., poison ivy and poison oak] and fauna [e.g., ticks, bees, spiders, mosquitoes, and snakes])	• Be aware of likely biological hazards in the work area. • Wear appropriate clothing (i.e., hat, long-sleeve shirt, long pants, leather gloves, boots, and coveralls, as appropriate), and apply insect repellant. • Wear hand and arm protection when clearing plants or debris from the work area. • Be aware of potential wildlife and defensive behavior (e.g., nesting birds, or animals with young).	• Ensure that insect repellent is available. • Inspect clothing and skin for insects (e.g., ticks) after working in insect-prone areas.
	Noise exposure	• Wear hearing protection in high-noise environments or when working around heavy machinery or equipment (action level of 85 decibels averaged over an 8-hour day).	• Ensure that hearing protection is available.

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 Code of Federal Regulations (CFR) 1910.120(e), including but not limited to initial 40-hour, 8-hour supervisor, and annual 8-hour refresher trainings.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120(f).
- If boating is involved, and a professional captained vessel is not in use, boat operators must take the appropriate state boater safety courses.
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their supervisor during their daily safety meeting.

Job Safety Analysis

Sediment Sampling

Project Name: Portage Canal – Segment 2	**Project Number:** 181779-02.01	**JSA Number:** 002	**Issue Date:**
Location: Portage, Wisconsin	**Contractor:** Anchor QEA, LLC	**Analysis by:** Mike Conese	**Analysis Date:** 10/27/2018
Work Operation: Sediment and soil sampling	**Superintendent/Competent Person:** Mike Conese	**Revised by:**	**Revised Date:**
Required Personal Protective Equipment (PPE): • Modified Level D—Long pants and/or Tyvek coveralls if handling potentially contaminated media, and steel-toed footwear conforming to ASTM International (ASTM) F2412-05/ASTM F2413-05 • Safety glasses/splash goggles, hard hat, nitrile outer gloves and latex inner gloves, and, if boating, U.S. Coast Guard-approved personal flotation device (PFD; see cold stress section for cold-weather PFD information)		**Reviewed by:** Christopher R. Torell, PG, CSP	**Reviewed Date:** 10/30/2018
		Approved by:	**Approved Date:**

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
If boating		• Follow the Job Safety Analysis (JSA) for boating activities.	
If using glassware		• Follow the JSA for handling glassware.	
Sediment and soil sample retrieval and processing	Injury from hand and power tool operation (e.g., spatula or drill)	• Be aware of sharp edges on hand tools (e.g., spatulas, knives, drill bits, and saw blades). • Be aware of electrical connections and water hazards when working with electric- or battery-operated tools. • Ensure that all tools are working properly; repair or replace defective tools. Repair when unplugged and off. • Keep guards on power tools when not in use.	• Inspect tools to ensure that they are in good working order. • Inspect electrical connections (if applicable). • Inspect tools periodically to ensure dry and clean operation.
	Noise exposure	• Wear hearing protection in high noise environments or when working around heavy machinery or equipment (action level of 85 decibels averaged over an 8-hour day).	• Ensure that hearing protection is available.

PLAYING IT SAFE

Job Safety Analysis

Sediment Sampling

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Sediment and soil sample retrieval and processing (continued)	Slips, trips, and falls	• Avoid walking while writing or texting—maintain a heads-up posture. • Be aware of potentially slippery surfaces, including boat decks, riprap, muddy or algae-covered rocks, shoreline plants/seaweed, thick mud, and tripping hazards. Use handrails where available. Wear footwear that has sufficient traction. • Maintain good housekeeping practices. Clean up all spills immediately. • Be aware of weather effects on the work area, including wet and/or frozen ground. • Jumping, running, and horseplay are prohibited. • Be cautious when entering or exiting the vessel, and load/unload items onto/off of the pier or shore once boarded. • Keep all areas clean and free of debris to prevent any trips and falls. • Notify the field team members of any unsafe conditions. • Use the buddy system.	• Routinely inspect work area for unsafe conditions.
	Ingestion of contaminants, skin/eye contact with contaminants	• Wear appropriate PPE to prevent/reduce exposure. • Contact 911, as necessary; perform CPR if breathing stops. • Move exposed person away from source of contamination, and rinse mouth. If exposure to skin occurs, promptly wash contaminated skin using soap or mild detergent and water. Rinse eyes with large amounts of water. • Follow decontamination procedures as outlined in the Site Safety Plan.	• Ensure that decontamination procedures are on hand and are reviewed. • Ensure that PPE and rinsing water are available.
	Muscle strain or injuries from improper lifting	• Use proper lifting techniques or ask for assistance with heavy objects. • If boating, avoid carrying objects directly onto or off the boat; rather, load/unload objects while on the boat to/from the pier/shore.	• Evaluate weight and center of gravity of heavier items prior to lifting or moving.
	Pinch points	• If boating, secure any unsecured objects on deck; they may shift on deck quickly in wave, current, or engine acceleration conditions. • Maintain a safe distance from closing mechanisms and moving parts on sampling gear. • Avoid placing hands or self between boat and dock/piles.	

Job Safety Analysis

Sediment Sampling

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Sediment and soil sample retrieval and processing (continued)	Wading	• Be aware of potentially slippery surfaces and tripping hazards such as fallen brush, logs, rocks, and other debris. Wear footwear that has sufficient traction. • Be aware of water depth and potential drop-offs. • Be aware of existing and projected river flows. • Wear knee or chest waders as appropriate for traction and to protect against cold water. • Keep extra dry clothes on hand, including socks. • Consider carrying a walking staff for balance. • Always wear a PFD, even if water looks shallow or slow; drop-offs occur, and water is often moving faster than it looks. • Use the buddy system. • Be aware of soft sediment.	• Inspect work area for tripping hazards visible from streambank. • Inspect waders for leaks. • Check depths and flows before wading. • Ensure that change of dry clothes is available if wading in cold weather or cold-water conditions.
Working outdoors	Heat stress	• Adjust work schedules, as necessary, to avoid the hottest part of the day. • Take rest breaks as warranted. • Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods. • Maintain body fluids at normal levels. • Train workers to recognize the symptoms of heat-related illness.	• Review weather forecast prior to field work. • Monitor workers' physical conditions. • Monitor outside temperature versus worker activity.
	Cold stress	• Provide shelter (enclosed, heated environment) to protect personnel during rest periods. • Educate workers to recognize the symptoms of frostbite and hypothermia. • Use appropriate cold-weather gear, up to and including Mustang-type bib coveralls or jacket/bib combinations. • Consider additional precautions if working near water in cold weather. • Have a dry change of clothing available. • Train workers to recognize the symptoms of cold-related illness.	• Review weather forecast prior to field work. • Monitor workers' physical conditions and PPE. • Monitor outside and water temperature versus worker activity and PPE.
	Rain/snow	• Wear appropriate PPE (rain gear). • Be aware of slip hazards, puddles, and electrical hazards when working in wet conditions. • If extremely cold conditions are forecast, consider additional precautions or postponing work activity.	• Review weather forecast prior to field work. • Inspect PPE daily prior to use. • Routinely inspect work area for deteriorating conditions.

Job Safety Analysis

Sediment Sampling

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Working outdoors (continued)	Sunshine	• Have appropriate sunscreen available for ultraviolet protection. • Have abundant water available to prevent dehydration. • Consider wearing wide-brimmed headwear and light-colored, lightweight, sun-blocking clothing.	• Ensure that sunscreen and water are available.
	Lightning	• Do not begin or continue work until lightning subsides for 30 minutes. Disconnect and do not use or touch electronic equipment. • Immediately head for shore if on the water and lightning is observed. If not able to get to shore, disconnect and do not use or touch the major electronic equipment, including the radio, throughout the duration of the storm.	• Obtain weather forecast and updates as needed.
	High winds	• Wear goggles or safety glasses if dust or debris are visible.	• Review weather forecast prior to field work. • Ensure that goggles or safety glasses are available.
	Biological hazards (flora [e.g., poison ivy and poison oak] and fauna [e.g., ticks, bees, spiders, mosquitoes, and snakes])	• Be aware of likely biological hazards in the work area. • Wear appropriate clothing (i.e., hat, long-sleeve shirt, long pants, leather gloves, boots, and coveralls, as appropriate), and apply insect repellant. • Wear hand and arm protection when clearing plants or debris from the work area.	• Ensure that insect repellent is available. • Inspect clothing and skin for insects (e.g., ticks) after working in insect-prone areas.

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 Code of Federal Regulations (CFR) 1910.120(e), including but not limited to initial 40-hour, 8-hour supervisor, and annual 8-hour refresher trainings.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120(f).
- If boating is involved, and a professional captained vessel is not in use, boat operators must take the appropriate state boater safety courses.
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their supervisor during their daily safety meeting.

Job Safety Analysis

General Boating Activities

Project Name: Portage Canal – Segment 2	**Project Number:** 181779-02.01	**JSA Number:** 003	**Issue Date:**
Location: Portage, Wisconsin	**Contractor:** Anchor QEA, LLC	**Analysis by:** Mike Conese	**Analysis Date:** 10/27/2018
Work Operation: General Boating Activities	**Superintendent/Competent Person:** Mike Conese	**Revised by:**	**Revised Date:**
Required Personal Protective Equipment (PPE): • Modified Level D—Long pants and/or Tyvek coveralls if handling potentially contaminated media, and steel-toed footwear conforming to ASTM International (ASTM) F2412-05/ASTM F2413-05 • Safety glasses/splash goggles, hard hat, nitrile outer gloves and latex inner gloves, and, if boating, U.S. Coast Guard-approved personal flotation device (PFD; see cold stress section for cold-weather PFD information)		**Reviewed by:** Christopher R. Torell, PG, CSP	**Reviewed Date:** 10/30/2018
		Approved by:	**Approved Date:**

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
General Boating		• Anchor QEA staff will be passengers only during on-water work.	
Walking on deck	Pinch points	• Secure any unsecured objects on deck; they may shift quickly in wave, current, or engine acceleration conditions. • Maintain a safe distance from closing mechanisms and moving parts, such as on sampling gear. • Avoid placing your hands or yourself between the boat and the dock or piles.	

PLAYING IT SAFE

Job Safety Analysis

General Boating Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Walking on deck (continued)	Slips, trips, and falls	• Avoid walking while writing or texting—maintain a heads-up posture. • Be aware of potentially slippery surfaces, including boat decks, riprap, muddy or algae-covered rocks, shoreline plants or seaweed, thick mud, and tripping hazards. Use handrails where available. Wear footwear that has sufficient traction. • Maintain good housekeeping practices. Clean up all spills immediately. • Be aware of weather effects on the work area, including wet and/or frozen ground. • Jumping, running, and horseplay are prohibited. • Be cautious when entering or exiting the vessel, and load/unload items onto/off of the pier or shore once boarded. • Keep all areas clean and free of debris to prevent any trips and falls. • Notify the field team members of any unsafe conditions. • Keep rope lines neatly coiled and stowed. Avoid stepping on or over lines.	• Routinely inspect work area for unsafe conditions.
	Exceeding boat capacity	• Keep the number of passengers and equipment as posted on boat placards within limits at all times. If conditions warrant, reduce capacity to maintain boat stability.	• Ensure that field team is aware of limits and adheres accordingly.
	Noise exposure	• Wear hearing protection in high noise environments or when working around heavy machinery or equipment (action level of 85 decibels averaged over an 8-hour day).	• Ensure that hearing protection is available.
Working outdoors	Heat stress	• Adjust work schedules, as necessary, to avoid the hottest part of the day. • Take rest breaks as warranted. • Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods. • Maintain body fluids at normal levels. • Train workers to recognize the symptoms of heat-related illness.	• Review weather forecast prior to field work. • Monitor workers' physical conditions. • Monitor outside temperature versus worker activity.
	Cold stress	• Provide shelter (enclosed, heated environment) to protect personnel during rest periods. • Educate workers to recognize the symptoms of frostbite and hypothermia. • If the combined air and water temperature is below 90 degrees Fahrenheit (˚F), wear a USCG-approved float coat, Mustang-type bib coveralls, or one-piece survival suit. • Have a dry change of clothing available. • Train workers to recognize the symptoms of cold-related illness.	• Review weather forecast prior to field work. • Monitor workers' physical conditions and PPE. • Monitor outside and water temperature versus worker activity and PPE.

Job Safety Analysis

General Boating Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Working outdoors (continued)	Rain/snow	• Wear appropriate PPE (rain gear). • Be aware of slip hazards, puddles, and electrical hazards when working in wet conditions. • If extremely cold conditions are forecast, consider additional precautions or postponing work activity.	• Review weather forecast prior to field work. • Inspect PPE daily prior to use. • Routinely inspect work area for deteriorating conditions.
	Sunshine	• Have appropriate sunscreen available for ultraviolet protection. • Have abundant water available to prevent dehydration. • Consider wearing wide-brimmed headwear and light-colored, lightweight, sun-blocking clothing.	• Ensure that sunscreen and water are onboard.
	Fog	• Wait for fog to lift for adequate visibility.	• Review weather forecast prior to field work.
	Lightning	• Do not begin or continue work until lightning subsides for at least 30 minutes. Disconnect and do not use or touch electronic equipment. • Immediately head for shore if on the water and lightning is observed. • If not able to get to shore, disconnect and do not use or touch the major electronic equipment, including the radio, throughout the duration of the storm.	• Obtain weather forecast and updates as needed.
	High river flows or high waves	• Be aware of waves and forecasts and recent rainfall in your watershed.	• Have forecast available.
	High winds	• Wear goggles or safety glasses if dust or debris are visible. • Stow or secure loads or equipment that could be moved by wind, particularly when underway.	• Review weather forecast prior to field work. • Ensure that goggles or safety glasses are onboard.
	Biological hazards (e.g., mosquitoes, deer flies, and horse flies)	• Wear appropriate clothing (i.e., hat, long-sleeve shirt, long pants, leather gloves, boots, and coveralls, as appropriate), and apply insect repellent.	• Ensure that insect repellent is onboard.

Job Safety Analysis

General Boating Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Vessel emergencies	Person overboard	If you witness someone fall overboard: • Yell, "Person overboard!" • Throw a flotation device immediately. • If the engine is running, take it out of gear and swing the stern clear to keep from hitting the person. • Call 911 or USCG as appropriate. • Assign a spotter to keep the person in sight at all times. • Contact nearby vessels for assistance. • Recover the person from the water. If you fall overboard: • Hold your mouth and nose closed and protect your head. • When you reach the surface, look for movement, listen for sounds, and call for help. Use the whistle attached to the PFD and activate the beacon light. • It is only sensible to swim if there is reason to believe you have a chance of reaching your destination. Too much movement in cold water causes hypothermia.	• Ensure that flotation devices are available. • Ensure that team wears PFDs.
	Fire, abandon ship	• Be prepared to abandon ship in case of major fire (too large to control with a fire extinguisher) or another emergency. • Only the boat captain can order abandon ship. • Communicate intent to abandon ship to all personnel onboard. • Notify USCG and nearby vessels of intent to abandon ship. • Call 911. • Notify the Project Manager and Field Lead, if time permits. • Be aware of the propeller position before abandoning ship. • Identify a rally point for all personnel. • Know the dangers of hypothermia. • Use the buddy system to support injured personnel.	• Ensure that fire extinguisher is available, current, and in working order. • Review abandon ship procedures with field team prior to work.
Navigation	Boat traffic	• Maintain a safe operating distance from shoreline and other vessels.	• Be aware of on-water surroundings.
Motor vehicle operation and trailering	Boat not secured properly	• Ensure that latches, straps, antennas, and onboard gear are secure. Ensure that motor is up and lights are plugged in for driving. • Follow Job Safety Analysis (JSA) for motor vehicle operation.	• Inspect around entire boat before driving.

Job Safety Analysis

General Boating Activities

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 Code of Federal Regulations (CFR) 1910.120(e), including but not limited to initial 40-hour, 8-hour supervisor, and annual 8-hour refresher trainings.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120(f).
- If professional captained vessel is not in use, boat operators must take appropriate state boater safety courses.
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their supervisor during their daily safety meeting.

Job Safety Analysis

Decontamination Activities

Project Name: Portage Canal – Segment 2	**Project Number:** 181779-02.01	**JSA Number:** 004	**Issue Date:**
Location: Portage, Wisconsin	**Contractor:** Anchor QEA, LLC	**Analysis by:** Mike Conese	**Analysis Date:** 10/27/2018
Work Operation: Decontamination activities	**Superintendent/Competent Person:** Mike Conese	**Revised by:**	**Revised Date:**
Required Personal Protective Equipment (PPE): • See Table 5-1 in Health and Safety Plan		**Reviewed by:** Christopher R. Torell, PG, CSP	**Reviewed Date:** 10/30/2018
		Approved by:	**Approved Date:**

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
If boating		• Follow the Job Safety Analysis (JSA) for boating activities.	
Decontamination area setup	Vehicle, heavy equipment traffic, or boat traffic in work area	• Wear safety vest and hard hat PPE. • Be alert when working around heavy equipment and/or other boats, especially if wearing hearing protection.	• Ensure that safety vests are available for staff and visitors.
	Muscle strain or injuries from improper lifting	• Use proper lifting techniques or ask for assistance with heavy objects. • If boating, avoid carrying objects directly onto or off of the boat; rather, load/unload objects while on the boat to/from the pier/shore.	• Evaluate weight and center of gravity of heavier items prior to lifting or moving.
	Biological hazards (flora [e.g., poison ivy, and poison oak] and fauna [e.g., ticks, bees, mosquitoes, and snakes])	• Be aware of likely biological hazards in the work area. • Wear appropriate clothing (i.e., hat, long-sleeve shirt, long pants, leather gloves, boots, and Tyvek coveralls, as appropriate), and apply insect repellent. • Wear hand and arm protection when clearing plants or debris from the work area.	• Ensure that insect repellent is available.

Job Safety Analysis

Decontamination Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Decontamination activities	Injury from hand and power tool operation (e.g., spatula or drill)	• Be aware of sharp edges on hand tools (e.g., spatulas, knives, drill bits, and saw blades). • Be aware of electrical connections and water hazards when working with electric- or battery-operated tools. • Ensure that all tools are working properly; repair or replace defective tools. Repair when unplugged and off. • Keep guards on power tools when not in use.	• Inspect tools to ensure that they are in good working order. • Inspect electrical connections (if applicable). • Inspect tools periodically to ensure dry and clean operation.
	Noise exposure	• Wear hearing protection in high noise environments or when working around heavy machinery or equipment (action level of 85 decibels averaged over an 8-hour day).	• Ensure that hearing protection is available.
	Slips, trips, and falls	• Be aware of potentially slippery surfaces and tripping hazards. Use handrails where available. Wear footwear that has sufficient traction. • Maintain good housekeeping practices. Clean up all spills immediately. • Be aware of weather effects on the work area, including wet and/or frozen ground. • Jumping, running, and horseplay are prohibited. • Keep all areas clean and free of debris to prevent any trips and falls. • Notify the field team members of any unsafe conditions.	• Routinely inspect work area for unsafe conditions.
	Ingestion of contaminants, skin/eye contact with contaminants	• Wear appropriate PPE to prevent/reduce exposure. • Contact 911, as necessary; perform CPR if breathing stops. • Move exposed person away from source of contamination, and rinse mouth. If exposure to skin occurs, promptly wash contaminated skin using soap or mild detergent and water. Rinse eyes with large amounts of water. • Follow decontamination procedures as outlined in the Site Safety Plan.	• Ensure that decontamination procedures are on hand and are reviewed. • Ensure that PPE and rinsing water are available.
Working outdoors	Heat stress	• Adjust work schedules, as necessary, to avoid the hottest part of the day. • Take rest breaks as warranted. • Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods. • Maintain body fluids at normal levels. • Train workers to recognize the symptoms of heat-related illness.	• Monitor workers' physical conditions. • Monitor outside temperature versus worker activity.

Job Safety Analysis

Decontamination Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Working outdoors (continued)	Cold stress	• Provide shelter (enclosed, heated environment) to protect personnel during rest periods. • Educate workers to recognize the symptoms of frostbite and hypothermia. • Use appropriate cold-weather gear, up to and including Mustang-type bib coveralls or jacket/bib combinations. • Consider additional precautions if working near water in cold weather. • Have a dry change of clothing available. • Train workers to recognize the symptoms of cold-related illness.	• Monitor workers' physical conditions and PPE. • Monitor outside and water temperature versus worker activity and PPE.
	Rain/snow	• Wear appropriate PPE (rain gear). • Be aware of slip hazards, puddles, and electrical hazards when working in wet conditions. • If extremely cold conditions are forecast, consider additional precautions or postponing work activity.	• Inspect PPE daily prior to use. • Routinely inspect work area for deteriorating conditions.
	Sunshine	• Have appropriate sunscreen available for ultraviolet protection. • Have abundant water available to prevent dehydration. • Consider wearing wide-brimmed headwear and light-colored, lightweight, sun-blocking clothing.	• Ensure that sunscreen and water are available.
	Lightning	• Do not begin or continue work until lightning subsides for at least 20 minutes. Disconnect and do not use or touch electronic equipment.	• Obtain weather forecast and updates as needed.
	High winds	• Wear goggles or safety glasses if dust or debris are visible.	• Ensure that goggles or safety glasses are available.

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 Code of Federal Regulations (CFR) 1910.120(e), including but not limited to initial 40-hour, 8-hour supervisor, and annual 8-hour refresher trainings.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120(f).
- If boating is involved, and a professional captained vessel is not in use, boat operators must take the appropriate state boater safety courses.
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their supervisor during their daily safety meeting.

Job Safety Analysis

Anchor QEA Motor Vehicle Operation

Project Name: Portage Canal – Segment 2	**Project Number:** 181779-02.01	**JSA Number:** 005	**Issue Date:**
Location: Portage, Wisconsin	**Contractor:** Anchor QEA, LLC	**Analysis by:** Mike Conese	**Analysis Date:** 10/27/2018
Work Operation: Motor vehicle operation	**Superintendent/Competent Person:** Mike Conese	**Revised by:**	**Revised Date:**
Required Personal Protective Equipment (PPE): • Modified Level D—Long pants and/or Tyvek coveralls if handling potentially contaminated media, and steel-toed footwear conforming to ASTM International (ASTM) F2412-05/ASTM F2413-05 • Safety glasses/splash goggles, hard hat, nitrile outer gloves and latex inner gloves, and, if boating, U.S. Coast Guard-approved personal flotation device (PFD; see cold stress section for cold-weather PFD information)		**Reviewed by:** Christopher R. Torell, PG, CSP	**Reviewed Date:** 10/30/2018
		Approved by:	**Approved Date:**

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Anchor QEA motor vehicle operation	Unfamiliar with the vehicle	• Allow yourself some time to get familiar with an Anchor QEA vehicle, a rental vehicle, or one not used often. • Test the lights, windshield wipers, hazard lights, horn, parking brake, and other important functions. • Review the dashboard controls, steering radius, and overhead and side clearances. • Allow extra side, front, and back space around the vehicle while driving or parking an unfamiliar vehicle. • Adjust mirrors and the seat while the vehicle is in park. • Drive slowly in confined locations, as in a parking garage, parking lots, or industrial settings. Confirm adequate clearances by sight before turning or backing up in tight or unfamiliar locations. • Use a second person to be a spotter outside the vehicle if needed in tight spaces.	• Inspect fluid levels and air pressure in tires, adjust mirrors and seat positions appropriately, monitor the fuel level, and fill up when the fuel level is low

PLAYING IT SAFE

Job Safety Analysis

Anchor QEA Motor Vehicle Operation

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Anchor QEA motor vehicle operation (continued)	Speed and Braking	• Fasten and properly adjust the seat belt. • Obey all posted and designated speed limits. • Radar detectors are prohibited in all company-owned, leased, or rented vehicles. • Reduce travel speed during hazardous conditions (e.g., rain, fog, or snow). • Identify whether your vehicle has Anti-Lock Brakes (ABS). If it does, DO NOT pump the brakes to stop when the vehicle has begun to skid. Apply steady pressure to the brakes. If the vehicle does not have ABS, pump the brakes to stop during slippery conditions.	• Seatbelt • Identify designated speed limits • Determine if vehicle has ABS
	Distance spacing	• Continually check your rear and side view mirrors. • Use the 3-second rule to keep a safe distance between vehicles. • Increase the 3-second rule as necessary during hazardous travel conditions. • Regularly scan the area you will be entering in the next 10 to 12 seconds. • Always leave yourself an “out” during travel. • When stopping, make sure that you leave enough distance between you and the car in front of you. You should be able to see the rear tires of the vehicle in front when stopped. • Obey the speed limit and traffic regulations. • When at a red light and it turns green, use the “delayed start” technique, by counting to three before you take your foot off the brake. • DO NOT TAILGATE. • Keep headlights (and running lights, if available) on for maximum visibility.	• Seatbelt
	Skids	• If the vehicle has begun to skid out of control, turn the steering wheel in the direction of the skid and re-adjust the wheel, as necessary. • Reduce speed during hazardous travel conditions. • Use 4-wheel drive, if available, when driving vehicles off-road, on steep inclines, or in muddy conditions. • Do not take vehicles off-road if they cannot be operated safely in such conditions.	• Seatbelt
	Blind spots	• Become familiar with any blind spots associated with your vehicle. • Adjust mirrors to give the maximum viewing area. • Use your directional devices to signal all turns and when changing lanes; check rear and side view mirror and glance over your shoulder to check that the lane is clear. • Avoid other driver’s blind spots; slow down and let the other vehicle pass. • If parked for an extended period and staying in the vehicle, be sure to inspect the area for changed conditions (e.g., a car that moved in behind you) before leaving.	• Seatbelt • Mirrors

Job Safety Analysis

Anchor QEA Motor Vehicle Operation

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Anchor QEA motor vehicle operation (continued)	Backing	• Back into parking spaces upon arrival whenever possible. • Perform a 360-degree walk around the vehicle before backing to identify any new conditions or obstructions. • Use a spotter when backing whenever possible. • Understand hand signals. • Sound the horn prior to backing. • Check the rear and side view mirrors prior to backing. • Back slowly in areas of obstructed vision. • Anticipate others who may be backing out into your pathway and adjust accordingly.	• Seatbelt • Mirrors
	Distractions (e.g., cell phones, reading maps or directions, eating)	• Do not engage in distracted driving—focus on operating the vehicle, and on your surroundings (e.g., road conditions and other drivers). • Obey state or local laws regarding cell phone use, at a minimum. • Certain clients prohibit cell phone use regardless of the state you are operating in—know your client's policy. • Use hands-free devices (not hand-held cellular phones) while driving. • Pull over to the side of the road when making a call or checking directions.	• Seatbelt • Hands-free devices connected and ready for use
	Accidents	• In the event of an accident, use the following procedures: – Stop, call for medical assistance, notify police, and complete an accident report and submit it to your supervisor. – Notify the Project Manager (PM) and Field Lead (FL). – Complete the appropriate incident investigation reports. – Contact Debbie Ashton, Operations Manager, at (503) 924-6172. – Contact Diana Reynolds, Insurance Liaison, at (302) 236-8403.	• Seatbelt
	Influenced by drugs or alcohol	• NEVER DRIVE UNDER THE INFLUENCE OF DRUGS OR ALCOHOL. • Keep in mind that the person in another vehicle may be under the influence of controlled substances, and be prepared for erratic or sudden driving changes on their part.	• Seatbelt
	Driver attitude	• Do not operate any vehicle when abnormally tired, temporarily disabled (i.e., injured), or under the influence of drugs or alcohol. • Keep an even temper when driving. Do not let the actions of others affect your attitude. • Do not allow yourself to become frustrated, rushed, distracted, or drowsy.	• Seatbelt

Job Safety Analysis

Anchor QEA Motor Vehicle Operation

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Anchor QEA motor vehicle operation (continued)	Fatigue	• Stop and rest if fatigued. Exit the road and enter a safe area. Rest until fully refreshed. • Be aware that certain medications (such as cold or allergy medicines) may make you drowsy when driving a vehicle.	• Seatbelt
	Vehicle loading	• DO NOT OVERLOAD the vehicle. • Secure all equipment and supplies within the body of the vehicle using proper tie-downs. • Do not block side view mirrors with the load. • Do not transport U.S. Department of Transportation (DOT)-manifested hazardous materials. • Dispatch all equipment and personnel with proper forms and identification.	• Seatbelt
	Equipment failure	• Perform daily inspections of your vehicle. • Maintain vehicle safety equipment (e.g., mirrors, alarms, horns, wipers, lights, and brakes). • Maintain the vehicle (e.g., tire pressure and fluid levels). • Any vehicle with mechanical defects that may endanger the safety of the driver, passengers, or the public shall not be used. • Ensure that appropriate safety equipment is in the vehicle. Safety equipment should include a spare tire, jack, first-aid kit, fire extinguisher, and flashlight. Flares and/or reflective triangles should be available in larger trucks. • Ensure that the proper documentation is in the vehicle. Documentation should include an operations manual for the vehicle, insurance card, vehicle registration, and accident forms.	• Inspect and maintain the vehicle

Training Requirements:

- All drivers are required to have a valid driver's license, and all vehicles must have appropriate state vehicle registration and inspection stickers. The use of hand-held wireless devices is prohibited while driving any vehicle for business use at any time, for personal use during business hours, and as defined by law.
- **If operating a vehicle or vehicle and trailer with a capacity greater than 10,000 pounds, U.S. DOT regulations may apply. Contact the PM prior to any travel in this configuration.**

Job Safety Analysis

Anchor QEA Motor Vehicle Operation

- All assigned employees are required to read, familiarize themselves with the contents of this Job Safety Analysis and review it with their supervisor during their daily safety meeting.

Job Safety Analysis

Anchor QEA Motor Vehicle Operation

Vehicle Operation Job Safety Analysis Acknowledgement Form

The Anchor QEA Motor Vehicle Operation Job Safety Analysis must be read, understood, and signed before the operation of any Anchor QEA vehicle. My signature below certifies that I have read and understand the procedures presented in the Anchor QEA Motor Vehicle Operation Job Safety Analysis and have completed the Smith System Virtual Driving *Distracted Driving* and *Small Vehicle Forward - Five Keys to Safe Driving* training programs.

Date	Name (print)	Signature

Job Safety Analysis

Anchor QEA Motor Vehicle Operation

Date	Name (print)	Signature

PLAYING IT SAFE

Job Safety Analysis

Stream, Wetland, and Habitat Surveys

Project Name: Portage Canal – Segment 2	**Project Number:** 181779-02.01	**JSA Number:** 006	**Issue Date:**
Location: Portage, Wisconsin	**Contractor:** Anchor QEA, LLC	**Analysis by:** Mike Conese	**Analysis Date:** 10/27/2018
Work Operation: Stream, wetland, and habitat surveys	**Superintendent/Competent Person:** Mike Conese	**Revised by:**	**Revised Date:**
Required Personal Protective Equipment (PPE): • Modified Level D—Long pants and/or coveralls if handling potentially contaminated media, and steel-toed footwear conforming to ASTM International (ASTM) F2412-05/ASTM F2413-05 • Safety glasses/splash goggles, hard hat, nitrile outer gloves and latex inner gloves, and, if boating, U.S. Coast Guard-approved personal flotation device (PFD; see cold stress section for cold-weather PFD information)		**Reviewed by:** Christopher R. Torell, PG, CSP	**Reviewed Date:** 10/30/2018
		Approved by:	**Approved Date:**

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
If boating		• Follow the Job Safety Analysis (JSA) for boating activities.	
Walking and working in natural environments	Slips, trips, and falls	• Avoid walking while writing or texting—maintain a heads-up posture. • Be aware of potentially slippery surfaces, including boat decks, riprap, muddy or algae-covered rocks, shoreline plants or seaweed, thick mud, and tripping hazards such as vines and logs. • Use handrails where available. • Wear footwear that has sufficient traction. • Maintain good housekeeping practices. Clean up all spills immediately. • Be aware of weather effects on the work area, including wet and/or frozen ground. • Jumping, running, and horseplay are prohibited. • Be cautious when entering or exiting the vessel, and load/unload items onto/off of the pier or shore once boarded. • Keep all areas clean and free of debris to prevent any trips and falls. • Notify the field team members of any unsafe conditions. • Use the buddy system.	• Routinely inspect work area for unsafe conditions.

PLAYING IT SAFE

Job Safety Analysis

Stream, Wetland, and Habitat Surveys

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Walking and working in natural environments (continued)	Wading	• Be aware of potentially slippery surfaces and tripping hazards such as fallen brush, logs, rocks, and other debris. Wear footwear that has sufficient traction. • Be aware of the water depth and potential drop-offs. • Be aware of existing and projected river flows. • Wear knee or chest waders as appropriate for traction and to protect against cold water. • Keep extra dry clothes on hand, including socks. • Consider carrying a walking staff for balance. • Always wear a PFD, even if water looks shallow or slow; drop-offs occur, and water is often moving faster than it looks. • Use the buddy system. • Be aware of soft sediment.	• Inspect work area for tripping hazards visible from streambank. • Inspect waders for leaks. • Check depths and flows before wading. • Ensure that change of dry clothes is available if wading in cold weather or cold water conditions.
	Biological hazards (flora [e.g., poison ivy and poison oak] and fauna [e.g., ticks, bees, spiders, mosquitoes, and snakes])	• Be aware of likely biological hazards in the work area. • Wear appropriate clothing (i.e., hat, long-sleeve shirt, long pants, leather gloves, boots, and coveralls, as appropriate), and apply insect repellent. • Wear hand and arm protection when clearing plants or debris from the work area. • Be aware of potential wildlife and defensive behavior (e.g., nesting birds, or animals with young).	• Ensure that insect repellent is available. • Inspect clothing and skin for insects (e.g., ticks) after working in insect-prone areas.
	Noise exposure	• Wear hearing protection in high noise environments or when working around heavy machinery or equipment (action level of 85 decibels averaged over an 8-hour day).	• Ensure that hearing protection is available.
Working outdoors	Heat stress	• Adjust work schedules, as necessary, to avoid the hottest part of the day. • Take rest breaks as warranted. • Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods. • Maintain body fluids at normal levels. • Train workers to recognize the symptoms of heat-related illness.	• Review weather forecast prior to field work. • Monitor workers' physical conditions. • Monitor outside temperature versus worker activity.

Job Safety Analysis

Stream, Wetland, and Habitat Surveys

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Working outdoors (continued)	Cold stress	• Provide shelter (enclosed, heated environment) to protect personnel during rest periods. • Educate workers to recognize the symptoms of frostbite and hypothermia. • Use appropriate cold-weather gear, up to and including Mustang-type bib coveralls or jacket/bib combinations. • Consider additional precautions if working near water in cold weather. • Have a dry change of clothing available. • Train workers to recognize the symptoms of cold-related illness.	• Review weather forecast prior to field work. • Monitor workers' physical conditions and PPE. • Monitor outside and water temperature versus worker activity and PPE.
	Rain/snow	• Wear appropriate PPE (rain gear). • Be aware of slip hazards, puddles, and electrical hazards when working in wet conditions. • If extremely cold conditions are forecast, consider additional precautions or postponing work activity.	• Review weather forecast prior to field work. • Inspect PPE daily prior to use. • Routinely inspect work area for deteriorating conditions.
	Sunshine	• Have appropriate sunscreen available for ultraviolet protection. • Have abundant water available to prevent dehydration. • Consider wearing wide-brimmed headwear and light-colored, lightweight, sun-blocking clothing.	• Ensure that sunscreen and water are available.
	Lightning	• Do not begin or continue work until lightning subsides for at least 30 minutes. Disconnect and do not use or touch electronic equipment.	• Obtain weather forecast and updates as needed.
	High winds	• Wear goggles or safety glasses if dust or debris are visible.	• Review weather forecast prior to field work. • Ensure that goggles or safety glasses are available.

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 Code of Federal Regulations (CFR) 1910.120(e), including but not limited to initial 40-hour, 8-hour supervisor, and annual 8-hour refresher trainings.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120(f).

Stream, Wetland, and Habitat Surveys

- If boating is involved, and a professional captained vessel is not in use, boat operators must take the appropriate state boater safety courses.
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their supervisor during their daily safety meeting.

Job Safety Analysis

Investigation-Derived Waste Management

Project Name: Portage Canal – Segment 2	**Project Number:** 181779-02.01	**JSA Number:** 007	**Issue Date:**
Location: Portage, Wisconsin	**Contractor:** Anchor QEA, LLC	**Analysis by:** Mike Conese	**Analysis Date:** 10/27/2018
Work Operation: Investigation-derived waste (IDW) management	**Superintendent/Competent Person:** Mike Conese	**Revised by:** --	**Revised Date:** --
Required Personal Protective Equipment (PPE): • See Table 5-1 in Site Safety Plan		**Reviewed by:** Christopher R. Torell, PG, CSP	**Reviewed Date:** 10/30/2018
		Approved by:	**Approved Date:**

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Containerizing IDW at the source	Lifting	• Use care when lifting to redistribute IDW from one container (e.g., drums and buckets) to another at the source. • Seek assistance if loads are too heavy, or if you are experiencing fatigue. • Fill containers only to the degree that will be manageable in the future (e.g., half full) and to limit weight.	• Inspect containers for competency (i.e., no cracks, and handles in good repair).
	Pinch points	• Wear hand protection when closing containers. • Use the buddy system when affixing drum rings.	• Inspect drums for rust or sharp edges prior to opening or closing.
Relocating or staging IDW containers	Lifting	• Use task-specific tools whenever possible to move full containers (i.e., hoists, drum caddies or dollies, and vehicles). • When task-specific tools are not available, use the buddy system to move containers that are reasonable to lift. • Never roll drums or containers holding IDW. • Stage containers in areas protected from heavy traffic and weather, if possible.	• Ensure tools are in good repair. • Assess IDW container weight prior to moving.

Job Safety Analysis

Investigation-Derived Waste Management

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Relocating or staging IDW containers (continued)	Pinch points or crushing	• Use tools to achieve the final arrangement when staging containers—do not place hands on the edges of containers while moving them into place. • Stand well clear of containers being moved in case they become dislodged from their handling tool during transport. • Do not stack IDW containers, as this poses a risk for container toppling and damage. • Place containers on a wooden pallet for easy transfer using a pallet jack, if possible.	• Inspect drums for evidence of cracks or rust.
IDW management – general	Splash	• Wear the required PPE at all times. • Use care to minimize splashing or smearing of IDW during handling and containerization.	• Inspect PPE upon donning and periodically during tasks.

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 Code of Federal Regulations (CFR) 1910.120(e), including but not limited to initial 40-hour, 8-hour supervisor, and annual 8-hour refresher trainings.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120(f).
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their supervisor during their daily safety meeting.

Job Safety Analysis

Sample and Laboratory Glassware Handling

Project Name: Portage Canal – Segment 2	**Project Number:** 181799-02.01	**JSA Number:** 008	**Issue Date:**
Location: Portage, Wisconsin	**Contractor:** Anchor QEA, LLC	**Analysis by:** Mike Conese	**Analysis Date:** 10/27/2018
Work Operation: Sample and laboratory glassware handling	**Superintendent/Competent Person:** Mike Conese	**Revised by:**	**Revised Date:**
Required Personal Protective Equipment (PPE): • Modified Level D—Long pants and/or Tyvek coveralls if handling potentially contaminated media, and steel-toed footwear conforming to ASTM International (ASTM) F2412-05/ASTM F2413-05 • Depending on activity, the following PPE may also be required: safety glasses/splash goggles, hard hat, nitrile outer gloves and latex inner gloves, and, if boating, U.S. Coast Guard-approved personal flotation device (PFD)		**Reviewed by:** Christopher R. Torell, PG, CSP	**Reviewed Date:** 10/30/2018
		Approved by:	**Approved Date:**

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Transporting and using glassware	Breakage of containers during field activities	• Use appropriately sized tubs or bottle carriers with dividers to prevent bottle-to-bottle contact during transport. • Consider using coated glassware, if practicable. • Carry oversize bottles in tubs or bottle carriers using both hands during transfer to the sampling vessel and whenever the vessel is underway.	• Ensure dividers are sufficient and will remain in place during transport.
	Faulty glassware	• Replace any glassware that is chipped, nicked, or cracked.	• Inspect glassware before use.
	Impact with equipment and other objects	• Use care when loading and unloading sampling equipment. • Minimize the handling of individual containers to the extent possible.	
Filling sample containers	Over-tightening of bottle lids causing breakage	• Avoid use of excessive force to tighten bottle caps (i.e., finger tight). • Secure lids with clear tape to prevent opening during transport.	
	Breakage during sample collection	• Place containers in plastic tubs between aliquots to limit contact with hard surfaces. • Place containers on a stable and non-slip surface during collection. • Use the buddy system as needed to hold bottles during filling.	

PLAYING IT SAFE

Job Safety Analysis

Sample and Laboratory Glassware Handling

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Filling sample containers (continued)	Contact with sample preservatives (generally HCL or H_2SO_4 to lower pH to less than 2)	• Wear nitrile gloves and protective eyewear to prevent skin and eye contact if a container is damaged. • Do not open preserved bottles until necessary.	
Packing samples for shipment	Breakage during packing and shipment	• Use bottle wraps, foam sleeves, or bubble wrap to prevent bottle contact in the cooler. • Pack coolers snugly, but do not overpack.	• Ensure glass bottles do not touch to minimize potential breakage during transport.

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 Code of Federal Regulations (CFR) 1910.120(e), including, but not limited to initial 40-hour, 8-hour supervisor, and annual 8-hour refresher trainings.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120(f).
- All assigned employees are required to familiarize themselves with the contents of this Job Safety Analysis before starting a work activity and review it with their supervisor during their daily safety meeting.

Appendix C
Safety Data Sheets (SDS)

SAFETY DATA SHEET

1. Identification

Product identifier: ALCONOX®

Other means of identification
Product No.: A461

Recommended use and restriction on use
Recommended use: Not determined.
Restrictions on use: Not determined.

Details of the supplier of the safety data sheet

Avantor Performance Materials, LLC.
3477 Corporate Parkway
Center Valley, PA 18034

Telephone:
Customer Service: 855-282-6867
Fax: 610-573-2610
Contact Person: Environmental Health & Safety
E-mail: info@avantormaterials.com

Emergency telephone number:
CHEMTREC: 1-800-424-9300 within US and Canada

2. Hazard(s) identification

Hazard Classification

Health Hazards

Skin Corrosion/Irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2A

Unknown toxicity - Health

Acute toxicity, oral	42 %
Acute toxicity, dermal	100 %
Acute toxicity, inhalation, vapor	100 %
Acute toxicity, inhalation, dust or mist	100 %

Environmental Hazards

Acute hazards to the aquatic environment	Category 2

Unknown toxicity - Environment

Acute hazards to the aquatic environment	27 %

Chronic hazards to the aquatic environment	100 %

Label Elements

Hazard Symbol:

Signal Word: Warning

Hazard Statement:
Causes skin irritation.
Causes serious eye irritation.
Toxic to aquatic life.

Precautionary Statements

Prevention: Wash hands thoroughly after handling. Wear protective gloves/eye protection/face protection. Avoid release to the environment.

Response: IF ON SKIN: Wash with plenty of water. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash it before reuse. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

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

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

3. Composition/information on ingredients

Mixtures

Chemical name	Common name and synonyms	CAS number	Content in percent (%)*
Sodium carbonate		497-19-8	1 - 10%
SODIUM DODECYL SULPHATE		151-21-3	1 - 5%

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

4. First-aid measures

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

Ingestion:	Call a POISON CENTER/doctor if you feel unwell. Rinse mouth. Never give liquid to an unconscious person. Do not induce vomiting without advice from poison control center.
Inhalation:	Move to fresh air. Get medical attention if symptoms persist.
Skin Contact:	Immediately flush with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash contaminated clothing before reuse. Destroy or thoroughly clean contaminated shoes. Call a POISON CENTER/doctor if you feel unwell.
Eye contact:	Immediately flush with plenty of water for at least 15 minutes. If easy to do, remove contact lenses. Call a POISON CENTER/doctor if you feel unwell.

Most important symptoms/effects, acute and delayed

Symptoms:	May cause skin and eye irritation.
Hazards:	None known.

Indication of immediate medical attention and special treatment needed

Treatment:	Treat symptomatically. Symptoms may be delayed.

5. Fire-fighting measures

General Fire Hazards:	Fire may produce irritating, corrosive and/or toxic gases.

Suitable (and unsuitable) extinguishing media

Suitable extinguishing media:	Water spray, foam, dry powder or carbon dioxide.
Unsuitable extinguishing media:	None known.
Specific hazards arising from the chemical:	None known.

Special protective equipment and precautions for firefighters

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

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures:	Evacuate area. See Section 8 of the SDS for Personal Protective Equipment. Keep unauthorized personnel away. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.

Methods and material for containment and cleaning up:	Sweep up and place in a clearly labeled container for chemical waste. Clean surface thoroughly to remove residual contamination.
Notification Procedures:	Dike for later disposal. Prevent entry into waterways, sewer, basements or confined areas. Stop the flow of material, if this is without risk.
Environmental Precautions:	Do not contaminate water sources or sewer. Prevent further leakage or spillage if safe to do so. Avoid release to the environment.

7. Handling and storage

Precautions for safe handling:	Avoid contact with eyes, skin, and clothing. Wash hands thoroughly after handling. Do not taste or swallow.
Conditions for safe storage, including any incompatibilities:	Keep container tightly closed. Store away from incompatible materials.

8. Exposure controls/personal protection

Control Parameters

Occupational Exposure Limits

None of the components have assigned exposure limits.

Appropriate Engineering Controls	No data available.

Individual protection measures, such as personal protective equipment

General information:	Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. An eye wash and safety shower must be available in the immediate work area. If exposure limits have not been established, maintain airborne levels to an acceptable level.
Eye/face protection:	Wear safety glasses with side shields (or goggles).
Skin Protection	
Hand Protection:	Chemical resistant gloves
Other:	Wear suitable protective clothing.
Respiratory Protection:	If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn.
Hygiene measures:	Wash contaminated clothing before reuse. Avoid contact with skin. Observe good industrial hygiene practices. Wash hands before breaks and immediately after handling the product. Do not eat, drink or smoke when using the product. Wash hands after handling. Avoid contact with eyes.

9. Physical and chemical properties

Appearance

Physical state:	Solid
Form:	Powder.
Color:	White
Odor:	Odorless
Odor threshold:	No data available.
pH:	No data available.
Melting point/freezing point:	No data available.
Initial boiling point and boiling range:	No data available.
Flash Point:	Not applicable
Evaporation rate:	No data available.
Flammability (solid, gas):	No data available.
Upper/lower limit on flammability or explosive limits	
Flammability limit - upper (%):	No data available.
Flammability limit - lower (%):	No data available.
Explosive limit - upper (%):	No data available.
Explosive limit - lower (%):	No data available.
Vapor pressure:	No data available.
Vapor density:	No data available.
Density:	No data available.
Relative density:	No data available.
Solubility(ies)	
Solubility in water:	Moderate
Solubility (other):	No data available.
Partition coefficient (n-octanol/water):	No data available.
Auto-ignition temperature:	No data available.
Decomposition temperature:	No data available.
Viscosity:	No data available.

10. Stability and reactivity

Reactivity:	No dangerous reaction known under conditions of normal use.
Chemical Stability:	Material is stable under normal conditions.
Possibility of hazardous reactions:	Hazardous polymerization does not occur.
Conditions to avoid:	Contact with incompatible materials. Avoid dust formation.
Incompatible Materials:	Strong acids. Strong oxidizing agents.
Hazardous Decomposition Products:	Thermal decomposition may produce oxides of carbon and sulfur. Sodium oxides

11. Toxicological information

Information on likely routes of exposure

Inhalation:	May cause irritation to the respiratory system.
Skin Contact:	Causes skin irritation.

Eye contact: Causes serious eye irritation.

Ingestion: May be harmful if swallowed.

Information on toxicological effects

Acute toxicity (list all possible routes of exposure)

Oral
Product: ATEmix (Rat): 3.506 mg/kg
ATEmix : 3.267,19 mg/kg

Dermal
Product: No data available.

Inhalation
Product: No data available.

Repeated dose toxicity
Product: No data available.

Skin Corrosion/Irritation
Product: Causes skin irritation.

Serious Eye Damage/Eye Irritation
Product: Causes serious eye irritation.

Respiratory or Skin Sensitization
Product: Not a skin sensitizer.

Carcinogenicity
Product: This substance has no evidence of carcinogenic properties.

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

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

ACGIH Carcinogen List:
No carcinogenic components identified

Germ Cell Mutagenicity

In vitro
Product: No mutagenic components identified

In vivo
Product: No mutagenic components identified

Reproductive toxicity
Product: No components toxic to reproduction

Specific Target Organ Toxicity - Single Exposure
Product: None known.

Specific Target Organ Toxicity - Repeated Exposure
Product: None known.

Aspiration Hazard
Product: Not classified

Other effects: None known.

12. Ecological information

Ecotoxicity:

Acute hazards to the aquatic environment:

Fish
Product: No data available.

Aquatic Invertebrates
Product: No data available.

Chronic hazards to the aquatic environment:

Fish
Product: No data available.

Aquatic Invertebrates
Product: No data available.

Toxicity to Aquatic Plants
Product: No data available.

Persistence and Degradability

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

BOD/COD Ratio
Product: No data available.

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

Partition Coefficient n-octanol / water (log Kow)
Product: No data available.

Mobility in soil: No data available.

Other adverse effects: Toxic to aquatic organisms.

13. Disposal considerations

Disposal instructions: Discharge, treatment, or disposal may be subject to national, state, or local laws. Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.

Contaminated Packaging: Since emptied containers retain product residue, follow label warnings even

after container is emptied.

14. Transport information

TDG
Not regulated.

IMDG
Not regulated.

IATA
Not regulated.

Transport in bulk according to Annex II of MARPOL and the IBC Code: Not applicable

15. Regulatory information

Canada Federal Regulations

List of Toxic Substances (CEPA, Schedule 1)
Not Regulated

Export Control List (CEPA 1999, Schedule 3)
Not Regulated

National Pollutant Release Inventory (NPRI)

Canada. National Pollutant Release Inventory (NPRI) Substances, Part 5, VOCs with Additional Reporting Requirements

NPRI PT5	Not Regulated

Canada. National Pollutant Release Inventory (NPRI) (Schedule 1, Parts 1-4)

NPRI	Not Regulated

Greenhouse Gases
Not Regulated

Controlled Drugs and Substances Act

CA CDSI	Not Regulated
CA CDSII	Not Regulated
CA CDSIII	Not Regulated
CA CDSIV	Not Regulated
CA CDSV	Not Regulated
CA CDSVII	Not Regulated
CA CDSVIII	Not Regulated

Precursor Control Regulations
Not Regulated

International regulations

Montreal protocol
Not applicable

Stockholm convention

Not applicable

Rotterdam convention

Not applicable

Kyoto protocol

Not applicable

Inventory Status:

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

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

Revision Date: 17.05.2018

Version #: 1.1

Further Information: No data available.

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Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 05/17/2017 **Revision** : 05/17/2017

Trade Name: Liquinox

1 Identification of the substance/mixture and of the supplier

1.1 Product identifier

Trade Name: Liquinox
Synonyms:
Product number: Liquinox

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

1.3 Details of the supplier of the Safety Data Sheet

Manufacturer	Supplier
Alconox, Inc. 30 Glenn Street White Plains, NY 10603 1-914-948-4040	Not Applicable

Emergency telephone number:
ChemTel Inc
North America: 1-800-255-3924
International: 01-813-248-0585

2 Hazards identification

2.1 Classification of the substance or mixture:

In compliance with EC regulation No. 1272/2008, 29CFR1910/1200 and GHS Rev. 3 and amendments.

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

2.2 Label elements:

Eye irritation, category 2A.
Skin irritation, category 2.

Hazard pictograms:

Signal word: Warning

Hazard statements:
H315 Causes skin irritation.
H319 Causes serious eye irritation.

Precautionary statements:
P264 Wash skin thoroughly after handling.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P302+P352 If on skin: Wash with soap and water.
P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P332+P313 If skin irritation occurs: Get medical advice/attention.
P501 Dispose of contents and container as instructed in Section 13.

Additional information: None.

Hazard description

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 05/17/2017 **Revision** : 05/17/2017

Trade Name: Liquinox

Hazards Not Otherwise Classified (HNOC): None

Information concerning particular hazards for humans and environment:

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

Classification system:

The classification is according to EC regulation No. 1272/2008, 29CFR1910/1200 and GHS Rev. 3 and amendments, and extended by company and literature data. The classification is in accordance with the latest editions of international substances lists, and is supplemented by information from technical literature and by information provided by the company.

3 Composition/information on ingredients

3.1 Chemical characterization : None

3.2 Description : None

3.3 Hazardous components (percentages by weight)

Identification	Chemical Name	Classification	Wt. %
CAS number: 68081-81-2	Sodium Alkylbenzene Sulfonate	Acute Tox. 4; H303 Skin Irrit. 2 ; H315 Eye Irrit. 2; H319	10-25
CAS number: 1300-72-7	Sodium Xylenesulphonate	Eye Irrit. 2; H319	2.5-10
CAS number: 84133-50-6	Alcohol Ethoxylate	Skin Irrit. 2 ; H315 Eye Dam. 1; H318	2.5-10
CAS number: 1643-20-5	Lauramine oxide	Skin Irrit. 2 ; H315 Eye Dam. 1; H318	1-2

3.4 Additional Information: None.

4 First aid measures

4.1 Description of first aid measures

General information: None.

After inhalation:

Maintain an unobstructed airway.

Loosen clothing as necessary and position individual in a comfortable position.

After skin contact:

Wash affected area with soap and water.

Seek medical attention if symptoms develop or persist.

After eye contact:

Rinse/flush exposed eye(s) gently using water for 15-20 minutes.

Remove contact lens(es) if able to do so during rinsing.

Seek medical attention if irritation persists or if concerned.

After swallowing:

Rinse mouth thoroughly.

Seek medical attention if irritation, discomfort, or vomiting persists.

4.2 Most important symptoms and effects, both acute and delayed

None

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 05/17/2017 **Revision** : 05/17/2017

Trade Name: Liquinox

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

No additional information.

5 Firefighting measures

5.1 Extinguishing media

Suitable extinguishing agents:

Use appropriate fire suppression agents for adjacent combustible materials or sources of ignition.

For safety reasons unsuitable extinguishing agents : None

5.2 Special hazards arising from the substance or mixture :

Thermal decomposition can lead to release of irritating gases and vapors.

5.3 Advice for firefighters

Protective equipment:

Wear protective eye wear, gloves and clothing.
Refer to Section 8.

5.4 Additional information :

Avoid inhaling gases, fumes, dust, mist, vapor and aerosols.
Avoid contact with skin, eyes and clothing.

6 Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures :

Ensure adequate ventilation.
Ensure air handling systems are operational.

6.2 Environmental precautions :

Should not be released into the environment.
Prevent from reaching drains, sewer or waterway.

6.3 Methods and material for containment and cleaning up :

Wear protective eye wear, gloves and clothing.

6.4 Reference to other sections : None

7 Handling and storage

7.1 Precautions for safe handling :

Avoid breathing mist or vapor.
Do not eat, drink, smoke or use personal products when handling chemical substances.
Conditions for safe storage, including any incompatibilities:
Store closed upright and in a cool dry place, should be 15 - 30 deg C or 60 - 90 deg F.

7.2 Specific end use(s):

No additional information.

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 05/17/2017 **Revision** : 05/17/2017

Trade Name: Liquinox

8 Exposure controls/personal protection

8.1 Control parameters :

No applicable occupational exposure limits

8.2 Exposure controls

Appropriate engineering controls:

Emergency eye wash fountains and safety showers should be available in the immediate vicinity of use or handling.

Respiratory protection:

Not needed under normal conditions.

Protection of skin:

Select glove material impermeable and resistant to the substance.

Eye protection:

Safety goggles or glasses, or appropriate eye protection.

General hygienic measures:

Wash hands before breaks and at the end of work.
Avoid contact with skin, eyes and clothing.

9 Physical and chemical properties

Appearance (physical state, color):	Pale yellow liquid	**Explosion limit lower**: **Explosion limit upper**:	Not determined or not available. Not determined or not available.
Odor:	Not determined or not available.	**Vapor pressure at 20°C**:	Not determined or not available.
Odor threshold:	Not determined or not available.	**Vapor density**:	Not determined or not available.
pH-value:	8.5 as is	**Relative density**:	Not determined or not available.
Melting/Freezing point:	Not determined or not available.	**Solubilities**:	Not determined or not available.
Boiling point/Boiling range:	Not determined or not available.	**Partition coefficient (n-octanol/water)**:	Not determined or not available.
Flash point (closed cup):	Not determined or not available.	**Auto/Self-ignition temperature**:	Not determined or not available.

Evaporation rate:	Not determined or not available.	**Decomposition temperature**:	Not determined or not available.
Flammability (solid, gaseous):	Not determined or not available.	**Viscosity**:	a. Kinematic: Not determined or not available. b. Dynamic: Not determined or not available.

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 05/17/2017 **Revision** : 05/17/2017

Trade Name: Liquinox	
Density at 20°C:	Not determined or not available.

10 Stability and reactivity

10.1 Reactivity : None

10.2 Chemical stability : None

10.3 Possibility hazardous reactions : None

10.4 Conditions to avoid : None

10.5 Incompatible materials : None

10.6 Hazardous decomposition products : None

11 Toxicological information

11.1 Information on toxicological effects :

Acute Toxicity:

Oral:

: LD50 >5000 mg per kg Rat, Oral) - product .

Chronic Toxicity: No additional information.

Skin corrosion/irritation:

Alcohol Ethoxylate: May cause mild to moderate skin irritation.

Sodium Alkylbenzene Sulfonate: Causes skin irritation.

Lauramine oxide: Causes skin irritation.

Serious eye damage/irritation:

Sodium Alkylbenzene Sulfonate: Causes serious eye irritation.

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

Sodium xylenesulphonate: Rabbit: irritating to eyes.

Lauramine oxide: Causes serious eye damage.

Respiratory or skin sensitization: No additional information.

Carcinogenicity: No additional information.

IARC (International Agency for Research on Cancer): None of the ingredients are listed.

NTP (National Toxicology Program): None of the ingredients are listed.

Germ cell mutagenicity: No additional information.

Reproductive toxicity: No additional information.

STOT-single and repeated exposure: No additional information.

Additional toxicological information: No additional information.

12 Ecological information

12.1 Toxicity:

Sodium Alkylbenzene Sulfonate: Fish, LC50 1.67 mg/l, 96 hours.

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 05/17/2017 **Revision** : 05/17/2017

Trade Name: Liquinox

Sodium Alkylbenzene Sulfonate: Aquatic invertebrates, EC50 Daphnia 2.4 mg/l, 48 hours.
Sodium Alkylbenzene Sulfonate: Aquatic Plants, EC50 Algae 29 mg/l, 96 hours.
Lauramine oxide: Fish, LC0 24.3 mg/l, 96h [Killifish (Cyprinodontidae)]
Lauramine oxide: Aquatic invertebrates, (LC50): 3.6 mg/l 96 hours [Daphnia (Daphnia)].
Lauramine oxide: Aquatic plants, EC50 Algae 0.31 mg/l 72 hours [Algae]
Alcohol Ethoxylate: Aquatic invertebrates, (LC50): 4.01 mg/l 48 hours [Daphnia (daphnia)].

12.2 Persistence and degradability: No additional information.

12.3 Bioaccumulative potential: No additional information.

12.4 Mobility in soil: No additional information.

General notes: No additional information.

12.5 Results of PBT and vPvB assessment:

PBT: No additional information.

vPvB: No additional information.

12.6 Other adverse effects: No additional information.

13 Disposal considerations

13.1 Waste treatment methods (consult local, regional and national authorities for proper disposal)

Relevant Information:

It is the responsibility of the waste generator to properly characterize all waste materials according to applicable regulatory entities. (US 40CFR262.11).

14 Transport information

14.1 UN Number: None
ADR, ADN, DOT, IMDG, IATA

14.2 UN Proper shipping name: None
ADR, ADN, DOT, IMDG, IATA

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

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 05/17/2017 **Revision** : 05/17/2017

Trade Name: Liquinox

14.4 Packing group: ADR, ADN, DOT, IMDG, IATA	None
14.5 Environmental hazards :	None
14.6 Special precautions for user:	None
Danger code (Kemler):	None
EMS number:	None
Segregation groups:	None

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

14.8 Transport/Additional information:

Transport category:	None
Tunnel restriction code:	None
UN "Model Regulation":	None

15 Regulatory information

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

North American

SARA

Section 313 (specific toxic chemical listings): None of the ingredients are listed.
Section 302 (extremely hazardous substances): None of the ingredients are listed.

CERCLA (Comprehensive Environmental Response, Clean up and Liability Act) Reportable

Spill Quantity: None of the ingredients are listed.

TSCA (Toxic Substances Control Act):

Inventory: All ingredients are listed.
Rules and Orders: Not applicable.

Proposition 65 (California):

Chemicals known to cause cancer: None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for females: None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for males: None of the ingredients are listed.

Chemicals known to cause developmental toxicity: None of the ingredients are listed.

Canadian

Canadian Domestic Substances List (DSL):
All ingredients are listed.

EU

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

Germany MAK: Not classified.

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 05/17/2017 **Revision** : 05/17/2017

Trade Name: Liquinox

Asia Pacific

Australia

Australian Inventory of Chemical Substances (AICS): All ingredients are listed.

China

Inventory of Existing Chemical Substances in China (IECSC): All ingredients are listed.

Japan

Inventory of Existing and New Chemical Substances (ENCS): All ingredients are listed.

Korea

Existing Chemicals List (ECL): All ingredients are listed.

New Zealand

New Zealand Inventory of Chemicals (NZOIC): All ingredients are listed.

Philippines

Philippine Inventory of Chemicals and Chemical Substances (PICCS): All ingredients are listed.

Taiwan

Taiwan Chemical Substance Inventory (TSCI): All ingredients are listed.

16 Other information

Abbreviations and Acronyms: None

Summary of Phrases

Hazard statements:

H315 Causes skin irritation.
H319 Causes serious eye irritation.

Precautionary statements:

P264 Wash skin thoroughly after handling.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P302+P352 If on skin: Wash with soap and water.
P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P332+P313 If skin irritation occurs: Get medical advice/attention.
P501 Dispose of contents and container as instructed in Section 13.

Manufacturer Statement:

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as guidance for safe handling,

use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

NFPA: 1-0-0

HMIS: 1-0-0

ARCO

SAFETY DATA SHEET

bp

Section 1. Identification

Product name	ARCO Unleaded Gasoline
Other means of identification	ARCO Unleaded Regular, Midgrade and Premium gasolines; ARCO EC Unleaded Regular, Midgrade and Premium gasolines, CARB Gasoline
SDS #	APPC306
Code	APPC306

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

Product use	USE AS MOTOR FUEL ONLY.
Supplier	BP Products North America Inc. 150 West Warrenville Road Naperville, Illinois 60563-8460 USA
EMERGENCY HEALTH INFORMATION:	1 (800) 447-8735 Outside the US: +1 703-527-3887 (CHEMTREC)
EMERGENCY SPILL INFORMATION:	1 (800) 424-9300 CHEMTREC (USA)
OTHER PRODUCT INFORMATION	1 (866) 4 BP - MSDS (866-427-6737 Toll Free - North America) email: bpcares@bp.com

Section 2. Hazards identification

OSHA/HCS status	This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).
Classification of the substance or mixture	FLAMMABLE LIQUIDS - Category 1 SKIN IRRITATION - Category 2 EYE IRRITATION - Category 2A GERM CELL MUTAGENICITY - Category 1B CARCINOGENICITY - Category 1A TOXIC TO REPRODUCTION (Unborn child) - Category 2 SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Narcotic effects) - Category 3 ASPIRATION HAZARD - Category 1

GHS label elements

Hazard pictograms

Signal word	Danger
Hazard statements	Extremely flammable liquid and vapor. Causes serious eye irritation. Causes skin irritation. May cause genetic defects. May cause cancer. Suspected of damaging the unborn child. May be fatal if swallowed and enters airways.

Section 2. Hazards identification

May cause drowsiness and dizziness.

Precautionary statements

Prevention

Obtain special instructions before use.
Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
Take precautionary measures against static discharge.
Avoid breathing vapor.
Wash thoroughly after handling.
Avoid release to the environment.

Response

IF SWALLOWED: Immediately call a POISON CENTER or physician. Do NOT induce vomiting. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical attention.

Storage

Store in well-ventilated place. Keep container tightly closed.

Disposal

Dispose of contents and container in accordance with all local, regional, national and international regulations.

Hazards not otherwise classified

Contains Benzene. Prolonged or repeated exposure to benzene can cause anaemia and other blood diseases, including leukemia. See toxicological information (Section 11).

Section 3. Composition/information on ingredients

Substance/mixture Mixture

Ingredient name	CAS number	%
Gasoline	Mixture	90 - 100
Ethanol	64-17-5	0 - 10
Contains:		
Benzene	71-43-2	0 - 3
Cyclohexane	110-82-7	0 - 1
Ethylbenzene	100-41-4	0 - 2
Toluene	108-88-3	4 - 11
1,2,4-Trimethylbenzene	95-63-6	0 - 3
xylene	1330-20-7	4 - 11
Naphthalene	91-20-3	0 - 0.5

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Check for and remove any contact lenses. Get medical attention.

Skin contact

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention.

Inhalation

If inhaled, remove to fresh air. Get medical attention.

If exposure to vapor, mists or fumes causes drowsiness, headache, blurred vision or irritation of the eyes, nose or throat, remove immediately to fresh air. Keep patient warm and at rest. If any symptoms persist obtain medical advice.

Ingestion

Do not induce vomiting. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Aspiration hazard if swallowed. Can enter lungs and cause damage. Get medical attention immediately.

Section 4. First aid measures

Protection of first-aiders

No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

Most important symptoms/effects, acute and delayed

See Section 11 for more detailed information on health effects and symptoms.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician

Treatment should in general be symptomatic and directed to relieving any effects. Product can be aspirated on swallowing or following regurgitation of stomach contents, and can cause severe and potentially fatal chemical pneumonitis, which will require urgent treatment. Because of the risk of aspiration, induction of vomiting and gastric lavage should be avoided. Gastric lavage should be undertaken only after endotracheal intubation. Monitor for cardiac dysrhythmias.

Specific treatments

No specific treatment.

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media

In case of fire, use foam, dry chemical or carbon dioxide extinguisher or spray. This substance will float and can be reignited on surface water.

Unsuitable extinguishing media

Do not use water jet. Never use water.

Specific hazards arising from the chemical

Flammable liquid and vapor. Vapor may cause flash fire. Vapors may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back. Runoff to sewer may create fire or explosion hazard.

Hazardous combustion products

Combustion products may include the following:
carbon dioxide
carbon monoxide
other hazardous substances.

Special protective actions for fire-fighters

Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters

Fire-fighters should wear positive pressure self-contained breathing apparatus (SCBA) and full turnout gear.

Special remarks on fire hazards

Do not use water jet.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel

Immediately contact emergency personnel. No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. Provide adequate ventilation. Put on appropriate personal protective equipment. Floors may be slippery; use care to avoid falling. Eliminate all ignition sources. Entry into a confined space or poorly ventilated area contaminated with vapor, mist or fume is extremely hazardous without the correct respiratory protective equipment and a safe system of work. Wear self-contained positive pressure breathing apparatus (SCBA).

Section 6. Accidental release measures

For emergency responders

Entry into a confined space or poorly ventilated area contaminated with vapor, mist or fume is extremely hazardous without the correct respiratory protective equipment and a safe system of work. Wear self-contained breathing apparatus. Wear a suitable chemical protective suit. Chemical resistant boots. See also the information in "For non-emergency personnel".

Environmental precautions

Liquid leaks generate large volumes of flammable vapor, heavier than air, which may travel to remote sources of ignition (eg. along drainage systems). Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill

Eliminate all ignition sources. Stop leak if without risk. Move containers from spill area. Absorb with an inert material and place in an appropriate waste disposal container. Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor. The method and equipment used must be in conformance with appropriate regulations and industry practice on explosive atmospheres.

Large spill

Eliminate all ignition sources. Stop leak if without risk. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Dike spill area and do not allow product to reach sewage system and surface or ground water. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations. Use spark-proof tools and explosion-proof equipment. Contaminated absorbent material may pose the same hazard as the spilled product. The method and equipment used must be in conformance with appropriate regulations and industry practice on explosive atmospheres. Dispose of via a licensed waste disposal contractor.

Section 7. Handling and storage

Precautions for safe handling

Protective measures

Put on appropriate personal protective equipment (see Section 8). Do not get in eyes or on skin or clothing. Avoid breathing vapor or mist. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Take precautionary measures against electrostatic discharges. Empty containers retain product residue and can be hazardous. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Do not reuse container. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Avoid exposure - obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Avoid exposure during pregnancy. Do not swallow. Aspiration hazard if swallowed. Can enter lungs and cause damage. Never siphon by mouth.

To avoid fire or explosion, dissipate static electricity during transfer by grounding and bonding containers and equipment before transferring material.

Advice on general occupational hygiene

Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Wash thoroughly after handling. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities

Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Store and use only in equipment/ containers designed for use with this product. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Section 7. Handling and storage

Light hydrocarbon vapors can build up in the headspace of tanks. These can cause flammability/explosion hazards even at temperatures below the normal flash point (note: flash point must not be regarded as a reliable indicator of the potential flammability of vapor in tank headspaces). Tank headspaces should always be regarded as potentially flammable and care should be taken to avoid static electrical discharge and all ignition sources during filling, ullaging and sampling from storage tanks. Do not enter storage tanks. If entry to vessels is necessary, follow permit to work procedures. Entry to any tanks or other confined space requires a full risk assessment and appropriate control measures to be put in place in conformance with appropriate regulations and industry practice on confined space entry. When the product is pumped (e.g. during filling, discharge or ullaging) and when sampling, there is a risk of static discharge. Ensure equipment used is properly earthed or bonded to the tank structure. Electrical equipment should not be used unless it is intrinsically safe (i.e. will not produce sparks). Explosive air/vapor mixtures may form at ambient temperature. If product comes into contact with hot surfaces, or leaks occur from pressurized fuel pipes, the vapor or mists generated will create a flammability or explosion hazard. Product contaminated rags, paper or material used to absorb spillages, represent a fire hazard, and should not be allowed to accumulate. Dispose of safely immediately after use.

Do not enter storage tanks without breathing apparatus unless the tank has been well ventilated and the tank atmosphere has been shown to contain hydrocarbon vapor concentrations of less than 1% of the lower flammability limit and an oxygen concentration of at least 20% volume.

Light hydrocarbon vapors can build up in the headspace of tanks. These can cause flammability/explosion hazards even at temperatures below the normal flash point (note: flash point must not be regarded as a reliable indicator of the potential flammability of vapor in tank headspaces). Tank headspaces should always be regarded as potentially flammable and care should be taken to avoid static electrical discharge and all ignition sources during filling, ullaging and sampling from storage tanks. When the product is pumped (e.g. during filling, discharge or ullaging) and when sampling, there is a risk of static discharge. Ensure equipment used is properly earthed or bonded to the tank structure. Electrical equipment should not be used unless it is intrinsically safe (i.e. will not produce sparks).

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Gasoline	**ACGIH TLV (United States).** TWA: 300 ppm 8 hours. Issued/Revised: 5/1996 TWA: 890 mg/m³ 8 hours. Issued/Revised: 5/1996 STEL: 500 ppm 15 minutes. Issued/Revised: 5/1996 STEL: 1480 mg/m³ 15 minutes. Issued/Revised: 5/1996
Ethanol	**ACGIH TLV (United States).** STEL: 1000 ppm 15 minutes. Issued/Revised: 11/2008 **OSHA PEL (United States).** TWA: 1900 mg/m³ 8 hours. Issued/Revised: 6/1993 TWA: 1000 ppm 8 hours. Issued/Revised: 6/1993
Benzene	**ACGIH TLV (United States). Absorbed through skin.** STEL: 8 mg/m³ 15 minutes. Issued/Revised: 5/1997 STEL: 2.5 ppm 15 minutes. Issued/Revised:

	5/1997 TWA: 1.6 mg/m³ 8 hours. Issued/Revised: 5/1997 TWA: 0.5 ppm 8 hours. Issued/Revised: 5/1997 **OSHA PEL (United States).** STEL: 5 ppm 15 minutes. Issued/Revised: 6/1993 TWA: 1 ppm 8 hours. Issued/Revised: 6/1993 **OSHA PEL Z2 (United States).** AMP: 50 ppm 10 minutes. Issued/Revised: 6/1993 CEIL: 25 ppm Issued/Revised: 6/1993 TWA: 10 ppm 8 hours. Issued/Revised: 6/1993
xylene	**ACGIH TLV (United States).** STEL: 651 mg/m³ 15 minutes. Issued/Revised: 5/1996 STEL: 150 ppm 15 minutes. Issued/Revised: 5/1996 TWA: 434 mg/m³ 8 hours. Issued/Revised: 5/1996 TWA: 100 ppm 8 hours. Issued/Revised: 5/1996 **OSHA PEL (United States).** TWA: 435 mg/m³ 8 hours. Issued/Revised: 6/1993 TWA: 100 ppm 8 hours. Issued/Revised: 6/1993
toluene	**OSHA PEL Z2 (United States).** AMP: 500 ppm 10 minutes. Issued/Revised: 6/1993 CEIL: 300 ppm Issued/Revised: 6/1993 TWA: 200 ppm 8 hours. Issued/Revised: 6/1993 **ACGIH TLV (United States).** TWA: 20 ppm 8 hours. Issued/Revised: 11/2006
1,2,4-Trimethylbenzene	**ACGIH TLV (United States).** TWA: 123 mg/m³ 8 hours. Issued/Revised: 9/1994 TWA: 25 ppm 8 hours. Issued/Revised: 9/1994
ethylbenzene	**ACGIH TLV (United States).** TWA: 20 ppm 8 hours. Issued/Revised: 12/2010 **OSHA PEL (United States).** TWA: 435 mg/m³ 8 hours. Issued/Revised: 6/1993 TWA: 100 ppm 8 hours. Issued/Revised: 6/1993
cyclohexane	**ACGIH TLV (United States).** TWA: 100 ppm 8 hours. Issued/Revised: 1/2002 **OSHA PEL (United States).** TWA: 1050 mg/m³ 8 hours. Issued/Revised: 6/1993 TWA: 300 ppm 8 hours. Issued/Revised: 6/1993
naphthalene	**ACGIH TLV (United States). Absorbed**

Section 8. Exposure controls/personal protection

	through skin. TWA: 52 mg/m³ 8 hours. Issued/Revised: 5/1996 TWA: 10 ppm 8 hours. Issued/Revised: 5/1996 **OSHA PEL (United States).** TWA: 50 mg/m³ 8 hours. Issued/Revised: 6/1993 TWA: 10 ppm 8 hours. Issued/Revised: 6/1993

While specific OELs for certain components may be shown in this section, other components may be present in any mist, vapor or dust produced. Therefore, the specific OELs may not be applicable to the product as a whole and are provided for guidance only.

Appropriate engineering controls

All activities involving chemicals should be assessed for their risks to health, to ensure exposures are adequately controlled. Personal protective equipment should only be considered after other forms of control measures (e.g. engineering controls) have been suitably evaluated. Personal protective equipment should conform to appropriate standards, be suitable for use, be kept in good condition and properly maintained. Your supplier of personal protective equipment should be consulted for advice on selection and appropriate standards. For further information contact your national organisation for standards.
Provide exhaust ventilation or other engineering controls to keep the relevant airborne concentrations below their respective occupational exposure limits.
The final choice of protective equipment will depend upon a risk assessment. It is important to ensure that all items of personal protective equipment are compatible.

Environmental exposure controls

Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures

Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection

Chemical splash goggles.

Skin protection

Hand protection

Wear chemical resistant gloves. Gloves made from fluoroelastomer resistant to hydrocarbons and a wide range of chemicals. Nitrile gloves.

Do not re-use gloves. Protective gloves must give suitable protection against mechanical risks (i.e. abrasion, blade cut and puncture). Protective gloves will deteriorate over time due to physical and chemical damage. Inspect and replace gloves on a regular basis. The frequency of replacement will depend upon the circumstances of use.

Consult your supervisor or Standard Operating Procedure (S.O.P) for special handling instructions.

Body protection

Use of protective clothing is good industrial practice. Cotton or polyester/cotton overalls will only provide protection against light superficial contamination that will not soak through to the skin. Overalls should be laundered on a regular basis. When the risk of skin exposure is high (e.g. when cleaning up spillages or if there is a risk of splashing) then chemical resistant aprons and/or impervious chemical suits and boots will be required. Wear suitable protective clothing. Footwear highly resistant to chemicals. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For greatest effectiveness against static electricity, overalls, boots and gloves should all be anti-static. When there is a risk of ignition wear inherently fire resistant protective clothes and gloves. Work clothing / overalls should be laundered on a regular basis. Laundering of contaminated work clothing should only be done by professional cleaners who have been told about the hazards of the contamination. Always keep contaminated work clothing away from uncontaminated work clothing and uncontaminated personal

Section 8. Exposure controls/personal protection

	clothes. When the risk of skin exposure is high (from experience this could apply to the following tasks: cleaning work, maintenance and service, filling and transfer, taking samples and cleaning up spillages) then a chemical protective suit and boots will be required. Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
Other skin protection	Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
Respiratory protection	Use only with adequate ventilation. Do not breathe vapor or mist. If ventilation is inadequate, use a NIOSH certified respirator with an organic vapor cartridge and P95 particulate filter. If operating conditions cause high vapor concentrations or the TLV is exceeded, use NIOSH-certified, supplied-air respirator. Use with adequate ventilation. In case of insufficient ventilation, wear suitable respiratory equipment. If there is a requirement for the use of a respiratory protective device, but the use of breathing apparatus (independent of ambient atmosphere) is not required, then a suitable filtering device must be worn. The filter class must be suitable for the maximum contaminant concentration (gas/vapor/aerosol/particulates) that may arise when handling the product. The correct choice of respiratory protection depends upon the chemicals being handled, the conditions of work and use, and the condition of the respiratory equipment. Safety procedures should be developed for each intended application. Respiratory protection equipment should therefore be chosen in consultation with the supplier/manufacturer and with a full assessment of the working conditions.

Section 9. Physical and chemical properties

<u>Appearance</u>	
Physical state	Liquid.
Color	Clear
Odor	Hydrocarbon.
Odor threshold	Not available.
pH	Not available.
Melting point	Not available.
Boiling point	26.67 to 221°C (80 to 430°F)
Flash point	Closed cup: -42.778°C (-45°F)
Evaporation rate	Not available.
Flammability (solid, gas)	Not applicable. Based on - Physical state
Lower and upper explosive (flammable) limits	Lower: 1.3% Upper: 7.6% (Estimated.)
Vapor pressure	48.134 to 103.146 kPa (361.97 to 775.66 mm Hg)
Vapor density	3 to 4 [Air = 1]
Density	750 kg/m^3 (0.75 g/cm^3)
Solubility	Very slightly soluble in water
Solubility	Very slightly soluble in the following materials: cold water.
Partition coefficient: n-octanol/water	>3
Auto-ignition temperature	257°C (494.6°F)
Decomposition temperature	Not available.
Viscosity	Not available.

Section 10. Stability and reactivity

Reactivity	No specific test data available for this product. Refer to Conditions to avoid and Incompatible materials for additional information.
Chemical stability	The product is stable.
Possibility of hazardous reactions	Under normal conditions of storage and use, hazardous reactions will not occur. Under normal conditions of storage and use, hazardous polymerization will not occur.
Conditions to avoid	Keep away from heat, sparks and flame. Avoid all possible sources of ignition (spark or flame).
Incompatible materials	Reactive or incompatible with the following materials: oxidizing materials. Chlorine and Fluorine
Hazardous decomposition products	Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Test	Species	Result	Exposure	Remarks
Gasoline	LC50 Inhalation Vapor	Rat	>5610 g/m³ analytical	4 hours	Based on Gasoline
	LC50 Inhalation Vapor	Rat	>7630 mg/m³ Nominal	4 hours	Based on Gasoline
	LD50 Dermal	Rabbit	>2000 mg/kg	-	Based on Gasoline
	LD50 Oral	Rat	>5000 mg/kg	-	Based on Gasoline
Ethanol	LC50 Inhalation Vapor	Rat	124.7 mg/l	4 hours	Based on Ethanol
	LC50 Inhalation Vapor	Rat	116.9 mg/l	4 hours	Based on Ethanol
	LC50 Inhalation Vapor	Rat	133.8 mg/l	4 hours	Based on Ethanol
	LD50 Oral	Rat	10470 mg/kg	-	Based on Ethanol

Conclusion/Summary Not available.

Irritation/Corrosion

Product/ingredient name	Species	Result	Score	Exposure	Observation	Conc.	Remarks
Gasoline	Rabbit	Skin - Irritant	-	-	-	-	Based on Gasoline
	Rabbit	Eyes - Non-irritating to the eyes.	-	-	-	-	Based on Gasoline
Ethanol	Rabbit	Skin - Non-irritant to skin.	-	-	-	-	Based on Ethanol

	Rabbit	Eyes - Cornea opacity	-	-	-	-	Based on Ethanol
	Rabbit	Eyes - Iris lesion	-	-	-	-	Based on Ethanol
	Rabbit	Eyes - Irritant	-	-	-	-	Based on Ethanol

Sensitizer

Product/ingredient name	Route of exposure	Species	Result	Remarks
Gasoline	skin	Guinea pig	Not sensitizing	Based on Gasoline

Mutagenicity

Product/ingredient name	Test	Experiment	Result	Remarks
Gasoline	Equivalent to OECD 476	Experiment: In vitro Subject: Mammal - species unspecified	Negative	Based on Gasoline
	Equivalent to OECD 471	Experiment: In vitro Subject: Non-mammalian species	Negative	Based on Gasoline
	EPA OPPTS 870.5395	Experiment: In vivo Subject: Unspecified Cell: Germ	Negative	Based on Gasoline vapor condensate
	Equivalent to OECD 475	Experiment: In vivo Subject: Unspecified Cell: Germ	Negative	Based on Gasoline
Ethanol	Equivalent to OECD 476	Experiment: In vitro Subject: Mammal - species unspecified	Negative	Based on Ethanol
	Equivalent to OECD 473	Experiment: In vitro Subject: Non-mammalian species	Negative	Based on Ethanol
	Equivalent to OECD 478	Experiment: In vivo Subject: Unspecified Cell: Germ	Negative	Based on Ethanol

Conclusion/Summary May cause genetic defects.

Carcinogenicity

Product/ingredient name							
Gasoline	Equivalent to OECD	451	Rat	Inhalation	113 weeks	Negative - Inhalation - Unspecified	Based on Gasoline
	Equivalent to OECD	451	Mouse	Dermal	102 weeks	Negative - Dermal - Unspecified	Based on Gasoline
Ethanol	EPA	OPPTS 870.4200	Mouse	Oral	105 weeks	Positive - Oral - Unspecified	Based on Ethanol

Section 11. Toxicological information

Equivalent to OECD	-	Rat	Oral	104 weeks	Negative - Oral - Unspecified	Based on Ethanol

Conclusion/Summary May cause cancer

Classification

Product/ingredient name	OSHA	IARC	NTP
Gasoline	-	2B	-
toluene	-	3	-
xylene	-	3	-
Benzene	+	1	Known to be a human carcinogen.
ethylbenzene	-	2B	-
naphthalene	-	2B	Reasonably anticipated to be a human carcinogen.

Descriptors:

OSHA:
+ - Potential occupational carcinogen

IARC:
1 - Carcinogenic to human.
2A - Probable human carcinogen.
2B - Possible carcinogen to human.
3 - Not classifiable as a human carcinogen.
4 - Probably not a human carcinogen.

NTP:
Proven - Known to be human carcinogens.
Possible - Reasonably anticipated to be human carcinogens.

Reproductive toxicity

Product/ingredient name	Maternal toxicity	Fertility	Development toxin	Species	Result	Exposure
Gasoline	-	Negative	-	Rat	Inhalation	2 generation
	-	-	Negative	Rat	Inhalation	14 days
Ethanol	-	Positive	-	Rat	Oral	2 generation
	-	-	Negative	Rat	Inhalation	18 days

Conclusion/Summary Development: Suspected of damaging the unborn child.
Fertility: Not classified. Based on available data, the classification criteria are not met.
Effects on or via lactation: Not classified. Based on available data, the classification criteria are not met.

Specific target organ toxicity (single exposure)

Name	Category	Route of exposure	Target organs
Gasoline	Category 3	Not applicable.	Narcotic effects
xylene	Category 3	Not applicable.	Respiratory tract irritation
toluene	Category 3	Not applicable.	Narcotic effects
1,2,4-Trimethylbenzene	Category 3	Not applicable.	Respiratory tract irritation
ethylbenzene	Category 3	Not applicable.	Respiratory tract irritation
cyclohexane	Category 3	Not applicable.	Narcotic effects

Specific target organ toxicity (repeated exposure)

Name	Category	Route of exposure	Target organs
toluene	Category 2	Not determined	ears
Benzene	Category 1	Not determined	blood system

Aspiration hazard

Section 11. Toxicological information

Name	Result
Gasoline	ASPIRATION HAZARD - Category 1
xylene	ASPIRATION HAZARD - Category 1
toluene	ASPIRATION HAZARD - Category 1
Benzene	ASPIRATION HAZARD - Category 1
ethylbenzene	ASPIRATION HAZARD - Category 1
cyclohexane	ASPIRATION HAZARD - Category 1

Information on the likely routes of exposure Routes of entry anticipated: Oral, Dermal, Inhalation.

Potential acute health effects

Eye contact Causes serious eye irritation.

Skin contact Causes skin irritation.

Inhalation Can cause central nervous system (CNS) depression. May cause drowsiness and dizziness.

Ingestion Can cause central nervous system (CNS) depression. Irritating to mouth, throat and stomach. Aspiration hazard if swallowed -- harmful or fatal if liquid is aspirated into lungs.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact Adverse symptoms may include the following:
pain or irritation
watering
redness

Skin contact Adverse symptoms may include the following:
irritation
redness
reduced fetal weight
increase in fetal deaths
skeletal malformations

Inhalation Adverse symptoms may include the following:
nausea or vomiting
headache
drowsiness/fatigue
dizziness/vertigo
unconsciousness

Ingestion Adverse symptoms may include the following:
nausea or vomiting
reduced fetal weight
increase in fetal deaths
skeletal malformations

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects Not available.

Potential delayed effects Not available.

Long term exposure

Potential immediate effects Not available.

Potential delayed effects Not available.

Potential chronic health effects

General Solvent "sniffing" (abuse) or intentional overexposure to vapors can produce serious central nervous system effects, including unconsciousness, and possibly death.

Carcinogenicity May cause cancer. Risk of cancer depends on duration and level of exposure.

Mutagenicity May cause genetic defects.

Teratogenicity Suspected of damaging the unborn child.

Developmental effects No known significant effects or critical hazards.

Section 11. Toxicological information

Fertility effects No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Other information Aspiration of this product into the lungs can cause chemical pneumonia and can be fatal. Aspiration into the lungs can occur while vomiting after ingestion of this product. Do not siphon by mouth.

Additional information Gasoline - Excess exposure to vapors may produce headaches, dizziness, nausea, drowsiness, irritation of eyes, nose and throat and central nervous system depression. Aspiration of this material into the lungs can cause chemical pneumonia and can be fatal. Aspiration into the lungs can occur while vomiting after ingestion of this product. Inhalation of unleaded gasoline vapors did not produce birth defects in laboratory animals. Ingestion of this material can cause gastrointestinal irritation and diarrhea.

In a long-term inhalation study of whole unleaded gasoline vapors, exposure-related kidney damage and kidney tumors were observed in male rats. Similar kidney effects were not seen in female rats or in mice. At the highest exposure level (2056 ppm), female mice had an increased incidence of liver tumors. Results from subsequent scientific studies have shown that a broad variety of chemicals cause these kidney effects only in the male rat. Further studies have discovered the means by which the physiology of the male rat uniquely predispose it to these effects. Consequently, the Risk Assessment Forum of the Environmental Protection Agency has recognized that these responses are not predictive of a human health hazard. The liver tumors that were increased in the high-dose female mice are likewise of questionable significance because of their high spontaneous occurrence even without chemical exposure and because the rate of their occurrence is accelerated by a broad spectrum of chemicals not commonly considered to be carcinogens (e.g., phenobarbital). Thus, the significance of the mouse liver tumor response in terms of human health is questionable.

Gasoline is a complex mixture of hydrocarbons and contains benzene (typically no more than 2 volume%), toluene, and xylene. Chronic exposure to high levels of benzene has been shown to cause cancer (leukemia) in humans and other adverse blood effects (anemia). Benzene is considered a human carcinogen by IARC, NTP and OSHA. Over exposure to xylene and toluene can cause irritation to the upper respiratory tract, headache and narcosis. Some liver damage and lung inflammation were seen in chronic studies on xylene in guinea pigs but not in rats.

Solvent "sniffing" (abuse) or intentional overexposure to vapors can produce serious central nervous system effects, including unconsciousness, and possibly death.

Gasoline as a mixture is classified as a 2B (possible human) carcinogen by IARC.

Gasoline engine exhaust is classified as possibly carcinogenic to humans by IARC (2B). This classification is based primarily on animal and in vitro studies of gasoline engine exhaust condensates/extracts. Studies of the gaseous exhaust stream in animals did not provided sufficient evidence for classification as a carcinogen.

Gasoline: Additional toxicity information on the components:

Benzene: Acute toxicity of benzene results primarily from depression of the central nervous system (CNS). Inhalation of concentrations over 50 ppm can produce headache, lassitude, weariness, dizziness, drowsiness, or excitation. Exposure to very high levels can result in unconsciousness and death.

Benzene: Long-term overexposure to benzene has been associated with certain types of leukemia in humans. In addition, the International Agency for Research on Cancer (IARC), the National Toxicology Program, and OSHA consider benzene to be a human carcinogen. Chronic exposures to high levels of benzene have been reported to cause adverse blood effects including anemia. Benzene exposure can occur by inhalation and absorption through the skin.
Inhalation and forced feeding studies of benzene in laboratory animals have produced a carcinogenic response in a variety of organs, including possibly leukemia, other adverse effects on the blood, chromosomal changes and some effects on the immune system. Exposure to benzene at levels up to 300 ppm did not produce birth defects in animal studies; however, exposure to higher dosage levels resulted in a reduction of body weight of the rat pups (fetotoxicity). Changes in the testes have been observed in mice exposed to benzene at 300 ppm, but reproductive performance was not altered in rats exposed to benzene at the same level. Aspiration of this material into the lungs can cause chemical pneumonia and can be fatal. Aspiration into the lungs can occur while vomiting after ingestion of this material.

Toluene: Aspiration of this material into the lungs can cause chemical pneumonia and can be fatal. Aspiration into the lungs can occur while vomiting after ingestion of this material. Deliberate inhalation of high concentrations of toluene has been linked to damage of the brain, liver and kidney. Inhalation of very high concentrations of toluene, such as in cases of solvent abuse, has resulted in sudden death which may be a result of cardiac arrhythmia or central nervous system depression. Mental and/or growth retardation has been reported in children of women who deliberately inhale toluene during pregnancy (usually at thousands of ppm). Fetal developmental toxicity was observed when pregnant rats were exposed to toluene at levels of 1500 ppm. Maternal toxicity was also observed at this concentration. Prolonged, high level exposure to toluene in laboratory animals has resulted in hearing loss. Exposure studies in rats have resulted in adverse effects on the kidney, liver and central nervous system. Studies in occupationally exposed individuals indicate that toluene exposure has been associated with impaired color vision and decreased performance in some neurobehavioral tests. There are occupational studies which report an association between inhalation exposure to toluene and adverse effects on reproduction including spontaneous abortion. The methodology of these studies and the reliability of the results have been questioned. In a two-generation study in rats, inhalation of toluene at levels up to 2000 ppm did not produce adverse effects on fertility or reproductive performance.

Xylenes: Xylene has been reported to cause central nervous system effects at concentrations above the recommended exposure limit. Xylene vapor becomes irritating at relatively high levels. In one study, eye irritation was reported at exposures of 460 ppm and in one person at 230 ppm after 15 minutes. In another study, no one reported eyes, nose and throat irritation at mixed xylene exposures up to 230 ppm for 30 minutes. Dermal LD50 is expected to be greater than 10g/kg in rabbits, based on test results from similar materials.

Mixed xylenes caused slight hearing loss in rats exposed to 800 ppm in the air for 14 hours/day for six weeks. There is no information available for lower concentrations; however, similar chemicals that have caused these hearing effects at similar concentrations have not caused effects at lower concentrations.

Pregnant animals exposed to xylene or its isomers have been reported to cause development toxicity in rodents when exposed by inhalation. The developmental effects observed consisted of delayed development and minor skeletal variations, but no malformations. Because of the high exposure levels used in these studies, we do not believe that these results imply an increased risk of reproductive toxicity to workers exposed to xylene levels at or below the exposure limits.

Xylene and its isomers are not genotoxic.

Technical grade xylene has been tested in a National Toxicology Program carcinogenicity study in rats and mice dosed orally for two years. There was no evidence of carcinogenicity.

Ethylbenzene: :The National Toxicology Program (NTP) conducted a 13-week inhalation study with male and female rats and mice at exposure concentrations ranging from 100

Section 11. Toxicological information

to 1000 ppm ethylbenzene. No rats or mice died during the study. Kidney, liver, and lung weights were increased in the exposed rats, while weight increases were observed only in the livers of exposed mice. Treatment-related histopathologic changes were not observed in any tissues of rats and mice.
NTP also exposed male and female rats and mice by inhalation to 0, 75, 250, or 750 ppm ethylbenzene for 2 years. There was a statistically significant increase in the number of kidney tumors in male and female rats at 750 ppm. There were also increased incidences of lung tumors in male mice and liver tumors in female mice that were statistically significant at 750 ppm. Except for the male rat kidney tumors, the incidence of the tumors were within the range observed for non-exposed animals from other studies conducted by NTP. The significance of these findings to humans is unknown. Ethylbenzene is not genotoxic. The International Agency for Research on Cancer (IARC) has evaluated ethylbenzene and found it to be possibly carcinogenic to humans (Group 2B).

Ethylbenzene is not genotoxic.

This product contains trimethylbenzenes. These compounds cause irritation to the eyes, nose and respiratory tract. Repeated dermal exposure can defat and irritate the skin. Inhalation may cause dizziness and drowsiness. Studies in laboratory animals with mixtures of C9 aromatic hydrocarbons produced adverse effects on development such as increased fetal mortality, reduced fetal weight, and delayed ossification at high exposure concentrations. Effects were reduced if exposure was terminated prior to delivery. There was no evidence of reproductive toxicity.

Naphthalene has been reported to cause developmental toxicity in mice after oral exposure to relatively high dose levels, but developmental toxicity was not observed in NTP (National Toxicology Program) sponsored studies in rats and rabbits. Ingestion or inhalation of naphthalene can result in hemolysis and other blood abnormalities, and individuals (and infants) deficient in glucose-6-phosphate dehydrogenase may be especially susceptible to these effects. Inhalation of naphthalene may cause headache and nausea. Airborne exposure can result in eye irritation. Naphthalene exposure has been associated with cataracts in animals and humans.

Ethanol - Human data: In humans excessive consumption of alcoholic beverages during pregnancy is associated with the induction of Fetal Alcohol Syndrome in the offspring. Reduced birth weight and physical and mental defects occur. There is no evidence that such effects might be caused by exposures other than direct ingestion of alcoholic drinks. In humans high lifetime consumption of alcoholic beverages can be associated with certain cancers and effects on the liver. There is no evidence that these can be caused by exposure other than direct ingestion of alcoholic drinks (IARC 1988).

Section 12. Ecological information

Toxicity

No testing has been performed by the manufacturer.

Product/ingredient name	Species	Test/Result	Exposure	Effects	Remarks
Gasoline	Micro-organism	Acute EC50 15.41 mg/l Nominal Fresh water	40 hours	growth inhibition	-
	Algae	Acute EL50 3.1 mg/l Nominal Fresh water	72 hours	(growth rate)	Based on Gasoline
	Algae	Acute EL50 3.7 mg/l Nominal Fresh water	96 hours	(growth rate)	Based on Gasoline
	Daphnia	Acute EL50 4.5 mg/l Nominal Fresh water	48 hours	Mobility	Based on straight-run light gasoline
	Fish	Acute LL50 10 mg/l Nominal	96 hours	Mortality	Based on Naphtha

Section 12. Ecological information

		Fresh water			(petroleum), isomerisation
	Fish	Acute LL50 8.2 mg/l Nominal Fresh water	96 hours	Mortality	Based on Naphtha (petroleum), light alkylate
	Algae	Acute NOELR 0.5 mg/l Nominal Fresh water	72 hours	(growth rate)	Based on Gasoline
	Daphnia	Acute NOELR 0.5 mg/l Nominal Fresh water	48 hours	Mobility	Based on Straight run gas oil
	Daphnia	Chronic EL50 10 mg/l Nominal Fresh water	21 days	Reproduction	Based on Naphtha (petroleum), light alkylate
	Daphnia	Chronic EL50 >40 mg/l Nominal Fresh water	21 days	Mobility	Based on Naphtha (petroleum), light alkylate
	Fish	Chronic EL50 10 mg/l Nominal Fresh water	21 days	Reproduction	Based on: Naphtha (petroleum), light alkylate; read across between species
	Fish	Chronic LL50 5.2 mg/l Nominal Fresh water	14 days	Mortality	Based on Naphtha (petroleum), light catalytic reformed
	Daphnia	Chronic NOELR 2.6 mg/l Nominal Fresh water	21 days	Reproduction	Based on Naphtha (petroleum), light alkylate
	Daphnia	Chronic NOELR 16 mg/l Nominal Fresh water	21 days	Mobility	Based on Naphtha (petroleum), light alkylate
	Fish	Chronic NOELR 2.6 mg/l Nominal Fresh water	14 days	Mortality	Based on Naphtha (petroleum), light catalytic reformed
	Fish	Chronic NOELR 2.6 mg/l Nominal Fresh water	21 days	Reproduction	Based on: Naphtha (petroleum), light alkylate; read across between species
	soil, plants	Chronic PNEC >0.4 mg/kg	-	-	-
Ethanol	Algae	EC50 675 mg/l	4 days	-	Based on Ethanol
	Aquatic plants	EC50 4432 mg/l	7 days	-	Based on Ethanol

Section 12. Ecological information

Daphnia	Acute LC50 5012 mg/l	48 hours	-	Based on Ethanol
Fish	Acute LC50 153 g/l	96 hours	-	Based on Ethanol
Fish	Acute LC50 14.2 g/l	96 hours	-	Based on Ethanol
Daphnia	Chronic LC50 2 mg/l	10 days	-	Based on Ethanol
Daphnia	Chronic LC50 9.6 mg/l	9 days	-	Based on Ethanol

Conclusion/Summary Not available.

Persistence and degradability

Partially biodegradable.

Product/ingredient name	Test	Result	Remarks
Ethanol	EPA	95 % - Readily - 15 days	Based on Ethanol
	EPA	84 % - Readily - 20 days	Based on Ethanol
	EPA	74 % - Readily - 5 days	Based on Ethanol
	EPA	74 % - Readily - 10 days	Based on Ethanol

Conclusion/Summary Not available.

Product/ingredient name	Aquatic half-life	Photolysis	Biodegradability
Ethanol	-	-	Readily

Bioaccumulative potential

This product is not expected to bioaccumulate through food chains in the environment.

Mobility in soil

Soil/water partition coefficient (K_{OC}) Not available.

Mobility Spillages may penetrate the soil causing ground water contamination.

Other ecological information Spills may form a film on water surfaces causing physical damage to organisms. Oxygen transfer could also be impaired.

Section 13. Disposal considerations

Disposal methods The generation of waste should be avoided or minimized wherever possible. Significant quantities of waste product residues should not be disposed of via the foul sewer but processed in a suitable effluent treatment plant. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Vapor from product residues may create a highly flammable or explosive atmosphere inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

United States - RCRA Toxic hazardous waste "U" List

Section 13. Disposal considerations

Ingredient	CAS #	Status	Reference number
Xylene	1330-20-7	Listed	U239
Toluene; Benzene, methyl-	108-88-3	Listed	U220
Benzene (I,T)	71-43-2	Listed	U019
Cyclohexane (I); Benzene, hexahydro- (I)	110-82-7	Listed	U056

Section 14. Transport information

	DOT Classification	TDG Classification	IMDG	IATA
UN number	UN1203	UN1203	UN1203	UN1203
UN proper shipping name	GASOLINE	GASOLINE	MOTOR SPIRIT or GASOLINE or PETROL MARINE POLLUTANT	Motor spirit or Gasoline or Petrol
Transport hazard class(es)	3	3	3	3
Packing group	II	II	II	-----
Environmental hazards	No.	No.	Yes.	No.
Additional information	**Reportable quantity** 333.33 lbs / 151.33 kg [53.304 gal / 201.78 L] Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements. **Limited quantity** Yes. **Packaging instruction** Passenger aircraft Quantity	The marine pollutant mark is not required when transported by road or rail. **Explosive Limit and Limited Quantity Index** 30 **Passenger Carrying Ship Index** 100 **Passenger Carrying Road or Rail Index** 5 **Special provisions** 17, 82, 88	The marine pollutant mark is not required when transported in sizes of ≤5 L or ≤5 kg. **Emergency schedules (EmS)** F-E, S-E **Special provisions** 243	The environmentally hazardous substance mark may appear if required by other transportation regulations. **Passenger and Cargo Aircraft** Quantity limitation: 5 L Packaging instructions: 353 **Cargo Aircraft Only**Quantity limitation: 60 L Packaging instructions: 364 **Limited Quantities - Passenger Aircraft**

Section 14. Transport information

	limitation: 5 L **Cargo aircraft** Quantity limitation: 60 L **Special provisions** 144, 177, B1, B33, IB2, T4, TP1			Quantity limitation: 1 L Packaging instructions: Y341 **Special provisions** A100

Special precautions for user Not available.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Proper shipping name MARPOL Annex 1 rules apply for bulk shipments by sea.
Category: gasoline and spirits

Section 15. Regulatory information

U.S. Federal regulations

United States inventory (TSCA 8b) All components are listed or exempted.

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 311/312

Classification Fire hazard
Immediate (acute) health hazard
Delayed (chronic) health hazard

SARA 313

	Product name	CAS number	Concentration
Form R - Reporting requirements	toluene	108-88-3	4 - 11
	xylene	1330-20-7	4 - 11
	Benzene	71-43-2	0 - 3
	1,2,4-Trimethylbenzene	95-63-6	0 - 3
	ethylbenzene	100-41-4	0 - 2
	cyclohexane	110-82-7	0 - 1
	naphthalene	91-20-3	0 - 0.5
Supplier notification	toluene	108-88-3	4 - 11
	xylene	1330-20-7	4 - 11
	Benzene	71-43-2	0 - 3
	1,2,4-Trimethylbenzene	95-63-6	0 - 3
	ethylbenzene	100-41-4	0 - 2
	cyclohexane	110-82-7	0 - 1
	naphthalene	91-20-3	0 - 0.5

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations

Massachusetts The following components are listed: XYLENE; TOLUENE; ETHYL ALCOHOL; BENZENE; PSEUDOCUMENE; ETHYL BENZENE; CYCLOHEXANE

New Jersey The following components are listed: XYLENES; BENZENE, DIMETHYL-; TOLUENE; BENZENE, METHYL-; ETHYL ALCOHOL; ALCOHOL; BENZENE; PSEUDOCUMENE; 1, 2,4-TRIMETHYL BENZENE; ETHYL BENZENE; BENZENE, ETHYL-; CYCLOHEXANE; NAPHTHALENE; MOTH FLAKES

Section 15. Regulatory information

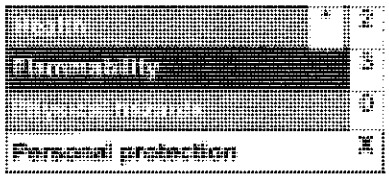
Pennsylvania	The following components are listed: GASOLINE; BENZENE, DIMETHYL-; BENZENE, METHYL-; DENATURED ALCOHOL; BENZENE; PSEUDOCUMENE; BENZENE, ETHYL-; CYCLOHEXANE; NAPHTHALENE
California Prop. 65	**WARNING:** This product contains a chemical known to the State of California to cause cancer. ethylbenzene; naphthalene; cumene **WARNING:** This product contains a chemical known to the State of California to cause birth defects or other reproductive harm. toluene **WARNING:** This product contains a chemical known to the State of California to cause cancer and birth defects or other reproductive harm. Benzene Other Prop 65 chemicals will result under certain conditions from the use of this material. For example, burning fuels produces combustion products including carbon monoxide, a Prop 65 reproductive toxin.

Other regulations

Australia inventory (AICS)	At least one component is not listed.
Canada inventory	All components are listed or exempted.
China inventory (IECSC)	At least one component is not listed.
Japan inventory (ENCS)	At least one component is not listed.
Korea inventory (KECI)	At least one component is not listed.
Philippines inventory (PICCS)	At least one component is not listed.
Taiwan inventory (CSNN)	
REACH Status	For the REACH status of this product please consult your company contact, as identified in Section 1.

Section 16. Other information

Hazardous Material Information System (U.S.A.)



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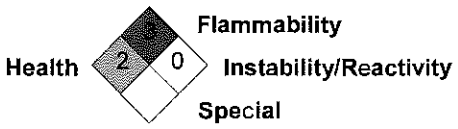
National Fire Protection Association (U.S.A.)



History

Date of issue/Date of revision	03/20/2015.
Date of previous issue	03/20/2015.

Section 16. Other information

Key to abbreviations

ACGIH = American Conference of Industrial Hygienists
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
CAS Number = Chemical Abstracts Service Registry Number
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
OEL = Occupational Exposure Limit
SDS = Safety Data Sheet
STEL = Short term exposure limit
TWA = Time weighted average
UN = United Nations
UN Number = United Nations Number, a four digit number assigned by the United Nations Committee of Experts on the Transport of Dangerous Goods.

Indicates information that has changed from previously issued version.

Notice to reader

All reasonably practicable steps have been taken to ensure this data sheet and the health, safety and environmental information contained in it is accurate as of the date specified below. No warranty or representation, express or implied is made as to the accuracy or completeness of the data and information in this data sheet.

The data and advice given apply when the product is sold for the stated application or applications. You should not use the product other than for the stated application or applications without seeking advice from BP Group.

It is the user's obligation to evaluate and use this product safely and to comply with all applicable laws and regulations. The BP Group shall not be responsible for any damage or injury resulting from use, other than the stated product use of the material, from any failure to adhere to recommendations, or from any hazards inherent in the nature of the material. Purchasers of the product for supply to a third party for use at work, have a duty to take all necessary steps to ensure that any person handling or using the product is provided with the information in this sheet. Employers have a duty to tell employees and others who may be affected of any hazards described in this sheet and of any precautions that should be taken. You can contact the BP Group to ensure that this document is the most current available. Alteration of this document is strictly prohibited.

SAFETY DATA SHEET

Issuing Date 19-Aug-2012 **Revision Date** 04-Oct-2017 **Revision Number** 2

The supplier identified below generated this SDS using the UL SDS template. UL did not test, certify, or approve the substance described in this SDS, and all information in this SDS was provided by the supplier or was reproduced from publically available regulatory data sources. UL makes no representations or warranties regarding the completeness or accuracy of the information in this SDS and disclaims all liability in connection with the use of this information or the substance described in this SDS. The layout, appearance and format of this SDS is © 2014 UL LLC. All rights reserved.

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product identifier

Product Name **Super Tech 85W140**

Other means of identification

Synonyms None

Recommended use of the chemical and restrictions on use

Recommended Use Engine (motor) oil for Auto or Boat

Uses advised against No information available

Details of the supplier of the safety data sheet

Supplier Name Warren Distribution, Inc.

Supplier Address 727 S.13th Street
Omaha
NE
68102
US

Supplier Phone Number Phone:800-424-9300
Fax:402-977-5857
Contact Phone402-977-5786

Supplier Email alowery@wd-wpp.com

Distributor Wal-Mart Stores Incorporated
Bentonville, AR USA 72716

Emergency telephone number

Company Emergency Phone Number 800-424-9300

2. HAZARDS IDENTIFICATION

Classification

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

Skin sensitization	Category 1
Carcinogenicity	Category 1A

GHS Label elements, including precautionary statements

Emergency Overview

Signal word **Danger**

Hazard Statements
May cause an allergic skin reaction
May cause cancer

Appearance Brown **Physical state** Liquid Oil **Odor** Mild

Precautionary Statements - Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Avoid breathing dust/fume/gas/mist/vapors/spray
Contaminated work clothing should not be allowed out of the workplace
Wear protective gloves

Precautionary Statements - Response
IF exposed or concerned: Get medical advice/attention
Specific treatment (see supplemental first aid instructions on this label)

Skin
IF ON SKIN: Wash with plenty of soap and water
If skin irritation or rash occurs: Get medical advice/attention
Wash contaminated clothing before reuse

Precautionary Statements - Storage
Store locked up

Precautionary Statements - Disposal
Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)

Not applicable

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

Other information

Toxic to aquatic life with long lasting effects

Repeated or prolonged skin contact may cause allergic reactions with susceptible persons

Interactions with Other Chemicals
No information available.

3. COMPOSITION/INFORMATION ON INGREDIENTS

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Chemical name	CAS-No	Percent	Trade Secret
Residual oils (petroleum), solvent refined	64742-01-4	60 - 100	*
Petroleum distillates, hydrotreated heavy paraffinic	64742-54-7	5 - 10	*
Petroleum distillates, solvent-refined heavy paraffinic	64741-88-4	0.1 - 1	*
Petroleum distillates, hydrotreated middle	64742-46-7	0.1 - 1	*
Petroleum distillates, hydrotreated light paraffinic	64742-55-8	0.1 - 1	*
Oleamine	112-90-3	0.1 - 1	*
Amines, C12-14-tert-alkyl	68955-53-3	0.1 - 1	*
Petroleum distillates, solvent dewaxed heavy paraffinic	64742-65-0	0.1 - 1	*
Petroleum distillates, solvent dewaxed light paraffinic	64742-56-9	0.1 - 1	*

*The exact percentage (concentration) of composition has been withheld as a trade secret

4. FIRST AID MEASURES

First aid measures

General Advice Note: When using this product in high pressure equipment - Accidential high velocity dermal injection of this material requires immediate medical attention.

Eye contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention immediately if symptoms occur.

Skin contact Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes.

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

Ingestion Call a physician or poison control center immediately. Do NOT induce vomiting.

Most important symptoms and effects, both acute and delayed

Most Important Symptoms and Effects Itching. Rashes. Hives.

Indication of any immediate medical attention and special treatment needed

Notes to Physician 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 skin contact.

Uniform Fire Code	Sensitizer: Liquid Combustible Liquid: III-B

Hazardous Combustion Products
Carbon oxides.

Explosion Data

Sensitivity to Mechanical Impact	No.
Sensitivity to Static Discharge	No.

Protective equipment and precautions for firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions	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.

7. HANDLING AND STORAGE

Precautions for safe handling

Handling Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes or clothing. Use personal protection equipment. Take off contaminated clothing and wash before reuse.

Conditions for safe storage, including any incompatibilities

Storage Keep in properly labeled containers. Keep containers tightly closed in a cool, well-ventilated place.

Incompatible Products Oxidizing agent.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines The following ingredients are the only ingredients of the product above the cut-off level (or level that contributes to the hazard classification of the mixture) which have an exposure limit applicable in the region for which this safety data sheet is intended or other recommended limit. At this time, the other relevant constituents have no known exposure limits from the sources listed here

Chemical name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Petroleum distillates, hydrotreated heavy paraffinic 64742-54-7	TWA: 5 mg/m^3, as oil mist, mineral STEL: TWA: 10 mg/m^3, as oil mist, mineral	TWA: 5 mg/m^3, as oil mist, mineral	
Petroleum distillates, hydrotreated light paraffinic 64742-55-8	TWA: 5 mg/m^3 STEL: 10 mg/m^3 (as oil mist)	TWA: 5 mg/m^3 (as oil mist)	
Petroleum distillates, solvent dewaxed heavy paraffinic 64742-65-0	TWA: 5 mg/m^3, as oil mist, mineral STEL: TWA: 10 mg/m^3, as oil mist, mineral	TWA: 5 mg/m^3, as oil mist, mineral	

ACGIH TLV: American Conference of Governmental Industrial Hygienists - Threshold Limit Value OSHA PEL: Occupational Safety and Health Administration - Permissible Exposure Limits NIOSH IDLH Immediately Dangerous to Life or Health

Other Exposure Guidelines Vacated limits revoked by the Court of Appeals decision in AFL-CIO v. OSHA, 965 F.2d 962 (11th Cir., 1992) See section 15 for national exposure control parameters

Appropriate engineering controls

Engineering Measures Showers
Eyewash stations
Ventilation systems

Individual protection measures, such as personal protective equipment

Eye/face protection Tight sealing safety goggles.

Skin and body protection Wear protective gloves and protective clothing.

Respiratory protection If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice. When using do not eat, drink or smoke.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical and Chemical Properties

Physical state	Liquid, Oil		
Appearance	Brown	**Odor**	Mild
Color	No information available	**Odor Threshold**	No information available

Property	**Values**	**Remarks Method**
pH	UNKNOWN	None known
Melting / freezing point	No data available	None known
Boiling point / boiling range	No data available	None known
Flash Point	218 C / 424 F	None known
Evaporation Rate	No data available	None known
Flammability (solid, gas)	No data available	None known
Flammability Limit in Air		
Upper flammability limit	No data available	
Lower flammability limit	No data available	
Vapor pressure	No data available	None known
Vapor density	No data available	None known
Specific Gravity	1	None known
Water Solubility	Negligible	None known
Solubility in other solvents	No data available	None known
Partition coefficient: n-octanol/water	No data available	None known
Autoignition temperature	No data available	None known
Decomposition temperature	No data available	None known
Kinematic viscosity	No data available	None known
Dynamic viscosity	No data available	None known
Explosive properties	No data available	
Oxidizing properties	No data available	

Other Information

Softening Point	No data available
VOC Content (%)	No data available
Particle Size	No data available
Particle Size Distribution	

10. STABILITY AND REACTIVITY

Reactivity

No data available.

Chemical stability
Stable under recommended storage conditions.

Possibility of Hazardous Reactions
None under normal processing.

Hazardous Polymerization
Hazardous polymerization does not occur.

Conditions to avoid
Keep away from open flames, hot surfaces and sources of ignition.

Incompatible materials
Oxidizing agent.

Hazardous Decomposition Products
Carbon oxides.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Product Information .

Inhalation Specific test data for the substance or mixture is not available.

Eye contact Specific test data for the substance or mixture is not available.

Skin contact Specific test data for the substance or mixture is not available.

Ingestion Specific test data for the substance or mixture is not available.

Component Information

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
Residual oils (petroleum), solvent refined 64742-01-4	> 5000 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	= 2.18 mg/L (Rat) 4 h
Petroleum distillates, hydrotreated heavy paraffinic 64742-54-7	> 15 g/kg (Rat)	-	-
Petroleum distillates, solvent-refined heavy paraffinic 64741-88-4	> 5000 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	= 2.18 mg/L (Rat) 4 h
Petroleum distillates, hydrotreated middle 64742-46-7	= 7400 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	= 4.6 mg/L (Rat) 4 h
Petroleum distillates, hydrotreated light paraffinic	-	-	= 3900 mg/m³ (Rat) 4 h

64742-55-8			
Oleamine 112-90-3	= 1689 mg/kg (Rat)	-	-
Amines, C12-14-tert-alkyl 68955-53-3	= 300 mg/kg (Rat)	= 1120 mg/kg (Rabbit)	-
Petroleum distillates, solvent dewaxed heavy paraffinic 64742-65-0	> 15000 mg/kg (Rat)	-	-
Petroleum distillates, solvent dewaxed light paraffinic 64742-56-9	> 5000 mg/kg (Rat)	-	-

Information on toxicological effects

Symptoms Itching. Rashes. Hives.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Sensitization May cause sensitization in susceptible persons. May cause sensitization by skin contact.

Mutagenic Effects No information available.

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Chemical name	ACGIH	IARC	NTP	OSHA
Residual oils (petroleum), solvent refined 64742-01-4	A2	Group 1	Known	X
Petroleum distillates, hydrotreated heavy paraffinic 64742-54-7	A2	Group 1	Known	X
Petroleum distillates, solvent-refined heavy paraffinic 64741-88-4	A2	Group 1	Known	X
Petroleum distillates, hydrotreated light paraffinic 64742-55-8	A2	Group 1	Known	X
Petroleum distillates, solvent dewaxed heavy paraffinic 64742-65-0	A2	Group 1	Known	X
Petroleum distillates, solvent dewaxed light paraffinic 64742-56-9	A2	Group 1	Known	X

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

Reproductive toxicity No information available.

STOT - single exposure No information available.

STOT - repeated exposure No information available.

Chronic Toxicity Contains a known or suspected carcinogen.

Target Organ Effects Skin.

Aspiration Hazard No information available.

Numerical measures of toxicity Product Information

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

ATEmix (dermal)
97,847.00 mg/kg (ATE)
ATEmix (inhalation-dust/mist)
16.34 mg/l

12. ECOLOGICAL INFORMATION

Ecotoxicity
Toxic to aquatic life with long lasting effects.

Chemical name	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Daphnia Magna (Water Flea)
Residual oils (petroleum), solvent refined 64742-01-4		96h LC50: > 5000 mg/L (Oncorhynchus mykiss)		48h EC50: > 1000 mg/L
Petroleum distillates, hydrotreated heavy paraffinic 64742-54-7		96h LC50: > 5000 mg/L (Oncorhynchus mykiss)		48h EC50: > 1000 mg/L
Petroleum distillates, solvent-refined heavy paraffinic 64741-88-4		96h LC50: > 5000 mg/L (Oncorhynchus mykiss)		48h EC50: > 1000 mg/L
Petroleum distillates, hydrotreated middle 64742-46-7		96h LC50: = 35 mg/L (Pimephales promelas) 96h LC50: > 10000 mg/L (Pimephales promelas)		
Petroleum distillates, hydrotreated light paraffinic 64742-55-8		96h LC50: > 5000 mg/L (Oncorhynchus mykiss)		48h EC50: > 1000 mg/L
Petroleum distillates, solvent dewaxed heavy paraffinic 64742-65-0		96h LC50: > 5000 mg/L (Oncorhynchus mykiss)		48h EC50: > 1000 mg/L
Petroleum distillates, solvent dewaxed light paraffinic 64742-56-9		96h LC50: > 5000 mg/L (Oncorhynchus mykiss)		48h EC50: > 1000 mg/L

Persistence and Degradability
No information available.

Bioaccumulation
No information available

Other adverse effects
No information available.

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Disposal methods This material, as supplied, is not a hazardous waste according to Federal regulations (40 CFR 261). This material could become a hazardous waste if it is mixed with or otherwise comes in contact with a hazardous waste, if chemical additions are made to this material, or if the material is processed or otherwise altered. Consult 40 CFR 261 to determine whether the altered material is a hazardous waste. Consult the appropriate state, regional, or local regulations for additional requirements.

Contaminated Packaging Dispose of contents/containers in accordance with local regulations.

California Hazardous Waste Codes 221

14. TRANSPORT INFORMATION

DOT NOT REGULATED
Proper Shipping Name NON-REGULATED
Hazard Class N/A

TDG Not regulated

MEX Not regulated

ICAO Not regulated

IATA Not regulated
Proper Shipping Name NON REGULATED
Hazard Class N/A

IMDG/IMO Not regulated
Hazard Class N/A

RID Not regulated

ADR Not regulated

ADN Not regulated

15. REGULATORY INFORMATION

International Inventories

TSCA	Not determined
DSL	Not determined

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

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

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)

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

US State Regulations

California Proposition 65

This product contains the following Proposition 65 chemicals.

Chemical name	California Proposition 65
1,4-Dioxane - 123-91-1	Carcinogen
Ethyl acrylate - 140-88-5	Carcinogen
Ethylene oxide - 75-21-8	Carcinogen Developmental Female Reproductive Male Reproductive
Propylene oxide - 75-56-9	Carcinogen
Naphthalene - 91-20-3	Carcinogen

U.S. State Right-to-Know Regulations

.

Chemical name	New Jersey	Massachusetts	Pennsylvania	Rhode Island	Illinois
Residual oils (petroleum), solvent refined 64742-01-4					X
Petroleum distillates, hydrotreated heavy paraffinic 64742-54-7					X
Petroleum distillates, solvent-refined heavy paraffinic 64741-88-4					X
Petroleum distillates, hydrotreated light paraffinic 64742-55-8		X			X
Petroleum distillates, solvent dewaxed heavy paraffinic 64742-65-0					X
Petroleum distillates, solvent dewaxed light paraffinic 64742-56-9		X			X

International Regulations

Mexico

National occupational exposure limits

Chemical name	Carcinogen Status	Exposure Limits
Residual oils (petroleum), solvent refined	A2	
Petroleum distillates, hydrotreated heavy paraffinic	A2	
Petroleum distillates, solvent-refined heavy paraffinic	A2	
Petroleum distillates, hydrotreated light paraffinic	A2	
Petroleum distillates, solvent dewaxed heavy paraffinic	A2	

Petroleum distillates, solvent dewaxed light paraffinic	A2	

A2 - Suspected Human Carcinogen
Mexico - Occupational Exposure Limits - Carcinogens

Canada
WHMIS Hazard Class
Not determined

16. OTHER INFORMATION

NFPA	**Health Hazards** 2	**Flammability** 1	**Instability** 0	**Physical and Chemical Hazards** -
HMIS	**Health Hazards** 2 *	**Flammability** 1	**Physical Hazard** 0	**Personal Protection** X

Chronic Hazard Star Legend * = Chronic Health Hazard

Prepared By
Product Stewardship
23 British American Blvd.
Latham, NY 12110
1-800-572-6501

Issuing Date 19-Aug-2012
Revision Date 04-Oct-2017
Revision Note No information available

Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of Safety Data Sheet

Appendix D
Certifications

Health & Safety Summary

Chad Robinson

Training	Date	Notes
Medical Monitoring	9/28/2018	Fit for duty
8 Hour Refresher	12/21/2017	Safety Unlimited
Medical Monitoring	10/10/2017	fit for duty
Medical Authorization Release Letter	6/27/2017	CHS
CPR, AED and First Aid - 2 yrs.	2/25/2017	ARC
8 Hour Refresher	1/3/2017	Safety Unlimited
Medical Monitoring	10/5/2016	fit for duty
8 Hour Refresher	12/30/2015	Safety Unlimited
CPR/AED - 2 yr.	2/13/2015	ARC
First Aid - 2 yr	2/13/2015	ARC
8 Hour Refresher	11/7/2014	Safety Unlimited
Smith System Distracted Driving Course	10/3/2014	ONLINE
Medical Monitoring	8/26/2014	Annual/Fit for Duty/no restrictions
Hazard Communication Training	11/22/2013	In-House Training
8 Hour Refresher	11/12/2013	Safety Unlimited
First Aid - 2 yr	7/25/2013	ARC
CPR/AED - 2 yr.	7/25/2013	ARC
8 HR Initial Supervisor	6/3/2013	Safety Unlimited
8 Hour Refresher	12/27/2012	Safety Unlimited
Bloodborne Pathogens Course	9/8/2011	ARC
First Aid - 3 yr.	9/8/2011	ARC
OSHA 30-Hour Construction Training Seminar	7/15/2011	Royal ARC Industrial Training Division
30 hour Construction	7/15/2011	Royal ARC
Rigger/Signal Person Training	7/14/2011	Royal ARC
Confined Space Entry	3/31/2011	Metro Occupational Trainers, Inc.
40 Hour Hazwoper	8/26/2010	Metro Occupational Trainers

ANCHOR QEA

Certificate of Completion

This certifies that

Chad Robinson

has successfully completed

8 Hour HAZWOPER Refresher Training

Refresher certification does NOT necessarily indicate initial 24 or 40 Hour HAZWOPER certification

In Accordance w/Federal OSHA Regulation 29 CFR 1910.120(e) & (p)

And all State OSHA/EPA Regulations as well including 29 CFR 1926.65 for Construction.

This course (Version 3) is approved for 8 Contact Hours (0.8 CEUs) of continuing education per the California Department of Public Health for Registered Environmental Health Specialist (REHS) (Accreditation # 044).

Julius P. Griggs
Julius P. Griggs
Instructor #892

171221583207
Certificate Number

12/21/2017
Issue Date

SAFETY **UNLIMITED, Inc.**
OSHA Compliant Safety Training Since 1993

2139 Tapo St., Suite 228 Simi Valley,CA 93063
(888) 309-SAFE (7233) or 805 306-8027
https://www.safetyunlimited.com

Scan this code or visit www.safetyunlimited.com/v to verify certificate.

Proof of initial certification and subsequent refresher training is NOT required to take refresher training

American Red Cross

Chad Robinson

has successfully completed requirements for

Adult and Pediatric First Aid/CPR/AED: valid 2 Years

Date Completed: 02/25/2017

conducted by: American Red Cross

Instructor: Roland Pete Theetge

ID: 0ZJ95E

Scan code or visit:

redcross.org/confirm

Certificate of Completion

This certifies that

Chad Robinson

Has Successfully completed

8 Hour HAZWOPER Supervisor Training

This certificate does not in itself indicate initial 24 or 40 Hour HAZWOPER Training

In Accordance With Federal OSHA Regulation 29 CFR 1910.120(e)(4)

And all State OSHA/EPA Regulations as well

This course is approved for 8 Contact Hours (0.8 CEUs) of continuing education per the California Department of Public Health for Registered Environmental Health Specialist (REHS) issued by Safety Unlimited, Inc. (Accreditation # 044)

Julius P. Griggs
Julius P. Griggs
Instructor #892

130603483207
Certificate Number

6/3/2013
Issue Date

SAFETY **UNLIMITED, Inc.**
OSHA Compliant Safety Training Since 1993

2139 Tapo St., Suite 228 Simi Valley, CA 93063
888 309-SAFE (7233) or 805 306-8027 866-869-7097 (fax)
www.safetyunlimited.com

Annual Refresher Training NOT Required
Want to be sure this certificate is valid? Visit safetyunlimited.com/verification

METRO

OCCUPATIONAL TRAINERS, INC.

Certify That

CHAD ROBINSON

has successfully completed the

40 Hour, Hazardous Waste Operations and Emergency Response Course

In compliance with 29 CFR 1910.120 (e), (3)

Metro Occupational Trainers, Inc.

August 26, 2010

Date

City or Metropolitan Area of Class Attended: Lansing
Company Name: SOMAT Engineering
Student ID# 100823-15709

Metro Occupational Trainers, Inc., 54344 Verona Park Dr., Macomb, MI 48042 (888)-METRO-49

Health & Safety Summary of Training

MICHAEL (MIKE) CONESE		
Training	**Date**	**Instructor**
Mercury Testing	7/5/2018	cleared - VO Toys
Medical Monitoring	7/5/2018	fit for duty
Respirator Fit Test	7/5/2018	Qualitative - VO Toys
Bloodborne Pathogens Course	5/14/2018	ProTraining
CPR, AED and First Aid - 2 yrs.	4/30/2018	AHA
Drug and Alcohol Testing	4/23/2018	Healthstreet, AEP - negative
Drug and Alcohol Testing	3/26/2018	negative
Medical Monitoring	3/26/2018	fit for duty
8 Hour Refresher	1/26/2018	in-house
Smith System Distracted Driving Course	1/26/2018	in-house
Medical Authorization Release Letter	6/27/2017	CHS
DOT HAZMAT BASIC General Awareness Training	4/28/2017	Safety Unlimited
Medical Monitoring	4/11/2017	fit for duty
Drug and Alcohol Testing	4/11/2017	negative
8 Hour Refresher	2/28/2017	in house
Tetanus	1/22/2017	
8 HR Initial Supervisor	9/8/2016	In house
CPR, AED and First Aid - 2 yrs.	5/9/2016	ARC
Medical Monitoring	4/4/2016	fit for duty
Drug and Alcohol Testing	4/4/2016	negative
8 Hour Refresher	2/5/2016	IN HOUSE
Drug and Alcohol Testing	9/10/2015	Parsons
Drug and Alcohol Testing	6/24/2015	Parsons
Drug and Alcohol Testing	4/1/2015	Onondaga Lake
Medical Monitoring	4/1/2015	ANNUAL
8 Hour Refresher	2/5/2015	Anchor QEA, LLC
HEP A (2nd)	10/20/2014	
Smith System Distracted Driving Course	9/23/2014	In House
First Aid - 2 yr	5/21/2014	ARC
CPR/AED - 2 yr.	5/21/2014	ARC
DOT HAZMAT Security Awareness Training	4/29/2014	Safety Unlimited
Drug and Alcohol Testing	4/18/2014	ONONDAGA LAKE

Health & Safety Summary of Training

MICHAEL (MIKE) CONESE		
Training	**Date**	**Instructor**
HEP A (1st)	4/18/2014	
Medical Monitoring	4/18/2014	Initial/Fit for Duty/no restrictions
8 Hour Refresher	2/7/2014	ETG Environmental
Hazard Communication Training	11/21/2013	in-house training
Boating Course	8/13/2013	Boat US Foundation
Drug and Alcohol Testing	5/16/2013	Onondaga Lake
Medical Monitoring	5/16/2013	Initial
8 Hour Refresher	5/9/2013	Safety Unlimited
D&A Client Mandated Testing Policy Letter	5/9/2013	Project: Onondaga Lake/Parsons
40 Hour Hazwoper	6/4/2012	IACET
Tetanus	6/18/2008	every 10 years
HEP B (3rd)	6/28/2000	
HEP B (2nd)	11/24/1999	6 months
HEP B (1st)	10/21/1999	Initial

HEARTSAVER

Heartsaver® First Aid CPR AED

American Heart Association®

Michael Conese

has successfully completed the cognitive and skills evaluations in accordance with the curriculum of the American Heart Association Heartsaver® First Aid CPR AED Program.

Optional modules completed:

Issue Date
4/30/2018

Training Center Name
Onondaga County EMS Bureau

Training Center ID
NY15366

Training Center Address
421 Montgomery St
Syracuse NY 13202-2923 USA

Training Center Phone Number
(315) 435-3211

Recommended Renewal Date
04/2020

Instructor Name
jeffrey brown

Instructor ID
12170639001

eCard Code
186004124510

QR Code

To view or verify authenticity, students and employers should scan this QR code with their mobile device or go to www.heart.org/cpr/mycards.

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ANCHOR QEA

CERTIFICATE OF COMPLETION

This certifies that

Mike Conese

has successfully completed

8-hour HAZWOPER Refresher Training

in accordance with 29 CFR 1910.120(e)

C R Torell

Christopher R. Torell, P.G., CSP
Instructor

January 26, 2018
Issue Date

ANCHOR QEA

CERTIFICATE OF COMPLETION

This certifies that

Michael Conese

has successfully completed

8-hour HAZWOPER Initial Supervisor Refresher Training

in accordance with 29 CFR 1910.120(e)

C R Torell

Christopher R. Torell, P.G., CSP
Instructor

September 8, 2016
Issue Date

Certificate of Completion

360training.com™

This Certifies That

Michael A Conese

is awarded this certificate for

HAZWOPER 40 HR

Credit Hours: 40

Completion Date: 06/04/2012 14:31 CST

CEU: 4.0

Marie Athey

Marie Athey, OSHA Trainer

AUTHORIZED IACET PROVIDER

360training.com, Inc. has been approved as an Authorized Provider by the International Association for Continuing Education and Training (IACET), 1760 Old Meadow Road, Suite 500, McLean, VA 22102.

This course complies with OSHA 29 CFR 1910.120.

360training.com ♦ 13801 Burnet Rd., Suite 100 ♦ Austin, TX 78727 ♦ 888-360-TRNG ♦ www.360training.com

Health & Safety Summary

PAUL DOODY		
Training	**Date**	**Instructor**
8 Hour Refresher	1/26/2018	in-house
Smith System Distracted Driving Course	1/26/2018	in-house
8 Hour Refresher	1/19/2017	in house
8 Hour Refresher	2/5/2015	Anchor QEA, LLC
Hazard Communication Training	11/21/2013	in-house training
8 Hour Refresher	2/15/2012	Saratoga Safety
Small Vehicle Backing	7/20/2009	Smith System
Non-Harassment Training	7/20/2009	Arcadis
Small Vehicle Forward Motion	7/2/2009	Smith System
8 Hour Refresher	12/22/2008	Arcadis
Small Vehicle Forward Motion	5/22/2007	Smith System
Small Vehicle Backing	5/22/2007	Smith System
8 Hour Refresher	12/22/2004	BBL
8 Hour Refresher	9/27/2002	BBL
8 Hour Refresher	7/12/1999	BBL
8 Hour Refresher	6/15/1998	BBL
8 Hour Refresher	7/14/1997	BBL
8 Hour Refresher	6/17/1996	BBL
8 Hour Refresher	6/20/1995	BBL
8 Hour Refresher	6/21/1994	BBL
8 Hour Refresher	6/21/1993	BBL
8 Hour Refresher	6/22/1992	BBL
8 Hour Refresher	8/16/1991	BBL
40 Hour Hazwoper	1/1/1980	

ANCHOR OEA

CERTIFICATE OF COMPLETION

This certifies that

Paul Doody

has successfully completed

8-hour HAZWOPER Refresher Training

in accordance with 29 CFR 1910.120(e)

C R Torell

Christopher R. Torell, P.G., CSP
Instructor

January 26, 2018
Issue Date

CERTIFICATE OF TRAINING

This is to certify that

J. PAUL DOODY, P.E.

has successfully completed the requirements of

29 CFR 1910.120 HAZARDOUS WASTE OPERATIONS AND EMERGENCY RESPONSE, SECTION (e)(9) EQUIVALENT TRAINING

Sponsored by

Blasland, Bouck & Lee
Engineers and Geoscientists

Marc S Evans
Instructor

AUGUST 16, 1991
Date of Completion

Health & Safety Summary

SAM GIANNAKOS		
Training	**Date**	**Instructor**
40 Hour Hazwoper	7/5/2018	Safety Unlimited
CPR, AED and First Aid - 2 yrs.	7/3/2018	American Red Cross
DOT HAZMAT BASIC General Awareness Training	7/2/2018	Safety Unlimited
Medical Monitoring	7/2/2018	fit for duty
Tetanus	3/22/2017	
HEP A (2nd)	8/5/2011	
HEP A (1st)	3/31/2010	
Tetanus	5/15/2007	
HEP B (3rd)	8/16/1995	
HEP B (2nd)	3/16/1995	
HEP B (1st)	2/16/1995	

Certificate of Completion

This certifies that

Samuel D. Giannakos

has successfully completed

OSHA 40 Hour HAZWOPER Training

Annual Refresher Training Required

In Accordance With Federal OSHA Regulation 29 CFR 1910.120(e)

And State OSHA/EPA Regulations as well including 29 CFR 1926.65(e)

This course is approved for 40 Contact Hours (4 CEUs) of continuing education per the California Department of Public Health for Registered Environmental Health Specialist (REHS) (Accreditation # 044)

Julius P. Griggs

Julius P. Griggs
Instructor #892

1807051241965

Certificate Number

7/5/2018

Issue Date

SAFETY **UNLIMITED, Inc.**
OSHA Compliant Safety Training Since 1993

2139 Tapo St., Suite 228 Simi Valley,CA 93063
(888) 309-SAFE (7233) or 805 306-8027
https://www.safetyunlimited.com

Scan this code or visit www.safetyunlimited.com/v to verify certificate.

Annual Refresher Training Required

American Red Cross

Samuel Giannakos

has successfully completed requirements for

Adult First Aid/CPR/AED: valid 2 Years

Date Completed: 07/03/2018

conducted by: American Red Cross

Instructor: Nicholas Jonathan Flesch

ID: 134UHA

Scan code or visit:

redcross.org/confirm

Health & Safety Summary

KIMBERLY (KIM) POWELL		
Training	**Date**	**Instructor**
8 Hour Refresher	1/26/2018	in-house
Smith System Distracted Driving Course	1/26/2018	in-house
CPR, AED and First Aid - 2 yrs.	2/17/2017	in house
8 Hour Refresher	1/27/2017	in house
8 Hour Refresher	2/5/2016	IN HOUSE
First Aid - 2 yr	2/20/2015	ARC
CPR/AED - 2 yr.	2/20/2015	ARC
8 HOUR Refresher	2/5/2015	Anchor QEA
Smith System Distracted Driving Course	9/23/2014	IN HOUSE
8 Hour Refresher	2/7/2014	ETG Environmental
Hazard Communication Training	11/26/2013	In-House Training
NASSCO Shipyard	5/15/2013	S-Lane Site Visit
BAE Systems	4/16/2013	San Diego Shipyards
First Aid - 2 yr	2/22/2013	ARC
CPR/AED - 2 yr.	2/22/2013	ARC
8 Hour Refresher	3/12/2010	Saratoga Safety
First Aid - 3 yr.	3/12/2010	American Red Cross
CPR/AED	3/2/2010	American Red Cross
8 Hour Refresher	3/29/2009	Safety Unlimited, Inc.
40 Hour Hazwoper	7/13/2001	ROE Environmental, Inc.

ANCHOR QEA

CERTIFICATE OF COMPLETION

This certifies that

Kim Powell

has successfully completed

8-hour HAZWOPER Refresher Training

in accordance with 29 CFR 1910.120(e)

C R Torell

Christopher R. Torell, P.G., CSP
Instructor

January 26, 2018
Issue Date

Certificate of Completion

Kimberly Powell
has completed requirements for

Adult First Aid/CPR/AED

conducted by
American Red Cross

Date completed: **02/17/2017**
Validity Period: **2 Years**

Certificate ID: **GU77VV**

American Red Cross

Scan code or visit:
redcross.org/confirm

sit:
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Certificate of Training

This Certifies That

KIMBERLY ELENBAAS

Has satisfactorily completed the requirements for

OSHA 40HR HAZARDOUS WASTE OPERATIONS AND EMERGENCY RESPONSE TRAINING

developed pursuant to

Regulations promulgated by the Occupational Safety and Health Administration
And is hereby award this certificate
by

ROE Environmental, Inc.
Syracuse, New York

on this 13th *day of* JULY *19* 2001

363-04-4190-2151F

Certificate Number

Authorized Signature

NATIONAL ENVIRONMENTAL TRAINERS

Certificate of Completion

Thomas McCoy

has satisfactorily passed an exam and completed an 8-hour annual refresher training course entitled

Hazardous Waste Operations and Emergency Response

meeting the requirements identified in Title 29 CFR 1910.120.

This course has been awarded 1.34 Industrial Hygiene CM Points by the American Board of Industrial Hygiene-Approval Number 13334. This course is also eligible for .66 Continuance of Certification (COC) points from the Board of Certified Safety Professionals.

Signature of Instructor

NATIONAL ENVIRONMENTAL TRAINERS Inc.®

10/06/2017

Certificate Number: 637646

www.nationalenvironmentaltrainers.com

Clay A. Bednarz, MS, RPIH

The Official Site of Environmental Health & Safety Training®

Lindberg Compliance Services Group, LLC

is pleased to present this certificate to

Edward Pencak

for the successful completion of the
40 Hour Hazardous Waste Site Worker Initial Training
in accordance with 29 CFR 1910.120(e)3(iii) and
29FR 1926.65(e)3(iii)

William Lindberg, CET, CHMM

June 11-14, 2018
Certificate #060818

5101 S. Meadowlark Lane, Hales Corners, WI 53130 414-427-9844

NATIONAL ENVIRONMENTAL TRAINERS

Certificate of Completion

Justin Van Wieringen

has satisfactorily passed an exam and completed an 8-hour annual refresher training course entitled

Hazardous Waste Operations and Emergency Response

meeting the requirements identified in Title 29 CFR 1910.120.

This course has been awarded 1.34 Industrial Hygiene CM Points by the American Board of Industrial Hygiene-Approval Number 13334. This course is also eligible for .66 Continuance of Certification (COC) points from the Board of Certified Safety Professionals.

Signature of Instructor

NATIONAL ENVIRONMENTAL TRAINERS Inc.

01/11/2018

Certificate Number: 515332

www.nationalenvironmentaltrainers.com

Clay A. Bednarz, MS, RPIH

The Official Site of Environmental Health & Safety Training®

NATIONAL ENVIRONMENTAL TRAINERS

Certificate of Completion

Stacy Oszuscik

has satisfactorily passed an exam and completed an 8-hour annual refresher training course entitled

Hazardous Waste Operations and Emergency Response

meeting the requirements identified in Title 29 CFR 1910.120.

This course has been awarded 1.34 Industrial Hygiene CM Points by the American Board of Industrial Hygiene-Approval Number 13334. This course is also eligible for .66 Continuance of Certification (COC) points from the Board of Certified Safety Professionals.

Signature of Instructor

NATIONAL ENVIRONMENTAL TRAINERS Inc.®

02/19/2018

Certificate Number: 202870

www.nationalenvironmentaltrainers.com

Clay A. Bednarz, MS, RPIH

The Official Site of Environmental Health & Safety Training®

NATIONAL ENVIRONMENTAL TRAINERS

Certificate of Completion

Kevin Slottke

has satisfactorily passed an exam and completed an 8-hour annual refresher training course entitled

Hazardous Waste Operations and Emergency Response

meeting the requirements identified in Title 29 CFR 1910.120.

This course has been awarded 1.34 Industrial Hygiene CM Points by the American Board of Industrial Hygiene-Approval Number 13334. This course is also eligible for .66 Continuance of Certification (COC) points from the Board of Certified Safety Professionals.

Signature of Instructor

NATIONAL ENVIRONMENTAL TRAINERS Inc.®

04/11/2018

Certificate Number: 614316

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Clay A. Bednarz, MS, RPIH

The Official Site of Environmental Health & Safety Training®

NATIONAL ENVIRONMENTAL TRAINERS

Certificate of Completion

Conner Tennessen

has satisfactorily passed an exam and completed an 8-hour annual refresher training course entitled

Hazardous Waste Operations and Emergency Response

meeting the requirements identified in Title 29 CFR 1910.120.

This course has been awarded 1.34 Industrial Hygiene CM Points by the American Board of Industrial Hygiene-Approval Number 13334. This course is also eligible for .66 Continuance of Certification (COC) points from the Board of Certified Safety Professionals.

Signature of Instructor

NATIONAL ENVIRONMENTAL TRAINERS Inc.

04/17/2018

Certificate Number: 770238

www.nationalenvironmentaltrainers.com

Clay A. Bednarz, MS, RPIH

The Official Site of Environmental Health & Safety Training®

NATIONAL ENVIRONMENTAL TRAINERS

Certificate of Completion

Kristin Kurzka

has satisfactorily passed an exam and completed an 8-hour annual refresher training course entitled

Hazardous Waste Operations and Emergency Response

meeting the requirements identified in Title 29 CFR 1910.120.

This course has been awarded 1.34 Industrial Hygiene CM Points by the American Board of Industrial Hygiene-Approval Number 13334. This course is also eligible for .66 Continuance of Certification (COC) points from the Board of Certified Safety Professionals.

Signature of Instructor

NATIONAL ENVIRONMENTAL TRAINERS Inc.®

05/25/2018

Certificate Number: 864856

www.nationalenvironmentaltrainers.com

Clay A. Bednarz, MS, RPIH

The Official Site of Environmental Health & Safety Training®

NATIONAL ENVIRONMENTAL TRAINERS

Certificate of Completion

Jonathan O'Brien

has satisfactorily passed an exam and completed an 8-hour annual refresher training course entitled

Hazardous Waste Operations and Emergency Response

meeting the requirements identified in Title 29 CFR 1910.120.

This course has been awarded 1.34 Industrial Hygiene CM Points by the American Board of Industrial Hygiene-Approval Number 13334. This course is also eligible for .66 Continuance of Certification (COC) points from the Board of Certified Safety Professionals.

Signature of Instructor

NATIONAL ENVIRONMENTAL TRAINERS Inc.

06/14/2018

Certificate Number: 803051

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Clay A. Bednarz, MS, RPIH

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NATIONAL ENVIRONMENTAL TRAINERS

Certificate of Completion

Michael Murray

has satisfactorily passed an exam and completed an 8-hour annual refresher training course entitled

Hazardous Waste Operations and Emergency Response

meeting the requirements identified in Title 29 CFR 1910.120.

This course has been awarded 1.34 Industrial Hygiene CM Points by the American Board of Industrial Hygiene-Approval Number 13334. This course is also eligible for .66 Continuance of Certification (COC) points from the Board of Certified Safety Professionals.

Signature of Instructor

NATIONAL ENVIRONMENTAL TRAINERS Inc.

06/17/2018

Certificate Number: 689166

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Clay A. Bednarz, MS, RPIH

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Appendix E
Sigma SSP

SITE HEALTH AND SAFETY PLAN

1. GENERAL INFORMATION

Client:	Anchor QEA	Site Owner:	Wisconsin DNR – City of Portage
Site Name:	Portage Canal – Segment 2		
Site Address:	City of Portage, Wisconsin		
Project Manager:	Kristin Kurzka, P.G., P.E.		
Required Signature:			
Plan Prepared by:	Jonathan O'Brien	Date:	10/17/2018
Reviewed and Approved by:		Date:	

Page

1. General Information 1
2. Emergency Contingency Plan 2
3. Site Description and Background Information..... 3
4. Waste Characterization..... 4
5. Hazard Evaluation 5
6. Personal Protection 6
7. Standard Operating Procedures..... 8
8. Acknowledgement Agreement..... 17

List of Attachments

A Hospital Route

B Site Map

C Safety Data Sheets

2. EMERGENCY CONTINGENCY PLAN

A. EMERGENCY ROUTES

Hospital name: Divine Savior Healthcare ER Phone number: 911 / (608) 745-5604

Hospital address: 2817 New Pinery Road, Portage, Wisconsin

Directions to nearest hospital: **See Attachment A**

Estimated driving distance & time: 5 - 10 minutes

MAP OF HOSPITAL ROUTE – ATTACHMENT A

B. PROJECT TEAM / SITE EMERGENCY CONTACTS

	PHONE NUMBER (provide area codes)	
	Primary	Secondary
1. Kristin Kurzka, P.G., P.E.	(414) 643-4127	(414) 588-0415
2. Justin Van Wieringen, P.E.	(414) 588-7178	(414) 643-4128
3. Stacy Oszuscik, P.E.	(414) 588-7526	(414) 643-4137
4. Jonathan O'Brien	(414) 588-9994	(414) 643-4167
5. Steven Kikkert, E.I.T.	(414) 588-4952	(414) 643-4174
6. Edward Pencak, G.I.T.	(414) 333-3515	(414) 643-4123
7. Conner Tennessen, E.I.T.	(414) 588-4965	(414) 643-4140
8. Kevin Slottke, P.L.S.	(414) 217-0001	(414) 643-4161
9. Michael Murray	(414) 588-7944	
10. Dale Armbruster, P.G.	(262) 488-4165	

C. UTILITIES

Has the utility service locator company (Diggers Hotline) been notified and have utilities been appropriately field marked? Yes [X] No [ ]

Confirmation #, if applicable: Utility clearance procedures in **Section 12.1.6** of Anchor QEA's Site Specific Health and Safety Plan of September 2018 will be followed.

D. SITE MAP

ATTACHMENT B

3. SITE DESCRIPTION AND BACKGROUND INFORMATION

A. SITE DESCRIPTION

The 2.5-mile long and 17-acre Canal is in the City of Portage in Columbia County, Wisconsin. The Canal project corridor includes four segments beginning at the Wisconsin River and flowing northeast, through the City's downtown before emptying into the Upper Fox River.

The scope of this project includes 3,600 feet of the Canal, from Adams Street to a location approximately 100 feet downstream of the Canadian Pacific Railway (CPR) bridge near Center Street. This consists of all of **Segment 2** and approximately 100 feet of **Segment 3**. See the Site Map in **Attachment B**.

B. SITE HISTORY

The Canal is not a natural waterbody; private entities and United States Army Corps of Engineers (Corps) created the Canal from 1838 - 1876. The remains of navigation locks lie at either end of the Canal. Water flow through the Canal has been reduced since the Corps closed the locks and abandoned the Canal in 1959. Current water flow is largely from groundwater and stormwater during precipitation events. An intake structure in the Wisconsin River supplies a nominal amount of water to the Canal beneath a levee constructed by the Corps in 1998. The Canal is in the Great Lakes Basin as a tributary to Lake Michigan.

Gruber Automotive is presumed to have been dumping petroleum substances into the Canal. The storm sewers from the former Gruber facility empty directly into the most upstream section of **Segment 2**. In addition, inspection of Sanborn maps identified a former Manufactured Gas Plant (MGP) along **Segment 1** that operated from the 1890s to between 1910 and 1920. The former Gruber and MGP have been closed and are inactive.

C. NATURE AND EXTENT OF CONTAMINATION

Sediments in the Canal are contaminated with heavy metals, polycyclic aromatic hydrocarbons, petroleum compounds, and polychlorinated biphenyls (PCBs). The site is in the Great Lakes Basin and is listed on the impaired waters list due to contaminated sediment. The site also has a fish consumption advisory for PCBs in common carp. Exposure pathways are complete for both human and ecological receptors. Mercury is the primary contaminant of concern with a remedial goal of 0.36 milligrams per kilogram.

Sediment consists primarily of dark brown to black silty sand containing variable amounts of organics, clay, and gravel. The sediment also contains various amounts of debris that includes an extensive range of urban garbage, such as plastics and cans, and large cobbles. Material under the soft sediment is a poorly graded fine sand and is visually distinct from the overlying sediment. Mercury in sediment core samples ranges from non-detect to 11 milligrams per kilogram (mg/kg) and averages 2-3 mg/kg. The thickness of the soft sediment ranges from 0.4 to 5.0 feet. Normal water depths vary from 0 to 2.1 feet.

4. WASTE CHARACTERIZATION

A. WASTE / CONTAMINANT TYPE(S):

[ ] Liquid [X] Soil [X] Solid [ ] Sludge [ ] Gas

Type	Date	Chemical	Quantity	Contaminated Media*
Soil	Indefinite	Heavy metals incl. Hg and Pb, PAHs, PCBs.	Unknown	Canal bank shallow soils.
Solid	Indefinite	Heavy metals incl. Hg and Pb, PAHs, PCBs.	Unknown	Canal sediments.

(* surface water, soil, groundwater, debris, etc.)

Safety Data Sheets (SDSs) are required for site chemicals.
Please indicate where SDS's can be found for this site:

[ ] Separate Site SDS Log/binder [X] **SEE ATTACHMENT C**

5. HAZARD EVALUATION

Potential Hazards (check boxes that apply to the site):

	corroded containers		visible leachate		underground tanks
	overhead electric lines	X	underground utilities		surface tanks
X	visible soil contamination		odors		observed tanks
X	observed free product		dust		confined spaces
X	open lagoons		open pits	X	walking surfaces
	air stack emissions	X	surface water contamination	X	fall hazards
X	visible on-site releases		interior building contamination		
X	visible off-site releases		electrical hazards		
	lead paint/ surfaces	X	other Canal – Open Water		
	asbestos-containing materials		no obvious hazards		

6. PERSONAL PROTECTION

A. PERSONAL PROTECTION REQUIREMENTS

Level of Protection: B ☐ C ☐ D ☒ (with modifications)

Modifications (check all that apply)

1. **Non-intrusive field activities, including site surveys and work on or over water, WITHOUT THE POTENTIAL to contact contaminants of concern.**

☒ Standard work uniform/coveralls

☒ Work boots with safety toe conforming to ASTM International F2412-05/ASTM F2413-05

☒ High-visibility traffic safety vest

☐ Chemical-resistant clothing check appropriate garments:
- ☐ One-piece coverall
- ☐ Disposable chemical coveralls
- ☐ Bib-style overalls and jacket with hood
- ☐ Hooded one- or two-piece chemical splash suit
- ☐ Chemical-resistant hood and apron

Fabric Type: Tyvek
NOTE: Thick rain pants and coveralls may be substituted for coated Tyvek if sediments are not obviously contaminated with PAHs or related petroleum products. Rain slickers cannot be effectively decontaminated of tar/petroleum contamination.

☐ Disposable inner gloves (latex or equivalent "surgical")

☐ Disposable chemical-resistant outer gloves
Material Type: leather

☐ Chemical-resistant boots with safety toe conforming to ASTM International F2412-05/ASTM F2413-05 or disposable boot covers for safety toe/work boots
Material Type: Rubber or leather

☐ Sleeves to be duct-taped over gloves and pants to be duct-taped over boots

☐ Splash-proof safety goggles

☒ Safety glasses

☒ Hard hat

☐ Hard hat with face shield

☐ Hearing protectors

☐ Hard hat with face shield

☒ High-visibility, U.S. Coast Guard (USCG)-approved personal flotation device (PFD) (if working on any water vessel or without fall protection within 10 feet of water)

☐ USCG-approved float coat and bid-overalls

☐ Half-face Air-Purifying Respirator (OSHA/NIOSH-approved)

☐ Full-face Air-Purifying Respirator (OSHA/NIOSH-approved)

☐ **Type of Cartridges to be Used:** ☐ OV or ☐ OV/HEPA **(if samples are dry)**

2. Intrusive field activities or general activities WITH THE POTENTIAL to contact contaminants of concern.

☒ Standard work uniform/coveralls

☒ Work boots with safety toe conforming to ASTM International F2412-05/ASTM F2413-05

☒ High-visibility traffic safety vest

☒ Chemical-resistant clothing check appropriate garments:
- ☐ One-piece coverall
- ☐ Disposable chemical coveralls
- ☐ Bib-style overalls and jacket with hood
- ☐ Hooded one- or two-piece chemical splash suit
- ☐ Chemical-resistant hood and apron

Fabric Type: Tyvek
NOTE: Thick rain pants and coveralls may be substituted for coated Tyvek if sediments are not obviously contaminated with PAHs or related petroleum products. Rain slickers cannot be effectively decontaminated of tar/petroleum contamination.

☒ Disposable inner gloves (latex or equivalent "surgical")

☐ Disposable chemical-resistant outer gloves
Material Type: Heavy nitrile

☐ Chemical-resistant boots with safety toe conforming to ASTM International F2412-05/ASTM F2413-05 or disposable boot covers for safety toe/work boots
Material Type: Rubber or leather

☐ Sleeves to be duct-taped over gloves and pants to be duct-taped over boots

☐ Splash-proof safety goggles

☒ Safety glasses

☒ Hard hat

☐ Hard hat with face shield

☐ Hearing protectors

☐ Hard hat with face shield

☒ High-visibility, U.S. Coast Guard (USCG)-approved personal flotation device (PFD) (if working on any water vessel or without fall protection within 10 feet of water)

OR

☒ USCG-approved float coat and bid-overalls

☐ Half-face Air-Purifying Respirator (OSHA/NIOSH-approved)

☐ Full-face Air-Purifying Respirator (OSHA/NIOSH-approved)

☐ **Type of Cartridges to be Used:** ☐ OV or ☐ OV/HEPA **(if samples are dry)**

☐ Respiratory protection is dependent on conditions listed in **Section 7.B**.

☒ Other: Waders and/or a flat-bottomed boat may be required to access areas of investigation.

7. STANDARD OPERATING PROCEDURES

A. FIRST AID EQUIPMENT AND PROCEDURES

3. First Aid Equipment
   - Standard First Aid Kit (sized for number of individuals on-site).
   - Portable eye wash (appropriate for number of individuals on-site).

4. First Aid Procedures
   - **Ingestion:** Follow instructions from Poison Control Center or the MSDS.
   - **Inhalation:** Move victim to fresh air. Seek medical attention if needed.
   - **Dermal Exposure:** Remove contaminated clothing. Wash thoroughly with water.

   A First Aid Kit will be provided on-site for use in case of minor injuries. A portable eye wash will also be provided. If a worker suffers a chemical splash in the eye, the field team will be instructed to flush the eye for 15 minutes and arrange for off-site medical treatment immediately. Workers will also be instructed to thoroughly wash with soap and water any unprotected skin which comes in direct contact with contaminated soil or water.

   Workers providing CPR or First Aid should use Universal Precautions to control possible exposure to bloodborne and infectious agents. Report all CPR or First Aid assistance to the Project Manager immediately.

5. Site Emergencies
   In the event of a fire or explosion, evacuate the site immediately and call the appropriate emergency responder. Phone numbers are listed in **Sections 2.A-B**.

   In case of a spill, try to contain or stop the spill if it can be done safely and call the local fire department or hazardous materials response (HAZMAT) unit. Phone numbers are listed in **Section 2.A**.

B. CHEMICAL HAZARDS

1. General
   Action limits for use of respiratory protective equipment are outlined in this section. Any respiratory protection equipment shall be NIOSH/MSHA-approved and use shall conform to OSHA 29 CFR 1910.134. A written Respiratory Protection Program is maintained at the Sigma office.

   In addition to posing inhalation hazards, many hazardous contaminants can also be absorbed through the skin. Skin contact with any contaminated liquid or soil should be prevented. In situations where sampling would result in direct skin contact with contaminated liquids, saturated soil or contaminated equipment, appropriate gloves will be worn.

2. Organic Vapors
   A photoionization detector (PID) or flame ionization detector (FID) will be used to measure the relative concentration of organic vapors. Monitoring for exposure to specific, known contaminants may be done using activated charcoal tubes and vacuum pumps, vapor badges, or colorimetric tubes in the breathing zone when working with heavily contaminated soil or water.

3. Hydrogen Sulfide
   Drilling or digging may also liberate pockets of hydrogen sulfide (H2S). While the characteristic "rotten egg" odor of H2S is detectable at levels as low as 0.0005 ppm, prolonged detection is unreliable due to its olfactory fatigue properties. Should H2S be encountered, workers shall be instructed to stop drilling/digging and move to an upwind location until the vapors have dissipated, as measured by colorimetric H2S detector tubes. The borehole or excavation will be immediately backfilled.

4. Flammable Gases
   A combination explosion meter/oxygen (O2) meter will be available on-site to monitor the levels of flammable gases, such as petroleum vapors and methane.

5. Potential Lead Bearing Surfaces
   Samples of lead-based paint (LBP) may be obtained from painted surfaces where the coating is loose and chipping-away from the surface it had been adhered to. Gloves will be worn to protect dermal contact with the LBP sample, and hands will be immediately washed after each sample location.

6. Asbestos
   Persons conducting inspections and sampling of suspect and/or ACMs, must hold a valid asbestos inspector certification card issued by the Wisconsin Department of Health and Family Services. In general, do not disturb ACM or suspect ACM unless you are an asbestos inspector collecting a sample.

   Project Team personnel shall be familiar with materials that could contain asbestos such as (but not limited to): floor tiles, mastics, ceiling tiles, roofing felts, asbestos-cement pipe and sheeting, fire-resistant drywall, laboratory counter tops, pipe and boiler insulation, sprayed-on building insulation, automotive or heavy equipment brake and clutch linings, fire-resistant clothing, and other materials.

   Materials suspected of containing asbestos will be treated as asbestos unless documentation and testing results indicate that the material is a non-ACM.

   If ACM is suspected to be present within the buildings at the Site, precautions will be implemented to minimize contact with that material during sample collection.

   Suspected asbestos or ACM shall be in a wet state whenever possible when handled, mixed, removed, cut, or scored.

   Samples of suspected asbestos or ACM such as cement, mortar, coating, grout, plaster, or similar materials shall be thoroughly wetted and placed into appropriate airtight sealable sample bags.

   Do not dry sweep or sand materials that contain or are suspected of containing asbestos.

   Do not remove materials that contain or are suspected of containing asbestos with compressed air.

   To prevent release and\or contact with fibers during sample collection, the following may apply if deemed necessary:

   - Personnel collecting ACM wear assigned respirators fitted with high-efficiency particulate air (HEPA) filters, and other personal protective clothing.
   - Use of an exhaust ventilation and dust collection system, especially when using saws, drills, scores, abrasive wheels, or other destructive means of sample collection.
   - Use engineering controls, work practices, and respirators to reduce the risk when cutting, grinding, and sanding suspected asbestos or ACM.

C. PHYSICAL HAZARDS

1. Mechanical Hazards/Walking Surfaces/Fall Protection
   Cuts, abrasions, contusions; slips, trips, falls; being struck or entrapped by moving parts of heavy equipment or falling objects. Such hazards will be minimized by keeping the work area free of equipment and debris that could cause slips, trips or falls and maintaining a safe distance from heavy equipment and moving machinery parts. Verify walking areas are structurally sound and free of slip and trip hazards prior to access.

   Comply with fall protection requirements per OSHA 29 CFR 1926 Subpart M when working within six feet of an unprotected edge. Sigma employees using fall protection equipment are required to be trained in the proper use of the equipment and associated potential fall hazards.

   Refer to **Section 7.I** regarding confined space entry.

2. Electrical Hazards
   Possible excavation of unanticipated electrical cables and potential contact by heavy equipment with overhead power lines during drilling and excavation. Maintain appropriate clearance from underground and overhead power lines.

   Possible electrical hazards when working in proximity to energized electrical systems. Maintain appropriate clearance from energized electrical equipment. Avoid standing in water when operating electrical tools or equipment.

3. Traffic Hazards
   Site work may occasionally necessitate working in parking lots, streets or other areas with vehicular traffic. In such instances, the work team will use neon traffic safety vests and will use traffic cones and/or barricades as necessary to prevent collision between pedestrians and motor vehicles.

4. Open Excavations
   When scheduling or work conditions necessitate leaving excavations open overnight, security fencing will be erected to restrict access to the site or work zones described in **Section 2**.

5. Sediment Core Sampling and Geotechnical Data Collection
   Sediment/soil samples will be collected using manual direct push coring or drilling rig techniques. Geotechnical data will be obtained using specialized equipment deployed by a drilling rig. Rules specific to manual direct push coring include the following:

   - Use care when applying body weight to advance corer.
   - Extract the corer with assistance from crew members and using proper lifting techniques.
   - Be aware of the potential to encounter subsurface materials of differing densities and the effects these may have on corer advancement and retrieval.
   - If the manual corer requires torque to advance or retrieve, use care to turn the corer in a controlled manner.

   Vibracore sampling equipment may be operated from a boat if water depths, targeted sediment depths, sediment material type, or other field conditions require this methodology. Please see Sections **7.C.6-7** for additional safety information regarding working on or near the water.

   If used, all operations involving the use of powered sediment coring rigs will follow generally accepted drilling/coring practices. One person will be assigned the responsibility of Lead Driller/Corer. Additional

personnel will assist with equipment as needed. The Lead Driller/Corer will be responsible for operating the drilling/coring rig and ensuring safety.

General rules associated with drilling/coring rig operations will be as follows:

- While drilling, all non-essential personnel shall remain at a distance that is past the radius of any moving parts.
- All operators and team members will be familiar with the rig operations and will have received practical training.
- All personnel will be instructed in the use of the emergency kill switch/shutdown on the drill rig.
- No loose-fitting clothing, jewelry, or free long hair is permitted near the drilling rig or moving machinery parts.
- A first aid kit and fire extinguisher will be available at all times.
- No drilling will occur during impending electrical storms or tornadoes, or when rain, ice, snow, or wind conditions create undue potential hazards.
- Never allow "horsing around" within the vicinity of the drill rig and tool and supply storage areas, even when the drill rig is shut down.

6. Boating Operations

The following precautions shall be followed when conducting boating trailer and launch activities:

- Follow the trailer and boat manufacturers' instructions for securing the boat to the trailer.
- Follow the trailer manufacturer's instructions for securing the trailer to the towing vehicle.
- Prohibit site personnel from moving into trailer/vehicle pinch points without advising the
- vehicle operator.
- Use experienced operators when backing trailers on boat ramps.
- Wear proper work gloves when the possibility of pinching or other injury may be caused by
- moving or handling large or heavy objects.
- Maintain all equipment in a safe condition.
- Launch boats one at a time to avoid collisions.
- Use a spotter for vehicles backing boats to the launch area.
- Understand and review hand signals.
- Wear boots with non-slip soles when launching boats.
- Wear USCG-approved PFDs when working within 10 feet of the water.
- Keep ropes and lines coiled and stowed to eliminate trip hazards.
- Maintain three-point contact on dock/pier or boat ladders.
- Verify that drain plugs are in place, as present.

The following precautions shall be followed when conducting boating operations:

- Maintain a current boater's license(s) as required.
- Wear USCG-approved PFDs for work activities within 10 feet of the water.
- Obtain and review information regarding dams that may be present in work areas, particularly
- with regard to "no boating" zones and safety buoys, cables, and warning signage.
- Maintain boat anchorage devices commensurate with anticipate currents, distance to shore,
- and water depths.
- Provide a floating ring buoy in the immediate boat launch/landing areas with at least 60 feet
- (18.3 meters) of line for a vessel less than 65 feet (19.8 meters) in length, or 90 feet
- (27.4 meters) of line for a vessel 65 feet (19.8 meters) or greater in length (see
- http://www.uscg.mil/d13/cfvs/CheckLists/Regs/28.115.pdf for more information).
- Step into the center of the boat.
- Keep your weight low when moving on the boat.

- Move slowly and deliberately.
- Steer directly across other boat wakes at a 90-degree angle to avoid capsizing.
- Steer the boat facing forward.
- Watch for floating objects in the water.
- Right-of-way is yielded to vessels on your boat's right, or starboard, and vessels with limited
- ability to maneuver such as any wind-propelled vessel.

The following precautions shall be followed when working on a boat:

- Observe proper lifting techniques.
- Use mechanical lifting equipment (i.e., pulleys or winches) to move large or awkward loads.
- Wear USCG-approved PFDs for work activities within 10 feet of the water.

7. Working Over Or Near Water:
   a. Personal Flotation Devices (PFD)
      PFDs are not required where employees are continuously protected from the hazard of drowning by railings, nets, safety belts, or other applicable provisions.

      Type I, II, III or V USCG-approved, high-visibility PFD shall be provided and properly worn by all personnel in the following circumstances:

      - On or within 10 feet of water.
      - On floating pipelines, pontoons, rafts, or stages.
      - On structures extending over or next to the water, except where guard rails or safety nets are provided for employees.
      - Working alone at night where there are drowning hazards, regardless of other safeguards provided.
      - In skiffs, small boats, or launches, unless in an enclosed cabin or cockpit.
      - Whenever there is a drowning hazard.

      The following precautions shall be followed when using PFDs:

      - Prior to and after each use, the buoyant work vests or life preservers shall be inspected for defects that would alter their strength or buoyancy. Defective devices or devices with less than 13 pounds buoyancy shall be removed from service.
      - All PFDs shall be equipped with reflective tape as specified in 46 CFR 25.25-15.
      - Thirty-inch USCG-approved ring buoys with at least 150 feet of 600-pound capacity line shall be provided and readily available for emergency rescue operations. The distance between ring buoys shall not exceed 200 feet.
      - PFD lights conforming to 46 CFR 161.012 shall be required whenever there is a potential need for life rings to be used after dark. Onshore installations, at least one life ring, and every third one thereafter, shall have a PFD light attached. PFD lights on life rings are required only in locations where adequate general lighting (e.g., floodlights or light stanchions) is not provided.

   b. Cold Water Work
      When the combined air and water temperature is below 90°F, field personnel working on or near water shall wear either a float coat and bib overalls (e.g., a full two-piece "Mustang" survival suit or similar) or a one-piece survival suit. Suits or float coats shall be USCG approved. If extremely cold or severe weather conditions are forecast, work activities should be postponed. Work activities will be continually reviewed and adjustments made if wearing a survival suit during work activities potentially poses a hazard due to warm air temperatures, or limited mobility or agility. In addition, proximity of water work to shore and scope/duration/timing of work activities will be considered when stipulating the above requirement. Overall, if water craft will be used during work, or work will be conducted near water, it is

imperative that site-specific conditions are considered and evaluated so that proper safeguards and procedures are in place prior to beginning work.

In addition to considering the use of apparel appropriate for anticipated air, weather, and water conditions, field teams shall identify any procedures necessary for cold-water "man-overboard" scenarios.

c. Work Near Dams
Work near dams should be avoided unless necessary to complete the required work scope. In the event that working near dams is required, the following shall be considered:

- Obtain safety procedures from the dam owner/operator prior to beginning work.
- Follow required safety procedures including no boating offsets and fall protection procedures.
- Obtain dam operation (i.e., spillway use and trash rack locations) schedules and plan work activities to the extent practicable during periods of no or low dam activity.

D. WORK LIMITATIONS (time of day, weather, heat/cold stress)

1. Heat Stress
In high ambient temperatures (especially in conjunction with high humidity), follow heat-stress precautions.

- Take frequent breaks in areas out of direct sunlight.
- Remove protective clothing during breaks.
- Drink plenty of cool water and/or electrolyte replacement beverages.
- Check the resting pulse rate and increase the number of breaks if the pulse rate does not return to normal during work breaks.
- If possible, alter work schedules so work may be conducted during cooler parts of the day (i.e., morning or evening). Work may only progress during daylight hours or under conditions of adequate lighting.

Symptoms of heat exhaustion and heat stress include:

- Profuse sweating or complete cessation of sweating.
- Changes in skin color.
- Increased respiration.
- Vision problems, confusion.
- Body temperatures in excess of 100° F.
- Increased heart rate.

Any member of the work team who exhibits these symptoms should immediately be removed from the area and observed while resting in a shaded area after removal of impervious or restrictive clothing and after consumption of cool water or electrolyte fluid. If symptoms persist, immediate medical attention shall be sought.

2. Cold Stress
Observe the following procedures and practices regarding cold stress:

- Take breaks in heated shelters when working in extremely cold temperatures.
- Upon entering the shelter, remove the outer layer of clothing and loosen other layers to promote evaporation of perspiration.
- Drink warm liquids to reduce the susceptibility to cold stress.
- Be aware of cold stress symptoms, including shivering, numbness in the extremities, and sluggishness.

- Provide adequate insulating dry clothing to maintain warmth if work is performed in air temperature below 40°F. Wind chill cooling rates and the cooling power of air are critical factors. The higher the wind speed and the lower the temperature in the work area, the greater the insulation value of the protective clothing required.
- If the air temperature is 32°F or less, hands should be protected.
- If only light work is involved and if the clothing on the worker may become wet on the job site, the outer layer of the clothing in use should be impermeable to water. With more severe work under such conditions, the outer layer should be water repellent, and the outer wear should be changed as it becomes wetted. The outer garments should include provisions for easy ventilation in order to prevent wetting of the inner layer by sweat.
- If available clothing does not give adequate protection to prevent cold injury, work should be modified or suspended until adequate clothing is made available, or until weather conditions improve.
- Implement a buddy system in which site personnel are responsible for observing fellow workers for early signs and symptoms of cold stress.

Cold stress can range from frostbite to hypothermia. The signs and symptoms of cold stress are listed below. The appropriate guidelines should be followed if any personnel exhibit these symptoms:

Frostbite. Frostbite is characterized by pain in the extremities and loss of manual dexterity. "Frostnip," or reddening of the tissue, is accompanied by a tingling or loss of sensation in the extremities and continuous shivering.

Hypothermia. Hypothermia is characterized by pain in the extremities and loss of manual dexterity, with severe, uncontrollable shivering, and an inability to maintain the level of activity. Symptoms include excessive fatigue, drowsiness, irritability, or euphoria. Severe hypothermia includes clouded consciousness, low blood pressure, pupil dilation, cessation of shivering, unconsciousness, and possible death.

Move the individual to a warm, dry place. If the individual's clothing is wet, remove it and replace it with dry clothing. Keep the individual warm. Re-warming of the individual should be gradual to avoid stroke symptoms. Dehydration, or the loss of body fluids, may result in a cold injury due to a significant change in blood flow to the extremities. If the individual is conscious and alert, warm sweet liquids should be provided. Coffee and other caffeinated liquids should be avoided because of diuretic and circulatory effects. Extremities affected by frostbite should be gradually warmed up and returned to normal temperature. Moist compresses should be applied; begin with lukewarm compresses and slowly increase the temperature as changes in skin temperature are detected. Keep the individual warm and calm and move them to a medical facility as soon as possible.

E. FIRE AND EXPLOSION HAZARDS

During any drilling, excavation or other activities on sites with flammable contaminants, the potential for fire and explosion of flammable vapors exists. Extreme caution should be taken to monitor for the presence of flammable vapors or conditions which could create flammable conditions. Explosion meters are available for this monitoring and action levels are defined in **Sections 7.B.3-4**. Fire extinguishers must be available on all sites with the potential for flammable vapors or electrical fires (i.e., systems, control panels). Use of fire extinguishers by employees trained in their use is limited to employee rescue, or extinguishing relatively small, controllable fires. Sigma does not expect or require its employees to fight fires.

In the event of a fire or explosion, the following action plan should be followed:

- Shut down equipment and shut off all supply lines immediately, if this can be done safely.
- Evacuate the immediate area.

- Notify the fire department. Sigma employees are not trained firefighters. Every fire should be treated as an emergency. Even if the fire is extinguished by site personnel, professional fire departments should evaluate the situation to ensure that the danger is over and that a fire will not reoccur.
- Evaluate the situation to identify the source of the flammable vapors and to assess the danger to employees, the public and property. From a safe distance, try to determine if the fire is a supply line fire, soil vapor, electrical, or methane fire. This information should be communicated to the fire department. Small fires from known sources (i.e., engine fires, electrical panel fires, etc.) may be extinguished if the employee can do it without high risk. Employees or subcontractors shall not enter an excavation or confined space to attempt to extinguish a fire.

F. NOISE / HEARING PROTECTION

Workers shall be instructed in the recognition of noise hazards and shall be provided, and trained in the use of, hearing protective devices. In general, hearing protective devices shall be worn when working around heavy or noisy equipment or when background noise is so high that a worker has to shout to be heard at a distance of 3 feet.

G. LEVELS OF PROTECTION

Conditions may allow work to be performed in Level D protection: hard hat, steel-toed shoes/boots, cotton coveralls or long-sleeved shirts and long pants, eye protection, hearing protection, and gloves if needed.

If monitoring equipment or site conditions indicate the need to upgrade the level of protection to Level C, air-purifying respirators with organic vapor canisters (or other appropriate cartridges), Tyvek or chemically resistant coveralls with hoods, chemical resistant inner and outer gloves, and disposable boot covers will be donned.

At no time will a Sigma employee conduct work on any site requiring Level A protection. On worksites requiring Level B protection, workers will be provided with additional training and equipment. A Health and Safety Specialist must be on-site at all times while work is being conducted.

H. DECONTAMINATION PROCEDURE

Contamination may result from walking through contaminated soils or liquids, splashing liquids during sampling, use of or contact with contaminated equipment, or contact with air contaminants. Field team workers will be instructed to observe the following precautions to assure contaminants will be effectively removed from tools, equipment, and protective clothing.

- Tools, equipment and personnel will be decontaminated using procedures appropriate for the level of personal protection worn.
- All contaminated, disposable clothing (e.g., Tyvek suits, gloves and disposable boot covers) will be properly bagged for disposal and left on site.
- All personnel with potential for exposure to contaminants are instructed to wash hands, face, neck and forearms at the end of the work shift and to shower at the end of the workday.
- No eating, drinking, or smoking will be permitted in the immediate vicinity of heavy equipment and/or drilling and excavating activities.

Special Decontamination Requirements

_____

_____

_____

I. CONFINED SPACES

If entry into a confined space is necessary, a Confined Space Entry Permit must be completed and authorized, and confined space entry procedures followed. Sigma maintains detailed information on Confined Space Entry classification, entry procedures and required permitting systems.

Does this site have any permit-required confined spaces? Yes [ ] No [X]

8. ACKNOWLEDGMENT AGREEMENT

SIGMA EMPLOYEE
SITE HEALTH AND SAFETY PLAN REVIEW RECORD

I acknowledge that I have read and understood the contents of this Site Health and Safety Plan and I agree to abide by all provisions as set forth.

Signature	Date

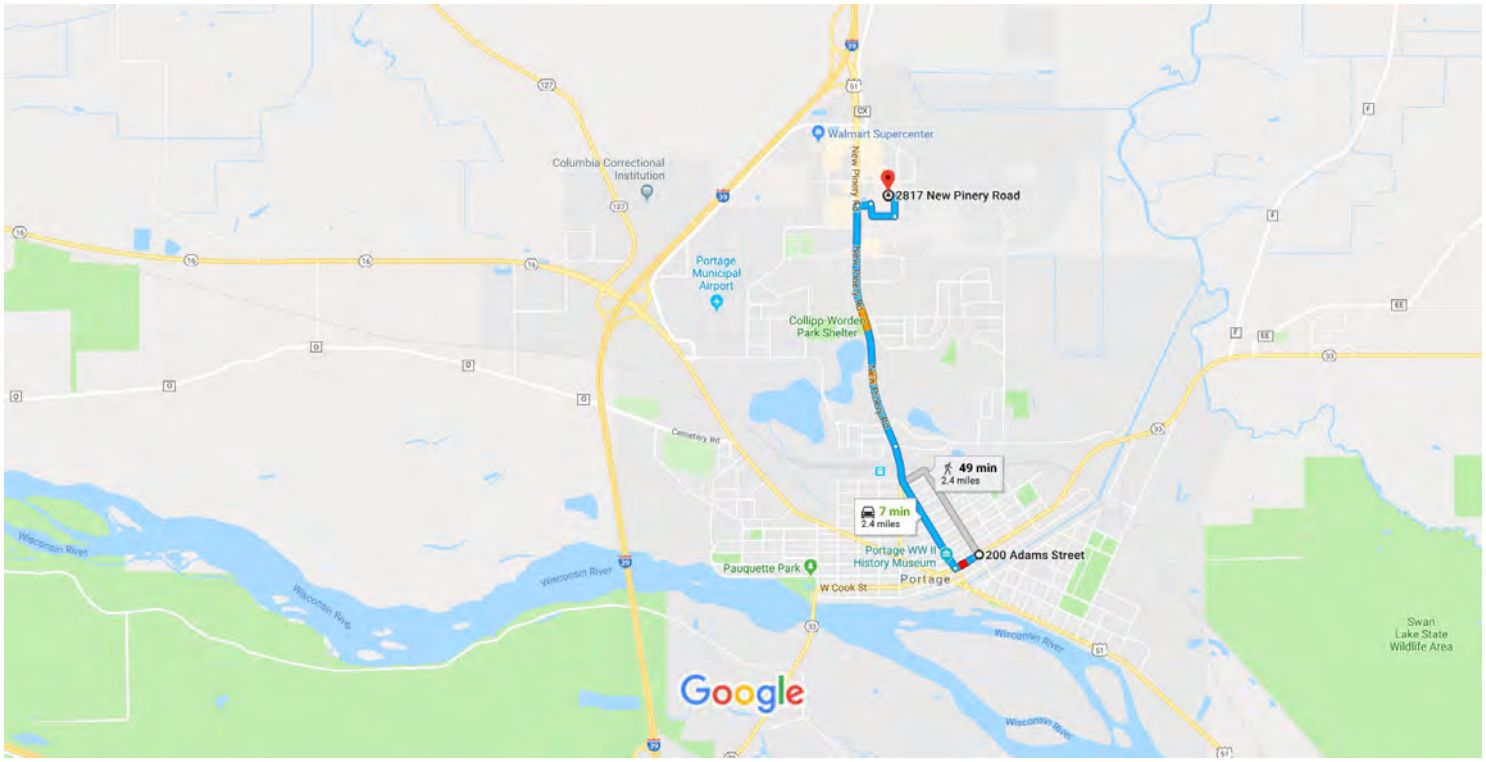
ATTACHMENT A

HOSPITAL ROUTE

Google Maps

200 Adams St, Portage, WI 53901 to 2817 new pinery rd portage wi

Drive 2.4 miles, 7 min



Map data ©2018 Google 2000 ft

200 Adams St

Portage, WI 53901

1. Head southwest on E Cook St toward Marachowsky Pl

0.1 mi

2. Turn right onto De Witt St

0.7 mi

3. Continue onto New Pinery Rd

Pass by Jimmy John's (on the right in 1.0 mi)

1.2 mi

4. Turn right

381 ft

5. Turn right

0.2 mi

6. Turn left

0.1 mi

7. Turn left

Destination will be on the right

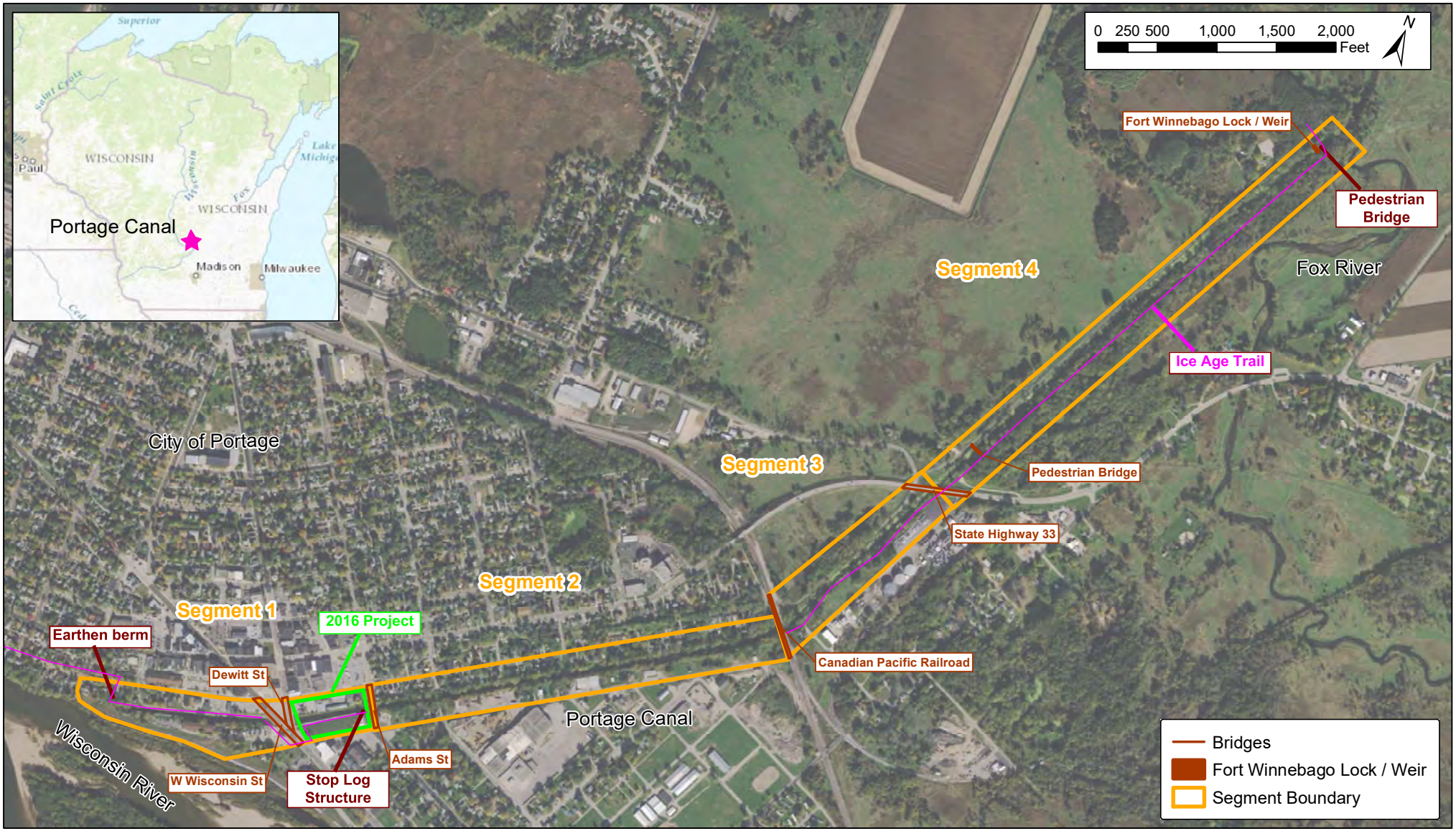
69 ft

2817 New Pinery Rd

Portage, WI 53901

ATTACHMENT B

SITE MAP



RAMBOLL ENVIRON	SITE OVERVIEW	Figure 1-1
DRAFTED BY: FK	Portage Canal Site - City of Portage, Wisconsin	
DATE: 02/28/2017		

ATTACHMENT C

SAFETY DATA SHEETS (SDS)

(Reference Electronic Copy)

PCB DISPOSAL

MATERIAL SAFETY DATA SHEET

(POLYCHLORINATED BIPHENYLS)

COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients Name: polychlorinated biphenyls (PCBs)

HAZARD IDENTIFICATION

Reports of Carcinogenicity: YES

HEALTH HAZARDS ACUTE AND CHRONIC

- **Eyes**: Moderately irritating to eye tissues.
- **Skin**: Can be absorbed through intact skin, may cause de-fatting, potential for chloracne.
- **Inhalation**: Possible liver injury.
- **Ingestion**: Slightly toxic; reasonably anticipated to be carcinogenic.

EFFECTS OF OVER-EXPOSURE

Can cause dermatological symptoms; however, these are reversible upon removal of exposure source.

FIRST AID MEASURES

- **Eyes**: Irrigate immediately with copious quantities of running water for at least 15 minutes if liquid or solid PCBs get into them.
- **Skin:** Contaminated clothing should be removed and the skin washed thoroughly with soap and water. Hot PCBs may cause thermal burns.
- **Inhalation**: Remove to fresh air; if skin rash or respiratory irritation persists, consult a physician (if electrical equipment arcs over, PCBs may decompose to produce hydrochloric acid).
- **Ingestion**: Consult a physician. Do not induce vomiting or give any oily laxatives. (If large amounts are ingested, gastric lavage is suggested).

FIRE FIGHTING MEASURES: Flash Point: >141 ^{o}C (285.8 ^{o}F)

EXTINGUISHING MEDIA: PCBs are fire-resistant compounds.

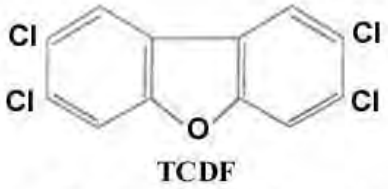
FIRE-FIGHTING PROCEDURES

Standard fire-fighting wearing apparel and self-contained breathing apparatus should be worn when fighting fires that involve possible exposure to chemical combustion products. Fire fighting equipment should be thoroughly cleaned and decontaminated after use.

UNUSUAL FIRE/EXPLOSION HAZARD

If a PCB transformer is involved in a fire-related incident, the owner of the transformer is required to report the incident. Consult and follow appropriate federal, provincial and local regulations.

***Note**: When askarel liquid becomes involved in a fire, toxic by-products of combustion are typically produced including polychlorinated dibenzofurans and polychlorinated dibenzodioxins, both known carcinogens. The structures of these chemical species are as follows:*

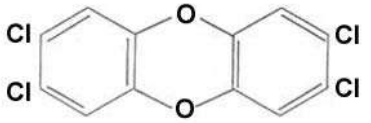


TCDF

$C_{12}H_{8-n}Cl_nO$

$n = 4 - 8$

2,3,7,8-tetrachlorodibenzofuran



TCDD

$C_{12}H_{8-n}Cl_nO_2$

$n = 4 - 8$

2,3,7,8-tetrachloro-dibenzo-p-dioxin

***Note**: 2,3,7,8-tetrachloro-dibenzo-p-dioxin is one of the most potent teratogenic, mutagenic and carcinogenic agents known to man.*

SPILL RELEASE PROCEDURES

Cleanup & disposal of liquid PCBs are strictly regulated by the federal government. Ventilate area. Contain spill/leak. Remove spill by means of absorptive material. Spill clean-up personnel should use proper protective clothing. All wastes and residues containing PCBs should be collected, containerized, marked and disposed of in the manner prescribed by applicable federal, provincial and local laws.

HANDLING AND STORAGE PRECAUTIONS

Care should be taken to prevent entry into the environment through spills, leakage, use, vaporization, or disposal of liquid. Avoid prolonged breathing of vapours or mists. Avoid contact with eyes or prolonged contact with skin. Comply with all federal, provincial and local regulations.

OTHER PRECAUTIONS

Federal regulations require PCBs, PCB items, storage areas, transformer vaults, and transport vehicles to be appropriately labelled.

RESPIRATORY PROTECTION

Use OHSA approved equipment when airborne exposure limits are exceeded. Full facepiece equipment is recommended and, if used, replaces need for face shield and/or chemical splash goggles. The respirator use limitations specified by the manufacturer must be observed.

VENTILATION

Provide natural or mechanical ventilation to control exposure levels below airborne exposure levels.

PROTECTIVE GLOVES: Wear appropriate chemical resistant gloves to prevent skin contact.

EYE PROTECTION: Wear chemical splash goggles and have eye baths available.

OTHER PROTECTIVE EQUIPMENT

Wear appropriate protective clothing. Provide a safety shower at any location where skin contact can occur.

WORK HYGIENIC PRACTICES

Wash thoroughly after handling. Supplemental safety and health : none

PHYSICAL/CHEMICAL PROPERTIES

- **Vapour pressure:** (mm Hg @100 ^{o}F) 0.005 - 0.00006
- **Viscosity:** (CENTISTOKES) 3.6 - 540
- **Stability indicator/materials to avoid:** Yes
- **Stability Condition to Avoid:** PCBs are very stable, fire-resistant compounds.

HAZARDOUS DECOMPOSITION PRODUCTS

Carbon monoxide, carbon dioxide, hydrogen chloride, phenolics, aldehydes, furans, dioxins

WASTE DISPOSAL METHODS

Consult the applicable PCB regulations prior to any disposal of PCBs or PCB-contaminated items.