February 2020
Reynolds Metals Company Superfund Site

Phase 2 – Supplemental Sampling and Analysis Plan

Prepared for Alcoa, Inc.
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**ABBREVIATIONS**

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<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>CFR</td>
<td>Code of Federal Regulations</td>
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<tr>
<td>COC</td>
<td>chain of custody</td>
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<tr>
<td>DAY</td>
<td>deep aquifer yield</td>
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<tr>
<td>EPA</td>
<td>U.S. Environmental Protection Agency</td>
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<tr>
<td>FE/PWO</td>
<td>focused extraction/production well optimization</td>
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<tr>
<td>HASP</td>
<td>Health and Safety Plan</td>
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<tr>
<td>IDW</td>
<td>investigation-derived waste</td>
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<tr>
<td>mg/L</td>
<td>milligrams per liter</td>
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<tr>
<td>MS/MSD</td>
<td>matrix spike/matrix spike duplicate</td>
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<td>NMDS</td>
<td>nylon mesh diffusion sampler</td>
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<td>OSHA</td>
<td>Occupational Safety and Health Administration</td>
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<td>Phase 2 SAP</td>
<td>Phase 2 Supplemental Sampling and Analysis Plan</td>
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<tr>
<td>PPE</td>
<td>personal protective equipment</td>
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<td>QA</td>
<td>quality assurance</td>
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<td>QAPP</td>
<td>Quality Assurance Project Plan</td>
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<td>QC</td>
<td>quality control</td>
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<td>RAO</td>
<td>Remedial Action Objective</td>
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<td>RMC</td>
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<td>ROD</td>
<td>Record of Decision</td>
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<td>Site</td>
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<td>SOP</td>
<td>standard operating procedure</td>
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1 Introduction

This Phase 2 Supplemental Sampling and Analysis Plan (Phase 2 SAP) outlines the scope for porewater/transition zone groundwater and surface water sampling and surface water elevation data collection at the Reynolds Metals Company (RMC) Superfund Site (site). Figures 1 and 2 show the site location and site plan.

Supplemental sampling is being conducted in two phases. During Phase 1 supplemental sampling, conducted in August and September 2018, soil, groundwater, and surface water samples were collected. The results of Phase 1 supplemental sampling were used to support development of a reactive transport model for the area outside of the dike and to verify a passive, time-integrated sampling technique for surface water (Anchor QEA 2018). The results of Phase 1 supplemental sampling were summarized in the Phase 1 Supplemental Sampling Data Report, submitted to the U.S. Environmental Protection Agency (EPA) in October 2019 (Anchor QEA 2019a). The Groundwater Flow and Reactive Transport Modeling Report was submitted to EPA in November 2019 (Anchor QEA 2019b).

The goals of Phase 2 supplemental sampling are the collection of depth-discrete porewater/transition zone groundwater samples collocated with surface water samples at locations along the shorelines of the Columbia and Sandy rivers and the collection of surface water elevation data in the Sandy and Columbia rivers adjacent to the site. The results of Phase 2 supplemental sampling and data collection will be used to evaluate fluoride attenuation in the transition zone and to document the fluoride concentrations in surface water adjacent to and upstream of the site. Surface water elevation data collected during Phase 2 will be used to assess the dynamic interaction between groundwater and surface water at the site.

1.1 Background

The site is a former aluminum smelter operated by RMC (a wholly owned subsidiary of Alcoa, Inc.) and is located approximately 20 miles east of Portland, Oregon, and approximately 1 mile north of Troutdale, Oregon, at the confluence of the Columbia and Sandy rivers (Figure 1). The site is bordered by the Columbia River to the north and the Sandy River to the east, as shown in Figure 2. A U.S. Army Corps of Engineers flood control dike runs approximately east-west through the northern portion of the site.

The RMC facility was constructed for the U.S. government in 1941 to support wartime production of aluminum and operated at varying capacities until it was closed permanently in July 2002. The site was placed on the EPA National Priorities List (Superfund) in 1994. The RMC facility was demolished between 2003 and 2006 per the 2004 Demolition Plan (Ch2M Hill 2004; EPA 2006). All plant structures

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1 Porewater refers to water collected from the biologically active zone (top 10 centimeters of sediment) or within 30 centimeters below the sediment-surface water interface. Water collected from greater depths is considered representative of the transition zone groundwater.
and most of the foundations were removed as part of the demolition. The remedy for the RMC facility included excavation and off-site disposal of contaminated waste, soil, and debris; capping of the western portion of the north landfill area and two small areas on the Company Lake shoreline located in the Outside the Dike Area (Figure 2); construction and operation of a focused extraction/production well optimization (FE/PWO) system; groundwater monitoring; and institutional controls. The FE/PWO system removes fluoride-contaminated groundwater from the Upper Grey Sand and provides hydraulic containment to control plume migration. Water extracted by the focused extraction wells is blended with cleaner (i.e., lower fluoride concentrations) groundwater extracted by the production wells from the deeper aquifers (dilution) and discharged to the Columbia River. An interim Record of Decision (ROD) for the source areas was signed on September 30, 2002 (EPA 2002). A final ROD (EPA 2006) was signed on September 29, 2006. The site achieved construction completion with the signing of the Preliminary Close-Out Report on September 29, 2006. Four post-demolition exposure areas established in the 2006 Post-Demolition Residual Risk Assessment (CH2M Hill 2006) are shown in Figure 2. Three 5-year reviews have been conducted for the site; the latest one was conducted in 2018.

Groundwater remediation at the site is being performed in accordance with the final ROD (EPA 2006). Remedial Action Objectives (RAOs) established in the final ROD for the final Remedial Action at the site are as follows:

1. Reduce human exposure through direct contact (ingestion, inhalation, and dermal contact) with contaminated soil and debris that would result in unacceptable excess lifetime cancer risk or greater than a Hazard Index of 1.0 for the reasonably anticipated (non-residential) future land uses.

2. Restore and maintain use of the groundwater (except the shallow silt zone) as a drinking water source. The restoration goal is the federal and state safe drinking water standard (maximum contaminant levels).

3. Minimize the migration of contaminants from waste and soils to groundwater at concentrations that protect underlying drinking water, reduce the fluoride mass in shallow and intermediate groundwater, and control migration of fluoride and other constituents of concern in groundwater.

4. Reduce and control the migration of fluoride in groundwater to the Sandy River.²

The long-term groundwater monitoring program provides data used to assess the effectiveness of the remedial action for the site and evaluate progress toward achieving the groundwater RAOs.³ Phase 1 and Phase 2 supplemental sampling efforts are intended to provide additional data that can

² Although RAO 4 refers only to the Sandy River, the Groundwater Monitoring Work Plan (2016 through 2020) (Apex 2018) identifies additional work required by EPA regarding groundwater and surface water sampling of both the Sandy and Columbia rivers. Groundwater performance criteria are presented in Section 5.2 of that report.

³ The Port of Portland purchased the land, but not the associated liability, from Alcoa in December 2007, following purchase and sale negotiations that began in 2004. The Port of Portland operated the FE/PWO system until December 2019, when responsibility for operations and maintenance passed back to Alcoa.
be used to document the effectiveness of the remedial actions performed at the site in achieving RAO 4. This Phase 2 SAP provides the necessary information to properly conduct sample collection and describes the methods and procedures to be implemented during the field program.

The following documents are supporting plans to this Phase 2 SAP:

- *Quality Assurance Project Plan (QAPP)* (Appendix A)
- *Health and Safety Plan (HASP)* (Appendix B)

### 1.2 Sampling and Analysis Plan Organization

This Phase 2 SAP is organized into the following sections:

- Section 1 provides the background and objectives of the field program.
- Section 2 presents the project organization and individual roles and responsibilities for implementation of the field program.
- Section 3 presents preparation activities required to complete the field program.
- Sections 4 through 6 include an overview of field activities, the rationale and design of the activities, the procedures that will be followed, and the schedule.
- Section 7 details quality assurance (QA) and quality control (QC) procedures to be followed during implementation of the field program. See the QAPP for more information on this subject (Appendix A).
- Section 8 presents field documentation requirements and sample management procedures.
- Section 9 discusses the management of investigation-derived waste (IDW).
- Section 10 provides the schedule and format for reporting the results.
- Section 11 cites references used in this Phase 2 SAP.

### 1.3 Objectives

The scope of Phase 1 supplemental sampling was described in the *Phase 1 – Supplemental SAP* (Anchor QEA 2018) and included groundwater, surface water, and soil sampling. Results were documented in the *Phase 1 Supplemental Sampling Data Report* (Anchor QEA 2019a), and the conclusions of that report are summarized as follows:

- Fluoride concentrations in groundwater along the shorelines of the Columbia and Sandy rivers have decreased compared to concentrations measured in geoprobe borings in 1997 (Ch2M Hill 1997). Results in shoreline borings ranged from non-detect (<0.05 milligrams per liter [mg/L]) to 4.77 mg/L (at an elevation of approximately -20 feet National Geodetic Vertical Datum of 1929 in GP17-04; Figure 3a).
- Fluoride concentrations in duplicate nylon mesh diffusion samplers (NMDS) were within 5%, indicating that the passive sampling technique produces reproducible results and is a viable sampling methodology for Phase 2.
Collocated soil and groundwater data and surface water data were collected to support the development of a reactive transport model for the area north of the dike.

Following the completion of Phase 1 supplemental sampling, reactive transport modeling to evaluate the fate and transport of fluoride was conducted. As discussed in the *Groundwater Flow and Reactive Transport Modeling Report* (Anchor QEA 2019b), the results of Phase 1 supplemental sampling, modeling, and additional data collected by EPA in 2018 indicated that processes occurring within the transition zone groundwater immediately beneath the sediment-water interface (before groundwater discharges to surface water) provided an additional opportunity for attenuation of fluoride (Figures 3a and 3b). As shown in Figure 3a, transition-zone groundwater fluoride concentrations measured in several locations were an order of magnitude higher than concentrations in nearby surface water samples (e.g., PW-01, PW-23, and PW-06). Additional depth-discrete porewater/transition zone groundwater data are needed to evaluate fluoride attenuation in the transition zone.

The objectives of Phase 2 supplemental sampling are as follows:

1. Measure fluoride concentrations and water quality parameters at multiple depths and locations across the porewater and groundwater/surface water transition zone to the Columbia and Sandy rivers to support evaluation of fluoride attenuation (see Figure 4 for proposed surface water sampling locations).
2. Measure time-integrated, surface water fluoride concentrations and water quality parameters in the Columbia and Sandy rivers collocated with porewater/transition zone groundwater profiles to establish the boundary conditions for transition zone attenuation modeling.
3. Collect fluoride data upstream of the site in the Columbia and Sandy rivers to confirm background surface water fluoride concentrations.
4. Collect surface water elevation data in the Columbia and Sandy rivers adjacent to the site to support evaluation of the interactions between groundwater and surface water at the site.

A summary of Phase 2 supplemental sampling and data collection is presented in Table 1.

To ensure that the data is representative of conditions throughout the year, Phase 2 supplemental sampling events will be scheduled to align with the ongoing semiannual groundwater monitoring events conducted in the spring and the fall, and at least 12 months of surface water elevation data will be collected. Sampling locations and methods for Phase 2 supplemental sampling and data collection are described in detail in Sections 4 through 6. Information gathered during Phase 1 field

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4 Data collected by EPA are presented in the *Office of Environmental Review and Assessment Data Report – Porewater Sampling in the Hyporheic Zone to Determine Groundwater/Surface Water Interaction at the Reynolds Site, Troutdale, OR* (EPA 2019).
activities was used in conjunction with the findings of EPA porewater/transition zone groundwater sampling conducted in 2018 to select Phase 2 supplemental sampling locations (EPA 2019).

1.4 Schedule

Upon being notified of EPA’s approval of this Phase 2 SAP, Alcoa and Anchor QEA will coordinate with subcontractors (see Section 2.5) to schedule the field work required to accomplish the scope of work described in this Phase 2 SAP. The Alcoa Project Manager will provide the EPA Project Manager with at least 2 weeks’ notice prior to commencing all field activities. Contact information for individuals who receive notifications is provided in Table 2.

1.5 Health and Safety and Procedural Requirements

This section provides an overview of the health and safety requirements, standard operating procedures (SOPs), and equipment calibration and decontamination requirements for the field program to ensure activities are conducted safely and adhere to specific standards and procedures.

1.5.1 Compliance with Health and Safety Requirements

All activities proposed for the field program will follow the procedures outlined in the site-specific HASP (Appendix B). The HASP was prepared in accordance with the Occupational Safety and Health Administration (OSHA) requirements contained in 29 Code of Federal Regulations (CFR) 1910, including the final rule contained in 29 CFR 1910.120.

All field team staff and subcontractor personnel must read and comply with the site-specific HASP and sign an acknowledgement form contained in the HASP (Appendix B). Visitors and new staff will be given a safety briefing by the Field Lead, including a review of site environmental health and safety procedures required by the HASP, and sign the corresponding acknowledgement form.

The field team staff will be trained as specified in the HASP (Appendix B). If new tasks or different investigative techniques are proposed that are not addressed in the HASP, the field team staff will complete an Activity Hazard Analysis form. The forms 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 its implementation.

The implementation of health and safety will be the shared responsibility of the Project Manager, SAP Coordinator, Field Lead, Safety Manager, and field team staff implementing the Phase 2 SAP as well as Technical Consultant subcontractors (see Section 2 for descriptions of these roles). 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. See Section 1 of the HASP for further details (Appendix B).

1.5.2 Standard Operating Procedures

SOPs were developed to ensure consistency and quality in the implementation of the field work. The activities that compose the field program and their associated procedures are presented in Sections 4 through 6 of this Phase 2 SAP. Detailed SOPs for specific project tasks are referenced in these sections and provided in Appendix C.

1.5.3 Maintenance, Calibration, and Decontamination of Instruments

Instruments used for field measurements (e.g., multiparameter sonde water quality meters) will be maintained and calibrated per the manufacturer’s specifications and applicable SOPs. If post-sampling calibration data are not within an acceptable range, data for the period of use will be qualified accordingly. Instruction manuals for all field instruments will be available where the instruments are being used. Instruments will be stored in a temperature-controlled climate when not in use. Instruments will be inspected daily for possible problems (e.g., cracked or clogged lines or tubing and weak batteries). Instruments will be calibrated at the beginning of each field event and as needed thereafter (e.g., where readings are suspect) to produce accurate and reproducible data.

All field equipment or instruments encountering potentially contaminated media or used for sample collection and/or sample processing will be decontaminated before and after use and between stations.
2 Organization and Responsibilities

An organizational framework and management control system capable of executing the work described in this Phase 2 SAP involves an integrated structure where each member understands their function and their relationship to the overall project. Lines of communication will be maintained among project personnel and managers. Communication will also be maintained regularly between Anchor QEA, Alcoa, and EPA.

Figure 5 presents an organizational chart depicting the current hierarchy of roles and responsibilities. These roles and responsibilities are defined in the following subsections.

2.1 EPA Project Manager

Piper Peterson is the EPA Project Manager and is responsible for overseeing implementation of the cleanup consistent with the final ROD (EPA 2006).

2.2 Alcoa Project Manager

Michele Maidman is the Alcoa Project Manager and is responsible for leading Alcoa’s activities at the site. She is the primary point of contact with the EPA Project Manager.

2.3 Project and Task Management

Anchor QEA is currently the Technical Consultant performing the field work on behalf of Alcoa. Technical Consultant individuals with specifically designated project and task management responsibilities for implementation of the field program include the Project Manager, Technical Lead, SAP Coordinator, Safety Manager, and Field Lead. The QA/Data Validation Lead will be responsible for sample tracking and data validation.

2.3.1 Project Manager

Halah Voges is the Anchor QEA Project Manager and is leading the implementation of this Phase 2 SAP. She will oversee all activities, including data collection and reporting. Ms. Voges will serve as the point of contact with the Alcoa Project Manager.

2.3.2 Technical Lead

Dr. Dimitri Vlassopoulos is the Anchor QEA Technical Lead and will provide technical oversight of the Field Lead. The Technical Lead will work with Alcoa and Anchor QEA Project Managers to communicate the project approach with EPA. Dr. Vlassopoulos will review all field data and analytical results to confirm that these data are sufficient to achieve the Phase 2 SAP objectives.
2.3.3 **SAP Coordinator**
Grace Weatherford, PE, is the SAP Coordinator and is responsible for the preparation of this Phase 2 SAP. The SAP Coordinator will track the schedule and completion of tasks and keep the Anchor QEA Project Manager apprised of the status of the SAP program.

2.3.4 **Corporate Health and Safety Manager**
David Templeton is the Corporate Health and Safety Manager and is responsible for the preparation, interpretation, and modification of the project-specific HASP (Appendix B). The Safety Manager or his designee advises the Anchor QEA Project Manager, SAP Coordinator, and Field Lead on matters relating to health and safety; recommends appropriate personal protective equipment (PPE) and safety equipment; and maintains regular contact with the Anchor QEA Project Manager, SAP Coordinator, and Field Lead to evaluate conditions and new information that might require modifications to the HASP.

2.3.5 **QA/Data Validation Lead**
Delaney Peterson is the QA/Data Validation Lead and is responsible for managing data validation, which includes ensuring that data validation is conducted and documented according to the requirements of the QAPP (Appendix A) and interacting with the laboratories to resolve any issues.

2.4 **Field Management**
The field program will be implemented by a field team including a Field Lead.

2.4.1 **Field Lead**
Matt Wilson, RG, is the Field Lead and is responsible for supervising the field team staff and documenting proper sample collection protocols, sample collection, equipment decontamination, and chain of custody (COC). The Field Lead is also responsible for the initialization and accurate verification of field forms, COC records, sample labels, and other field-related documentation and for ensuring that field sampling activities are implemented in accordance with the approved plans (i.e., this Phase 2 SAP and its attached QAPP, HASP, and pertinent SOPs).

The Field Lead is responsible for ensuring that all personnel, including subcontractors, adhere to the HASP (Appendix B).

2.4.2 **Field Team Staff**
Field implementation of investigative activities will be conducted by experienced geologists, chemists, engineers, and environmental technicians. Their responsibilities will include the documentation of proper sample collection protocols, sample collection, equipment decontamination, and COC.
2.5 Subcontractors

Samples will be sent to Apex Laboratories, LLC, in Tigard, Oregon, and analyzed per the methods described in the QAPP (Appendix A). The Apex Laboratories project manager will be the primary point of contact with whom the QA/Data Validation Lead will communicate to resolve sampling, receipt, analysis, and storage issues.

Horizontal and vertical coordinates of any reference points or benchmarks established during this phase of work will be measured by a professional surveyor licensed in the State of Oregon.
3 Pre-Field Work Preparation Activities

The following activities will be performed to prepare for the field program:

- Site reconnaissance
- Procurement of subcontractors, materials, and equipment

Prior to commencing field activities, a site reconnaissance visit will be conducted by Anchor QEA staff to locate and confirm access to the proposed porewater and surface water sampling locations and surface water elevation data collection locations.

The Alcoa Project Manager will notify the EPA Project Manager at least 2 weeks prior to reconnaissance activities. The Anchor QEA Project Manager will coordinate with the Port of Portland and its Technical Consultant, Apex Companies, LLC, to obtain access to the area. Contact information for people who will receive notifications is provided in Table 2.

3.1 Subcontractor Procurement

As previously discussed in Section 2.5, field program tasks requiring subcontractors are limited to the analytical testing of water samples and the surveying of benchmarks or reference points at locations where surface water elevation data are collected.

All subcontractors will have experience with performing the specified work and current licenses, where appropriate. The laboratory subcontractor will be required to perform chemical and physical analyses of environmental samples collected during the field program. Laboratory qualifications are discussed in Section 5 of the QAPP (Appendix A).

The need for additional subcontractors may be identified during implementation of this supplemental sampling program. When necessary, these subcontractors will need to demonstrate that they have the equipment necessary to perform the required work, capacity to perform the required work, and appropriate licenses, if any, required to perform the work.
4 Porewater/Transition Zone Groundwater Sampling

Porewater/transition zone groundwater sampling will be conducted as part of this investigation. This section describes the background and objectives of porewater/transition zone groundwater sampling, the scope of work, procedures that will be followed to perform porewater/transition zone groundwater sampling, and the anticipated schedule.

4.1 Objectives

The objective for porewater/transition zone groundwater sampling is to measure fluoride concentration profiles at multiple depths and locations to support the evaluation of fluoride attenuation across the transition zone groundwater/surface water to the Columbia and Sandy rivers.

4.2 Summary of Work to be Performed

Porewater/transition zone groundwater samples will be collected along the Columbia and Sandy river shorelines at a total of six locations in the area where higher detections of fluoride occurred during Phase 1 sampling (Figure 4). Samples will be collected at 1-foot intervals within the transition zone groundwater/surface water from 6 inches to 6 feet below the sediment surface or refusal using the procedures detailed in SOP F.1: Porewater/Transition Zone Groundwater Sampling (Appendix C). Samples will be submitted for laboratory analysis according to the methods listed in Table 1 of the QAPP (Appendix A). Sample bottle and handling requirements and QA/QC requirements are provided in Tables 2 and 4 of the QAPP.

4.3 Procedures

Samples will be collected using a push-point sampling device with a screened or slotted interval 5 centimeters long. A water quality meter capable of measuring pH, temperature, dissolved oxygen, and specific conductance will be deployed to the bottom of the water body to evaluate the differences in water quality parameters between the surface water and the porewater and confirm that porewater/transition zone groundwater samples are not compromised by surface water entrainment. The push-point sampling device will be advanced in 1-foot intervals by manually pushing the device into the sediment or using a slide hammer to drive the device to the target depth. At each sampling depth interval, a peristaltic pump or clean syringe will be used to purge up to three times the sample tubing volume. The water quality parameters will be recorded for comparison to the surface water quality data.

After purging is complete, samples will be collected using the same method (syringe or peristaltic pump at the flow rate established during purging). Following sample collection, the push-point sampler will be advanced to the next 1-foot depth interval and the previously described procedures...
will be repeated until a sample from the 6-foot interval is collected or the push-point sampler can no longer be advanced into the sediment due to refusal.

The following SOPs apply to this activity and are included in Appendix C:

- SOP F.1: Porewater/Transition Zone Groundwater Sampling
- SOP F.2: Equipment Decontamination
- SOP F.3: Sample Custody
- SOP F.4: Sample Packaging and Shipping

4.4 Schedule

Porewater/transition zone groundwater sampling will be conducted following reconnaissance to confirm access to the proposed locations shown in Figure 4. Sampling will occur within 2 weeks of the semiannual groundwater monitoring event.
5 Surface Water Sampling

Surface water sampling will be conducted as part of this investigation. This section describes the background and objectives of surface water sampling, the scope of work, procedures that will be followed to perform surface water sampling, and an anticipated schedule.

5.1 Background and Objectives

The objectives of Phase 2 surface water sampling are to measure water quality parameters and time-integrated, surface water fluoride concentrations in the Columbia and Sandy rivers collocated with porewater/transition zone groundwater samples to establish the boundary conditions for transition zone attenuation modeling and document background fluoride concentrations upstream of the site in the Columbia and Sandy rivers.

5.2 Summary of Work to be Performed

Samples will be collected using passive NMDS devices at three nearshore locations in the Columbia River and three locations in the Sandy River. The six sampling locations are shown in Figure 4. The passive diffusive samplers will be deployed for 1 week to achieve equilibration (equilibration time was established during Phase 1 and is discussed in the Phase 1 Supplemental Sampling Data Report [Anchor QEA 2019a]). These data will provide a time-weighted average of fluoride concentrations in surface water along the shoreline of the site. Two surface water grab samples will also be collected upstream of the site in the Columbia and Sandy rivers.

Samples will be analyzed for the analytes shown in Table 1 via methods shown in Table 1 of the QAPP (Appendix A). Water samples will be transported to Apex Laboratories. Sample bottle and handling requirements and QA/QC requirements are provided in Tables 2 and 4 of the QAPP.

5.3 Procedures

Time-integrated surface water samples will be collected using passive samplers (i.e., sample containers filled with deionized water and capped with a nylon mesh). At each Columbia River and Sandy River surface water sampling location shown in Figure 4, two NMDS devices will be deployed approximately 12 inches above the river bottom. NMDS devices will be retrieved after a 1-week exposure time and submitted for analysis.

Grab surface water samples will also be collected using a weighted sampling tube connected to a peristaltic pump, lowered into the river water column (from the shoreline or from a boat), and suspended approximately 12 inches above the river bottom. It is anticipated that samples will be collected approximately 10 feet from the shoreline; actual sampling locations will be established during reconnaissance based on accessibility, health and safety considerations, and representativeness.
The following SOPs are applicable to this activity and are included in Appendix C:

- SOP F.2: Equipment Decontamination
- SOP F.3: Sample Custody
- SOP F.4: Sample Packaging and Shipping
- SOP F.5: Surface Water Sampling

5.4 Schedule

Surface water sampling will be conducted following reconnaissance to confirm access to the proposed surface water locations shown in Figure 4 and to coincide with porewater/transition zone groundwater sampling. NMDS samplers will be deployed for 1 week. Surface water grab samples will also be collected during retrieval of the NMDS samplers.
6 Surface Water Elevations

Surface water elevation data for the Sandy and Columbia rivers adjacent to the site will be collected as part of the Phase 2 supplemental sampling effort. This section describes the background and objectives of collecting surface water elevations adjacent to the site, the scope of work, procedures that will be followed to collect the data, and the anticipated schedule.

6.1 Background and Objectives

As discussed in Section 2.2 of the *Groundwater Flow and Reactive Transport Modeling Report*, surface water elevations in the Sandy and Columbia rivers are boundary conditions in the model (Anchor QEA 2019b). Currently, Columbia River elevations are estimated from data collected at the U.S. Geological Survey gauge located on the Interstate 5 bridge in Vancouver, Washington (approximately 14 miles downstream of the site), and semiannual manual surface water elevation measurements at the Knife River dock. Sandy River elevations are estimated based on the specified head for the Columbia River (11.90 feet North American Vertical Datum of 1988) and the hydraulic gradient for this reach in the regional deep aquifer yield (DAY) model (Leighton and Porcello 2001), which is approximately 0.002 foot per foot. Additional surface water elevation data adjacent to the site would allow refinement of the boundary conditions used in the model and support ongoing evaluations of the dynamic interaction between groundwater and surface water at the site.

6.2 Summary of Work to be Performed

Surface water elevations will be measured using transducers installed in stilling wells. Stilling wells are PVC or galvanized steel pipes with a perforated lower portion that is submerged in the river, allowing the water level in the well to rise or fall with the major fluctuation of the river. Pressure transducers are hung inside the stilling well. The top of the well is sealed for security. Stilling wells can be installed in vertical or angled configurations.

Feasible locations for stilling wells will be identified during reconnaissance. In each location, a State of Oregon-licensed surveyor will establish a benchmark. Transducers will be calibrated using the surveyed benchmark to convert pressures measured by the transducers to elevations. The stilling wells will be inspected on a monthly basis to confirm that the equipment is functioning as intended. Transducer data will be downloaded and processed each month.
6.3 Procedures

Feasible locations for stilling wells will be identified during reconnaissance. Considerations for locating the two stilling wells on the Sandy River are described as follows:

- The two stilling wells will be installed as far from each other as possible (e.g., at the upstream and downstream ends of the site's shoreline) to provide data to characterize the gradient along the shoreline.
- These stilling wells will likely be angled installations. As such, they must be secured to trees or structures (e.g., fence posts) on the top of the riverbank and extend at an angle toward and down into the water in locations where the transducer will remain submerged throughout the year. Aerial photographs and documentation from reconnaissance conducted prior to Phase 1 supplemental sampling (May 7, July 26, and August 3, 2018) will be used in conjunction with observations during Phase 2 reconnaissance to identify feasible locations.

A third vertical stilling well will be installed at the Knife River dock on the Columbia River.

Once the locations have been selected, a benchmark will be established in each location by a surveyor licensed in the State of Oregon. Transducers in angled stilling wells will be calibrated using the procedures detailed in SOP F.6: Surface Water Elevation Measurement to convert the measured pressures to elevations (Appendix C). Transducers in the vertical stilling well will be calibrated by measuring the depth to water in the stilling well from a surveyed reference point. Each month, data will be downloaded from the transducers, and stilling wells will be inspected to verify that the equipment has not been dislodged or damaged.

6.4 Schedule

Reconnaissance to identify feasible locations for stilling wells will be performed on the same day as the reconnaissance for the Phase 2 supplemental sampling locations. It is anticipated that installation of the stilling wells will take 2 days. Following installation, benchmarks or reference locations will be established by a surveyor. The schedule for surveying activities will depend on the surveyor’s availability. Surveying activities and transducer calibration are expected to take up to 2 days. Once the transducers are operational, data will be collected monthly for at least 12 months.
7 Quality Assurance/Quality Control

This section describes the field QA/QC procedures that will be followed during the implementation of the field program. Additional QA/QC procedures, including laboratory procedures, are detailed in the QAPP (Appendix A).

7.1 Field Quality Control Samples

Field QC samples will include field duplicates and extra sample volume for matrix spike/matrix spike duplicate (MS/MSD) analyses. Laboratory analysis of field duplicates will be used to evaluate the precision and accuracy of field sampling techniques. Field QC samples will be collected and analyzed as outlined in Table 4 of the QAPP (Appendix A).

Field duplicate samples will be co-collected with project samples. Field duplicate samples will be analyzed for all analytes at a rate of one per collection event. Extra sample volume for MS/MSD analyses will be collected at a rate of at least one MS/MSD sample per 20 samples (5%). MS/MSD analyses requests will be clearly marked on the COC form.

Field QC samples will be collected and labeled in the same manner as primary analytical samples (see Section 7). All field QC samples will be collected, handled, documented, preserved, packaged, and shipped using the same techniques as for all other samples.

The QC procedures for measuring direct-read parameters will include the initial calibration of the field instruments and checking the calibration to a reference standard as needed throughout the sampling period. Field personnel are responsible for proper calibration of field instruments throughout the program.
8 Documentation and Sample Management

This section describes how field data and documents will be archived and how samples will be named and handled. Laboratory documentation procedures are described in the QAPP (Appendix A).

8.1 Field Documentation

All documents generated during the field program 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 forms specific to the collection activity. Field forms will be maintained by the Field Lead. Sampling documentation will contain information on each sample collected and will include, at a minimum, the following information:

- Project name
- Field personnel on site
- Site visitors
- Weather conditions
- Field observations
- Sample collection date and time
- Sample collection method and description of activities
- Identification or serial numbers of instruments or equipment used
- Deviations from the QAPP (Appendix A)
- Meetings associated with field sampling activities

Entries for each day will begin on a new form. The person recording the information must record the date and time. 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 staff.

Field forms may be electronic or handwritten. If handwritten, they will be on water-resistant, durable paper. Notes will be made 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 or saved into Anchor QEA’s project file directory as convenient during the sampling event or upon completion of each sampling event. Data generated in the field will be checked for completeness and accuracy and entered in the project database.

8.2 Sample Management

This section describes how samples will be named and handled during the field program and addresses the sampling program requirements for sample nomenclature, field decontamination, IDW management, sample custody, and sample shipping requirements.
8.2.1 Sample Nomenclature
Sample nomenclature designs are described in the applicable sample collection SOPs located in Appendix C.

8.2.2 Decontamination Procedures
Sample containers, instruments, working surfaces, and other items that may come into contact with soil and water sample material must meet high standards of cleanliness. All equipment and instruments used that are in direct contact with the soil or water collected for chemical analysis must be made of glass, stainless steel, high density polyethylene, or polytetrafluoroethylene. The push-point sampling device will be decontaminated prior to going out into the field consistent with the procedure outlined in SOP F.2: Equipment Decontamination (Appendix C). The sampling device will be rinsed with distilled water between sampling locations and porewater purged through the sampler at each interval as described in SOP F.1: Porewater/Transition Zone Groundwater Sampling.

8.2.3 Sample Custody and Shipping Requirements
Samples are in one’s custody if they are in the custodian’s possession or view, in a secured location (under lock) with restricted access, or 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 all samples throughout the collection, handling, and analytical process. The principal document used to track possession and transfer of samples is the COC form. Each sample identifier will be listed on an electronic or handwritten COC form the day it is collected. All handwritten 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 shipment of samples to the analytical laboratory. Each person who has custody of the samples will ensure that the samples are not left unattended unless properly secured. Copies of all COC forms will be retained in the project files.

Each cooler or container with the samples for analysis will be hand-delivered the day of sample collection or couriered to the analytical laboratory. Ice may be kept in the bag it comes in and placed in the cooler if the samples will be couriered or hand-delivered. Individual samples will be placed in sealable plastic bags and transported in a sealed ice chest or other suitable container.
Upon transfer of sample possession to the analytical laboratory, the persons transferring custody of the sample container will sign the COC form. Upon receipt of samples at the laboratory, the person receiving the sample will sign the COC form. The shipping container seals will be broken (if applicable), and the receiver will 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.
9 Investigation-Derived Waste Management

All IDW will be handled and disposed of in accordance with the procedures described in this section. IDW will be classified as either liquid or solid waste. Solid waste consists of used PPE and other materials used in the handling, processing, and storage of porewater and surface water. Liquid waste consists of potable water used to rinse porewater/transition zone groundwater samplers.

9.1 Solid Waste
Solid waste will be placed into a garbage bag and disposed of with ordinary garbage.

9.2 Liquid Waste
Consistent with the *Groundwater Monitoring Work Plan* (Ash Creek 2010), liquid IDW will be transported to the FE/PWO treatment system building and incorporated into the flow of extracted groundwater at the sample sink.
10 Reporting

Results from Phase 2 supplemental sampling will be provided to EPA in a data summary report within 6 weeks of receiving the finalized data. Similar to the Phase 1 Supplemental Sampling Data Report (Anchor QEA 2019a), the Phase 2 Data Summary Report will document field activities, including site reconnaissance, porewater/transition zone groundwater, surface water sampling, and transducer installation and calibration. The Phase 2 Data Summary Report will document compliance with the requirements of the Phase 2 SAP and the QAPP (Appendix A), as well as any deviations that may occur. Data will be presented in tables and figures. The analytical laboratory report and surveyor’s report will be provided as attachments. Surface water elevation data for the 12-month monitoring period will be provided within 6 weeks of retrieving the data from the twelfth month of monitoring. Data collected during Phase 2 supplemental sampling and data collection will be used to inform ongoing modeling. Further discussion of the data is anticipated in technical reports associated with that effort.
11 References


Tables
<table>
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<tr>
<th>Type</th>
<th>Location(s)</th>
<th>Objectives(s) and Rationale</th>
<th>Number of Samples/ Method</th>
<th>Analytes</th>
<th>Comments</th>
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<tbody>
<tr>
<td>Porewater/Groundwater Quality Data in the Transition Zone</td>
<td>Columbia River and Sandy River</td>
<td><strong>Objective</strong> • Measure fluoride concentrations and water quality parameters at multiple depths and locations across the porewater and groundwater/surface water transition zone to the Columbia and Sandy rivers to support evaluation of fluoride attenuation. <strong>Rationale</strong> • The results of Phase 1 supplemental sampling, modeling, and additional data collected by EPA in 2018 indicated that processes occurring within the groundwater transition zone immediately beneath the sediment-water interface (before groundwater discharges to surface water) provided an additional opportunity for attenuation of fluoride. As shown in Figure 3a, transition-zone groundwater fluoride concentrations measured in several locations were an order of magnitude higher than concentrations in nearby surface water samples (e.g., PW-01, PW-23, PW-06). Additional depth-discrete porewater/transition zone groundwater data are needed to evaluate fluoride attenuation in the transition zone.</td>
<td>24 to 36 grab samples (six locations, four to six depth-discrete samples in each)</td>
<td>Field parameters (pH, temperature, specific conductivity, dissolved oxygen, oxidation/reduction potential, and turbidity)</td>
<td>Fluoride • Porewater/groundwater transition zone samples will be collected from multiple depths using a push-point sampling device.</td>
</tr>
<tr>
<td>Surface Water Quality Data</td>
<td>Columbia River and Sandy River</td>
<td><strong>Objectives</strong> • Measure time-integrated, surface water fluoride concentrations and water quality parameters in the Columbia and Sandy rivers collocated with porewater/groundwater transition zone profiles. • Collect fluoride data upstream of the site in the Columbia and Sandy rivers. <strong>Rationale</strong> • Surface water concentrations are needed to establish the boundary conditions for transition zone attenuation modeling and to confirm background surface water fluoride concentrations in the Columbia and Sandy rivers.</td>
<td>Six NMDS samples (collocated with porewater/transition zone groundwater sampling locations)</td>
<td>Field parameters (pH, temperature, specific conductivity, dissolved oxygen, oxidation/reduction potential, and turbidity)</td>
<td>Fluoride • Passive NMDS devices will be deployed approximately 12 inches above the riverbed. NMDS devices will be retrieved after an equilibration time of 1 week.</td>
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<tr>
<td>Surface Water Elevation Data</td>
<td>Columbia River and Sandy River</td>
<td><strong>Objectives</strong> • Collect surface water elevation data in the Columbia and Sandy rivers adjacent to the site. <strong>Rationale</strong> • Additional surface water elevation data adjacent to the site are needed to verify the boundary conditions used in the model and support ongoing evaluations of the dynamic interaction between groundwater and surface water.</td>
<td>Two transducers in the Sandy River, one in the Columbia river</td>
<td>Not applicable</td>
<td>If feasible, transducers on the Sandy River will be installed on the upstream and downstream ends of the site's shoreline in locations where the transducer will remain submerged throughout the year. Feasible locations will be identified during Phase 2 reconnaissance.</td>
</tr>
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Notes:
1. Sampling locations are shown in Figure 4.
EPA: U.S. Environmental Protection Agency
NMDS: non-metric multidimensional scaling
Table 2
Required Notifications

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<tr>
<th>Name</th>
<th>Role</th>
<th>Email</th>
<th>Phone Number</th>
</tr>
</thead>
<tbody>
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</tr>
<tr>
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</tr>
</tbody>
</table>

Notes:
DEQ: Oregon Department of Environmental Quality
EPA: U.S. Environmental Protection Agency
SAP: Sampling and Analysis Plan
Figures
Figure 1
Site Location
Phase 2 – Supplemental Sampling and Analysis Plan
Reynolds Superfund Site
NOTES:
1. Boundaries are shown in the 2006 Record of Decision.
NOTES:
1. AQ: Anchor QEA, LLC
2. bgs: below ground surface
3. EPA: U.S. Environmental Protection Agency
4. mg/L: milligrams per liter
5. U: not detected above method detection limit
6. In a subset of porewater/groundwater sampling locations, surface water samples were also collected. For those locations, the surface water concentration is shown as underlined text.
7. (Maximum Groundwater Fluoride Concentration [mg/L], Depth of Maximum Groundwater Concentration [feet bgs])
Fluoride Concentration (mg/L)
- EPA Porewater/Groundwater and Surface Water Samples
- EPA Porewater/Groundwater Sample

Outfall
Flood Control Dike
Site Boundary

NOTES:
1. EPA: U.S. Environmental Protection Agency
2. mg/L: milligrams per liter

Figure 3b
Fluoride Sample Results - Spring 2018
Phase 2 – Supplemental Sampling and Analysis Plan
Reynolds Superfund Site
NOTES:
1. AQ: Anchor QEA, LLC
2. bgs: below ground surface
3. mg/L: milligrams per liter
4. NMDS: non-metric multidimensional scaling
5. U: not detected above method detection limit
6. In a subset of porewater/groundwater sampling locations, surface water samples were also collected. For those locations, the surface water concentration is shown as underlined text.
7. Maximum Groundwater Fluoride Concentration (mg/L), Depth of Maximum Groundwater Concentration (feet bgs)
Figure 5
Project Organization
Phase 2 – Supplemental Sampling and Analysis Plan
Reynolds Superfund Site
Appendix A

Quality Assurance Project Plan
January 2020
Reynolds Metals Company Superfund Site

Quality Assurance Project Plan

Prepared for Alcoa, Inc.
January 2020
Reynolds Metals Company Superfund Site

Quality Assurance Project Plan

Prepared for
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Troutdale, Oregon 97060

Prepared by
Anchor QEA, LLC
6720 SW Macadam Avenue, Suite 125
Portland, Oregon 97219
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**ABBREVIATIONS**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>ASTM</td>
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<tr>
<td>CCV</td>
<td>continuing calibration verification</td>
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<td>DQO</td>
<td>data quality objective</td>
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<td>EPA</td>
<td>U.S. Environmental Protection Agency</td>
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<td>HAZWOPER</td>
<td>Hazardous Waste Operations and Emergency Response</td>
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<td>MD</td>
<td>matrix duplicate</td>
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<td>MDL</td>
<td>method detection limit</td>
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<td>matrix spike duplicate</td>
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<tr>
<td>NIST</td>
<td>National Institute of Standards and Technology</td>
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<tr>
<td>OSHA</td>
<td>Occupational Safety and Health Act</td>
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<td>Quality Assurance Project Plan</td>
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<td>QC</td>
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<td>RL</td>
<td>reporting limit</td>
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<td>RPD</td>
<td>relative percent difference</td>
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<td>SAP</td>
<td>Sampling and Analysis Plan</td>
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<tr>
<td>SDG</td>
<td>sample delivery group</td>
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<td>site</td>
<td>Reynolds Metals Company Superfund Site</td>
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<tr>
<td>SOP</td>
<td>standard operating procedures</td>
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1 Introduction and Background

This Quality Assurance Project Plan (QAPP) outlines the quality assurance and quality control (QA/QC) procedures associated with the Reynolds Metals Company Superfund Site (site) property for the collection of groundwater, soil, and surface water samples. This QAPP was prepared in conjunction with the Phase 2 – Supplemental Sampling and Analysis Plan (SAP; Anchor QEA 2020). Sample collection activities and field QA/QC procedures are described in the Phase 2 SAP.

The site property was a former aluminum smelter operated by Reynolds Metals Company (a wholly owned subsidiary of Alcoa, Inc.) that underwent demolition between 2003 and 2006. Groundwater underlying the site property is being remediated per a Record of Decision issued by the U.S. Environmental Protection Agency (EPA) in September 2006. Additional project and background information is included in the Phase 1 SAP (Anchor QEA 2017).
2  Data Quality Objectives and Criteria

The data quality objectives (DQOs) for this project will ensure that data collected are of known and acceptable quality so that the project objectives described in this QAPP are achieved. The quality of laboratory data is assessed by precision, accuracy, representativeness, comparability, completeness, and sensitivity (the “PARCCS” parameters). Definitions of these parameters and the applicable QC procedures are described in the following subsections. Applicable quantitative goals for these data quality parameters are listed or referenced in Table 1.

2.1  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 sampling, sample handling, and laboratory analyses. ASTM International (ASTM) recognizes the following two levels of precision (ASTM 2002):

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
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

In the laboratory, “within-batch” precision is measured using duplicate sample or QC analyses and is expressed as the relative percent difference (RPD) between the measurements. The “batch-to-batch” precision is determined from the variance observed in the analyses of standard solutions or laboratory control samples from multiple analytical batches.

Field precision will be evaluated by collecting field duplicates for chemistry samples at a frequency of 1 in 20 samples. Field chemistry duplicate precision will be screened against an RPD of 35% for water samples and 50% for soil samples. However, data may not be qualified based solely on field homogenization duplicate precision but will be left to the discretion of the validator. Laboratory precision control limits are listed in Table 1 for each analysis. The RPD equation used to express precision is shown in Equation 1.
Precision measurements can be affected by the nearness of a chemical concentration to the reporting limit (RL), where the percent error (expressed as RPD) increases. Parent and/or field duplicate results that are less than five times the RL will be evaluated by using the difference between the results using a control limit of plus or minus two times the RL.

2.2 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 value of results from analyses of laboratory control samples, standard reference materials, and standard solutions. In addition, matrix-spiked (MS) samples are also measured, which indicate the accuracy or bias in the actual sample matrix. Accuracy is expressed as percent recovery of the measured value, relative to the true or expected value. If a measurement process produces results that are not the true or expected values, the process is said to be biased. Bias is the systematic error either inherent in a method of analysis (e.g., extraction efficiencies) or caused by an artifact of the measurement system (e.g., contamination). Analytical laboratories use several QC measures to eliminate analytical bias, including systematic analysis 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 using quantitative laboratory control sample, MS, and standard reference material recoveries compared with method-specified performance criteria or criteria listed in Table 1. Accuracy can be expressed as a concentration compared to the true or reference value, or as a percent recovery in those analyses where reference materials are not available and spiked samples are analyzed. The equation used to express accuracy is shown in Equation 2.
Field accuracy will be controlled by adhering to sample collection procedures outlined in the Phase 2 SAP (Anchor QEA 2020).

2.3 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent an environmental condition. Sample collection and handling procedures described in the Phase 2 SAP (Anchor QEA 2020) will be followed to ensure samples represent field conditions.

2.4 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 by using standard analytical methodologies and reporting formats and through common traceable calibration standards and reference materials.

2.5 Completeness

Completeness is a measure of the amount of data determined to be valid in proportion to the amount of data collected. Completeness will be calculated as shown in Equation 3.
The DQO for completeness for all components of this project is 95%. Data are qualified as estimated because QC criteria are not met will be considered valid for the purposes of assessing completeness. Data that are rejected will not be considered valid for the purposes of assessing completeness.

2.6 Sensitivity

Sensitivity is a measure of analytical detection and reporting limits (RLs). In general, the lowest method detection limits (MDLs) and RLs achievable by the specified method will be targeted for this project.

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. Laboratory RLs are defined as the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. Laboratory MDLs and RLs will be used to evaluate the method sensitivity and applicability prior to the acceptance of a method for this program. Method blanks will be analyzed to ensure target analytes are not introduced during sample preparation or analysis that would affect the analytical sensitivities.

The sample-specific MDLs and RLs will be reported by the laboratory and will account for any factors relating to the sample analysis that might decrease or increase these limits (e.g., dilution factor, percent moisture, and analytical mass/volume). If MDLs and RLs are elevated due to matrix interferences and subsequent dilutions or reductions in sample aliquots, then data will be evaluated by Anchor QEA, LLC, and the laboratory to determine if an alternative course of action is required or possible. The sample-specific MDLs and RLs will be the values provided in the data transmittal.
3 Special Training and Certification

For sample collection tasks, it is important that field crews are trained in standardized data collection requirements so data are collected consistently among field crews. Field crews will comprise individuals who are fully trained in the collection and processing of groundwater, soil, and surface water samples; decontamination protocols; and chain-of-custody procedures.

In addition, the 29 Code of Federal Regulations 1910.120 Occupational Safety and Health Act (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. All field 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 OSHA regulations.
4 Documentation and Records

This project will require central project files to be maintained by Anchor QEA. Project records will be stored and maintained in a secure manner. Each project team member is responsible for filing all 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 offices or at a document storage facility throughout the duration of the project, and all electronic data will be maintained in a database or in a designated directory at Anchor QEA offices. Field documentation procedures are described in the Phase 2 SAP (Anchor QEA 2020).

4.1 Analytical Records

The laboratory will retain analytical data records. Additionally, Anchor QEA will retain a copy of analytical data in the central project files. Data reporting requirements will include those items necessary to complete data validation. Elements to be reported in the laboratory data packages are listed in Section 6.3.6.

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

4.2 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 data. Data reduction requires that all aspects of sample preparation that could affect the test result, such as sample mass or volume analyzed, sample moisture content, and/or dilutions required, be considered in the final result. It is the laboratory analyst’s responsibility to reduce data, which are subject to further review by the Laboratory Project Manager, Anchor QEA Project Manager, QA/Data Validation Lead, and independent reviewers. Data reduction may be performed manually or electronically.
5 Analytical Methods

This section summarizes the target physical and chemical analyses that will be conducted on the samples collected. Sample analyses will be conducted in accordance with EPA-approved methods, other commonly acceptable methods, or as described in the laboratory standard operating procedures (SOPs), as well as this QAPP. Prior to analyses, all samples will be maintained according to the appropriate holding times and temperatures for each analysis as listed in Table 2. Analytes, analytical methods, and target detection limits for chemical and physical testing are presented in Table 3. The laboratories will prepare reports in accordance with this QAPP.

Prior to the analyses of the samples, the laboratories will calculate MDLs and establish RLs for each analyte of interest, where applicable. RLs will be at or below the values specified in Table 3, if technically feasible.

Physical and chemical testing will be conducted at Apex Laboratories, LLC, in Tigard, Oregon. Apex Laboratories is accredited under the National Environmental Laboratories Accreditation Program. All physical and chemical testing will adhere to the most recent EPA QA/QC procedures outlined in the approved analytical methods, the laboratory SOPs, and this QAPP. If more current analytical methods are available, the laboratories may use them.

In completing chemical analyses for this project, the laboratory subcontractors are expected to meet the following minimum requirements:

- Adhere to the methods outlined in this QAPP, including methods referenced for each analytical procedure (Table 3).
- Deliver electronic data as specified.
- Meet reporting requirements for deliverables.
- Meet turnaround times for deliverables.
- Implement QA/QC procedures discussed in this QAPP, including following DQOs, laboratory QC requirements, and performance evaluation testing requirements.
- Notify the project QA/Data Validation Lead of any QAPP QA/QC problems when they are identified to allow for quick resolution.
- Allow laboratory and data audits to be performed, if deemed necessary.
6 Quality Assurance and Quality Control

Field and laboratory activities will 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 EPA SW-846 (EPA 1986), the EPA Contract Laboratory Program (EPA 2017), the laboratory SOPs, and the cited methods.

6.1 Field Quality Control

Field team staff will identify and label samples in a consistent manner to ensure that field samples are traceable. Labels should be used in conjunction with the chain-of-custody form, the Phase 2 SAP (Anchor QEA 2020), and this QAPP to provide all information necessary for the laboratory to conduct required analyses properly. QC samples will be collected in the field to ensure project DQOs are met. Samples will be placed in appropriate containers and preserved for shipment to the laboratory in accordance with the requirements presented in Table 2.

6.2 Field Quality Assurance Sampling

Field QA procedures will consist of following procedures for acceptable practices for sample collection and handling as well as periodic and routine equipment inspection.

Field QC samples will be collected along with the environmental samples. Field QC samples are useful in identifying possible problems resulting from sample collection or sample processing in the field. The collection of field QC samples includes equipment rinsate blanks and field duplicates as specified in Table 4. Rinsate blanks will be collected at a frequency of one per collection method per event, analyzed for total and dissolved metals, and results will be evaluated during data validation. Field duplicates will be collected at a frequency of one per sampling event per matrix, provided sufficient sample volume or mass can be collected.

Field QC samples will also include the collection of additional sample mass or volume as required to ensure that the laboratory has sufficient sample mass or volume to run the matrix-specified analytical QA/QC (matrix duplicate [MD]/MS) samples for analyses as specified in Table 4. Additional samples to meet this requirement will be collected at a frequency of one per matrix per sampling event or 1 per matrix per 20 samples collected, whichever is more frequent. The samples designated for MD/MS analyses should be clearly marked on the chain-of-custody form.

All field QC samples will be documented on the field forms and verified by the QA/Data Validation Lead.
6.2.1 Sample Containers
Sample containers and preservatives will be provided by the laboratory. The laboratory will maintain documentation certifying the cleanliness of bottles and the purity of preservatives provided. Container requirements are listed in Table 2.

6.2.2 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)
- Analysis to be performed

6.3 Laboratory Quality Control
Laboratory QC procedures, where applicable, include initial and continuing instrument calibrations, standard reference materials, laboratory control samples, matrix replicates, MS samples, and method blanks. A summary of the DQOs is provided in Table 1. QA/QC sample analytical frequencies are provided in Table 4.

The analyst will review the results of the QC samples from each sample group 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 sample group, the QA/Data Validation Lead will be contacted immediately, and corrective action (e.g., method modifications followed by reprocessing the affected samples) will be initiated prior to processing a subsequent group of samples.

6.3.1 Laboratory Instrument Calibration and Frequency
An initial calibration will be performed on each laboratory instrument to be used prior to the start of the project, after each major interruption to the analytical instrument, and when any ongoing calibration does not meet method control criteria. An initial calibration verification will be analyzed following each initial calibration and will meet method criteria prior to analyses of samples. Continuing calibration verifications (CCV) will be analyzed at method-required frequencies to track instrument performance. CCVs will be analyzed at a frequency of 1 for every 10 field samples analyzed and at the end of each run. If the continuing calibration is out of control, the analysis will be terminated until the source of the control failure is eliminated or reduced to meet control
specifications, which may include analyzing a new initial calibration. Any project samples analyzed while the 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 immediately following continuing calibration verification at the instrument for each type of applicable analysis.

6.3.2 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.

6.3.3 Matrix Spikes
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.

6.3.4 Method Blanks
Method blanks are prepared and analyzed in the same manner as project samples to assess possible laboratory contamination at all stages of sample preparation and analysis. The method blank for all analyses must be less than the method reporting limit of any single target analyte. If a laboratory method blank exceeds this criterion for any analyte, and the concentration of the analyte in any of the samples is less than five times the concentration found in the blank, analyses must stop and the source of contamination must be eliminated or reduced. Affected samples should be re-prepared and reanalyzed, if possible.

6.3.5 Laboratory Control Samples
Laboratory control samples are analyzed to assess possible laboratory bias at all 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, MD, MS, and method blank. 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.
6.3.6 Laboratory Deliverables

Data packages will be checked for completeness immediately upon receipt from the laboratory to ensure that data and QA/QC information requested are present. The analytical laboratory will be required, where applicable, to report the following:

- **Project Narrative.** This summary, in the form of a cover letter, will include a discussion of any problems encountered during analyses. This summary should include (but not be limited to) QA/QC, sample receipt, sample storage, and analytical difficulties. Any problems encountered and their resolutions will be documented in as much detail as appropriate.

- **Chain-of-Custody Records.** Legible copies of the chain-of-custody forms will be provided as part of the data package. This documentation will include the time of receipt and condition of the samples received by the laboratory. Additional internal tracking of sample custody by the 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 preparation/extraction
  - Date and time of analysis
  - Mass or volume used for preparation and analysis
  - Final dilution or concentration factors for the sample
  - Identification of the instrument used for analysis
  - MDLs and method RLs 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 will contain 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 are as follows (additional information may be requested):
  - **Method Blank Analysis.** The method blank analysis associated with each sample and the concentration of all target analytes identified in these blanks will be reported.
  - **MS Recovery.** MS recovery data for all applicable analyses will be reported. The names and concentrations of analytes added, percent recoveries, and range of acceptable recoveries will be listed. The percent recoveries and RPD values for matrix spike duplicate (MSD) analyses will be reported.
  - **MDs.** The RPD values for MD analyses will be reported.
Laboratory Control Sample. Laboratory control sample recovery data will be reported. The names and concentrations of analytes added, percent recoveries, and range of acceptable recoveries will be included. The percent recoveries and RPD values for laboratory control sample duplicate analyses will be included.

• Electronic Data Deliverable. An electronic data deliverable in the Anchor QEA custom EQuIS format specified in advance will be prepared.

6.4 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

This section describes procedures for testing, inspection, and maintenance of field and laboratory equipment.

6.4.1 Field Instruments/Equipment

In accordance with the QA program, Anchor QEA will maintain an inventory of field instruments and equipment. The frequency and types of maintenance will be based on the manufacturer’s recommendations and previous experience with the equipment.

The Field Lead will be responsible for the preparation, documentation, and implementation of the preventive 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 calibration and frequency of equipment calibration is provided in each specific manufacturer’s instruction manual.

All maintenance records will be verified prior to each sampling event. The Field Lead will be responsible for verifying that required maintenance has been performed prior to using the equipment in the field. Any problems will be noted in the field logbook and corrected prior to continuing sampling operations.

6.4.2 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/or previous experience with the equipment.

The laboratory preventative maintenance program, as detailed in the laboratory’s QA Plan, 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 gives
suspect results or has been overloaded, mishandled, or 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 or turnaround 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 laboratory personnel. The Laboratory Project Manager or designee shall be responsible for verifying compliance.

6.4.2.1 Laboratory Instrument/Equipment Calibration
As part of their QC program, laboratories perform two types of calibrations. A periodic calibration is performed at prescribed intervals (e.g., 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’s QA Plan. Calibrations are discussed in the laboratory SOPs for analyses.

The Laboratory QA/QC Manager will be responsible for ensuring that the laboratory instrumentation is calibrated in accordance with specifications. Implementation of the calibration program will be the responsibility of the respective laboratory group supervisors. Recognized procedures (EPA, ASTM, or manufacturer’s instructions) will be used when available.

Physical standards (i.e., weights or certified thermometers) will be traceable to nationally recognized standards such as the National Institute of Standards and Technology (NIST). Chemical reference standards will be NIST standard reference materials or vendor-certified materials traceable to these standards.

The calibration requirements for each method and respective corrective actions will be accessible, either in the laboratory SOPs or in the laboratory’s QA Plan for each instrument or analytical method in use. All calibrations will be preserved on electronic media.

6.5 Inspection/Acceptance of Supplies and Consumables
Inspection and acceptance of field supplies, including laboratory-prepared sampling bottles, will be performed by the Field Lead. All primary chemical standards and standard solutions used for this project, either in the field or laboratory, 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.
6.6 Data Management

Field data sheets will be checked for completeness and accuracy by the Field Lead prior to delivery to the QA/Data Validation Lead and SAP Coordinator. Data generated in the field will be documented on electronic or hard copy. Manually entered data will be verified by a second party. Field documentation will be filed in the main project folder after data entry and verification are complete.

Laboratory data will be provided to the QA/Data Validation Lead in the EQuIS electronic format. Laboratory data that is electronically provided and loaded into a 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 all manually entered data will be verified. Data tables and reports will be exported from EQuIS to Microsoft Excel tables.
7 Assessments and Response Actions

Once data are received from the laboratory, several 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.

7.1 Compliance Assessments

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, all laboratory audit reports will be made available to the project QA/Data Validation Lead upon request. The laboratory is required to have written procedures addressing internal QA/QC. These procedures have been submitted and the project QA/Data Validation Lead will review them to ensure compliance with this QAPP. The laboratory must ensure that personnel engaged in analytical tasks have appropriate training. The laboratory will provide written details of any and all method modifications planned prior to project commencement.

7.2 Response and Corrective Actions

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 of protocols identified in this document.

7.2.1 Field Activities

The Field Lead will be responsible for correcting equipment malfunctions during the field sampling effort. The project QA/Data Validation Lead will be responsible for resolving situations identified by the Field Lead that may result in non-compliance with this QAPP. All corrective measures will be immediately documented in the field logbook.

7.2.2 Laboratory

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 QAPP. All laboratory personnel will be responsible for reporting problems that may compromise the quality of the data.

The Laboratory Project Manager will be notified immediately if any QC sample exceeds the project-specified control limits and corrective action does not improve the result. The analyst will identify and correct the anomaly before continuing with the sample analysis. If the laboratory internal corrective action does not resolve the non-conformance, the Laboratory Project Manager will notify the QA/Data Validation Lead. 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 in the form of a cover letter.

7.3 Reports to Management

QA reports to management include verbal status reports, data validation reports, and final project reports. These reports shall be the responsibility of the QA/Data Validation Lead.
8 Data Validation, Usability, and Reporting

This section describes the processes that will be used to review project data quality.

8.1 Data Review, Validation, and Verification

During the validation process, analytical data will be evaluated for project, 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.

8.2 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 Field Lead and Laboratory Project Managers; review by the QA/Data Validation Lead for outliers and omissions; and the use of QC criteria to accept or reject specific data. If errors are found, further verification will be performed to ensure that all data are accurate. Any errors found will be corrected, and the laboratory will be notified of the errors.

All 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 QA/Data Validation Lead will be responsible for the final review of 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 generation of data. 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.

The analysts or laboratory department manager will prepare a preliminary QC checklist for each parameter and for each sample delivery group (SDG) as soon as analysis of an SDG has been completed. Any deviations from the DQOs listed on the checklist will be brought to the attention of the Laboratory Manager to determine whether corrective action is needed and to determine the impact on the reporting schedule.

Data packages will be checked for completeness immediately upon receipt from the laboratory to ensure that data and QA/QC information requested are present. Stage 2A validations (EPA 2009) will be conducted on all data packages. Data validation will be conducted by a reviewer using current National Functional Guidelines data validation requirements (EPA 2017) by considering the following information, as applicable:

- Chain-of-custody documentation and sample receipt condition
- Holding times
- Method blanks
- Detection limits
- Reporting limits
- Laboratory control samples
- MS/MSD samples
- Field and laboratory duplicates
- Rinsate blanks
- Standard reference material results

The data will be validated in accordance with the project-specific DQOs described previously, analytical method criteria, and the laboratory’s internal performance standards based on their SOPs.

### 8.3 Reconciliation with User Requirements

The QA/Data Validation Lead will review data after each survey to determine if DQOs have been met. If data do not meet the project's specifications, the QA/Data Validation Lead will review the errors and determine if the problem is due to calibration, maintenance, sampling techniques, or other factors and will suggest corrective action. Retraining, revision of techniques, or replacement of supplies/equipment should correct the problem; if not, the DQOs will be reviewed for feasibility. If specific DQOs are not achievable, the QA/Data Validation Lead will recommend appropriate modifications.

### 8.4 Data Reporting

Following data validation, Anchor QEA will prepare the reporting materials described in the following sections.

#### 8.4.1 Data Summary Report

Anchor QEA will prepare a data transmittal and data report. The report will reference the Phase 2 SAP (Anchor QEA 2020) and this QAPP and document any deviations from them. The following will be included in the data transmittal and report:

- Sample location coordinates. All geographical coordinates submitted will be in Oregon State Plane North, North American Datum of 1983, U.S. feet
- Chemical and physical results data tables
- Copies of complete laboratory data packages as appendices or attachments
- Copies of applicable sections of the field logs as appendices or attachments
- Copies of validation reports and findings

The data transmittal report will be accompanied by an electronic data deliverable.
9 References


Tables
Table 1
Quantitative Goals for Analytical Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Replicate and MS/MSD Precision</th>
<th>LCS and MS/MSD Accuracy</th>
<th>Completeness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Parameters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Parameters</td>
<td>± 20% RPD</td>
<td>N/A</td>
<td>95%</td>
</tr>
<tr>
<td>Fluoride</td>
<td>± 20% RPD</td>
<td>80% to 120% R</td>
<td>95%</td>
</tr>
</tbody>
</table>

Notes:
- LCS: laboratory control sample
- MS/MSD: matrix spike/matrix spike duplicate
- N/A: not applicable
- R: recovery
- RPD: relative percent difference
# Table 2
## Guidelines for Sample Handling and Storage

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sample Size</th>
<th>Container Size and Type</th>
<th>Holding Time</th>
<th>Preservative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Parameters</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluoride</td>
<td>50 mL</td>
<td>500-mL HDPE</td>
<td>28 days</td>
<td>Cool/4°C</td>
</tr>
</tbody>
</table>

Notes:
1. Container sizes may vary depending on laboratory requirements.
2. HDPE: high-density polyethylene
3. mL: milliliter
### Table 3
Parameters for Analysis, Methods, and Target Quantitation Limits

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Method</th>
<th>Laboratory Reporting Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Geochemical – Field Parameters</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature (°C)</td>
<td>Multimeter</td>
<td>N/A</td>
</tr>
<tr>
<td>pH (SU)</td>
<td>Multimeter</td>
<td>N/A</td>
</tr>
<tr>
<td>Dissolved oxygen (mg/L)</td>
<td>Multimeter</td>
<td>N/A</td>
</tr>
<tr>
<td>Oxidation Reduction Potential (mV)</td>
<td>Multimeter</td>
<td>N/A</td>
</tr>
<tr>
<td>Turbidity (NTU)</td>
<td>Multimeter</td>
<td>N/A</td>
</tr>
<tr>
<td>Conductivity (µS/cm)</td>
<td>Multimeter</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Geochemical – Conventionals (mg/L)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluoride</td>
<td>SM4500-F-C</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Notes:
- µS/cm: microSiemens per centimeter
- mg/L: milligrams per liter
- mV: millivolts
- N/A: not applicable
- NTU: Nephelometric Turbidity Unit
- SM: standard method
- SU: Standard Unit
### Table 4
Laboratory Quality Assurance/Quality Control Criteria

<table>
<thead>
<tr>
<th>Analysis Type</th>
<th>Field Quality Assurance Samples</th>
<th>Laboratory Quality Control Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rinsate Blank</td>
<td>Field Duplicates</td>
</tr>
<tr>
<td>Fluoride</td>
<td>N/A</td>
<td>1 per event</td>
</tr>
</tbody>
</table>

Notes:
1. A matrix spike duplicate or lab control sample duplicate may be used to assess precision in place of the replicate.

LCS: laboratory control sample

N/A: not applicable
Appendix B
Health and Safety Plan
Health and Safety Plan
2020 Supplemental Sampling

Prepared for Alcoa, Inc.
January 2020
Reynolds Metals Company Superfund Site

Health and Safety Plan
2020 Supplemental Sampling

Prepared for
Alcoa, Inc.
2460 NW Sundial Road
Troutdale, Oregon 97060

Prepared by
Anchor QEA, LLC
6720 SW Macadam Avenue, Suite 125
Portland, Oregon 97219
The information in this Health and Safety Plan has been designed for the 2017 Supplemental Sampling presently contemplated by Anchor QEA, LLC (Anchor QEA). 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 Health and Safety Plan for all conditions encountered.
Health and Safety Plan Acknowledgement Form

Project Number: 150002-01.01
Project Name: 2020 Supplemental Sampling – Reynolds Metals Company Superfund Site

My signature below certifies that I have read and understand the policies and procedures specified in this Health and Safety Plan (HASP). For non-Anchor QEA employees, this HASP may include company-specific appendices to this plan developed by entities other than Anchor QEA. Non-affiliated personnel may be required to sign the Liability Waiver following this Acknowledgement Form.

<table>
<thead>
<tr>
<th>Date</th>
<th>Name (print)</th>
<th>Signature</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>
Site Emergency Procedures

Site Map

Figure A
Site Location Overview

Emergency Contact Information

Table A
Site Emergency Form and Emergency Phone Numbers*

<table>
<thead>
<tr>
<th>Category</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible Chemicals of Concern</td>
<td>Fluoride and cyanide</td>
</tr>
<tr>
<td>Minimum Level of Protection</td>
<td>Level D</td>
</tr>
<tr>
<td>Site(s) Location Address</td>
<td>2460 N.W. Sundial Road, Troutdale, OR 97060</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Emergency Phone Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambulance</td>
</tr>
<tr>
<td>Fire</td>
</tr>
<tr>
<td>Police</td>
</tr>
</tbody>
</table>
**Health and Safety Plan**

**January 2020**

### Category | Information
---|---
Poison Control | (800) 222-1222
Client Contact | Michele Maidman  
Office: (843)-296-4619
Project Manager (PM) | Halah Voges  
Office: (206)-287-9130  
Cell: (206)-462-9572
Field Lead (FL) | Matt Wilson  
Office: (503)-972-5017  
Cell: (503)-347-8511
Corporate Health and Safety Manager (CHSM) | David Templeton  
Office: (206) 287-9130  
Cell: (206) 910-4279
State Emergency Response System | NA
EPA Emergency Response Team,¹ Region 10 | (800) 424-8802

**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](http://www2.epa.gov/emergency-response/emergency-response-my-community). The National Response Center hotline is 1-800-424-8802.

---

## Table B

**Hospital Information**

<table>
<thead>
<tr>
<th>Category</th>
<th>Information</th>
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</thead>
<tbody>
<tr>
<td>Hospital Name</td>
<td>Legacy Mt. Hood Medical Center</td>
</tr>
<tr>
<td>Address</td>
<td>24800 Southeast Stark Street</td>
</tr>
<tr>
<td>City, State</td>
<td>Gresham, Oregon 97030</td>
</tr>
<tr>
<td>Phone</td>
<td>(503)-674-1122</td>
</tr>
<tr>
<td>Emergency Phone</td>
<td>911</td>
</tr>
</tbody>
</table>

### Hospital Route Map and Driving Directions

1. **Start**: NW Sundial Road, Troutdale, Oregon 97060.
2. Head south on NW Sundial Road toward NW Rogers Circle (0.8 mile).
3. Turn left onto NW Marine Drive (1.1 miles).
4. Use any lane to turn left onto NW Frontage Road (0.4 mile).
5. Keep right to continue toward Graham Road (302 feet).
6. Continue onto Graham Road (0.2 mile).
7. Continue onto SW 257th Avenue (1.7 miles).
8. Turn right onto SE Stark Street.
9. **Directions End**: Legacy Mount Hood Medical Center, 24800 Southeast Stark Street, Gresham, Oregon 97030.
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 Health and Safety Plan (HASP) for a description of the role and responsibility of each.

Client Contact: Michele Maidman
Office: (843)-296-4619

Project Manager (PM): Halah Voges
Office: (206)-287-9130
Cell: (206)-462-9572

Field Lead (FL): Matt Wilson
Office: (503)-972-5017
Cell: (503)-347-8511

Corporate Health and Safety Manager (CHSM): David Templeton
Office: (206) 287-9130
Cell: (206) 910-4279

Emergency 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 ensure 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. Ensure 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. Notify the Project Manager (PM), Field Lead (FL), and owner.
7. Complete the appropriate incident investigation reports.
8. In the event that evacuation is required, the FL must perform a head count to verify that all Anchor QEA personnel are accounted for.

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 training in first aid or CPR.
Figure C
Incident Flowchart

Health and Safety: Incident Flowchart—What To Do If You Are Injured

Emergency?

In incident occurs
(requiring first aid or more)

Non-Emergency?

Immediatedly

Required
Within 1 hour

Recommended

Call
911
EMERGENCY

Call
Project Manager

As soon as possible
Then, within 4 hours

Call WorkCare
(24/7) Hotline
Tel: 1-888-449-7787
info@workcare.com

Project Manager Calls
H&S and HR Representatives Within 1 Hour
(step through the list until a person is reached)

<table>
<thead>
<tr>
<th>H&amp;S Representative</th>
<th>HR Representative</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>David Templeton</strong></td>
<td><strong>Elizabeth Barnick</strong></td>
</tr>
<tr>
<td>Health and Safety Director</td>
<td>Human Resources Managing Director</td>
</tr>
<tr>
<td>(206) 910-4279 (call or text)</td>
<td>(909) 455-8091</td>
</tr>
<tr>
<td><a href="mailto:dtempleton@anchorqea.com">dtempleton@anchorqea.com</a></td>
<td><a href="mailto:ebarnick@anchorqea.com">ebarnick@anchorqea.com</a></td>
</tr>
<tr>
<td><strong>Gloria Palermo</strong></td>
<td><strong>Paula Carnes</strong></td>
</tr>
<tr>
<td>Health and Safety Coordinator</td>
<td>Human Resources Coordinator</td>
</tr>
<tr>
<td>(315) 622-3723</td>
<td>(206) 903-3307</td>
</tr>
<tr>
<td><a href="mailto:gpalermo@anchorqea.com">gpalermo@anchorqea.com</a></td>
<td><a href="mailto:pcarnes@anchorqea.com">pcarnes@anchorqea.com</a></td>
</tr>
<tr>
<td><strong>Ashley Allington</strong></td>
<td><strong>Jennifer Cole</strong></td>
</tr>
<tr>
<td>Health and Safety Coordinator</td>
<td>Senior Human Resources Generalist</td>
</tr>
<tr>
<td>(315) 414-2038</td>
<td>(315) 727-3076</td>
</tr>
<tr>
<td><a href="mailto:aallington@anchorqea.com">aallington@anchorqea.com</a></td>
<td><a href="mailto:jcole@anchorqea.com">jcole@anchorqea.com</a></td>
</tr>
<tr>
<td><strong>Robin Utley</strong></td>
<td><strong>Robin Utley</strong></td>
</tr>
<tr>
<td>Human Resources Generalist</td>
<td>Human Resources Generalist</td>
</tr>
<tr>
<td>(949) 334-9618</td>
<td>(949) 334-9618</td>
</tr>
<tr>
<td><a href="mailto:rutley@anchorqea.com">rutley@anchorqea.com</a></td>
<td><a href="mailto:rutley@anchorqea.com">rutley@anchorqea.com</a></td>
</tr>
</tbody>
</table>
Incident Other Than Personal Injury

All incidents including, but not limited to, fire, explosion, property damage, or environmental release will be responded to in accordance with the site-specific HASP. 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.

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/or PM immediately so action can be taken to ensure that such conditions that led to the near-miss incident are readily corrected in order to prevent future occurrences.

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 facility
- 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, ensure 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

Ensure that all emergency equipment used is decontaminated, recharged, and fit for its intended use before operations are resumed.
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<td>AED</td>
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<td>ANSI</td>
<td>American National Standards Institute</td>
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<tr>
<td>APR</td>
<td>air-purifying respirator</td>
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<tr>
<td>ASTM</td>
<td>ASTM International</td>
</tr>
<tr>
<td>CFR</td>
<td>Code of Federal Regulations</td>
</tr>
<tr>
<td>CHSM</td>
<td>Corporate Health and Safety Manager</td>
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<tr>
<td>COC</td>
<td>chemical of concern</td>
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<tr>
<td>CPR</td>
<td>cardiopulmonary resuscitation</td>
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<tr>
<td>CRZ</td>
<td>Contamination Reduction Zone</td>
</tr>
<tr>
<td>dbA</td>
<td>A-weighted decibel</td>
</tr>
<tr>
<td>dB</td>
<td>decibel</td>
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<tr>
<td>EPA</td>
<td>U.S. Environmental Protection Agency</td>
</tr>
<tr>
<td>eV</td>
<td>electron volts</td>
</tr>
<tr>
<td>EZ</td>
<td>Exclusion Zone/Hot Zone</td>
</tr>
<tr>
<td>FL</td>
<td>Field Lead</td>
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<tr>
<td>GFCI</td>
<td>Ground-fault Circuit Interrupter</td>
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<td>HASP</td>
<td>Health and Safety Plan</td>
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<td>HAZMAT</td>
<td>Hazardous Materials</td>
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<td>HAZWOPER</td>
<td>Hazardous Waste Operations and Emergency Response</td>
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<td>High Efficiency Particulate Air</td>
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<td>HMIS</td>
<td>Hazardous Material Information System</td>
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<td>investigation-derived waste</td>
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<tr>
<td>JSA</td>
<td>Job Safety Analysis</td>
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<td>kilovolts</td>
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<tr>
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<td>Lower Explosive Limit</td>
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<tr>
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<td>maximum heart rate</td>
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<td>National Electrical Code</td>
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<td>National Fire Protection Association</td>
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<td>OSHA</td>
<td>Occupational Safety and Health Administration</td>
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<tr>
<td>OV</td>
<td>organic vapor</td>
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<tr>
<td>PAH</td>
<td>polycyclic aromatic hydrocarbon</td>
</tr>
<tr>
<td>PEL</td>
<td>Permissible Exposure Limit</td>
</tr>
<tr>
<td>PFD</td>
<td>personal flotation device</td>
</tr>
<tr>
<td>PM</td>
<td>Project Manager</td>
</tr>
</tbody>
</table>
PPE  personal protective equipment
ppm  parts per million
RCRA  Resource Conservation and Recovery Act
SAP  Sampling and Analysis Plan
SDS  Safety Data Sheets
site  Reynolds Metals Company Superfund Site
SPF  sun protection factor
SZ  Support Zone/Clean Zone
TLV  Threshold Limit Value
TWA  time-weighted average
USCG  U.S. Coast Guard
UV  ultraviolet
VHF  very high frequency
WBGT  wet bulb globe temperature
1 Introduction

This Health and Safety Plan (HASP) has been prepared on behalf of Alcoa, Inc., and presents health and safety requirements and procedures that will be followed by Anchor QEA, LLC, personnel and at a minimum by its subcontractors during work activities at the Reynolds Metals Company Superfund Site (site). This HASP has been 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 HASP modification procedures.

The provisions of this HASP are mandatory for all Anchor QEA personnel assigned to the project. A copy of this HASP 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 HASP unless they have their own HASP that covers their specific activities related to this project. Any subcontractor HASPs must include the requirements set forth in this HASP, at a minimum. All visitors to the work site must also abide by the requirements of this HASP and will attend a pre-work briefing where the contents of this HASP will be presented and discussed.

Personnel assigned to work at the project site will be required to read this plan and must sign the Health and Safety Plan Acknowledgement Form to confirm that they understand and agree to abide by the provisions of this HASP.

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 HASP.

The objectives of this HASP 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 HASP 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 plan documents that the workplace has been evaluated for hazards. A hazard assessment has been 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 Health and Safety Plan Modifications

This HASP 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 Health and 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

2.1 Site Description
The project site is located in Troutdale, Oregon, adjacent to the Sandy River.

2.2 Site Background Information
The project property was a former aluminum smelter operated by Reynolds Metals Company, a wholly owned subsidiary of Alcoa that underwent demolition between 2003 and 2006. Groundwater underlying the project property (see Figure 1) is being remediated according to a Record of Decision issued by the U.S. Environmental Protection Agency (EPA) in September 2006.

Groundwater remedial actions implemented at the site include focused extraction wells, production well optimization, production well decommissioning, and long-term monitoring.

This HASP covers the field work to be conducted as supplemental soil, groundwater, and surface water geochemical testing for the evaluation of fate and transport properties controlling fluoride mobility at the site and to obtain stable isotope data that can be used to better understand groundwater pathways at the site.

Figure 1
Site Location
3 Scope of Work

3.1 Project Scope of Work

This plan addresses health and safety issues associated with the following field activities:

- Soil sampling from direct-push and rotosonic soil borings
- Groundwater sampling from direct-push temporary monitoring wells
- Groundwater sampling from existing monitoring wells
- Porewater sampling from locations on the shorelines of the Columbia and Sandy rivers
- Surface water sampling from locations on the shorelines of the Sandy River and the shoreline of Company Lake
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 Emergency Site Procedures section at the beginning of this HASP. 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 ensure 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 2017 Supplemental Sampling and Analysis Plan (SAP), and the field team
- Ensures 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

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 HASP 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 HASP. 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 HASP. 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 HASP:

- Conduct and document daily safety meetings, or designate an alternate FL in his or her absence.
- Execute the SAP and schedule.
- Conduct periodic field health and safety inspections to ensure compliance with this HASP.
- Oversee implementation of safety procedures.
- Implement site personnel protection levels.
- Enforce site control measures to help ensure 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.
- Ensure that protective clothing and equipment are properly stored and maintained.
- Perform or oversee air monitoring (if required) in accordance with this HASP.
- 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 HASP) 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 on-site activities.
- If applicable, ensure 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. Other certifications or training may be stipulated based on client or site requirements.

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 HASP.
- Advise on the potential for occupational exposure to project hazards, along with appropriate methods and/or controls to eliminate site hazards.
- Ensure 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 HASP 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, and will have medical monitoring clearance. In addition, the CHSM or designee will have current training in first aid and CPR.

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 HASP. 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 HASP. 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 HASP
- Safe completion of on-site tasks required to fulfill the SAP
- Compliance with the HASP
- 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 ensure that their supervised field experience occurs (or has occurred) and is documented in the project field notes and on the Daily Safety Briefing form (see 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 SAP and the chemicals of concern (COCs).

5.1 Activity-Specific Level of Protection Requirements

Refer to Section 10 of this plan 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

Air monitoring is not required nor anticipated for site work activities. Concentrations of COCs are well documented from previous site investigations, and inhalation hazards are not present. If field conditions change such that inhalation hazards may exist, work will stop, and mitigation measures will be assessed.
### Table 5-1
**Project Job Tasks and Required PPE**

<table>
<thead>
<tr>
<th>Job Tasks</th>
<th>PPE Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard work uniform/coveralls</td>
<td>✗</td>
</tr>
<tr>
<td>Work boots with safety toe conforming to ASTM International (ASTM) F2412-05/ASTM F2413-05</td>
<td>✗</td>
</tr>
<tr>
<td>Traffic safety vest</td>
<td>✗</td>
</tr>
<tr>
<td>Chemical-resistant clothing check appropriate garments:</td>
<td>✗</td>
</tr>
<tr>
<td>One-piece coverall</td>
<td>✗</td>
</tr>
<tr>
<td>Disposable chemical coveralls</td>
<td>✗</td>
</tr>
<tr>
<td>Bib-style overalls and jacket with hood</td>
<td>✗</td>
</tr>
<tr>
<td>Fabric Type: Tyvek</td>
<td>✗</td>
</tr>
<tr>
<td>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.</td>
<td>✗</td>
</tr>
<tr>
<td>Leather gloves if abrasion or cut hazards are present</td>
<td>✗</td>
</tr>
<tr>
<td>Disposable chemical-resistant outer gloves</td>
<td>✗</td>
</tr>
<tr>
<td>Material Type: Nitrile</td>
<td>✗</td>
</tr>
<tr>
<td>Chemical-resistant boots with safety toe conforming to ASTM F2412-05/ASTM F2413-05 or disposable boot covers for safety toe/work boots</td>
<td>✗</td>
</tr>
<tr>
<td>Material Type: Rubber or leather</td>
<td>✗</td>
</tr>
<tr>
<td>Puncture-resistant shanks in safety shoes conforming to ASTM F2412-05/ASTM F2413-05</td>
<td>✗</td>
</tr>
<tr>
<td>Metatarsal guards conforming to ASTM F2412-05/ASTM F2413-05</td>
<td>✗</td>
</tr>
<tr>
<td>Sleeves to be duct-taped over gloves and pants to be duct-taped over boots</td>
<td>✗</td>
</tr>
<tr>
<td>Splash-proof safety goggles</td>
<td>✗</td>
</tr>
<tr>
<td>Safety glasses</td>
<td>✗</td>
</tr>
<tr>
<td>Hard hat</td>
<td>✗</td>
</tr>
<tr>
<td>Hard hat with face shield</td>
<td>✗</td>
</tr>
<tr>
<td>Hearing protectors (REQUIRED if site noise levels are greater than 85 decibels [dB] based on an 8-hour time-weighted average [TWA]). Type: Foam ear plugs</td>
<td>✗</td>
</tr>
<tr>
<td>Two-way radio communication (intrinsically safe, if explosive atmosphere is a potential)</td>
<td>✗</td>
</tr>
<tr>
<td>Long cotton underwear</td>
<td>✗</td>
</tr>
<tr>
<td>Job Tasks</td>
<td>PPE Requirements</td>
</tr>
<tr>
<td>----------------------------</td>
<td>------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>☑️</td>
<td>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)</td>
</tr>
<tr>
<td>☐️</td>
<td>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</td>
</tr>
<tr>
<td>☐️</td>
<td>Half-face air-purifying respirator (APR) (OSHA/NIOSH-approved)</td>
</tr>
<tr>
<td>☐️</td>
<td>Full-face APR (OSHA/NIOSH-approved)</td>
</tr>
<tr>
<td>☐️</td>
<td><strong>Type of Cartridges to be Used:</strong></td>
</tr>
<tr>
<td>☐️ ☐️</td>
<td>OV or ☐️ OV/HEPA (if samples are dry)</td>
</tr>
</tbody>
</table>
6 Risk Analysis and Control

The following sections discuss the potential health and safety hazards associated with the field tasks described in the 2017 Supplemental Sampling SAP. 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 SAP covered by this HASP must be communicated to the PM and CHSM, and a modification to this HASP must be created as needed (see Section 1.1). Any task conducted beyond those identified in the SAP and this HASP 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 ensure that these tasks are conducted 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/or 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:

- Groundwater and surface water purging and sampling
- Glassware handling
- General field activities
- Motor vehicle operation
- Borehole logging and soil sampling
- Investigation-derived waste (IDW) handling
- General boating activities

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 of this HASP, then a task-specific JSA
document must be developed at the project site prior to conducting the work. The PM and/or FL shall develop this document(s) with input from the CHSM, as needed, and this HASP will be modified to include the JSA document (see Section 1.1 for HASP 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 HASP.

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.

6.2.2 Dermal Contact

Dermal contact with potentially contaminated soil, sediment, or groundwater 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

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Exposure Routes</th>
<th>Symptoms</th>
<th>Target Organs</th>
<th>OSHA PEL</th>
<th>Odor Threshold (ppm)</th>
<th>LEL (%)</th>
<th>Ionization Potential (eV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluoride</td>
<td>Skin contact or eye contact</td>
<td>Eye, skin, nose, throat irritation; pulmonary edema; eye and skin burns; rhinitis; bronchitis; bone changes</td>
<td>Kidney, lungs, nervous system, heart</td>
<td>--</td>
<td>--</td>
<td>NA</td>
<td>17.42</td>
</tr>
<tr>
<td>Cyanide</td>
<td>Ingestion, inhalation, skin contact, or eye contact</td>
<td>Eye, skin, and respiratory tract irritation; headaches; dizziness; vomit; diarrhea; cyanosis; weak and irregular heartbeat; collapse; unconsciousness; convulsions; and death</td>
<td>Nervous system</td>
<td>--</td>
<td>--</td>
<td>5.6</td>
<td>13.6</td>
</tr>
</tbody>
</table>

**Notes:**
- eV: electron volts
- LEL: Lower Explosive Limit
- NA: not applicable
- OSHA: Occupational Safety and Health Administration
- PEL: Permissible Exposure Limit
- ppm: parts per million

**Sources:**
- [http://www.cdc.gov/niosh/npg/npgd0334.html](http://www.cdc.gov/niosh/npg/npgd0334.html)
- [http://www.cdc.gov/niosh/npg/npgd0333.html](http://www.cdc.gov/niosh/npg/npgd0333.html)
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 upon leaving the work area and 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 surveillance certification.
- All personnel must comply with established safety procedures. Any staff member who does not comply with safety policy as established in this HASP 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 HASP, 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 HASP.

7.4 Site-Specific Work Zone Requirements

This section contains guidelines for maintaining safe conditions when working at a drilling site, at a monitoring well, or when working along a waterbody shoreline.
7.4.1 **Access Control**

Security and control of access to the work area will be the responsibility of the FL. Access to the work 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.

7.5 **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 ensure 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**

<table>
<thead>
<tr>
<th>Type of Communication</th>
<th>Communication Device</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency notification</td>
<td>On-site telephone or cellular telephone</td>
<td>Initiate phone call using applicable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>emergency numbers</td>
</tr>
<tr>
<td>Hailing site personnel for distress,</td>
<td>Visual</td>
<td>Arms waved in circle over head</td>
</tr>
<tr>
<td>need help</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hailing site personnel for emergency</td>
<td>Visual</td>
<td>Arms waved in criss-cross over head</td>
</tr>
<tr>
<td>evacuation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contaminated air/strong odor</td>
<td>Visual</td>
<td>Hands clutching throat</td>
</tr>
<tr>
<td>Break, lunch, end of day</td>
<td>Visual</td>
<td>Two hands together, break apart</td>
</tr>
</tbody>
</table>
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. If the level of vehicle contamination is low, decontamination may be limited to rinsing tires and wheel wells with an appropriate detergent and water. If the vehicle is significantly contaminated, steam cleaning or pressure washing may be required. Tools will be cleaned in the same manner. 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
- Paper towels and plastic garbage bags
8.3 Sampling and Processing Equipment Decontamination

To prevent sample cross-contamination, non-disposable or non-dedicated sampling equipment that comes in contact with soil, groundwater, or surface 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 (e.g., Liquinox®).
3. Visually inspect the sampler and repeat the scrub and rinse step, if necessary.
4. Rinse sampling equipment once with potable water and three times with distilled or deionized water prior to and between sample collection.

8.4 Handling of Investigation-Derived Waste

All fluids generated during sampling activities (well purge water and decontamination fluids) will be disposed of in the on-site water treatment plant. Soil IDW generated during drilling operations will be spread on the ground at the boring location. All other sample collection disposable wastes (e.g., gloves, paper towels, foil, or others) will be placed into appropriate containers and staged on site for disposal.

8.4.1 Disposable PPE

Disposable PPE may include Tyvek suits and nitrile gloves. Dispose of PPE according to the requirements of the client and state and federal agencies.

8.4.2 Non-Disposable PPE

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.

8.5 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.
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 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 the SAP, this HASP, 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 HASP that covers their specific activities related to this project and includes the minimum requirements of this HASP.
- 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 HASP, will be required to read the plan and must sign the Health and 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 ensure 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 HASP. 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 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 HASP.

Refer to Section 5 of this plan for site-specific job task and level-of-protection requirements.

10.1  Minimum Requirements – Level D Protection

The minimum level of protection on the project site is Level D protection, which consists of the following equipment:

- Long pants
- 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 safety vest
- Disposable chemical-resistant gloves (i.e., nitrile or latex)
- 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

U.S. Coast Guard (USCG)-approved personal flotation devices (PFDs) will be worn when working within 10 feet of a waterbody, such as a river, pond, or lake.
11 Health and Safety Procedures and Practices

In addition to the task-specific JSAs listed in Section 6.1 and presented in Appendix B of this HASP, this section lists the health and safety procedures and practices applicable to this project. For additional information, consult with the PM.

11.1 Physical Hazards and Controls

11.1.1 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.
- 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.

11.1.2 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.
11.1.3 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.

11.1.4 Corrosive Material Handling Procedures

Corrosive materials include acids and bases. They are extremely corrosive materials with a variety of uses. Acids include hydrochloric, nitric, and sulfuric acids. Bases include sodium hydroxide. Observe the following procedures when working with corrosive materials:

- Wear gloves and eye-splash protection while using acid dispensed from a small dropper bottle during water sampling.
- Wear a full-face air-purifying respirator (APR) equipped with combination cartridges (organic vapor/acid gas) as well as Tyvek coveralls and nitrile gloves for large-volume applications.
- Have an eyewash bottle and/or portable eyewash station on site.
- Do not add anything into a virgin chemical drum, including unused product.
- Avoid mixing strong acids and bases. Consult the CHSM for task-specific evaluation. If mixing is absolutely necessary, do it slowly. Avoid vapors or fumes that are generated.
- When diluting acids and bases, add the acid or base to water in small quantities and mix cautiously.
11.1.5 Drilling Activities

All operations involving the use of powered drilling rigs will follow generally accepted drilling practices. One person will be assigned the responsibility of Lead Driller. Additional personnel will assist with equipment as needed. The Lead Driller will be responsible for operating the drilling rig and ensuring safety.

General rules associated with drilling rig operations will be as follows:

- While drilling, all non-essential personnel shall remain at a distance that is past the radius of the boom, whenever possible. Workers (e.g., drillers and hydrogeologists) remaining around the drill rig will be kept to a minimum.
- All operators and crew 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.
- Hard-hats, steel-toed boots conforming to ASTM F2412-05/ASTM F2413-05, goggles or safety glasses with side shields, hearing protection, and gloves for hand protection are required.
- No loose-fitting clothing, jewelry, or free long hair is permitted near the drilling rig or moving machinery parts.
- Before leaving the controls, the Lead Driller will shift the transmission controlling the drive into neutral and place the feed level in neutral. Before leaving the vicinity of the drill, the Lead Driller will shut down the drill engine.
- A first aid kit and fire extinguisher will be available at all times.
- If lubrication fittings are not accessible with guards in place, machinery must be stopped for oil and greasing.
- The work area around the borehole shall be kept free of obstructions and undue accumulations of oil, water, ice, or circulating fluids.
- No drilling will occur during impending electrical storms or tornadoes, or when rain, ice, snow, or wind conditions create undue potential hazards.
- During freezing weather, do not touch any metal parts of the drill rig with exposed flesh. Freezing of moist skin to metal can occur almost instantaneously.
- The driller will not attempt to reach a well or borehole location in a manner that compromises the safety of the rig or crew.
- All well or borehole locations will be inspected by the drill crew to ensure that a stable surface exists.
- Before raising the drill mast, the Lead Driller will check for overhead obstructions.
- Before the mast of a drill rig is raised, the drill rig must first be leveled and stabilized with leveling jacks and/or cribbing. Re-level the drill rig if it settles after initial setup. Lower the
mast only when the leveling jacks are down, and do not raise the leveling jack pads until the mast is lowered completely.

• The drill rig shall be driven or moved only after the mast has been lowered.
• The leveling jacks shall not be raised until the derrick is lowered.
• Adequately cover or protect all unattended boreholes to prevent drill rig personnel or site visitors from stepping or falling into the borehole.
• Maintain professional behavior at all times in the work area, even when the rig is shut down.

11.1.6 Underground/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 ensure that all existing underground or overhead utilities in the work area are located per the state or local mark-out methods. 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 hand digging 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 11-1 shows the minimum clearances required for energized overhead electrical lines.
Table 11-1  
Overhead Utility Clearance Requirements

<table>
<thead>
<tr>
<th>Nominal System Voltage</th>
<th>Minimum Required Clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 50 kV</td>
<td>10 feet</td>
</tr>
<tr>
<td>51 to 100 kV</td>
<td>12 feet</td>
</tr>
<tr>
<td>101 to 200 kV</td>
<td>15 feet</td>
</tr>
<tr>
<td>201 to 300 kV</td>
<td>20 feet</td>
</tr>
<tr>
<td>301 to 500 kV</td>
<td>25 feet</td>
</tr>
<tr>
<td>501 to 750 kV</td>
<td>35 feet</td>
</tr>
<tr>
<td>751 to 1000 kV</td>
<td>45 feet</td>
</tr>
</tbody>
</table>

Notes:  
kV: kilovolts  
Whenever equipment operations must be performed closer than 20 feet from overhead power lines, the Field Leader (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 kV to obtain the safe distance between equipment and power lines.

11.1.7 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.

11.1.8 Manual Lifting and Material Handling
Equipment and samples must be lifted and carried. Back strain can result if lifting is done improperly. 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, and 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.
- Ensure that your body, material, tools, and equipment are safe from such unexpected movement as falling, slipping, rolling, tripping, bowing, or any other uncontrolled motion.

11.1.9 General Falls/Ladders

Observe the following general falls/ladders procedures and practices:

- Assess work areas for fall hazards. A fall protection system that meets OSHA and ANSI Z3591 standards must be used if work is conducted 6 feet or more above the surface.
- Use ANSI Type 1A rated ladders.
- Ensure that ladders are placed so their rungs, cleats, and steps are parallel, level, and uniformly spaced prior to use.
- Make sure ladder rungs are sturdy and free of cracks.
- Use ladders with secure safety feet.
- Pitch ladders at a 1 horizontal to 4 vertical (1H:4V) ratio.
- Secure ladders at the top or have another person at the bottom to help stabilize it.
- Ladders used to access an upper landing surface shall extend at least 3 feet above the upper landing surface.
- Use non-conductive ladders near electrical wires.
- The top rung of a ladder should not be used as a step.
- Do not carry any object or load that could cause a loss of balance or a fall.
- If a ladder is defective, damaged, or in disrepair (i.e., broken or missing rungs, cleats, or steps; broken or split rails; corroded components; or other faulty or defective components), tag the ladder “Do Not Use” and remove it from service until repaired.

11.1.10 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. Ensure 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.

11.1.11 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.

11.1.12 Vehicular Traffic
Observe the following procedures and practices regarding vehicular traffic:

• Wear a 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 Department of Transportation Manual of Uniform Traffic Control Devices and/or local requirements.

See Section 7.4.2 for additional information regarding work in roadways.

11.1.13 Working Near Railways
When working near railways or in rail yards, observe the following procedures and practices:

• Plan work activities well ahead of time, including coordination with the railway owner(s) and operator(s).
• Always assume work near railways requires a permit from the owner/operator.
• Maintain emergency rail yard and owner/operator contact information at the field location.
• Become cognizant of train signals such as horns and lights, in order to understand potential train activity.
• Follow all owner/operator required procedures.
• Plan work activities to minimize time spent adjacent to tracks.
• Expect movement from on-track equipment at any time.
• Before approaching a track, look in both directions. Make sure it’s safe to get on or cross the track.
• Never cross a track in front of oncoming traffic.
• When on-track equipment is approaching, stay at least 30 feet from the track while the equipment is passing.
• Watch for protruding structures on passing equipment as well as other hazards.
• Do not stage or store equipment unattended within 30 feet of tracks.
• When rail traffic is approaching, move away from the track, and warn your coworkers of approaching rail traffic.
• Never sit, walk, step, stand, or lie down on rails, including other track components such as switch points, frogs, guard rails, derails, and wheel stops.
• Do not lean on, climb on, or go under any on-track equipment unless your job requires it, in which case do so only after all required safety procedures have been put in place.
• Do not walk between on-track equipment unless they are separated by at least 50 feet.
• Keep at least 30 feet from the end of standing trains, cars, or locomotives. This will allow you time to react safely to any movement of the equipment.
• Avoid being trapped between on-track equipment passing on adjacent tracks.

11.1.14 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.

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 anticipated 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 https://www.law.cornell.edu/cfr/text/46/117.70 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 11.1.7)
• 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 11-2 shall be available when conducting boating operations.
### Table 11-2

**Safety Equipment Specific to In-Water Work**

<table>
<thead>
<tr>
<th>Additional Safety Equipment for Sampling Vessel per USCG Requirements:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Proper vessel registration, numbering, and documentation (registered with state, certificate of vessel registration number displayed, and carrying a valid certificate of number)</td>
</tr>
<tr>
<td>- USCG-approved PFDs or life jackets for every person on the sampling vessel (Type I, II, III, or V are required); high-visibility PFDs or life jackets required by Anchor QEA</td>
</tr>
<tr>
<td>- Appropriate, non-expired, visual distress devices for day and night use from the following:</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
</tr>
<tr>
<td>- Alternate means of propulsion (oars or paddles)</td>
</tr>
<tr>
<td>- Dewatering device (pump or bailer)</td>
</tr>
<tr>
<td>- 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)</td>
</tr>
<tr>
<td>- Proper ventilation of gasoline-powered vessels</td>
</tr>
<tr>
<td>- Sound-producing device (whistle, bell, or horn)</td>
</tr>
<tr>
<td>- VHF 2-way radio</td>
</tr>
<tr>
<td>- Proper navigational light display</td>
</tr>
<tr>
<td>- Throwable life ring with attached line (any vessel larger than 16 feet is required to carry one Type IV [throwable] PFD)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Additional USCG-Recommended Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Extra visual distress signals</td>
</tr>
<tr>
<td>- Primary and spare anchor</td>
</tr>
<tr>
<td>- Heaving line</td>
</tr>
<tr>
<td>- Fenders</td>
</tr>
<tr>
<td>- First aid kit</td>
</tr>
<tr>
<td>- Flashlight</td>
</tr>
<tr>
<td>- Mirror</td>
</tr>
<tr>
<td>- Searchlight</td>
</tr>
<tr>
<td>- Sunburn lotion</td>
</tr>
<tr>
<td>- Tool kit</td>
</tr>
<tr>
<td>- Spare fuel</td>
</tr>
<tr>
<td>- Boat hook</td>
</tr>
<tr>
<td>- Spare propeller</td>
</tr>
<tr>
<td>- Mooring line</td>
</tr>
<tr>
<td>- Food and water</td>
</tr>
<tr>
<td>- Binoculars</td>
</tr>
<tr>
<td>- Spare batteries</td>
</tr>
<tr>
<td>- Sunglasses</td>
</tr>
<tr>
<td>- Marine hardware</td>
</tr>
<tr>
<td>- Extra clothing</td>
</tr>
<tr>
<td>- Spare parts</td>
</tr>
<tr>
<td>- Pertinent navigational chart(s) and compass</td>
</tr>
</tbody>
</table>

### 11.1.15 Working Over or Near Water

#### 11.1.15.1 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 III, Type V, or better 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.

11.1.15.2 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. These procedures should be identified in the site-specific HASP, described in the JSA used for boating activities and, if prudent, practiced before work.

11.1.16 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 (NRR) 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 (dB(A) (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 dB(A) 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 11-3 will trigger the use of appropriate hearing protection (plugs or muffs). Hearing protection must be able to attenuate noise below 90 dB(A) (8-hour TWA). Each hearing protection or device has a NRR assigned by EPA. The calculation for a hearing protection device’s effectiveness is:
Equation 1

Noise reading $dbA - (NRR - 7db) < 90dbA$

where:

$dbA$ = A-weighted decibel

$NRR$ = Noise Reduction Rating

Table 11-3
Noise Exposure Action Levels

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Measurement</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I or Type II</td>
<td>&gt; 80 dbA to 85 dbA</td>
<td>Hearing protection recommended. Limit work duration to 8-hour shifts.</td>
</tr>
<tr>
<td>Sound Level Meter or Dosimeter</td>
<td>&gt; 85 dbA to 90 dbA</td>
<td>Hearing protection required. Limit work duration to 8-hour shifts.</td>
</tr>
<tr>
<td></td>
<td>&gt; 90 dbA to 115 dbA</td>
<td>Hearing protection required. Investigate use of engineering controls. Limit work duration to 8-hour shifts.</td>
</tr>
<tr>
<td></td>
<td>&gt; 115 dbA</td>
<td>Stop work. Consult CHSM.</td>
</tr>
</tbody>
</table>

Notes:
CHSM: Corporate Health and Safety Manager
dBA: A-weighted decibel

11.1.17 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.
- Ensure fire safety integrity of equipment installations according to National Electrical Code (NEC) specifications.

11.1.18 Cleaning Equipment
Observe the following procedures and practices when cleaning equipment:

- Wear appropriate PPE to avoid skin and eye contact with Liquinox® or other cleaning materials.
- Stand upwind to minimize any potential inhalation exposure.
• Dispose of spent cleaning solutions and rinses accordingly.

11.2 Environmental Hazards and Controls

11.2.1 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.

11.2.2 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.

11.2.2.1 Signs, Symptoms, and Treatment

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
patient to a medical facility immediately. Prior to transport, remove as much clothing as possible and
wrap the patient in a sheet soaked with water. Fan the patient 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 patient in a cool-water bath (however, be
careful not to over-chill the patient once body temperature is reduced below 102° F). If this is not
possible, keep the patient wrapped in a sheet and continuously douse with water and fan.

### 11.2.2.2 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.

11.2.2.3 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 11-4 should be followed.

<table>
<thead>
<tr>
<th>Work/Rest Regimen</th>
<th>Light</th>
<th>Moderate</th>
<th>Heavy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous work</td>
<td>86° F (30.0° C)</td>
<td>80° F (26.7° C)</td>
<td>77° F (25.0° C)</td>
</tr>
<tr>
<td>75% work, 25% rest each hour</td>
<td>87° F (30.6° C)</td>
<td>82° F (28.0° C)</td>
<td>78° F (25.9° C)</td>
</tr>
<tr>
<td>50% work, 50% rest, each hour</td>
<td>89° F (31.4° C)</td>
<td>85° F (29.4° C)</td>
<td>82° F (27.9° C)</td>
</tr>
<tr>
<td>25% work, 75% rest, each hour</td>
<td>90° F (32.2° C)</td>
<td>88° F (31.1° C)</td>
<td>86° F (30.0° C)</td>
</tr>
</tbody>
</table>

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 11-4 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 11-5.

### Table 11-5
**WBGT Correction Factors**

<table>
<thead>
<tr>
<th>Clothing Type</th>
<th>WBGT Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer lightweight working clothing</td>
<td>32° F (0° C)</td>
</tr>
<tr>
<td>Cotton coveralls</td>
<td>28° F (-2° C)</td>
</tr>
<tr>
<td>Winter work clothing</td>
<td>25° F (-4° C)</td>
</tr>
<tr>
<td>Water barrier, permeable</td>
<td>21° F (-6° C)</td>
</tr>
<tr>
<td>Fully encapsulating</td>
<td>-14.4° F (-10° C)</td>
</tr>
</tbody>
</table>

**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.

#### 11.2.2.4 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.
11.2.3 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.

11.2.3.1 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 patient to a warm, dry place. If the patient’s clothing is wet, remove it and replace it with dry clothing. Keep the patient warm. Re-warming of the patient 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 patient 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 patient warm and calm and move them to a medical facility as soon as possible.

11.2.4 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-sun protection factor (SPF), broad-spectrum sunscreen applied frequently.
- Plan work to avoid unnecessary UV exposure (see Section 11.2.4.2).
- 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. Consider monitoring the UV index for your work area: [http://www2.epa.gov/sunwise/uv-index](http://www2.epa.gov/sunwise/uv-index).
  - Reflection off surfaces: UV rays can bounce off surfaces like water, sand, snow, pavement, or grass, leading to an increase in UV exposure.
- Evaluate site-specific factors affecting UV exposure and address work practices as appropriate.

11.2.4.1 Signs, Symptoms, and Treatment

The best way to treat sunburn is to prevent it using the guidelines listed in the preceding section and in Section 11.2.4.2. 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.

11.2.4.2 Prevention
UV exposure hazards and their impacts on each work site 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.

11.2.5 Inclement Weather
Observe the following procedures and practices regarding inclement weather:

• 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.
• Listen to local forecasts for warnings about specific weather hazards such as tornadoes, hurricanes, and flash floods.

11.2.6 Insects/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 11-6.
Table 11-6  
North American Hazardous Spider Identification Guide

<table>
<thead>
<tr>
<th>Hazardous Spider Identification Guide</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Black Widow Spider</strong></td>
<td>![Image]</td>
</tr>
<tr>
<td>• Abdomen usually shows hourglass marking</td>
<td></td>
</tr>
<tr>
<td>• Female is 3 to 4 centimeters in diameter</td>
<td></td>
</tr>
<tr>
<td>• Have been found in well casings and flush-mount covers</td>
<td></td>
</tr>
<tr>
<td>• Not aggressive, but more likely to bite if guarding eggs</td>
<td></td>
</tr>
<tr>
<td>• 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</td>
<td></td>
</tr>
<tr>
<td>• If bitten, see a physician as soon as possible</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Brown Spiders (aka Brown Recluse or Fiddleback)</th>
<th>![Image]</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Found in the central and southern United States, although in some other areas, as well</td>
<td></td>
</tr>
<tr>
<td>• 1/4-to-1/2-inch-long body, and size of a silver dollar</td>
<td></td>
</tr>
<tr>
<td>• Hide in baseboards, ceiling cracks, and undisturbed piles of material</td>
<td></td>
</tr>
<tr>
<td>• 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</td>
<td></td>
</tr>
<tr>
<td>• If bitten, see a physician as soon as possible</td>
<td></td>
</tr>
</tbody>
</table>

### 11.2.7 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 any samples collected.
11.2.8 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.

11.2.9 Mosquitoes

Mosquitoes in the United States have been known to carry West Nile 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.

11.2.10 Poisonous Plants
Poisonous plants include poison ivy, poison oak, and poison sumac as shown in Table 11-7. 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 11-7
North American Hazardous Plant Identification Guide

<table>
<thead>
<tr>
<th>Hazardous Plant Identification Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Poison Ivy</strong></td>
</tr>
<tr>
<td>• Grows in the West, Midwest, Texas, and the East Coast</td>
</tr>
<tr>
<td>• Several forms—vines, trailing shrub, or shrub</td>
</tr>
<tr>
<td>• Three leaflets (can vary from three to nine)</td>
</tr>
<tr>
<td>• Leaves are green in summer and red in fall</td>
</tr>
<tr>
<td>• Yellow or green flowers</td>
</tr>
<tr>
<td>• White berries</td>
</tr>
<tr>
<td><strong>Poison Oak</strong></td>
</tr>
<tr>
<td>• Grows in the East (New Jersey to Texas) and Pacific Coast</td>
</tr>
<tr>
<td>• 6-foot tall shrubs or long vines</td>
</tr>
<tr>
<td>• Oak-like leaves in clusters of three</td>
</tr>
<tr>
<td>• Yellow berries</td>
</tr>
<tr>
<td><strong>Poison Sumac</strong></td>
</tr>
<tr>
<td>• Grows in boggy areas, especially in the Southwest and Northern United States</td>
</tr>
<tr>
<td>• Shrub up to 15 feet tall</td>
</tr>
<tr>
<td>• Seven to 13 smooth-edged leaflets</td>
</tr>
<tr>
<td>• Glossy pale yellow or cream-colored berries</td>
</tr>
</tbody>
</table>
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.

11.2.11 The Public at Large
The community residents around work sites 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 previously mentioned scenarios 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.

11.2.12 Personal Health and Safety

In addition to hazards associated with chemicals of concern, equipment, operations, or site conditions discussed previously, 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 prior listed conditions or scenarios 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 less likely.
  – 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 about 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).
12 Medical Surveillance Program

This section describes the medical surveillance 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.

12.1 General Requirements

Anchor QEA employees shall be enrolled in a medical surveillance 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 (RCRA) of 1976 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 facilities regulated by 40 CFR Parts 264 and 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 surveillance 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 surveillance 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 surveillance and other employee-related medical records shall be retained for at least the duration of employment plus 30 years.
12.2 Crew 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.
Appendix A
Health and Safety Logs and Forms
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
☐ Field Team Medical Conditions for Emergency Purposes (Confidential):

☐ Other: __________________________________

Weather Conditions: ________________________

Daily Work Scope: __________________________

Site-specific Hazards: ________________________

Safety Comments: __________________________

<table>
<thead>
<tr>
<th>Attendees</th>
<th>Printed Name</th>
<th>Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

1 of 1
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.
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: ____________

Name: ___________________________________________ Date: ____________

Name: ___________________________________________ Date: ____________

Approvals

Field Lead: ________________________________________

Printed Name: ___________________________ Signature: ___________________________ Date: ____________

Project Manager: ____________________________

Printed Name: ___________________________ Signature: ___________________________ Date: ____________
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**

<table>
<thead>
<tr>
<th>Consideration</th>
<th>Check</th>
<th>Explanation</th>
<th>Initial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has the state One Call been contacted?</td>
<td>☐ Yes</td>
<td>☐ No</td>
<td></td>
</tr>
<tr>
<td>Has the property owner or client been contacted for local knowledge of utilities, as applicable?</td>
<td>☐ Yes</td>
<td>☐ No</td>
<td></td>
</tr>
<tr>
<td>Does the property owner or client have specific utility contact prevention procedures and, if so, have they been completed?</td>
<td>☐ Yes</td>
<td>☐ No</td>
<td></td>
</tr>
<tr>
<td>Are any as-built drawings available? If so, do they show any utilities?</td>
<td>☐ Yes</td>
<td>☐ No</td>
<td></td>
</tr>
<tr>
<td>Has a visual inspection of the work area(s) been completed?</td>
<td>☐ Yes</td>
<td>☐ No</td>
<td></td>
</tr>
<tr>
<td>Has the potential presence of in-water utilities been assessed (shore markers, streets dead-ending at water’s edge, etc.)</td>
<td>☐ Yes</td>
<td>☐ No</td>
<td></td>
</tr>
<tr>
<td>Is evidence of electrical utilities present? (electric meters on structures, conduits, overhead lines, light poles, etc.)</td>
<td>☐ Yes</td>
<td>☐ No</td>
<td></td>
</tr>
<tr>
<td>Is evidence of water/sewer utilities present? (water meter, hydrants, restrooms, grates in ground, etc.)</td>
<td>☐ Yes</td>
<td>☐ No</td>
<td></td>
</tr>
<tr>
<td>Is evidence of telecommunications utilities present? (fiber optic warning signs, conduits from utility poles, wall-mounted boxes, etc.)</td>
<td>☐ Yes</td>
<td>☐ No</td>
<td></td>
</tr>
<tr>
<td>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.)</td>
<td>☐ Yes</td>
<td>☐ No</td>
<td></td>
</tr>
</tbody>
</table>
Utility Contact Prevention Checklist

NOTE: Utility mark-out requirements vary from state to state; consult state authorities before beginning work.

<table>
<thead>
<tr>
<th>Consideration</th>
<th>Check</th>
<th>Explanation</th>
<th>Initial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has a private locating service been contacted?</td>
<td>☐</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>☐ No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Were any utilities identified and marked out through a private locating service? If so, duplicate mark-outs on site drawings.</td>
<td>☐</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>☐ No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are there any fiber optic cables, fuel lines, or high-pressure lines within 50 feet of work locations?</td>
<td>☐</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>☐ No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If fiber optic cables, fuel lines, or high-pressure lines are within 50 feet, has an agreement with the utility owner been established?</td>
<td>☐</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>☐ No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Can a test borehole be advanced by hand digging, probing, post-hole digging, and/or air knifing to 5 feet below ground surface (bgs)?</td>
<td>☐</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>☐ No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>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?</td>
<td>☐</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>☐ No</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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: ____________________________
Appendix B
Job Safety Analysis (JSA) Documents
# Job Safety Analysis

## General Boating Activities

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Project Number:</th>
<th>JSA Number:</th>
<th>Issue Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020 Supplemental Sampling – Troutdale Reynolds Industrial Park</td>
<td>150002-01.01</td>
<td>008</td>
<td>1/23/20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location:</th>
<th>Contractor:</th>
<th>Analysis by:</th>
<th>Analysis Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Troutdale, Oregon</td>
<td>Anchor QEA, LLC</td>
<td>Matt Wilson</td>
<td>01/22/20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Work Operation:</th>
<th>Superintendent/Competent Person:</th>
<th>Revised by:</th>
<th>Revised Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>General boating activities</td>
<td>Matt Wilson</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Required Personal Protective Equipment (PPE):
- U.S. Coast Guard (USCG)-approved personal flotation device (PFD; see cold stress section for cold-weather PFD information)

<table>
<thead>
<tr>
<th>Reviewed by:</th>
<th>Reviewed Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nik Bacher</td>
<td>1/23/20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Approved by:</th>
<th>Approved Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nik Bacher</td>
<td>1/23/20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Work Activity</th>
<th>Potential Hazards</th>
<th>Preventive or Corrective Measures</th>
<th>Inspection Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working on a boat</td>
<td>Pinch points</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
- 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. |  
- Routinely inspect work area for unsafe conditions. |

| Slips, trips, and falls |  
- 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. |  |

| 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. |
<table>
<thead>
<tr>
<th>Work Activity</th>
<th>Potential Hazards</th>
<th>Preventive or Corrective Measures</th>
<th>Inspection Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking on deck (continued)</td>
<td>Noise exposure</td>
<td>• 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).</td>
<td>• Ensure that hearing protection is available.</td>
</tr>
</tbody>
</table>
| 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. |
| Rain or 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 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. |
## Job Safety Analysis

### General Boating Activities

<table>
<thead>
<tr>
<th>Work Activity</th>
<th>Potential Hazards</th>
<th>Preventive or Corrective Measures</th>
<th>Inspection Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working outdoors (continued)</td>
<td>Lightning</td>
<td>• Do not begin or continue work until lightning subsides for at least 30 minutes.</td>
<td>• Obtain weather forecast and updates as needed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Disconnect and do not use or touch electronic equipment.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Immediately head for shore if on the water and lightning is observed.</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>• If not able to get to shore, disconnect and do not use or touch the major electronic equipment,</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>including the radio, throughout the duration of the storm.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High river flows or high waves</td>
<td>• Be aware of waves and forecasts and recent rainfall in your watershed.</td>
<td>• Have forecast available.</td>
</tr>
<tr>
<td></td>
<td>High winds</td>
<td>• Wear goggles or safety glasses if dust or debris are visible.</td>
<td>• Review weather forecast prior to field work.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Stow or secure loads or equipment that could be moved by wind, particularly when underway.</td>
<td>• Ensure that goggles or safety glasses are onboard.</td>
</tr>
<tr>
<td></td>
<td>Biological hazards (e.g., mosquitoes, deer flies, and horse flies)</td>
<td>• Wear appropriate clothing (i.e., hat, long-sleeve shirt, long pants, leather gloves, boots, and Tyvek coveralls, as appropriate), and apply insect repellent.</td>
<td>• Ensure that insect repellent is onboard.</td>
</tr>
<tr>
<td>Vessel emergencies</td>
<td>Person overboard</td>
<td>If you witness someone fall overboard:</td>
<td>• Ensure that flotation devices are available.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Yell, “Person overboard!”</td>
<td>• Ensure that team wears PFDs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Throw a flotation device immediately.</td>
<td>• Inspect PFDs for integrity, particularly the cartridge charge on inflatable PFDs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If the engine is running, take it out of gear and swing the stern clear to keep from hitting the person.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Call 911 or USCG as appropriate.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Assign a spotter to keep the person in sight at all times.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Contact nearby vessels for assistance.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Recover the person from the water.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>If you fall overboard:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Hold your mouth and nose closed and protect your head.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• When you reach the surface, look for movement, listen for sounds, and call for help.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use the whistle attached to the PFD and activate the beacon light.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 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.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• When you reach the surface, look for movement, listen for sounds, and call for help.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use the whistle attached to the PFD and activate the beacon light.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 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.</td>
<td></td>
</tr>
</tbody>
</table>
### Job Safety Analysis

#### General Boating Activities

<table>
<thead>
<tr>
<th>Work Activity</th>
<th>Potential Hazards</th>
<th>Preventive or Corrective Measures</th>
<th>Inspection Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vessel emergencies (continued)</td>
<td>Fire, abandon ship</td>
<td>• Be prepared to abandon ship in case of major fire (too large to control with a fire extinguisher), or other emergency.</td>
<td>• Ensure that fire extinguisher is available, current, and in working order.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Only the boat captain can order abandon ship.</td>
<td>• Review abandon ship procedures with field team prior to work.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Communicate intent to abandon ship to all personnel onboard.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Notify USCG and nearby vessels of intent to abandon ship.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Call 911.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Notify the Project Manager and Field Lead, if time permits.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Be aware of the propeller position before abandoning ship.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Identify a rally point for all personnel.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Know the dangers of hypothermia.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Use the buddy system to support injured personnel.</td>
<td></td>
</tr>
<tr>
<td>Navigation</td>
<td>Boat traffic</td>
<td>• Maintain a safe operating distance from shoreline and other vessels.</td>
<td>• Be aware of on-water surroundings.</td>
</tr>
<tr>
<td>Motor vehicle operation and</td>
<td>Boat not secured properly</td>
<td>• Ensure that latches, straps, antennas, and onboard gear are secure. Ensure that motor is up and lights are plugged in for driving.</td>
<td>• Inspect around entire boat before driving.</td>
</tr>
<tr>
<td>trailering</td>
<td></td>
<td>• Follow Job Safety Analysis (JSA) for motor vehicle operation.</td>
<td></td>
</tr>
</tbody>
</table>

### 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 or provincial 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

## Groundwater and Surface Water Purging and Sampling

<table>
<thead>
<tr>
<th>Work Activity</th>
<th>Potential Hazards</th>
<th>Preventive or Corrective Measures</th>
<th>Inspection Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>If using glassware</td>
<td></td>
<td>• Follow JSA 002 for handling glassware.</td>
<td></td>
</tr>
<tr>
<td>Opening above ground well</td>
<td></td>
<td>• Open lid slowly and evenly.</td>
<td>Walk around monument and inspect outside of monument for nests before opening.</td>
</tr>
<tr>
<td>monuments</td>
<td>Wasps</td>
<td>• Set lid on ground bottom-side up gently and walk away.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Inspect bottom of lid and inside of well monument at a safe distance for wasps and/or nests.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dispose of wasps with either insect spray or methanol.</td>
<td></td>
</tr>
<tr>
<td>Purging water and collecting</td>
<td>Skin or eye contact with, or inhalation of,</td>
<td>• Wear required PPE for work being performed.</td>
<td>Inspect sample bottles for leakage of corrosive preservatives before handling.</td>
</tr>
<tr>
<td>water samples</td>
<td>potentially contaminated, corrosive, or hazardous</td>
<td>• Review hazardous properties of site materials (Refer to Table 6-1 and Appendix C in HASP for Material Safety Data Sheets).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>substances</td>
<td>• Follow proper procedures for handling/preserving/packaging samples and chemical/preserving agents.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Follow proper decontamination procedures.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Position work activities downwind when possible.</td>
<td></td>
</tr>
</tbody>
</table>

## Project Details

- **Project Name:** 2017 Supplemental Sampling – Troutdale Reynolds Industrial Park
- **Project Number:** 150002-01.01
- **JSA Number:** 001
- **Issue Date:** September 13, 2017
- **Location:** Troutdale, Oregon
- **Contractor:** Anchor QEA, LLC
- **Analysis by:** Matt Wilson
- **Analysis Date:** 8/29/17
- **Superintendent/Competent Person:** Matt Wilson
- **Revised by:**
- **Revised Date:**
- **Reviewed by:** Christopher R. Torell P.G., CSP
- **Reviewed Date:** September 1, 2017
- **Approved by:** Christopher R. Torell P.G., CSP
- **Approved Date:** September 13, 2017
## Job Safety Analysis

### Groundwater and Surface Water Purging and Sampling

<table>
<thead>
<tr>
<th>Work Activity</th>
<th>Potential Hazards</th>
<th>Preventive or Corrective Measures</th>
<th>Inspection Requirements</th>
</tr>
</thead>
</table>
|               | Ingestion of contaminated materials                                              | • Decontaminate clothing and skin prior to eating, drinking, smoking, or other hand-to-mouth activities.  
• Follow the decontamination procedure for personal decontamination.                                                   | Evaluate weight and center of gravity of heavier items prior to lifting/moving.                                                                                                                      |
|               | Muscle strain/injuries from improper lifting                                     | • Use proper lifting techniques or ask for assistance with heavy objects.                                                                                                                                                                                | Inspect shoreline for slope stability, undermining, or wash outs.                                                                                                                                      |
|               | Falling in water (when collecting surface water samples)                          | • Wear personal floatation device.  
• Never work alone near a water body. Use the buddy system.  
• Stay as far from the edge of water body as work requirements will allow.                                                                                                                          |                                                                         |
|               | Pinch/crush of hands/body parts in pump equipment                                | • Keep hands, other body parts, and clothing clear of the moving pump parts.                                                                                                                                                                          |                                                                         |
| Handling, packaging, and shipping samples | Skin or eye contact with, or inhalation of, potentially contaminated, corrosive, or hazardous substances | • Wear required PPE for work being performed.  
• Review hazardous properties of site contaminants (Refer to Appendix C in HASP for Material Safety Data Sheets for site materials).  
• Follow proper procedures for handling/preserving/packaging samples and chemical/preserving agents.  
• Follow proper decontamination procedures.  
• Position work activities downwind when possible.                                                                                                                                             | Inspect sample bottles for leakage of corrosive preservatives before handling.                                                                                                                        |
|               | Back or muscle strain                                                            | • Use appropriate lifting technique when handling heavy equipment and lifting heavy sample containers. Enlist help if necessary.                                                                                                                          |                                                                         |

### 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 and annual 8-hour refresher training.
- 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.
## Job Safety Analysis

### Glassware Handling

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Project Number:</th>
<th>JSA Number:</th>
<th>Issue Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017 Supplemental Sampling – Troutdale Reynolds Industrial Park</td>
<td>150002-01.01</td>
<td>002</td>
<td>September 13, 2017</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location:</th>
<th>Contractor:</th>
<th>Analysis by:</th>
<th>Analysis Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Troutdale, Oregon</td>
<td>Anchor QEA, LLC</td>
<td>Matt Wilson</td>
<td>8/29/17</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Work Operation:</th>
<th>Superintendent/Competent Person:</th>
<th>Revised by:</th>
<th>Revised Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handling glassware during sample collection procedures</td>
<td>Matt Wilson</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Required Personal Protective Equipment (PPE):
- Level D PPE (Steel toed leather or chemically resistant boots, high-visibility vest, safety glasses, hard hat, nitrile gloves, long pants).

<table>
<thead>
<tr>
<th>Work Activity</th>
<th>Potential Hazards</th>
<th>Preventive or Corrective Measures</th>
<th>Inspection Requirements</th>
</tr>
</thead>
</table>
| Transporting and use of glassware | Breakage of containers during field activities | - Use appropriate-sized plastic tubs or bottle boxes with dividers and bubble wrap to prevent bottle-to-bottle contact or contact with hard surfaces.  
- Avoid over-tightening lid caps to prevent breakage.  
- Place bottles on stable surfaces during collection, if possible.  
- Consider using coated glassware if practicable.  
- Carry oversize bottles in tubs/carriers using both hands during transfer to or from sampling vessels and whenever vessel is underway.  
- Wear gloves when handling glass containers during sampling.  
- Use shatter-resistant glassware, if possible. | Inspect glassware upon arrival at field site or after transport to ensure that equipment is intact.  
Ensure dividers are sufficient and will remain in place during transport |

<table>
<thead>
<tr>
<th>Faulty glassware</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact with equipment and other objects</td>
<td></td>
<td></td>
<td>Inspect glassware before use.</td>
</tr>
<tr>
<td></td>
<td>Use care when loading and unloading sampling equipment. Minimize the handling of individual containers.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Job Safety Analysis

## Glassware Handling

<table>
<thead>
<tr>
<th>Work Activity</th>
<th>Potential Hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filling sample containers</td>
<td>Skin or eye contact with, or inhalation of, potentially contaminated, corrosive, or hazardous substances</td>
</tr>
<tr>
<td></td>
<td>Impact with equipment and other objects</td>
</tr>
<tr>
<td></td>
<td>Over-tightening of bottle lids may cause breakage</td>
</tr>
<tr>
<td></td>
<td>Breakage during sample collection</td>
</tr>
<tr>
<td>Packing samples for shipment</td>
<td>Breakage during packing and shipment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Preventive or Corrective Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Wear required PPE for work being performed.</td>
</tr>
<tr>
<td>• Review hazardous properties of site contaminants (Refer to Appendix C in HASP for Material Safety Data Sheets for site materials).</td>
</tr>
<tr>
<td>• Follow proper procedures for handling/preserving/packaging samples and chemical/preserving agents.</td>
</tr>
<tr>
<td>• Follow proper decontamination procedures.</td>
</tr>
<tr>
<td>• Position work activities downwind when possible. Do not open preserved bottles until necessary.</td>
</tr>
<tr>
<td>• Use care when loading and unloading sampling equipment. Minimize the handling of individual containers.</td>
</tr>
<tr>
<td>• Avoid use of excessive force to tighten bottle caps (i.e., finger tight). Secure lids with clear tape to prevent opening during transport.</td>
</tr>
<tr>
<td>• Place containers in plastic tubs in between aliquots to limit contact with hard surfaces.</td>
</tr>
<tr>
<td>• Place containers on stable and non-slip surface during collection.</td>
</tr>
<tr>
<td>• Use buddy system as needed to hold bottles during filling.</td>
</tr>
<tr>
<td>• Use bottle wraps, foam sleeves, or bubble wrap to prevent bottle contact in cooler.</td>
</tr>
<tr>
<td>• Pack coolers snugly, but do not over pack.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inspection Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspect sample bottles for leakage of corrosive preservatives before handling.</td>
</tr>
<tr>
<td>Ensure glass bottles do not touch each other to minimize potential breakage during transport.</td>
</tr>
</tbody>
</table>

## 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 and annual 8-hour refresher training.
- 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.
## Job Safety Analysis

### Field Activities

<table>
<thead>
<tr>
<th>Work Activity</th>
<th>Potential Hazards</th>
<th>Preventive or Corrective Measures</th>
<th>Inspection Requirements</th>
</tr>
</thead>
</table>
| Outdoor, physical activity    | 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. |

**Project Name:**  
2017 Supplemental Sampling – Troutdale Reynolds Industrial Park

**Project Number:**  
150002-01.01

**JSA Number:**  
003

**Issue Date:**  
September 13, 2017

**Location:**  
Troutdale, Oregon

**Contractor:**  
Anchor QEA, LLC

**Analysis by:**  
Matt Wilson

**Analysis Date:**  
8/29/17

**Superintendent/Competent Person:**  
Matt Wilson

**Revised by:**  

**Revised Date:**  

**Required Personal Protective Equipment (PPE):**
- Level D PPE (Steel toed leather or chemically resistant boots, high-visibility vest, safety glasses, hard hat, nitrile gloves, long pants, hearing protection [if above 85 decibels time-weighted average])
- U.S. Coast Guard approved personal floatation device (if work on or within 10 feet of a water body)

**Reviewed by:**  
Christopher R. Torell P.G., CSP

**Reviewed Date:**  
September 1, 2017

**Approved by:**  
Christopher R. Torell P.G., CSP

**Approved Date:**  
September 13, 2017
### Outdoor, physical activity (continued)

<table>
<thead>
<tr>
<th>Work Activity</th>
<th>Potential Hazards</th>
<th>Preventive or Corrective Measures</th>
<th>Inspection Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Heat stress</strong></td>
<td><strong>(see HASP Section 11.2.2)</strong></td>
<td>• Adjust work schedules, as necessary, to avoid hottest part of the day.</td>
<td>Monitor workers’ physical conditions.</td>
</tr>
<tr>
<td><strong>Heat stress</strong></td>
<td><strong>(see HASP Section 11.2.2)</strong></td>
<td>• Take rest breaks as warranted.</td>
<td>Monitor outside temperature versus worker activity.</td>
</tr>
<tr>
<td><strong>Heat stress</strong></td>
<td><strong>(see HASP Section 11.2.2)</strong></td>
<td>• Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods.</td>
<td></td>
</tr>
<tr>
<td><strong>Heat stress</strong></td>
<td><strong>(see HASP Section 11.2.2)</strong></td>
<td>• Maintain body fluids at normal levels.</td>
<td></td>
</tr>
<tr>
<td><strong>Heat stress</strong></td>
<td><strong>(see HASP Section 11.2.2)</strong></td>
<td>• Train workers to recognize the symptoms of heat-related illness.</td>
<td></td>
</tr>
<tr>
<td><strong>Cold stress</strong></td>
<td><strong>(see HASP Section 11.2.3)</strong></td>
<td>• Provide shelter (enclosed, heated environment) to protect personnel during rest periods.</td>
<td>Monitor workers’ physical conditions and PPE.</td>
</tr>
<tr>
<td><strong>Cold stress</strong></td>
<td><strong>(see HASP Section 11.2.3)</strong></td>
<td>• Educate workers to recognize the symptoms of frostbite and hypothermia.</td>
<td>Monitor outside and water temperature versus worker activity and PPE.</td>
</tr>
<tr>
<td><strong>Cold stress</strong></td>
<td><strong>(see HASP Section 11.2.3)</strong></td>
<td>• Use appropriate cold-weather gear, up to and including Mustang-type bib coveralls or jacket/bib combinations.</td>
<td></td>
</tr>
<tr>
<td><strong>Cold stress</strong></td>
<td><strong>(see HASP Section 11.2.3)</strong></td>
<td>• Consider additional precautions if working near water in cold weather.</td>
<td></td>
</tr>
<tr>
<td><strong>Cold stress</strong></td>
<td><strong>(see HASP Section 11.2.3)</strong></td>
<td>• Have a dry change of clothing available.</td>
<td></td>
</tr>
<tr>
<td><strong>Cold stress</strong></td>
<td><strong>(see HASP Section 11.2.3)</strong></td>
<td>• Train workers to recognize the symptoms of cold-related illness.</td>
<td></td>
</tr>
<tr>
<td><strong>Rain/snow</strong></td>
<td></td>
<td>• Wear appropriate PPE (rain gear).</td>
<td>PPE should be inspected daily prior to use.</td>
</tr>
<tr>
<td><strong>Rain/snow</strong></td>
<td></td>
<td>• Be aware of slip hazards, puddles, and electrical hazards when working in wet conditions.</td>
<td>Routinely inspect work area for deteriorating conditions.</td>
</tr>
<tr>
<td><strong>Rain/snow</strong></td>
<td></td>
<td>• If extremely cold conditions are forecast, consider additional precautions or postponing work activity.</td>
<td></td>
</tr>
<tr>
<td><strong>Sunshine</strong></td>
<td></td>
<td>• Have sunscreen available for ultraviolet protection.</td>
<td>Ensure that sunscreen and water are available.</td>
</tr>
<tr>
<td><strong>Sunshine</strong></td>
<td></td>
<td>• Have abundant water available to prevent dehydration.</td>
<td></td>
</tr>
<tr>
<td><strong>Sunshine</strong></td>
<td></td>
<td>• Consider wearing wide-brimmed headwear and light-colored, lightweight, sun-blocking clothing.</td>
<td></td>
</tr>
<tr>
<td><strong>Lightning</strong></td>
<td></td>
<td>• Do not begin or continue work until lightning subsides for at least 20 minutes. Disconnect and do not use or touch electronic equipment.</td>
<td>Obtain weather forecast and updates as needed.</td>
</tr>
<tr>
<td><strong>Lightning</strong></td>
<td></td>
<td>• Immediately head for shelter if lightning is observed. If not able to get to shelter, disconnect and do not use or touch the major electronic equipment, including the radio, throughout the duration of the storm.</td>
<td></td>
</tr>
</tbody>
</table>
## Job Safety Analysis

### Field Activities

<table>
<thead>
<tr>
<th>Work Activity</th>
<th>Potential Hazards</th>
<th>Preventive or Corrective Measures</th>
<th>Inspection Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>High winds</td>
<td>• Wear goggles or safety glasses if dust/debris is visible.</td>
<td>Ensure that goggles/safety glasses are available.</td>
<td></td>
</tr>
</tbody>
</table>
| Biological hazards (flora [e.g., poison ivy and poison oak] and fauna [e.g., ticks, wasps, 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. |
| Noise exposure    | • Wear hearing protection in high noise environments or when working around heavy machinery/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).
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity.
### Work Activity

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<th>Inspection Requirements</th>
</tr>
</thead>
</table>
| Motor vehicle operation       | New/unfamiliar vehicle                     | • Allow yourself some time to get familiar with a rental vehicle or one not used very often. Test lights, windshield wipers, hazard lights, horn, and parking brake, and other important functions.  
• Allow extra side, front, and back space around the vehicle while driving or parking an unfamiliar vehicle.  
• Adjust mirrors and seat while vehicle is in park. | Become familiar with important operating functions and space requirements for the vehicle. |
| Vehicle accident              |                                            | • Plan your travel route and avoid rush hour(s) if possible.  
• Obey traffic laws.  
• Use care when backing up; back up slowly and use a spotter for difficult locations or poor lighting, or while trailering.  
• Drive defensively and park in parking spaces uncrowded by other vehicles.  
• If an accident occurs, stay in the car and call for help. | Ensure that insurance information is in the vehicle. |
| Motor vehicle operation (continued) | Distraction while driving              | • Stop driving if a potential for a distracting conversation exists.  
• Do not use cell phones or GPS while driving; ask your colleagues to assist you, or safely pull over to use if you are alone. |                                                                       |
# Job Safety Analysis

## Motor Vehicle Operation

<table>
<thead>
<tr>
<th>Work Activity</th>
<th>Potential Hazards</th>
<th>Preventive or Corrective Measures</th>
<th>Inspection Requirements</th>
</tr>
</thead>
</table>
| Fatigue/falling asleep | • Get adequate rest prior to driving.  
• If feeling slightly tired, change seat position, open windows, and stretch often.  
• If experiencing extreme drowsiness or fatigue, pull over to a safe place and rest. |                                                                                                                                                                                                                                           | Ensure that windshield wipers are in good working order and washer fluid is adequate.                          |
| Weather/road conditions| • Check road and weather conditions on route before traveling; be prepared to adjust and have a plan for alternate stops or travel if conditions change.  
• Travel in daylight hours when possible.  
• Allow extra time for delays so that you do not feel rushed.  
• For road glare, consider wearing sunglasses and use caution particularly when driving during sunrise or sunset. |                                                                                                                                                                                                                                           | Check tires for adequate tread for road conditions.                                                                 |

### 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 (JSA) before starting a work activity.
## Job Safety Analysis

### Borehole Logging and Drilling

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Project Number:</th>
<th>JSA Number:</th>
<th>Issue Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017 Supplemental Sampling – Troutdale Reynolds Industrial Park</td>
<td>150002-01.01</td>
<td>005</td>
<td>September 13, 2017</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location:</th>
<th>Contractor:</th>
<th>Analysis by:</th>
<th>Analysis Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Troutdale, Oregon</td>
<td>Anchor QEA, LLC</td>
<td>Matt Wilson</td>
<td>8/29/17</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Work Operation:</th>
<th>Superintendent/Competent Person:</th>
<th>Revised by:</th>
<th>Revised Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Borehole logging and soil sampling using direct-push drilling techniques</td>
<td>Matt Wilson</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Required Personal Protective Equipment (PPE):
- Level D PPE (Steel toed leather or chemically resistant boots, high-visibility vest, safety glasses, hard hat, nitrile gloves, long pants, hearing protection [if above 85 decibels time-weighted average]).

### Work Activity

<table>
<thead>
<tr>
<th>Work Activity</th>
<th>Potential Hazards</th>
<th>Preventive or Corrective Measures</th>
<th>Inspection Requirements</th>
</tr>
</thead>
</table>
| Borehole logging | Cuts or incisions from opening sample liner with cutting tools | • If possible, have drilling contractor open plastic sample liners.  
• Wear appropriate PPE.  
• Cut away from body while opening plastic liners.  
• Use specialized core cutting table if available. | Evaluate weight and center of gravity of heavier items prior to lifting/moving. |
| | Muscle strain/injuries from improper lifting | • Use proper lifting techniques or ask for assistance with heavy objects. | |
| Drilling activities | Rotating and moving equipment | • Set up borehole logging station in area well clear of drill rig and drilling activities.  
• Set up borehole logging station in an upwind location, if possible.  
• Stay clear of drill rig while drill rig is in operation. | Get visual contact with driller and ensure driller has shut down rig before approaching drilling work area  
Confirm with driller that borehole logging station will not be in a potentially hazardous location. |

---

1 of 2
## Job Safety Analysis

### Borehole Logging and Drilling

<table>
<thead>
<tr>
<th>Work Activity</th>
<th>Potential Hazards</th>
<th>Preventive or Corrective Measures</th>
<th>Inspection Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic</td>
<td>• Use methods such as cones, signs, lights, caution tape, etc., to divert and slow traffic near work site.</td>
<td>Evaluate work site for traffic hazards before commencing work.</td>
<td></td>
</tr>
<tr>
<td>Moving support vehicles or forklifts</td>
<td>• Set up borehole logging station in area well clear of moving vehicles and work zones.</td>
<td>Confirm with driller that borehole logging station will not be in a potentially hazardous location.</td>
<td></td>
</tr>
<tr>
<td>Slips, trips, and falls</td>
<td>• Stay clear of drilling contractor work zones, if possible.</td>
<td>Inspect ground surface for uneven surfaces or equipment before entering a work area.</td>
<td></td>
</tr>
</tbody>
</table>

### 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 and annual 8-hour refresher training.
- 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.
# Job Safety Analysis

## Investigation-Derived Waste Handling

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Project Number:</th>
<th>JSA Number:</th>
<th>Issue Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017 Supplemental Sampling – Troutdale Reynolds Industrial Park</td>
<td>150002-01.01</td>
<td>006</td>
<td>September 13, 2017</td>
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</tbody>
</table>

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<tr>
<th>Location:</th>
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<th>Analysis by:</th>
<th>Analysis Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Troutdale, Oregon</td>
<td>Anchor QEA, LLC</td>
<td>Matt Wilson</td>
<td>9/1/2017</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Work Operation:</th>
<th>Superintendent/Competent Person:</th>
<th>Revised by:</th>
<th>Revised Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investigation-derived waste (IDW) handling</td>
<td>Matt Wilson</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Required Personal Protective Equipment (PPE):
- Level D PPE (Steel toed leather or chemically resistant boots, high-visibility vest, safety glasses, hard hat, nitrile inner gloves, leather outer gloves, long pants).

<table>
<thead>
<tr>
<th>Work Activity</th>
<th>Potential Hazards</th>
<th>Preventive or Corrective Measures</th>
<th>Inspection Requirements</th>
</tr>
</thead>
</table>
| 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 Handling

<table>
<thead>
<tr>
<th>Work Activity</th>
<th>Potential Hazards</th>
<th>Preventive or Corrective Measures</th>
<th>Inspection Requirements</th>
</tr>
</thead>
</table>
| 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 because 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.                                                      |
| Splash              | • Wear the required PPE at all times.                                               |                                                                                                   | Inspect PPE upon donning and periodically during tasks.   |
|                     | • Use care to minimize splashing or smearing of IDW during handling and containerization. |                                                                                                   |                                                   |

### 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 (JSA) before starting a work activity.
# Job Safety Analysis

## Wading in a River or Stream

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Project Number:</th>
<th>JSA Number:</th>
<th>Issue Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017 Supplemental Sampling – Troutdale Reynolds Industrial Park</td>
<td>150002-01.01</td>
<td>007</td>
<td>September 10, 2018</td>
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</table>

<table>
<thead>
<tr>
<th>Location:</th>
<th>Contractor:</th>
<th>Analysis by:</th>
<th>Analysis Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Troutdale, Oregon</td>
<td>Anchor QEA, LLC</td>
<td>Matt Wilson</td>
<td>September 10, 2018</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Work Operation:</th>
<th>Superintendent/Competent Person:</th>
<th>Revised by:</th>
<th>Revised Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wading in river or stream</td>
<td>Matt Wilson</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Required Personal Protective Equipment (PPE):
- Level D PPE (steel-toed leather or chemically resistant boots, high-visibility vest, safety glasses, hard hat, nitrile gloves, long pants, hearing protection [if above 85 decibels time-weighted average])
- U.S. Coast Guard-approved personal floatation device if working on or within 10 feet of a body of water
- Chest waders if entering water body

### Work Activity | Potential Hazards | Preventative or Corrective Measures | Inspection Requirements
---|---|---|---
Wading in river or stream | Slips, trips, and falls | • 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. | • 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.  
• Inspect PFDs for integrity, particularly the cartridge charge on inflatable PFDs.

Note:  
PFD: personal flotation device
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 and annual 8-hour refresher training.
- 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.
Appendix C
Safety Data Sheets (SDS)
LIQUINOX MSDS

Section 1 : MANUFACTURER INFORMATION

**Supplier:** Same as manufacturer.

**Manufacturer:** Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

**Manufacturer emergency phone number:** 800-255-3924.
813-248-0585 (outside of the United States).

**Supplier MSDS date:** 2005/02/24

**D.O.T. Classification:** Not regulated.

Section 2 : HAZARDOUS INGREDIENTS

<table>
<thead>
<tr>
<th>C.A.S.</th>
<th>CONCENTRATION %</th>
<th>Ingredient Name</th>
<th>T.L.V.</th>
<th>LD/50</th>
<th>LC/50</th>
</tr>
</thead>
<tbody>
<tr>
<td>25155-30-0</td>
<td>10-30</td>
<td>SODIUM DODECYLBENZENESULFONATE</td>
<td>NOT AVAILABLE</td>
<td>438 MG/KG RAT ORAL</td>
<td>1330 MG/KG MOUSE ORAL</td>
</tr>
</tbody>
</table>

Section 3 : PHYSICAL / CHEMICAL CHARACTERISTICS

**Physical state:** Liquid.

**Appearance & odor:** Odourless.
Pale yellow.

**Odor threshold (ppm):** Not available.

**Vapour pressure** @ 20°C (68°F).

**Vapour density (air=1):** >1

**Vapour pressure (mmHg):** 17

**Vapour density (air=1):** >1

**Vapour density (%)**

**By volume:** Not available.

**Evaporation rate (butyl acetate = 1):** < 1.
Boiling point (°C): 100 (212°F)
Freezing point (°C): Not available.

pH: 8.5
Specific gravity @ 20 °C: (water = 1).
1.083
Solubility in water (%): Complete.
Coefficient of water\oil dist.: Not available.
VOC: None

Section 4 : FIRE AND EXPLOSION HAZARD DATA

- **Flammability:** Not flammable.
- **Conditions of flammability:** Surrounding fire.
- **Extinguishing media:** Carbon dioxide, dry chemical, foam. Water Water fog.
- **Special procedures:** Self-contained breathing apparatus required. Firefighters should wear the usual protective gear. Use water spray to cool fire exposed containers.
- **Auto-ignition temperature:** Not available.
- **Flash point (°C), method:** None
- **Lower flammability limit (% vol):** Not applicable.
- **Upper flammability limit (% vol):** Not applicable.

Sensitivity to mechanical impact: Not available.
- **Hazardous combustion products:** Oxides of carbon (COx).
- **Hydrocarbons.**
- **Rate of burning:** Not available.
- **Explosive power:** Containers may rupture if exposed to heat or fire.

Section 5 : REACTIVITY DATA

- **Chemical stability:** Product is stable under normal handling and storage conditions.
- **Conditions of instability:** Extreme temperatures.
- **Hazardous polymerization:** Will not occur.
- **Incompatible substances:** Strong acids.
- **Strong oxidizing agents.**
- **Hazardous decomposition products:** See hazardous combustion products.

Section 6 : HEALTH HAZARD DATA
**Route of entry:** Skin contact, eye contact, inhalation and ingestion.

**Effects of Acute Exposure**

**Eye contact:** May cause irritation.

**Skin contact:** Prolonged and repeated contact may cause irritation.

**Inhalation:** May cause headache and nausea.

**Ingestion:** May cause vomiting and diarrhea. May cause gastric distress.

**Effects of chronic exposure:** See effects of acute exposure.

**LD50 of product, species & route:** > 5000 mg/kg rat oral.

**LC50 of product, species & route:** Not available.

**Exposure limit of material:** Not available.

**Sensitization to product:** Not available.

**Carcinogenic effects:** Not listed as a carcinogen.

**Reproductive effects:** Not available.

**Teratogenicity:** Not available.

**Mutagenicity:** Not available.

**Synergistic materials:** Not available.

**Medical conditions aggravated by exposure:** Not available.

**First Aid**

**Skin contact:** Remove contaminated clothing. Wash thoroughly with soap and water. Seek medical attention if irritation persists.

**Eye contact:** Check for and remove contact lenses. Flush eyes with clear, running water for 15 minutes while holding eyelids open: if irritation persists, consult a physician.

**Inhalation:** Remove victim to fresh air. If irritation persists, seek medical attention.

**Ingestion:** Do not induce vomiting, seek medical attention. Dilute with two glasses of water. Never give anything by mouth to an unconscious person.

### Section 7: PRECAUTIONS FOR SAFE HANDLING AND USE

**Leak/Spill:** Contain the spill. Prevent entry into drains, sewers, and other waterways. Wear appropriate protective equipment. Small amounts may be flushed to sewer with water. Soak up with an absorbent material. Place in appropriate container for disposal. Notify the appropriate authorities as required.

**Waste disposal:** In accordance with local and federal regulations.

**Handling procedures and equipment:** Protect against physical damage. Avoid breathing vapors/mists. Wear personal protective equipment appropriate to task.
Wash thoroughly after handling.
Keep out of reach of children.
Avoid contact with skin, eyes and clothing.
Avoid extreme temperatures.
Launder contaminated clothing prior to reuse.

**Storage requirements:** Store away from incompatible materials.
Keep containers closed when not in use.

---

### Section 8 : CONTROL MEASURES

**Precautionary Measures**

**Gloves/Type:**
Wear appropriate gloves.

**Respiratory/Type:** None required under normal use.

**Eye/Type:** Safety glasses recommended.

**Footwear/Type:** Safety shoes per local regulations.

**Clothing/Type:** As required to prevent skin contact.

**Other/Type:** Eye wash facility should be in close proximity.
Emergency shower should be in close proximity.

**Ventilation requirements:** Local exhaust at points of emission.
1. **CHEMICAL PRODUCT and EMERGENCY TELEPHONE CONTACT**

   Product Name: Methanol
   Chemical Family: Aliphatic Alcohol
   Synonyms: Carbinol, Columbian Spirits, Methyl Alcohol, Pyrolygneous Spirits, Wood Alcohol, Methylol, Wood Naptha, Wood Spirits, Manhattan Spirits, Pyroxylic Spirits, Colonial Spirits, Methyl Hydroxide, Monohydroxymethane
   Formula: CH₃OH

   **EMERGENCY TELEPHONE NUMBERS**
   CHEMTREC, United States, Canada, Puerto Rico, Virgin Islands: 1-800-424-9300
   CHEMTREC, International And Ships at Sea, emergency collect calls are accepted: 001-703-527-3887
   Emergency Contact for Malabo, Equatorial Guinea, West Africa:
   Call AMPCO at +240-222-245-367 (mobile) +1-713-328-1340 (land line via USA)

2. **COMPOSITION/INFORMATION ON INGREDIENTS**

<table>
<thead>
<tr>
<th>Ingredient Name/CAS Number</th>
<th>Concentration</th>
<th>Exposure Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methanol/# 67-56-1</td>
<td>99-100%</td>
<td>200 ppm TWA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>250 ppm STEL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6,500 ppm IDLH</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 ppm = 1.33 mg/m</td>
</tr>
</tbody>
</table>

3. **HAZARDOUS IDENTIFICATION**

   **EMERGENCY OVERVIEW**

   Methanol is a colorless volatile liquid with a faintly sweet pungent odor or similar to ethyl alcohol. The substance is fully soluble in water. Vapors of methanol are slightly heavier than air and may travel some distance to a source of ignition and flash back. Accumulations of vapors in confined spaces such as buildings or sewers may explode if ignited. There is potential for containers of liquid to rupture violently if exposed to fire or excessive heat for sufficient time duration. Methanol is listed as a “Poison-Class B”. It is harmful if swallowed or absorbed through the skin. Ingestion of as little as one ounce can cause irreversible injury to the nervous system, blindness, or death. It cannot be made non-poisonous. Causes eye and respiratory system irritation and may cause skin irritation. Avoid liquid, mist or vapor contact. Vapor inhalation or liquid penetration of the skin can cause central nervous system depression.
POTENTIAL HEALTH EFFECTS

Primary Route of Entry: Inhalation, skin contact/absorption, eye contact, and ingestion.

General Acute Exposure: Liquid, mist, or vapor can cause eye, skin, and respiratory tract irritation and Central Nervous System (CNS) depression.

Inhalation
Acute Exposure: Short term exposure to high concentrations of methanol may cause CNS depression. Symptoms may include headache, weakness, drowsiness, lightheadedness, nausea, difficult breathing, drunkenness, eye irritation, blurred vision, blindness, loss of consciousness, vertigo, fatigue, convulsions, and possibly death, depending on exposure. Victims may improve and then get worse again up to 30 hours later.

Skin
Acute Contact: Upon prolonged or repeated contact, absorption through the skin may occur and produce toxic effects similar to those resulting from inhalation exposure. Repeated or prolonged skin contact may cause drying, cracking, and inflammation of the skin due to the defatting action of the product.

Eye
Acute Contact: Eye irritation may occur upon short term exposure, including a burning sensation, tearing, redness, or swelling. Upon direct contact with liquid, conjunctivitis and corneal burns may occur. Methanol’s main toxic effect is exerted upon the nervous system, particularly the optic nerves and possibly the retina. The condition can progress to permanent blindness.

Ingestion
Ingestion may cause serious poisoning with effects similar to those of inhalation and absorption through the skin. Toxic effects are more common after ingestion. Death from as little as 1.0 ounce has been reported.

Neurologic
Acute Exposure: CNS depression may occur upon exposure.

Summary of Chronic Exposure
Methanol may slowly eliminate from the body, hence repeated exposure may result in toxic levels in the blood and tissues. Due to its slow elimination, methanol should be regarded as a cumulative poison. Though single exposures to fumes may cause no harmful effect, daily exposure may result in the accumulation of sufficient methanol in the body to cause illness.

Note to the Physician: Coma resulting from massive exposure may last as long as 2-4 days. In the body, products that may be formed by its oxidation are formaldehyde and formic acid.

Carcinogenicity:
NTP.................................................................: Not Listed
IARC...........................................................: Not Listed
OSHA..........................................................: Not Listed
Medical Conditions Aggravated by Exposure: Personnel with pre-existing CNS disease, skin disorders, impaired liver or kidney function, GI tract disorders or chronic respiratory disease should avoid exposure.

4. FIRST AID MEASURES

First Aid for Eyes: Immediately flush eyes with copious amounts of tepid water for at least 15 minutes. The patient should be seen in a health care facility and referral to an ophthalmologist should be considered.

First Aid for Skin: Immediately flush eyes with copious amounts of tepid water for at least 15 minutes while removing contaminated clothing and shoes, followed by washing area thoroughly with soap and water. The patient should be seen in a health care facility if irritation or pain persists or if symptoms of toxicity develop. Wash contaminated clothing and shoes before reuse.

First Aid for Inhalation: Move patient to fresh air and keep warm and at rest. Monitor for respiratory distress. If difficulty in breathing develops or if breathing has stopped, administer artificial respiration and seek medical attention. If trained to do so, administer supplemental oxygen with assisted ventilation as required. Caution: Administration of mouth-to-mouth resuscitation may expose the first aid provider to chemical within the victim's lungs or vomit.

First Aid for Ingestion: If patient is conscious, immediately give two glasses of water and induce vomiting. Do not make unconscious person vomit. Get immediate medical attention. NOTE: NIOSH suggests that vomiting be induced only if immediate medical attention is not available.

Note to Physicians: Provide standard methanol ingestion treatment. To prepare antidote, make a solution using 100 ml of 100-proof ethyl alcohol (grain alcohol) in 200 ml of water and give 1.5 ml per kg of body weight, or 100 ml for an average adult. Following this, at 2-hour intervals for 4 days, give antidote (0.5-1.0 ml per kg of body weight, orally or intravenously to reduce metabolism of the methanol and to allow time for its excretion). Blood ethanol levels should be 1.0-1.5 mg/ml.

5. FIRE FIGHTING MEASURES

Flash Point: 52°F (11°C), closed cup
Lower Flammable Limit: 6.0% Volume in Air
Upper Flammable Limit: 36.5% Volume in Air
Auto Ignition Temperature: 725°F, 385°C

General Information:
Methanol is extremely flammable. This material releases vapors at or below ambient temperatures. When mixed with air this substance can burn in the open or explode in confined space conditions. Methanol vapors are heavier than air and may travel long distances along the ground before reaching a point of ignition and flashing back. Methanol-water mixtures containing as little as 21% methanol by volume (25% by weight) are also flammable liquids. Methanol fires may not be visible to the naked eye during daylight.
Extinguishing Media:
Water may be ineffective but may be used to dilute spills to non flammable mixtures.
Small Fire..................................................: Dry Chemical, CO2, Water spray or alcohol-resistant foam
Large Fire..................................................: Water Spray, fog or alcohol-resistant foam

Special Fire Fighting Procedures:
a. Move container from fire area if you can do it without risk.
b. Apply cooling water to sides of containers that are exposed to flames until well after fire is out.
   Stay away from ends of tanks due to exploding potential when tanks are involved in a fire.
c. Dike fire control water for later disposal, do not scatter the material.
d. Do not use straight streams due to spreading of methanol.
e. Positive pressure self-contained breathing apparatus (SCBA) should be used when there is a
   potential for inhalation of vapors and/or fumes.
f. Structural fire fighter’s protective clothing is recommended for fire situations ONLY; it is not
   effective in spill situations.

Fire Involving Tanks or Rail Car/Trailer Loads
a. Fight from maximum distance or use unmanned hose holders or monitor nozzles.
b. Withdraw immediately in case of rising sound from venting safety devices or discoloration of
   tank.
c. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw
   from the area and let fire burn.
d. Isolate area for ½ mile (0.8 km) in all directions.

6. ACCIDENTAL RELEASE MEASURES

Spill or Leak Measures: Stop leak if you can do it without risk. Keep unnecessary people away and
deny entry. Isolate spill or leak area immediately for at least 330 to 660 feet (100 to 200 meters) in all
directions. Stay upwind, out of low areas, and ventilate closed spaces before entering. Eliminate all
ignition sources. Do not touch or walk through spilled material. Prevent entry of product to
waterways, sewers, basements, or confined spaces. A vapor suppressing foam may be used to reduce
vapors. All equipment used when handling the product must be grounded and/or spark resistant.
Water spray may reduce vapors, but may not prevent ignition in closed spaces. Fully encapsulating,
vapor protective clothing with flash protection should be worn for spills and leaks with no fire.

Determining Spill Size: Generally, a small spill is one which involves a single, small package (i.e. up to
55 gallon drum, 200 liters), small cylinder, or a small (non-continuing) leak from a large container.

Small Spill:
a. Absorb with earth, sand or non-combustible material and transfer to containers for later
   disposal.
b. Use clean non-sparking tools to collect absorbed material.

Large Spill:
a. Dike far ahead of liquid spill for later disposal.
b. Follow local protocol for handling.
c. Water spray may reduce vapor, but may not prevent ignition in closed spaces.
7. **HANDLING AND STORAGE**

Handling and storage for methanol should follow the standard listed below. Other standards or regulations may apply which are not listed.

a. National Electrical Code; Hazard Classification for Methanol is Class 1, Div. 1 or 2, Group D.


**Handling Precautions:** Use proper personal protective equipment when working with or around methanol. No smoking or open flame in storage, use, or handling areas. Use explosion-proof electrical equipment. Ensure proper electrical grounding procedures are in place. See Section 8.

**Storage:** Store in totally enclosed equipment, designed to avoid ignition and human contact. Tanks must be grounded, vented, and should have vapor emission controls. Tanks must be diked as per NFPA or API Standards. A flammable mixture of methanol vapor and air is possible inside a storage tank or transportation tank, and handlers should take appropriate precautions to reduce the risk of ignition. Handlers must eliminate ignition sources or purge the tank with an inert gas such as nitrogen. All equipment must be grounded – bonded when transferring product in order to avoid static discharge from the equipment, and subsequent possible fire. Avoid storage with incompatible materials. Anhydrous methanol is non-corrosive to most metals at ambient temperatures except for lead, nickel, monel, cast iron, and high silicon iron. Coatings of copper (or copper alloys), zinc (including galvanized steel), or aluminum are unsuitable for storage. These materials may be attacked slowly by the methanol. Storage tanks of welded construction are normally satisfactory. They should be designed and built in conformance with good engineering practice for the material being stored. While plastics can be used for short term storage, they are generally not recommended for long-term storage due to deterioration effects and the subsequent risk of contamination.

8. **EXPOSURE CONTROLS, PERSONAL PROTECTION**

**Respiratory Protection Requirements**

Less than 200 ppm...........: No protection required if TWA is not exceeded.

200 to 250 ppm..............: Protection required if the daily TWA is exceeded, fresh air supplied system must be used if protection is needed.

Greater than 200 ppm...: A fresh air supply system must be used if protection is needed (i.e., positive pressure self contained breathing apparatus).

**Skin Protection Requirements:** Equipment should prevent repeated or prolonged skin contact with the product. This may include rubber boots, resistant gloves, and other impervious and resistant clothing. Compatible materials may include butyl rubber, natural rubber, neoprene, nitrile rubber, viton and others. Review the manufacturer’s compatibility data.

**Eye Protection Requirements:** Use chemical (indirectly vented) goggles when there is a potential for contact with product. including vapor. A full-face shield may be worn over goggles for additional protection, but not as substitute for goggles.
Other Protective Equipment: Safety shower and eyewash fountain should be provided in the methanol handling area.

Engineering Controls: Adequate ventilation to keep methanol concentrations below applicable standards when possible.

NOTE: See Section 2 regulatory exposure guidelines.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical Form: Liquid
Color: Colorless
Odor: Faintly sweet pungent odor like ethyl alcohol
Boiling Point: 148° F (64° C) at atmospheric pressure
Melting Point: -144° F (-98° C)
pH: 7.2
Solubility: 100%
Specific Gravity: 0.792 @ 68° F (20° C)
Vapor Density: 1.11 @ 60° F, (15.6° C)
Vapor Pressure: 1.86 psia @ 68° F (20° C)
% Volatile by Volume: 100
Molecular Weight: 32.04
Density: 6.63 lb. per gallon @ 60° F
0.7945 kg per liter @ 15.6° C

Critical Temperature: 464° F (240° C)
Critical Pressure: 1,142 psia (77.77 bar)

10. REACTIVITY

Stability: This is a stable material
Hazardous Polymerization: Will not occur

Decomposition:
Excessive heating and/or incomplete combustion will generate carbon monoxide, formaldehyde, and possible unburned methanol.

Incompatibilities:

a. Methanol has an explosive reaction with chloroform + sodium methoxide and diethyl zinc (see following note).
b. Methanol has a violent reaction with alkyl aluminum salts, acetyl bromide, chloroform + sodium hydroxide, cyanuric chloride, nitric acid, etc. (see following note).
c. Incompatible with beryllium dihydride, metals (potassium, magnesium, etc.), oxidants (barium, perchlorate, bromine, chlorine, etc.), etc. (see following note).
d. Dangerous; can react vigorously with oxidizing materials (see following note).

11. TOXICOLOGICAL INFORMATION

LDL0 Human: 143 mg/kg; Eye, Pul, GIT
LD50 Mouse: 7300 mg/kg
LC50 Rat: 64,000 ppm/4H
LC50 Goldfish: 250 ppm/11H

Carcinogenicity: Not listed by IARC, NTP, ACGIH, or OSHA as carcinogen.

Teratogenicity: Methanol has produced fetotoxicity in rats and teratogenicity in mice exposed by inhalation to high concentration of methanol vapors.

Reproductive Toxicity: Information available does not suggest that methanol is a reproductive toxin.

Mutagenicity: There is insufficient information available to conclude that methanol is mutagenic.

Synergistic Products: In animals, high concentration of methanol can increase the toxicity of other chemicals, particularly liver toxins like carbon tetrachloride. Ethanol significantly reduces the toxicity of methanol because it completes for the same metabolic enzymes, and has been used to treat methanol poisoning.

Potential for Accumulation: Methanol is readily absorbed in the body following inhalation and ingestion. Skin absorption may occur if the skin is broken or exposure is prolonged. Once absorbed, methanol is rapidly distributed to the body tissues. A small amount is excreted unchanged in exhaled air and urine. The rest is first metabolized to formaldehyde, which is then metabolized to formic acid and/or formate. The formic acid and formate are converted into carbon dioxide and water. In humans, methanol clears from the body, after inhalation or oral exposure, with a half-life of 1 day or more for high doses (greater than 1000 mg/kg) or about 1.5 to 3 hours for low doses (less than 100 mg/kg or 76.5 to 230 ppm (100-300 mg/m³)).

Medical Condition Aggravated By Exposure: Persons with pre-existing skin disorders, eye problems, respiratory conditions, or impaired liver or kidney functions may be more susceptible to the effects of this substance.

12. ECOLOGICAL INFORMATION

a. Methanol is harmful to aquatic life in low concentrations and may be hazardous if it enters water intakes.
b. Local health and wildlife authorities, as well as operators of water intakes in the vicinity, should be notified of water releases.
c. Biological Oxygen Demand: 0.6 to 1.2 lb/lb in 5 days.
13. **DISPOSAL CONSIDERATIONS**

Waste must be disposed of in accordance with federal, state, and local environmental control regulations. Waste methanol in concentrations equal to or greater than 24%, by weight, meets the definition of an ignitable hazardous waste. Product grade methanol, when disposed, is listed as hazardous waste.

For large spills, maximize product recovery for reuse or recycling. Free liquid may be collected using explosion-proof pumps. For small spills, take up with sand or non-combustible absorbent. Use registered transporters to move contaminated product/soil/water in D.O.T. approved containers. Dispose of materials at a licensed facility permitted to handle RCRA/OSHA “Hazardous Wastes”. Incineration is the recommended disposal method. Burn concentrated liquid in systems compatible with water soluble waste. Biodegradation may be used on dilute aqueous waste. Assure emissions and effluent comply with applicable laws.

14. **TRANSPORTATION INFORMATION**

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<th>Regulation</th>
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<th>Proper Shipping Name</th>
<th>Hazard Class</th>
<th>Subsidiary Hazards</th>
<th>Packing Group</th>
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D.O.T. Placard: Flammable Liquid. Class 3, color: red
OSHA Label Required: Yes
RQ (Reportable Quantity): 5000 pounds or approx. 755 gallons
STCC Number: 49 092 30
15. REGULATORY INFORMATION

OSHA: This product is considered hazardous material under criteria of the Federal OSHA Hazard Communication Standard 29 CFR 1910.1200.

SARA TITLE III:
  a. EHS (Extremely Hazardous Substances) List : Not Listed
  b. Note: Chemicals on the original list that do not meet the toxicity criteria, but, because of their high production volume and recognized toxicity, are considered chemicals of concern (“other chemicals”).
  c. RQ (Reportable Quantity): Not Listed
  d. TPQ (Threshold Planning Quantity): Not Listed
  e. Section 313: “Specific Toxic Chemical Listings” – 40 CFR Part 372
  f. Methanol is subject to the reporting requirements of Section 313 and 40 CFR Part 372. 40 372.45 requires Atlantic Methanol Production Company LLC to notify certain customers as to which of its mixtures or trade name products contains those chemicals. The purpose of that notification is to ensure that facilities that may be subject to reporting requirements of Section 313 and that use products of unknown formulation will have knowledge that they are receiving products that contain chemicals subject to those reporting requirements.

CERCLA Hazardous Substance List:
  a. RQ (Reportable Quantity): 5,000 pounds or approximately 755 gallons

TSCA Inventory: Listed (RTECS)

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<td>Specific Hazard</td>
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16. OTHER INFORMATION

The information and recommendations herein are taken from data contained in independent, industry-recognized references we believe to be reliable including, but not limited to, NIOSH, OSHA, NFPA, D.O.T. ERG, CHRIS, and SAX’s Dangerous Properties of Industrial Materials. Thus Atlantic Methanol Production Company LLC makes no guarantee, warranty or other representation concerning the information provided above. Users should make their own investigation to determine the suitability of the information for their particular purposes. The substance is intended for use only by persons having the necessary technical skills and facilities for handling the product at their discretion and risk. Proper care and use of the substance is beyond Atlantic Methanol Production Company LLC’s control and sole responsibility lies with the users of the substance. Atlantic Methanol Production Company LLC disclaims any liability for loss or damage incurred in connection with the use of this substance.
Appendix C
Standard Operating Procedures

Field Standing Operating Procedures:

- SOP F.1: Porewater/Transition Zone Groundwater Sampling
- SOP F.2: Equipment Decontamination
- SOP F.3: Sample Custody
- SOP F.4: Sample Packaging and Shipping
- SOP F.5: Surface Water Sampling
- SOP F.6: Surface Water Elevation Measurement
POREWATER/TRANSITION ZONE GROUNDWATER SAMPLING

Introduction
This standard operating procedure outlines the equipment required and the general procedures for collection of porewater/transition zone groundwater samples from a water body shoreline or from a boat. These procedures may be amended or modified based on results of site reconnaissance to be performed before sample collection activities.

Minimum Equipment Checklist

- Sampling and analysis plan and health and safety plan (HASP)
- Standard personal protective equipment per project-specific HASP
- Personal floatation device
- Chest-waders
- Global positioning system (GPS) device
- Site map with proposed sample locations and coordinates
- Peristaltic pump
- 12-volt battery (preferably motorcycle-sized)
- Two water quality meters (with pH, conductivity, temperature, dissolved oxygen, and oxidation-reduction potential capabilities)
- Flow-through cell
- Portable turbidimeter
- One-quarter-inch outside diameter polyethylene tubing
- Nylon cable ties (“zip-ties”)
- Field Sampling Data Sheets (FSDS)
- 0.45-micron in-line filters
- Flexible tubing (Masterflex™ or similar)
- Sealable plastic bags
- Paper towels
- Duct tape
- Custody seals
- Chain-of-custody forms
- Sample bottles
- Sample labels
- Coolers and ice
- Fence-post driver or slide hammer
Porewater/Transition Zone Groundwater Sampling Procedures
The following general activities and sampling procedures will be implemented for sampling of porewater with a push-point sampler

1. Navigate to the proposed sampling location (within 3 meters) using a GPS navigation device.
2. Deploy water quality meter within 10 centimeters of the bottom of the water body (river or lake bed).
3. Advance push-probe into the sediment to the desired depth manually, with a fence-post driver, or with a slide hammer.
4. Insert 0.25-inch polyethylene tubing to the bottom of the push-probe.
5. Insert flexible tubing into peristaltic pump and attach end of polyethylene tubing to the flexible tubing.
6. Purge up to three tubing volumes of porewater at a pumping rate of 100 milliliters per minute or less to avoid creating excess negative pressure in the screened interval and “short-circuiting” the sample with surface water. Record water quality parameters (pH, conductivity, dissolved oxygen, temperature, oxidation-reduction potential, and turbidity) after each tubing volume has been purged with a YSI Professional Plus or similar instrument equipped with a flow-through cell.
7. When purging is complete, record water quality parameters from the YSI on the bottom (river or lake bed).
8. Disconnect tubing from the flow-through cell and collect sample into sample container. Attach in-line filter to collect samples for dissolved analyses. Store samples in a cooler with ice at 4°C for transport to the analytical laboratory.
9. Complete sample labels with the following information:
   a. Date and time of sample collection
   b. Sampler’s initials
   c. Sample identification consisting of Station ID-PW-depth (e.g., CR17-01-PW-1 would be the sample identification for a porewater/transition zone groundwater sample collected from station ID CR17-01 at a depth of one foot)
10. Repeat steps 3 through 9, advancing until a sample depth interval of 6 feet is collected or refusal.
11. All field activities, including water quality parameter measurements and sample collection information, will be documented on a FSDS. Place samples in a cooler with ice at 4°C for transport to the analytical laboratory.
12. If site conditions do not allow the sample location to be within 3 meters of the proposed sample location, record the coordinates of the actual sample location on the daily log and FSDS.
SOP F.1 Porewater/Transition Zone Groundwater Sampling

Acknowledgement Form

My signature below certifies that I have read and understand the procedures presented in SOP F.1.

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EQUIPMENT DECONTAMINATION

Introduction
This standard operating procedure outlines the equipment required and the general procedures for decontamination of sampling equipment, instruments, and other materials used during the 2017 Supplemental Sampling event.

Minimum Equipment Checklist
- Sampling and analysis plan and health and safety plan (HASP)
- Personal protective equipment as required by the HASP
- Scrub brushes
- Plastic wash/rinse buckets or tubs
- Phosphate-free biodegradable detergent (e.g., Liquinox®, Alconox®)
- Deionized (DI) or distilled water
- Spray bottles
- Aluminum foil
- Tap water source (any treated municipal water supply)

Decontamination Procedures
The following decontamination steps will be used to decontaminate sampling equipment that comes into contact with sample media. The decontamination procedure is as follows:

1. Residual sample media on equipment will be removed with potable water.
2. Wash with solution of tap water and detergent.
3. Rinse with tap water.
4. Rinse with DI or distilled water.
5. Use immediately or cover all decontaminated items with aluminum foil.

All used decontamination fluids will be land applied at the job site.

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.
**SOP F.2 Equipment Decontamination Acknowledgement Form**

My signature below certifies that I have read and understand the procedures presented in SOP F.2.

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SAMPLE CUSTODY

Introduction
This standard operating procedure addresses the sampling program requirements for maintaining custody of samples throughout the sample collection and shipping process as part of the 2017 Supplemental Sampling event.

Minimum Equipment Checklist
- Approved documents including Supplemental Sampling and Analysis Plan, Quality Assurance Project Plan, and Health and Safety Plan
- Black ballpoint pen or Sharpies (or equivalent)
- Custody tape or seals
- Sample labels
- Chain-of-custody (COC) forms
- Plastic sealable bags for COCs
- Clear plastic packing 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 Supplement Sampling and Analysis Plan for the sample identification protocol; Anchor QEA 2017). A label will be attached to each sample container. Labels will be applied to the container, not the lid.

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 waterproof, indelible ink. Individual sample bottles will be properly labeled and securely sealed before being placed in the container for shipment to the laboratory (see SOP F.8 – Sample Packaging and Shipping).

Samples are considered to be in one’s possession if they are as follows: 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. 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 (i.e., sediment, water, air, etc.)
- 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 (for example: 1 of 2, 2 of 2)
- Any special instructions

All 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/spaces on the COC form will be lined-out, dated, and initialed by the individual maintaining custody. 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. If shipping coolers to the analytical laboratory, one copy of the COC form should be placed in a waterproof bag and attached to the inside of each sample cooler. In the event that samples 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 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.

References
**SOP F.3 Sample Custody Acknowledgement Form**

My signature below certifies that I have read and understand the procedures presented in SOP F.3.

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SAMPLE PACKAGING AND SHIPPING

Introduction
This standard operating procedure describes procedures for packaging and shipping samples collected as part of the 2017 Supplemental Sampling event. 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, maintain required temperature, and limit the potential for damage to sample containers when the cooler is transported.

Minimum Equipment Checklist
- Approved documents including Supplemental Sampling and Analysis Plan, Quality Assurance Project Plan, and Health and Safety Plan
- Black, ballpoint pen or Sharpies (or equivalent)
- Personal protective equipment as required by the Health and Safety Plan
- Inert packing material (e.g., cardboard, bubble wrap)
- Pre-preserved sample containers as specified in the Quality Assurance Project Plan
- Sample labels
- Insulated coolers
- Custody seals
- Shipping tape
- Sealable Ziploc bags
- Temperature blanks (if not provided by the laboratory)
- Ice
- Overnight courier airbills or shipping forms
- Clear plastic packing tape

Sample Packing and Shipping 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 water) should be stored in 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 Quality Assurance Project Plan (Anchor QEA 2017).

Individual sample containers (or groups of sample containers) should be stored in the coolers packed in sealable 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 water 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 or 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 or synthetic ice can be used but either type 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) record for each shipping container should be filled out completely (See SOP F.7 – Sample Custody).
6. The original COC (described above) record and analysis request should be protected from damage by sealing in a sealable plastic bag and placing inside the shipping container (taped to the underside of the cover).
7. A custody seal should be attached so that the shipping container cannot be opened without breaking the seal.
8. 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 serve as a backup to the COC record.
SOP F.4 Sample Packaging and Shipping Acknowledgement Form

My signature below certifies that I have read and understand the procedures presented in SOP F.4.

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SURFACE WATER SAMPLING

Introduction
This standard operating procedure outlines the equipment required and the general procedures for collection of surface water grab samples and surface water sampling using a passive nylon mesh diffusion sampling device from a water body shoreline. These procedures may be amended or modified based on results of site reconnaissance to be performed before sample collection activities.

Minimum Equipment Checklist
- Sampling and analysis plan and health and safety plan (HASP)
- Standard personal protective equipment per project-specific HASP
- Personal floatation device
- Global positioning system (GPS) device
- Site map with proposed sample locations and coordinates
- Peristaltic pump
- 12-volt battery (preferably motorcycle-sized)
- Water quality meter (with pH, conductivity, temperature, dissolved oxygen, and oxidation-reduction potential capabilities)
- Portable turbidimeter
- One-quarter-inch outside diameter polyethylene tubing
- Floatation device (plastic bottle, fishing float, or similar)
- Mason line or similar
- Weights (e.g., large steel nuts)
- Large fishing weights
- Nylon cable ties (“zip-ties”)
- Field Sampling Data Sheets (FSDS)
- 0.45-micron in-line filters
- Flexible tubing (Masterflex™ or similar)
- Sealable plastic bags
- Paper towels
- Duct tape
- Custody seals
- Chain-of-custody forms
- Sample bottles
- Sample labels
- Coolers and ice
Surface Water Sampling Procedures Using Nylon Mesh Diffusion Samplers

The following general activities and sampling procedures will be implemented for passive sampling of surface water using NMDS devices:

1. Locate the proposed sampling location (within 3 meters) using a GPS navigation device.
2. Attach large weight to end of a polyethylene or nylon rope. The weight should be of sufficient mass to prevent the river current from moving the sample bottles.
3. Attach the NMDS bottles to the rope 1 foot above the end of the rope. Nylon cable ties, duct tape, or a combination of both can be used to secure the sample bottles to the rope.
4. Attach a flotation device to the rope immediately above the sample bottles of sufficient buoyancy to suspend the sample bottles in the water column.
5. Drive a stake or metal rod into the river bank with a hammer or screw into the ground if a “corkscrew” type rod. The stake or rod should have a loop at the top.
6. Tie the end of the rope to the loop on the rod.
7. Cast the bottles, rope, and weight assembly into the water body as far from the shore as possible. It is anticipated that samples will be collected approximately 10 feet from the shoreline; actual sampling locations will be established during reconnaissance.
8. At each sample station, repeat steps 2 through 7.
9. Allow the bottles to remain in the water body for the required amount of time. (Prior to sampling, the equilibration time for the passive diffusive samplers will be determined in the EGL. NMDS devices will be exposed to water spiked with a known concentration of fluoride for 24 hours, 48 hours, 96 hours, and 192 hours. The fluoride concentration in the NMDS will be measured by fluoride ion selective electrode (ISE) and compared to the spiked concentration to determine the minimum exposure time for equilibration.)
10. After required sample exposure time has passed, retrieve NMDS bottles by slowly pulling each assembly to shore with the rope, taking care not to drag the NMDS along the bottom.
11. Thoroughly dry NMDS bottles. Remove the nylon mesh cap and pour contents into appropriate sample bottles.
12. Complete sample labels with the following information:
   a. Date and time of sample collection
   b. Sampler’s initials
c. Sample identification consisting of Station ID-SWPD-exposure time (e.g., CR17-01-SWPD-24 would be the sample identification for surface water collected from station ID CR17-01 using a passive NMDS with 24-hour exposure time)

d. Sample analyses

13. Place samples in a cooler with ice for storage at 4°C for transport to the analytical laboratory.
14. If site conditions do not allow the sample location to be within 3 meters of the proposed sample location, record the coordinates of the actual sample location on the daily log and FSDS.
15. All field activities, including sample collection information, will be documented on an FSDS.
16. At the time of the 48-hour sample retrieval and collection, collect a surface water grab sample as described in the subsection below.

**Surface Water Grab Sampling Procedures**

The following general activities and sampling procedures will be implemented for surface water grab sampling:

1. Locate the proposed sampling location (within 3 meters) using a GPS navigation device.
2. Attach weights to end of mason line.
3. Attach polyethylene tubing to the mason line with nylon cable ties 1 foot from the bottom of mason line and connect a floatation device to the tubing to suspend the bottom of the tubing approximately 12 inches above the mudline. Connect the tubing to a 1-foot section of flexible tubing and attach to a peristaltic pump on the shore.
4. Cast the weight, tubing, line, and float assembly into the water body as far from shore as possible. It is anticipated that samples will be collected approximately 10 feet from the shoreline; actual sampling locations will be established during reconnaissance.
5. Purge surface water for at least 9 minutes at a pumping rate of 500 milliliters per minute or less to avoid over-pressure and clogging or excessive vacuum bubbles in the sampling line. Record water quality parameters (pH, conductivity, dissolved oxygen, temperature, oxidation reduction potential, and turbidity) every 3 minutes with a YSI Professional Plus or similar instrument equipped with a flow-through cell and a Hanna portable turbidimeter or similar instrument.
6. Disconnect tubing from the flow-through cell and collect sample into sample containers. Attach in-line filter to collect samples for dissolved analyses. Place samples in a cooler with ice for storage at 4°C for transport to the analytical laboratory.
7. Complete sample labels with the following information:
   a. Date and time of sample collection
   b. Sampler's initials
   c. Sample identification consisting of Station ID-SWG (e.g., CR17-01-SWG would be the sample identification for a surface water grab sample collected from station ID CR17-01)
   d. Sample analyses
All field activities, including water quality parameter measurements and sample collection information, will be documented on an FSDS.
SOP F.5 Surface Water Sampling Acknowledgement Form

My signature below certifies that I have read and understand the procedures presented in SOP F.5.

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SURFACE WATER ELEVATION MEASUREMENT

Introduction
This standard operating procedure outlines the equipment required and the general procedures for the measurement of surface water elevations using surveying equipment. These procedures may be amended or modified based on the results of site reconnaissance to be performed before measurement activities.

Minimum Equipment Checklist
- Sampling and analysis plan and health and safety plan (HASP)
- Standard personal protective equipment per project-specific HASP
- Personal floatation device
- Survey-grade rod with 0.01-foot gradations
- Survey-grade laser level
- Survey-grade laser detector
- Benchmark or other reference point with elevation measured to the closest 0.01 foot by a licensed surveyor
- Water Level Data Sheet

Surface Water Elevation Measurement Procedures Using Surveying Equipment
The following general activities and sampling procedures will be implemented for the measurement of surface water elevations using surveying equipment:
1. Set up laser level in direct line-of-sight with the benchmark and the surface water shoreline.
2. Adjust the laser level so that it is level (if not self-leveling).
3. Stand the grade rod plumb on top of the benchmark or reference point.
4. Attach the laser detector to the grade rod.
5. Move the laser detector up or down the grade rod until it beeps to indicate that it is level with the laser.
6. When laser level indicates that the detector is level with laser, record on the Water Level Data Sheet the distance (to the nearest 0.01 foot) from the benchmark to the detector.
7. Move the grade rod to the water body shoreline.
8. Attach the laser detector to the top of the grade rod.
9. Stand the grade rod plumb on the shoreline at the water’s edge. If the shoreline is soft or unstable, put a rock, piece of wood, or other hard object at the water’s edge so that the grade rod can be set on it at the water surface.
10. At a 15-minute time interval (either on the hour or at the 00:15, 00:30, or 00:45 point on the clock), extend the grade rod vertically until the laser level beeps to indicate that the detector is level with the laser.

11. Record on the Water Level Data Sheet the distance (to the nearest 0.01 foot) from the top of the grade rod to the measurement point on the rod.

12. Add the distance from the benchmark to the laser level to the benchmark elevation and subtract the distance from the top of the grade rod to the water surface to calculate the surface water elevation.
### SOP F.6 Surface Water Elevation Measurement Acknowledgement Form

My signature below certifies that I have read and understand the procedures presented in SOP F.6.

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