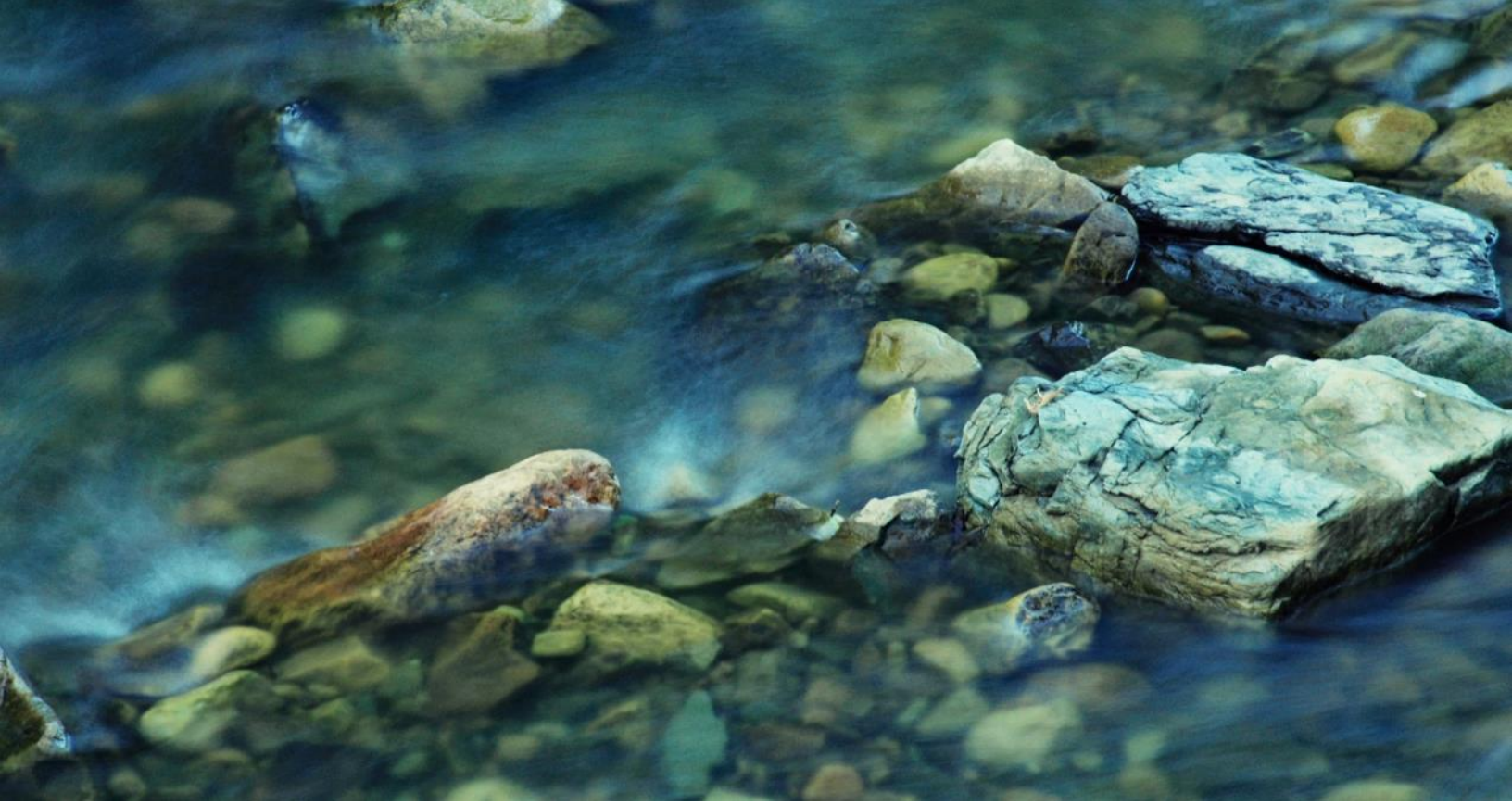

July 2019
Duwamish Shipyard, Inc. Tributyltin Bioaccumulation Study

ANCHOR QEA

Remedial Investigation Addendum
Tributyltin Bioaccumulation Study Work Plan

Prepared for Washington State Department of Ecology

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Prepared for
Washington Department of Ecology

Prepared on behalf of
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Project Number: 080111-01.01

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ABBREVIATIONS

µg/kg	micrograms per kilogram
ARI	Analytical Resources, Inc.
BAF	bioaccumulation factor
Cm	Centimeter
COC	chemical of concern
DGPS	differential global positioning system
DSI	Duwamish Shipyard, Inc.
DSI property	Duwamish Shipyard, Inc. property located at 5658 West Marginal Way Southwest in Seattle, Washington
Ecology	Washington Department of Ecology
EPA	U.S. Environmental Protection Agency
EWW	East Waterway
HASP	Health and Safety Plan
LDW	Lower Duwamish Waterway
mg/kg	milligrams per kilogram
PAH	polycyclic aromatic hydrocarbon
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
RBTC	risk-based threshold concentration
RI	Remedial Investigation
RM	River Mile
ROD	Record of Decision
SAP	Sampling and Analysis Plan
site	Duwamish Shipyard, Inc. property located at 5658 West Marginal Way Southwest and portions of the adjacent Lower Duwamish Waterway sediments in Seattle, Washington
SMS	Sediment Management Standards
SRI	Supplemental Remedial Investigation
TBT	Tributyltin
TOC	total organic carbon
TRV	toxicity reference value
Work Plan	*Remedial Investigation Addendum: Tributyltin Bioaccumulation Study Work Plan*

1 Introduction

In compliance with Washington Department of Ecology (Ecology) Agreed Order No. DE-6735, this *Remedial Investigation Addendum: Tributyltin Bioaccumulation Study Work Plan* (Work Plan) is part of the Remedial Investigation (RI) dated April 2019 for the Duwamish Shipyard, Inc. (DSI) property located at 5658 West Marginal Way Southwest (DSI property) and portions of the adjacent Lower Duwamish Waterway (LDW) sediments in Seattle, Washington (collectively, site; Figure 1). This Work Plan provides the background and analysis plan for the laboratory bioaccumulation study that was developed in coordination with Ecology and the U.S. Environmental Protection Agency (EPA) to derive a risk-based threshold concentration (RBTC) for tributyltin (TBT). This Work Plan also addresses the content of the Sampling and Analysis Plan (SAP) and the Quality Assurance Project Plan (QAPP), which are included as appendices.

Addressing the nature, extent and potential ecological effects of TBT in sediments adjacent to DSI was required by Ecology as a supplemental RI (Anchor QEA 2019) activity in order to determine a site-specific RBTC for TBT in sediment.[1] The RBTC is designed for the protection of bioaccumulation risk to the benthic community, including gastropods, in the LDW adjacent to and in the vicinity of the DSI upland property. The site includes the DSI uplands and portions of adjacent LDW sediments. The Record of Decision (ROD; EPA 2014) issued by EPA for the LDW identified TBT as a contaminant of potential concern for the benthic invertebrate community (receptor of concern), but it was not retained as a chemical of concern (COC) as part of the ecological risk assessment.[2] However, TBT was detected in bulk sediment at concentrations that could pose risk to ecological receptors during later sediment investigations conducted at DSI and thus Ecology has required that it be evaluated as a site-specific COC. Ultimately, the information generated by this Work Plan will be used to develop a site-specific sediment cleanup level for TBT consistent with the State of Washington's Sediment Management Standards (SMS).

1.1 Site Description

DSI is a former commercial shipyard in an industrial waterway that is located within the LDW Superfund Site (Figure 1). The DSI property is in the estuarine portion of the LDW, at approximately River Mile (RM) 1.3 (Figure 1). A tidal salt wedge moves through the area daily, and salinity is variable

[1] On September 27, 2018, October 1, 2018, and October 26, 2018, Anchor QEA, LLC held meetings with Ecology and EPA to discuss the extent and potential ecological effects of TBT in sediments adjacent to the DSI property. Since these meetings, Ecology (2019) approved the RI and stipulated that a supplemental investigation related to sediment TBT effects needs to be completed and submitted to Ecology as a supplemental RI memorandum.

[2] For the LDW (2007) ecological risk assessment, TBT risk to the benthic invertebrate community was determined on the basis of two endpoints: imposex observations in field-collected snails, and comparison of in situ tissue to literature survival, growth, and reproduction data using a critical tissue-residue approach. Although uncertain, risk to gastropods and the benthic community from TBT was considered to be low. All TBT concentrations detected or estimated in benthic macroinvertebrate tissue were below the no-effects toxicity reference value.

throughout the water column. Salinity is an important habitat variable determining benthic community composition, including the distribution of gastropods.

A federal navigation channel is adjacent to the site. River flows, tidal action, dredging, and large vessel propeller wash may act to influence sediment contaminant distributions throughout the LDW. The East Waterway (EWW) operable unit of the Harbor Island Superfund Site is located downstream. Risk assessment work for both the LDW (Windward 2007) and the EWW (Windward and Anchor QEA 2014), which included development of a TBT RBTC, was used to inform this Work Plan.

1.2 TBT Source

The LDW RI collected surface sediment data from throughout the 5-mile site, and TBT was detected in 94% of samples and ranged from 0.28 to 3,000 micrograms per kilogram (µg/kg) with a mean concentration of 90 µg/kg (EPA 2014).[3] LDW RI sampling locations with concentrations of TBT greater than the 95th percentile (250 µg/kg) were located adjacent to DSI, in Slip 1, and between RM 0.0 and RM 0.5 near Kellogg Island.

Historically, TBT was used as an antifouling compound and was a common constituent of vessel hull paint. Wood preservatives and resins historically used at lumber yards may have also contained TBT (EPA 2003). There are multiple historical and ongoing sources of TBT in the LDW. These include leaching from ship hulls, painting, and ship repair activities. Historical sandblasting of ship bottoms at DSI likely resulted in a coarse-grained source material (sandblast grit and paint chips) that was transported to sediments by various mechanisms (e.g., spills) and then mixed into the sediment through physical and biological processes. At DSI, the highest TBT concentrations are localized near the shoreline adjacent to the former dry dock and within the marine railway and in subsurface sediment (i.e., at depths greater than 10 centimeters [cm]).

1.3 Site Data Summary

In the vicinity of DSI, bulk TBT concentrations detected in surface sediments range from undetected (3.6 µg/kg detection limit) to 4,200 µg/kg, with the highest concentrations located in the marine railway area and within approximately 75 feet of the shoreline. The marine railway area samples also have less than 30% fines. Overall, the highest concentrations of TBT were observed in subsurface samples adjacent to the former marine railway and former dry dock, where concentrations ranged from undetected (3.5 µg/kg detection limit*)* in native material to a maximum of 15,000 µg/kg in sample DSI-SB-11, which was collected from the 8- to 8.9-foot interval. Grain size data were not collected for all subsurface core samples; however, coarse-grained source materials were noted in the samples with the highest TBT concentrations. Similar to the LDW, elevated concentrations of other site COCs (e.g., polycyclic aromatic hydrocarbons [PAHs] and other metals) are present throughout the site.

[3] Arithmetic average using one-half the reporting for non-detected results (Windward 2010).

In surface samples, the range of total organic carbon (TOC) at the site is approximately 1.5% to 3%. Although the highest TBT concentrations (e.g., greater than 1,500 µg/kg) are seen in lower TOC samples in the marine railway area (e.g., less than or equal to 1.5%), elevated TBT concentrations in this area (320 to 1,200 µg/kg) were also observed in samples with TOC fractions as high as 3.1%. There does not appear to be a consistent relationship between TOC and TBT.

1.4 Species Information

Approximately 12 species of gastropods were identified in the LDW, with four species found in samples collected in the vicinity of DSI (Windward 2006). Imposex in gastropods is a well-documented reproductive effect from TBT exposure that has been observed in field and laboratory studies. Gastropods are among the most sensitive benthic species to TBT. Gastropods in the LDW were surveyed in 2005 (Windward 2006), and imposex symptoms were documented in several species, although not in those samples collected near DSI. Gastropods were not abundant in the LDW reach near DSI, which may be a function of habitat (e.g., the site is located in the transition zone between marine and freshwater conditions) or possibly due to existing sediment contamination. Overall, based on available LDW benthic data, the field collection of an adequate volume of gastropod tissue was deemed to be impractical; therefore, a laboratory bioaccumulation test was determined to be a reasonable method to assess TBT bioavailability and to assess risk from bioaccumulation.

2 Study Plan

The study plan outlines the approach to determine the bioavailability of TBT in site sediment and to then use this data to develop the RBTC for TBT at the site. The study was developed in a risk assessment framework that addresses the assessment and measurement of exposure and effect and uncertainties in the evaluation methods for obtaining the RBTC.

2.1 Problem Formulation

2.1.1 Exposure

TBT is an organo-metallic compound that exhibits properties associated with both charged ionic chemicals and organic chemicals. TBT is hydrophobic and tends to bind with non-polar substrates like TOC and lipid (Meador et al. 2002). For this reason, TOC and lipid normalization are important when comparing exposure across samples and will be included for completeness. TBT is a bioaccumulative compound that has complex physio-chemical properties affecting its fate, transport and measurement, including source material presence in samples. As such, collection of site-specific data is proposed to determine the bioaccumulation potential of TBT in surface sediments at the site.

Similar studies were conducted as part of the EWW Supplemental Remedial Investigation (SRI) that can be used to inform this work. Specifically, field and laboratory bioaccumulation studies were conducted in support of the baseline ecological risk assessment for the EWW SRI. Bioaccumulation factors (BAFs) ranged from 0.03 to 0.39 and 0.02 to 0.12, respectively (Windward and Anchor QEA 2014). Differences in TBT accumulation were observed between the two species of polychaetes tested, *Nephtys caecoides* and *Armandia brevis*. Furthermore, *Armandia* were run using both static-renewal and flow-through text conditions. Tissue TBT in the organisms tested using the static-renewal method were consistently higher.

2.1.2 Effects

The toxicity of TBT was summarized in the LDW ecological risk assessment (Windward 2007) and EWW SRI (Windward and Anchor QEA 2014). Gastropods have been identified as one of the most sensitive species to TBT (EPA 2003). As detailed in the EWW SRI, the lowest tissue-residue toxicity reference value (TRV) for TBT (0.12 milligrams per kilogram [mg/kg] wet weight, lowest observable adverse effect level) is from Gibbs et al. (1988), based on a chronic exposure to dog whelk snails (*Nucella lapillus*) that resulted in sterilization of females. This value will be applied to derive the RBTC.

2.1.3 Uncertainties and Data Needs

Given that the EWW laboratory results were less variable than the field results and that field collection of sufficient tissue volume is impractical near DSI, a laboratory bioaccumulation study is proposed to develop the RBTC. The sediment bioaccumulation test organisms are representative

benthic species that have been documented in the LDW, a clam and a polychaete worm, and they are reasonable species to represent a dog whelk snail given similar lipid content and feeding strategies. The species are from two different trophic niches representing a suspension/filter-feeding and a burrowing deposit-feeding organism, respectively. The use of these species to estimate bioaccumulation risk is a standard practice (EPA 1993; EPA 1998; Kendall and McMillan 2009; Ecology 2017). A laboratory bioaccumulation study using standard methods that are consistent with Washington's SMS (Washington Administrative Code Chapter 173-204) is the preferred option for developing an RBTC because environmental variables are controlled, there is replication of sample treatments, and adequate tissue mass can be more easily obtained to ensure that high-quality data are obtained for comparison to the tissue TRV.

2.2 Overview of Proposed Study Methods

This section outlines the study design for calculating an RBTC for TBT. The design is generally based on the approach used for the EWW SRI (Windward and Anchor QEA 2014) and includes the following five elements, which are summarized here and further detailed below:

1. Collect surface sediment at 10 locations outside of DSI's nearshore sediment area that are anticipated to represent a gradient of TBT concentrations ranging from less than 100 to 400 µg/kg (Figure 2).
2. Conduct expedited bulk chemistry testing for TBT and TOC to determine which samples will be selected for bioaccumulation testing.
3. Perform 45-day bioaccumulation testing with an adult bivalve (*Macoma nasuta*) and an adult polychaete (*Nepthys caecoides*) on five samples selected to represent a range of TBT and TOC levels.
4. Evaluate the sediment and tissue data and calculate a BAF.
5. Calculate an RBTC using the tissue-based TRV from Gibbs et al (1988) divided by the BAF.

2.2.1 Element 1

The proposed surface sample collection will focus on areas where existing data show a range of TBT concentrations from less than 100 to 400 µg/kg and TOC concentrations from 1.4% to 3% in surface sediment. Ten composite sediment samples, consisting of three or more grab samples each at each location, will be collected. Multiple grab samples are required to collect the necessary sample volume for the bioaccumulation tests. Note that samples will not be collected from areas with the highest TBT concentrations (e.g., in the former marine railway footprint), as these areas are assumed to be actionable (i.e., to require active remediation such as dredging and/or capping) based on other contaminants, as documented in the ROD for the LDW. Proposed sediment sample locations are shown in Figure 2.

2.2.2 Element 2

Expedited bulk chemistry results for TBT and TOC will be used to determine which samples are selected for bioaccumulation testing. Five of the 10 composite samples will be selected for bioaccumulation testing using the following procedure:

- Plot the distributions of TOC and TBT for all samples.
- If TOC is within the range of 1% to 3.5% for all samples, select from all samples. If not, identify samples where TOC is atypical and remove them from the initial set.
- Select the sample with the highest TBT concentration less than 400 µg/kg.
- Select one sample each from approximately the 25th and 75th quartiles of the TBT distribution, ideally with similar TOC fractions (i.e., within +/- 50%).
- Select two samples with similar TBT concentrations from within the interquartile range (i.e., between the 25th and 75th quartiles) but with different TOC fractions.
- Any samples with non-detected results for sediment TBT will be eliminated from consideration for bioaccumulation testing. The non-detects may be used when determining the quartiles unless the 25th quartile was a non-detected result.
- Review selection of the proposed bioaccumulation samples with Ecology and EPA and revise as warranted.

A total of five samples will be selected for bioaccumulation testing to achieve a gradient of representative TBT concentrations at the site. The five samples selected for bioaccumulation testing will be analyzed for the full suite of site sediment COCs, percent moisture, and percent fines. The approximate proportion of paint chips visible in the samples will also be recorded. A sample from Carr Inlet with grain size near the median of the sample set will be included in the analysis as a reference sediment sample. The Carr Inlet sample will be collected shortly after the DSI sampling event.

If sample concentrations are not within the desired TOC and TBT concentration ranges, or fewer than five of the samples meet the selection criteria, Ecology will be consulted to determine the path forward for sample selection and testing.

2.2.3 Element 3

For the five selected samples and one reference sample, laboratory bioaccumulation testing with both an adult bivalve (*Macoma nasuta*) and an adult polychaete (*Nepthys caecoides*) will be conducted using standardized methods applied under Washington SMS (Ecology 2017, ASTM 2010; EPA 1993). Five replicate chambers are proposed for each test and reference sample. Pursuant to Ecology (2017) guidance, a 45-day testing period is required for contaminants that may not come into equilibrium within 28 days, such as TBT. Because of the long duration of the test, the potential for loss of contaminants is a consideration, as is the health of the test organisms due to a lack of food from consumption of the native sediment carbon. To account for this, an additional

175 milliliters of sediment will be added weekly to each replicate chamber as detailed in the SMS "Technical Memorandum, Clarifications to the DMMP Bioaccumulation Protocol" (Kendall and McMillan 2009).

Test water quality may be degraded over the course of a 45-day test due to microbial activity that can increase ammonia and/or sulfide concentrations. Refreshing the overlying water during the exposure is a standard method to mitigate this impact. Bioaccumulation testing will be conducted using a flow-through testing system, calibrated to mimic a typical Puget Sound tidal cycle and provide a continuous flow rate of four volume exchanges over a 24-hour period. Overlying water will be monitored regularly over the course of the test, according to method requirements. While some TBT may be lost from dissociation from the sediment during a water exchange, this arguably mimics the natural processes occurring in the LDW near the site due to the flow of the river and tidal exchange.

2.2.4 Element 4

The replicate and average treatment data will be evaluated for a correlation between sediment and tissue concentrations. If the correlation is statistically significant, the slope will be included as a potential BAF. The BAF will also be calculated for each species and replicated as the dry-weight tissue concentration divided by the TOC-normalized sediment concentration. All BAF results, including averages, will be recorded and considered. The BAF most representative of central tendency-based reasonable maximum exposure at the site will be selected in consultation with Ecology and EPA.

2.2.5 Element 5

The RBTC will be calculated using the TRV from Gibbs et al. (1988), 0.12 mg/kg wet weight (0.6 mg/kg dry weight assuming 80% moisture). The RBTC is the TRV (dry-weight basis) divided by the BAF. The RBTC will ultimately be used to develop a site-specific sediment cleanup level for TBT, which will be presented in the draft Feasibility Study Report.

3 Sampling and Analysis

This section of the Work Plan summarizes the sampling and analysis methods that are detailed in the SAP (Appendix A). The SAP addresses methods for sediment sampling, chemical analyses of sediment and tissue, and bedded-sediment bioaccumulation testing. Ecology has previously approved the SAP, QAPP, and Health and Safety Plan (HASP) that were prepared for surface sediment sampling as part of the DSI Supplemental RI Work Plan in 2013, and these documents are the basis of the appendices supporting this Work Plan. Detailed analytical chemistry methods, quality assurance/quality control (QA/QC), and validation steps are detailed in the QAPP (Appendix B). The HASP is provided in Appendix C.

3.1 Sediment Sample Collection and Processing

Surface sediment samples for bioaccumulation testing will be collected from the 0- to 10-cm biologically active zone using Van Veen grab methodology. Horizontal positioning will be determined in the field by differential global positioning system (DGPS) based on target coordinates. Approximately 10 surface sediment samples will be collected (Figure 2). Where visual field observations of more than 25%[4] of the surface contains paint chips, sand blast grit, or other debris in the sediment at the edge of the proposed sampling area, sampling locations will be moved offshore.

Because a large volume of samples (8 gallons) is required for bioaccumulation testing, multiple casts of the Van Veen Grab sample will be required, and deployments of the grab sample will be repeated within a 20-foot radius of the proposed sample location. If adequate penetration is not achieved after multiple attempts, the station will be moved and changes in location coordinates will be documented in the field notebook. Once accepted, overlying water will be siphoned off and a decontaminated stainless-steel trowel, spoon, or equivalent will be used to collect only the upper 10 cm of sediment from inside the sampler without touching the sidewalls. The sediment sample will be placed into a 15-gallon stainless-steel kettle and thoroughly homogenized using a stainless-steel mixing paddle attached to an electric drill. The sampler and mixing containers and apparatus will be decontaminated between stations and rinsed with site water between grabs.

Homogenized surface sediment will be spooned immediately into appropriate pre-cleaned, pre-labeled sample containers, placed in coolers filled with ice or equivalent, and maintained at 4°C. A wet-sieve grain size determination will be performed in the field with an aliquot of the homogenized sediment sample. Debris and materials more than 0.5 inch in diameter will be omitted from sample containers. Surface sediment samples will be submitted for expedited turnaround (i.e., less than 2 weeks) chemical and physical analyses. Bioaccumulation test samples will be archived under nitrogen at 4°C, pending review of the analytical chemistry results and sample selection for testing.

[4] Determined visually by comparison to example coverage in Geotechnical Gauge field reference card (W. W. McCollough, Beltsville, MD 20705)

3.2 Analytical Chemistry

All sediment samples will be analyzed by Analytical Resources, Inc. (ARI) of Tukwila, Washington. TBT, TOC, and total solids results will be expedited to provide enough time for data review and selection of five samples for the bioaccumulation testing. The preliminary expedited turnaround results will be reviewed for data quality but will not be validated. The five sediment samples selected for the TBT bioaccumulation testing will also be analyzed for the SMS parameters for metals, polychlorinated biphenyl Aroclors, PAHs, semivolatile organic compounds, dioxin/furans, and grain size (Table 2).

Tissue samples from the bioaccumulation test will be analyzed by ARI for TBT, lipid content, and percent moisture. Tissue sampling will be conducted by the bioaccumulation testing laboratory (EcoAnalysts, Inc.) and sample containers will be sent to the chemistry laboratory (ARI) for analysis.

Laboratory analysis methods, QA/QC procedures, laboratory sample handling, and data quality indicators for the samples collected for chemistry testing are described in detail in the QAPP (Appendix B).

3.3 Bedded-Sediment Bioaccumulation Test Methods

Bioaccumulation testing will be conducted by EcoAnalysts, Inc., Port Gamble, Washington, with one reference and five selected DSI samples to measure the relationship between sediment and test animal tissue burdens. The test will expose an adult marine clam (*Macoma nasuta*) and an adult polychaete (*Nepthys caecoides*) to test sediment using standard methods from the EPA *Guidance Manual: Bedded Sediment Bioaccumulation Tests* (EPA 1993), the *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual: Inland Testing Manual* (EPA 1998), the ASTM *Standard Guide for Determination of the Bioaccumulation of Sediment-Associated Contaminants by Benthic Invertebrates,* Method No. E-1688-10 (ASTM 2016), and the *Dredged Material Evaluation and Disposal Procedures User Manual* (USACE et al. 2018). The test will also apply the methods that lengthen the test duration to 45 days to allow sufficient time for tissue steady-state to be reached (Ecology 2017).

Test methods are detailed in the SAP (Appendix A). The bioaccumulation test replicate exposure chambers will be 10-gallon glass aquariums. Five replicates will be run for each test sample. The test will start with 6 liters of sediment and 18.5 liters of overlying water; 175 milliliters of sediment will be added weekly to each replicate chamber to refresh the carbon source and mitigate potential contaminant loss, for a total sediment volume of 7.1 liters. The overlying water will be refreshed using a flow-through testing system, calibrated to mimic a typical Puget Sound tidal cycle and provide a 100% renewal of test chamber volume, four times over a 24-hour period. The test chambers will be allowed to equilibrate overnight before starting the test. At the start of the test, *Macoma* and *Nepthys* subsamples will be weighed and time-zero tissue chemistry samples will be collected (see the SAP for details). The test organisms will be exposed for 45 days unless noticeable organism stress (i.e., clam gaping or immobilization) is observed during the last week, in which case

the test may be terminated. Any determination to end the test before 45 days will be made in consultation with Ecology. At test termination, the replicate sediment samples will be sieved and the numbers of *Macoma* and *Nepthys* survivors will be documented. The surviving organisms will be depurated separately in laboratory culture dilution water for 24 hours. Once weighed, the *Nepthys* replicate samples will be placed in separate sample jars for tissue analysis. All samples will be frozen and shipped to ARI (see the QAPP for details).

4 Interpretation of Data

The bioassessment study chemistry dataset for sediment and tissue will include six samples: one from Carr Inlet (reference) and five DSI (site) samples. The data from the bioaccumulation study will consist of six sample-level sediment TBT and TOC results and 30 replicate-level tissue (i.e., five replicate tissue samples will be analyzed for each of six chemistry samples) TBT, lipid, and organism weight results. For each parameter, data distributions will be plotted, and descriptive statistics will be calculated including means, medians, quantiles, and standard deviations. Goodness of fit and heterogeneity of variance statistics will also be determined.

The goal of the study is to calculate an RBTC for TBT using the best available site-specific estimate of bioaccumulation potential (i.e., the BAF). The RBTC will be calculated using the TRV from Gibbs et al. (1988), 0.12 mg/kg wet weight (0.6 mg/kg dry weight assuming 80% moisture). The RBTC is the TRV (dry-weight basis) divided by the BAF (Ecology 2017).

TBT is an ecological COC to the benthic community, and the RBTC does not account for higher trophic levels. Therefore, the RBTC is derived to be applied to current and future conditions on a point-by-point sample basis, not an area-weighted average. For completeness in the evaluation, the average and 95% upper confidence limit tissue sample concentrations of *Macoma* and *Nepthys* exposed to site sediment will also be compared to the study TBT TRV using plots and a t-test or non-parametric equivalent. If the mean TBT tissue concentration in any site sample exceeds the study TBT TRV, the concentration-response relationship between growth and survival will also be evaluated, and other TBT literature TRVs for benthic invertebrates will be reviewed for comparison.

The key uncertainty in the interpretation of the data is the variability in the relationship between sediment and tissue TBT concentrations. The TBT in sediment can be expressed on a dry weight or TOC normalized basis, and in tissue it can be expressed on a dry weight or lipid normalized basis. While the EWW study found that a BAF (the dry-weight tissue concentration divided by the TOC-normalized sediment concentration) provided the best relationship for that site, this study will also evaluate the lipid normalized tissue data and the dry weight sediment data. The relative strength of the sediment-tissue relationship across the different bases will be documented visually in plots and measured with correlation coefficients.

All regression and individual sample BAF results will be presented for discussion with Ecology. Because of the limited sample size, a regression-based BAF estimate is unlikely to be statistically significant (Ecology 2017). The BAF statistic that is assumed to be representative of the central tendency-based reasonable maximum exposure at the site is the 95% upper confidence limit on the mean; however, the final BAF will be determined in consultation with Ecology.

5 Schedule

The anticipated schedule for this study, contingent upon Ecology approvals and contractor availability, is provided in Figure 3 and is summarized as follows:

- Draft Work Plan development
  - Draft Work Plan annotated outline with sample location figure to Ecology/EPA for review –early April 2019
  - Received Ecology/EPA comments on Draft Work Plan annotated outline and sample location figure – mid to late April 2019
  - Incorporated Ecology/EPA comments– early May 2019
  - Draft Work Plan to Ecology/EPA for review – May 22, 2019
  - Ecology/EPA review – June 2019
  - Ecology/EPA comment review call – late June 2019
  - Final Work Plan – July 2019 (approximately 2 weeks after Ecology/EPA comment review call)
- Field sampling
  - Contractor coordination – May 2019
  - Site coordination and preparation for field sampling – July 2019
  - Field sampling – August 2019
- Analytical chemistry
  - Expedited bulk sediment TBT and TOC analysis for sample selection – September 2019
  - Bioaccumulation test sample confirmation meeting with Ecology/EPA – September 2019
  - Clam and polychaete tissue analysis – October 2019
  - Sediment analytical chemistry data report from laboratory – November 2019
  - Data validation – December 2019
- Bioaccumulation testing
  - 45-day laboratory bioaccumulation test – September to October 2019
  - Laboratory bioaccumulation test final report – December 2019
- Draft Supplemental RI TBT Study Report for Ecology review – 60 calendar days following receipt of final, validated Supplemental RI TBT Study data – anticipated February 2020

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Figures

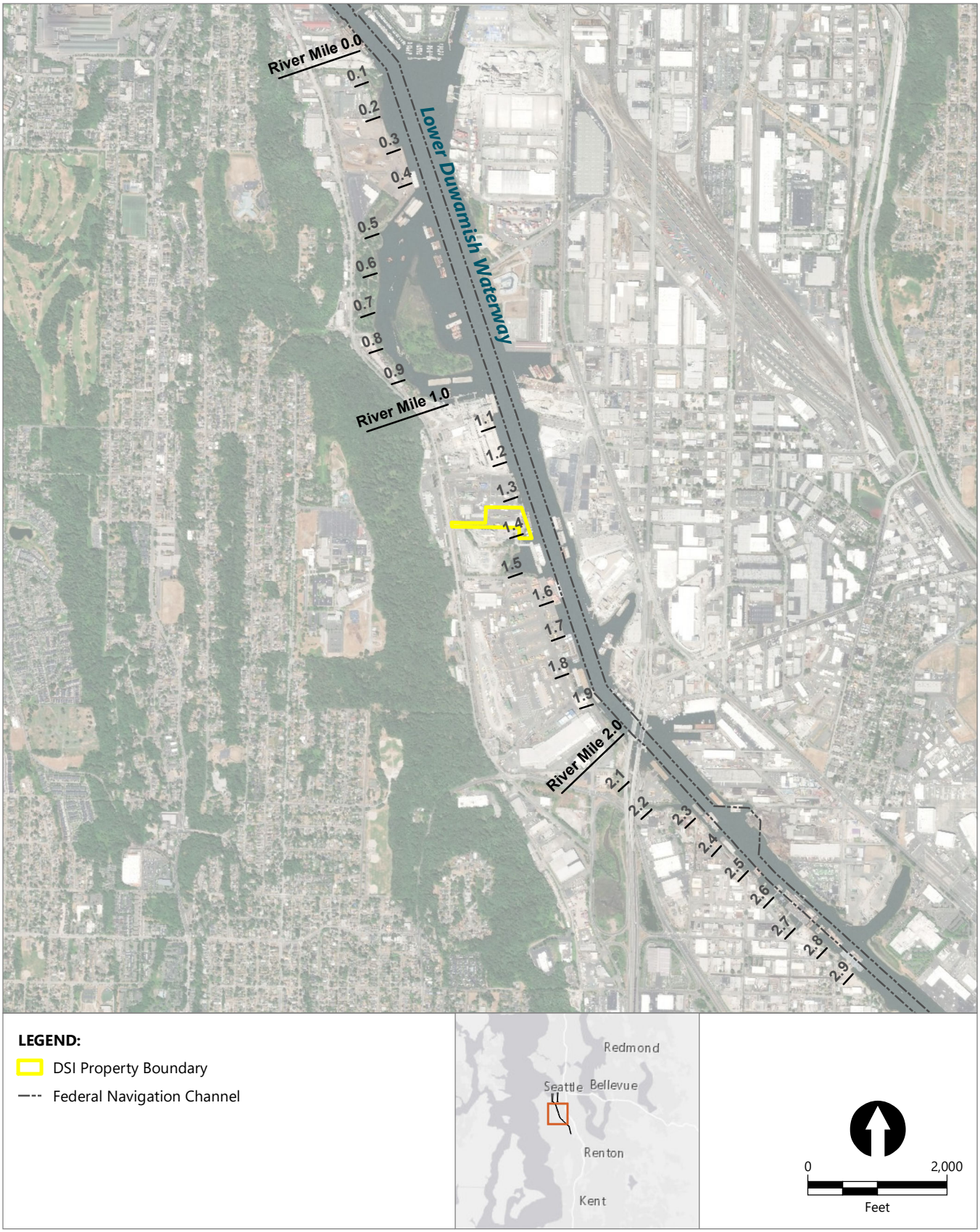

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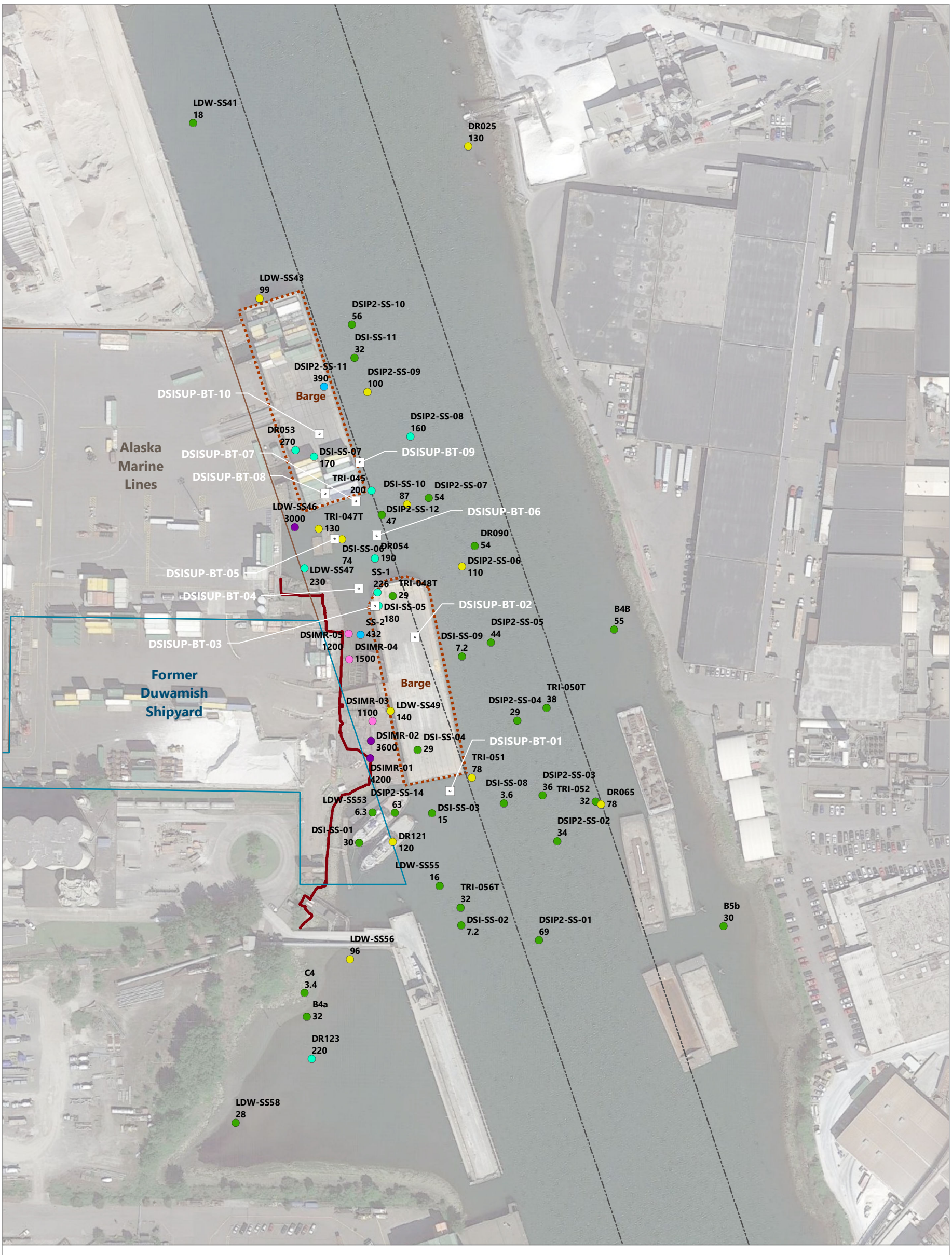
Figure 1
Vicinity Map

Remedial Investigation Addendum: Tributyltin Bioaccumulation Study Work Plan
Duwamish Shipyard, Inc. Tributyltin Bioaccumulation Study



LEGEND:

- Proposed Bioaccumulation Test Sample Location
- Top of Bank (Approximate)
- DSI Property Boundary
- AML Property Boundary
- Barge
- Federal Navigation Channel

Tributyltin in Surface Sediment (µg/kg), 0 to 10 cm

- <73
- 73 to 150
- 150 to 365
- 365 to 730
- 730 to 1,825
- >1,825

NOTES:
µg/kg: micrograms per kilogram
AML: Alaska Marine Lines
cm: centimeter
DSI: Duwamish Shipyards, Inc.

0 150
Feet

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Figure 2
Proposed Bioaccumulation Test Sample Locations
Remedial Investigation Addendum: Tributyltin Bioaccumulation Study Work Plan
Duwamish Shipyard, Inc. Tributyltin Bioaccumulation Study

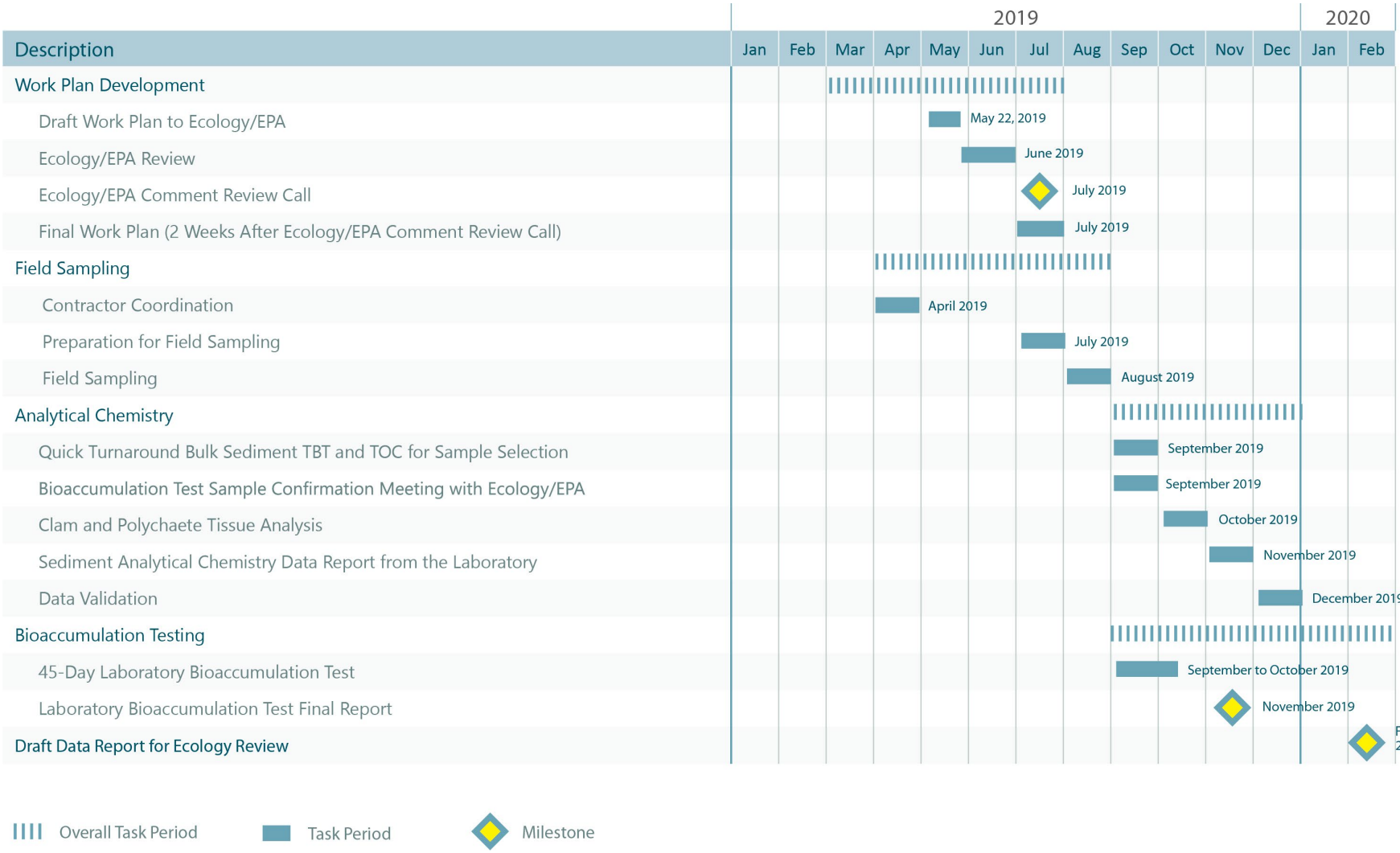

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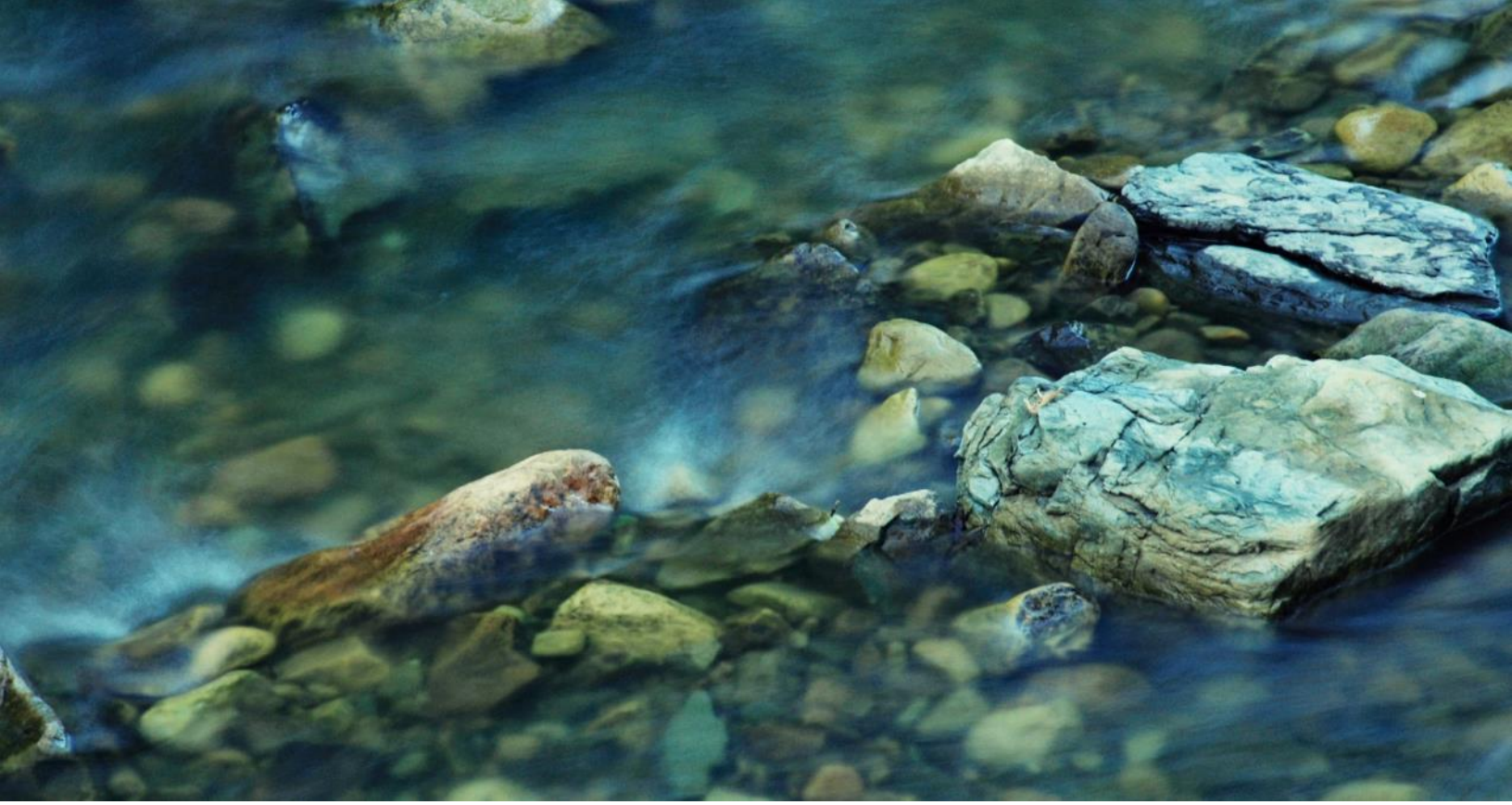
Figure 3

Tributyltin Bioaccumulation Study Schedule

Remedial Investigation Addendum: Tributyltin Bioaccumulation Study Work Plan
Duwamish Shipyard, Inc. Tributyltin Bioaccumulation Study

Appendix A
Sampling and Analysis Plan



July 2019
Duwamish Shipyard, Inc. Tributyltin Bioaccumulation Study

ANCHOR QEA

Remedial Investigation Addendum Sampling and Analysis Plan

Prepared for Washington State Department of Ecology

July 2019
Duwamish Shipyard, Inc. Tributyltin Bioaccumulation Study

Remedial Investigation Addendum Sampling and Analysis Plan

Prepared for
Washington Department of Ecology

Prepared on behalf of
Duwamish Shipyard, Inc.
5658 West Marginal Way Southwest
Seattle, Washington 98106

Prepared by
Anchor QEA, LLC
1201 3rd Avenue, Suite 2600
Seattle, Washington 98101

Project Number: 080111-01.01
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FIGURES

ATTACHMENT

ABBREVIATIONS

ARI	Analytical Resources, Inc.
Cm	centimeter
COC	chain-of-custody
DGPS	differential global positioning system
DQO	Data Quality Objective
DSI	Duwamish Shipyard, Inc.
DSI property	Duwamish Shipyard, Inc. property located at 5658 West Marginal Way Southwest in Seattle, Washington
DSISUP	Duwamish Shipyard, Inc. Supplemental Investigation
Ecology	Washington Department of Ecology
EDD	electronic data deliverable
EIM	Environmental Information Management
EPA	U.S. Environmental Protection Agency
FC	field coordinator
HDPE	high-density polyethylene
LDW	Lower Duwamish Waterway
MDL	method detection limit
NAD83	North American Datum of 1983
PSEP	Puget Sound Estuary Program
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
RBTC	risk-based threshold concentration
RI	Remedial Investigation
RL	reporting limit
SAP	Sampling and Analysis Plan
SCUM II	*Sediment Cleanup User's Manual II*
Site	Duwamish Shipyard, Inc., property located at 5658 West Marginal Way Southwest and portions of the adjacent Lower Duwamish Waterway sediments in Seattle, Washington
SMS	Sediment Management Standards
Work Plan	*Remedial Investigation Addendum: Tributyltin Bioaccumulation Study Work Plan*
T0	time-zero
TBT	Tributyltin

1 Introduction

This Sampling and Analysis Plan (SAP) is Appendix A to the *Remedial Investigation Addendum: Tributyltin Bioaccumulation Study Work Plan* (Work Plan), which presents the scope of work for completion of a supplemental Remedial Investigation (RI) effort at the Duwamish Shipyard, Inc. (DSI) property located at 5658 West Marginal Way Southwest (DSI property) and portions of the adjacent Lower Duwamish Waterway (LDW) sediments in Seattle, Washington (collectively, site; Figure A-1). The Work Plan describes the bioaccumulation study that will be conducted to develop a risk-based threshold concentration (RBTC) for tributyltin (TBT) in sediment, as required by the Washington Department of Ecology (Ecology).[1]

This SAP identifies the sampling and analysis protocols, sample location and frequency, equipment, sample handling, and analytical procedures for implementing a supplemental RI at the site. Work will consist of field sediment sampling and laboratory bioaccumulation testing. This SAP is supported by a Quality Assurance Project Plan (QAPP) and a Health and Safety Plan (Appendices B and C to the Work Plan, respectively).

1.1 Purpose and Overview of the Supplemental Remedial Investigation

The Work Plan outlines the scope and rationale for sediment sampling and bioaccumulation testing to be conducted at the site during this supplemental RI. Surface sediment samples will be collected from the 0- to 10-centimeter (cm) biologically active zone at approximately 10 locations in the LDW, as shown in Figure A-2. Surface sediment samples will be collected using a hydraulic Van Veen grab. Surface sediment testing parameters are outlined in Table A-1.

This SAP was prepared consistent with Puget Sound Estuary Program (PSEP) protocols for sampling and analysis (PSEP 1986, 1997a, 1997b, 1997c; EPA 1993a) and U.S. Environmental Protection Agency (EPA) *Test Methods for the Evaluation of Solid Waste: Physical/Chemical Methods, 3rd Edition* (EPA 1986). The contents and structure of this SAP are consistent with guidance provided in Ecology's *Sediment Cleanup User's Manual II (SCUM II), 2017 Guidance for Implementing the Cleanup Provisions of the Sediment Management Standards, Chapter 173-204 WAC* (SCUM II; Ecology 2017).

1.2 Sampling and Analysis Schedule

This SAP presents the supplemental investigations that will be completed to address data gaps regarding the development of a sediment RBTC for TBT. The supplemental investigation described in

[1] On September 27, 2018, October 1, 2018, and October 26, 2018, Anchor QEA, LLC, held meetings with Ecology and EPA to discuss the extent and potential ecological effects of TBT in sediments adjacent to the DSI property. Since these meetings, Ecology (2019) approved the RI and stipulated that a supplemental investigation related to sediment TBT effects need to be completed and submitted to Ecology as a supplemental RI memorandum.

this SAP will be implemented upon Ecology's approval. The schedule for primary project tasks and key deliverables is further detailed in Figure 3 of the Work Plan.

1.3 Document Organization

This SAP is organized into the following sections:

- Section 2: Project Management and Responsibilities
- Section 3: Sediment Sample Collection and Processing
- Section 4: Sample Handling Procedures
- Section 5: Chemical and Physical Analytical Testing
- Section 6: Bioaccumulation Testing
- Section 7: Data Management
- Section 8: References

2 Project Management and Responsibilities

This section describes the overall project management strategy for implementing and reporting for the SAP. Additional information about personnel responsible for project management and other roles is included in the QAPP (Appendix B to the Work Plan).

The project manager for Anchor QEA is David Templeton. He will be responsible for overall project coordination, including production of all project deliverables and administrative coordination to ensure timely and successful completion of the project.

The task manager for Anchor QEA is Julia Fitts. She is responsible for the direction and supervision of all RI activities, including the supplemental work described in the Work Plan.

The field coordinator (FC) from Anchor QEA will provide overall direction for the field sampling effort in terms of logistics, personnel assignments, and field operations. The FC will supervise field collection of all samples. The FC will also be responsible for positioning samples accurately; recording sample locations, depths, and identification; ensuring conformance to sampling and handling requirements, including field decontamination procedures; providing physical evaluation and logging of samples; and completing chain-of-custody (COC) forms.

Sampling and analysis will be completed with equipment owned or contracted by Anchor QEA. All subconsultants will follow the protocols established in this SAP. Anchor QEA will be responsible for the submittal of environmental samples to the designated laboratories for chemical and physical analyses. The laboratory project manager at each laboratory will provide analytical support and will be responsible for providing certified, pre-cleaned sample containers and sample preservatives (as appropriate) and for ensuring that all chemical analyses meet the project Data Quality Objectives (DQOs) and other quality specifications of the QAPP (Appendix B to the Work Plan).

3 Sediment Sample Collection and Processing

3.1 Sample Station Identification and Locating

Figure A-2 presents the proposed surface sediment sampling locations. The sediment sample nomenclature is described in this section.

Each sample will be assigned a unique alphanumeric identifier according to the following method:

- For bioaccumulation test stations, each station ID will be identified by DSI Supplemental Investigation (DSISUP)-Sample Method-Sample Number:
  - Sample method will be identified by two letters: BT for bioaccumulation test grab sample
  - Sample number will be in order of sampling locations beginning with -01
- Example sample identification nomenclature includes the following:
  - DSISUP-BT-01: Surface sediment sample collected from the first bioaccumulation study location
- A field duplicate collected from a sample will be identified by the addition of 50 to the sample number. A duplicate sample of the above first example would be DSISUP-BT-51.
- For rinsate blank samples, RB will be added in front of the sample number. The resulting nomenclature of a rinsate blank of the decontaminated sample processing equipment after sample collection of the above example would be DSISUP-BT-RB01.

Horizontal positioning will be determined in the field using a differential global positioning system (DGPS) based on target coordinates shown in Table A-1. The horizontal datum will be North American Datum of 1983 (NAD83), Washington State Plane North. Measured geographical coordinates for station positions will be recorded and reported to the nearest 0.01 second. In addition, state plane coordinates will be reported to the nearest foot. The DGPS is accurate to within 3 feet and generally to within 1 foot, depending on the satellite coverage and the number of data points collected.

3.2 Surface Sediment Collection and Sampling

Surface sediment collection at locations in the LDW will be performed using Van Veen grab methodology. Surface sediment samples for bioaccumulation testing will be collected from the 0 to 10 cm biologically active zone at the locations presented in Figure A-2. Additional surface sediment samples may be collected when field observations note the presence of paint chips, sand blast grit, or other debris in the sediment at the edge of the proposed study area.

A hydraulic Van Veen grab sampling device will be used to collect surface sediment samples in the study area. Final sampling methodology in the LDW will depend on access and water level. Van Veen sampling locations will be approached at slow boat speeds with minimal wake to minimize disturbance of bottom sediments prior to sampling. Sediment samples will be handled carefully to minimize disturbance during collection and transportation to the laboratory.

The grab sampler will be lowered over the side of the boat from a cable wire at an approximate speed of 0.3 foot per second. When the sampler reaches the mudline, the cable will be drawn taut and DGPS measurements recorded. Each surface grab sample will be retrieved aboard the vessel and evaluated for the following acceptance criteria:

- Overlying water is present and has low turbidity.
- Adequate penetration depth is achieved.
- The sampler is not overfilled.
- The sediment surface is undisturbed.
- There are no signs of winnowing or leaking from the sampling device.
- At least 10 cm of recovery is achieved.

Grab samples not meeting these criteria will be rejected near the location of sample collection. The process will be repeated until criteria have been met. Because a large sample volume (8 gallons) is required for bioaccumulation testing, multiple casts of the Van Veen grab sample are necessary, and deployments of the grab sample will be repeated within a 20-foot radius of the proposed sample location. If adequate penetration of the bottom sediment is not achieved after multiple attempts, the station will be moved, and changes in location coordinates will be documented in the field notebook. Once the sample is accepted, overlying water will be siphoned off and a decontaminated stainless-steel trowel, spoon, or equivalent will be used to collect only the upper 10 cm of sediment from inside the sampler without touching the sidewalls. The sediment sample will be placed into a 15-gallon stainless-steel kettle and thoroughly homogenized using a stainless-steel mixing paddle attached to an electric drill. The sampler and mixing containers and apparatus will be decontaminated between stations and rinsed with on-site water between grabs.

After sample collection, the following information will be recorded on the Field Log Sheet, on the Sediment Sampling Form, and in the field notebook:

- Date, time, and name of the person logging the sample
- Weather conditions
- Sample location number and coordinates
- Project designation
- Depth of water at the location and surface elevation
- Sediment penetration and depth
- Sediment sample interval
- Sample recovery
- Physical observations such as apparent grain size; wood debris; color; odor; density; layering; anoxic contact; and presence of surface sheen, shells, or other debris (e.g., paint chips, plastic, or metal)

3.2.1 Surface Sediment Sample Processing

Homogenized surface sediment will be spooned immediately into appropriate pre-cleaned, pre-labeled sample containers, placed in coolers filled with ice or equivalent, and maintained at 4°C. A wet-sieve grain size determination will be performed in the field with an aliquot of the homogenized sediment sample (PSEP 1997c). Debris and materials more than 0.5 inch in diameter will be omitted from sample containers. Surface sediment samples will be submitted for expedited chemical and physical analyses. Bioaccumulation test samples will be archived with zero headspace at 4°C. Surface sediment samples will be analyzed for parameters listed in Table A-1. TBT and TOC will be analyzed in all samples with an expedited turnaround time. All samples will be archived for analysis of site COCs, pending the expedited TBT and physical analysis. Five samples will be selected for bioaccumulation testing after review of the TBT and TOC data by Ecology. The five samples will also be analyzed for the site COCs, the Sediment Management Standards (SMS) parameters for metals, polychlorinated biphenyl Aroclors, polycyclic aromatic hydrocarbons, semivolatile organic compounds, dioxin/furans, and grain size. Sample concentrations will be reported down to the lowest laboratory limit available in order to accurately evaluate bioaccumulation potential. Analytical methods, method detection limits (MDLs), and method reporting limits (RLs) are defined in the QAPP (Appendix B to the Work Plan). Table A-2 presents the sample handling requirements.

Field information will be recorded on the sediment sampling forms (see Attachment A-1). Physical characterization includes the following:

- Grain size distribution
- Density and consistency
- Plasticity
- Color and moisture content
- Biological structures (e.g., shells, tubes, macrophytes, and bioturbation)
- Presence of debris and quantitative estimate (e.g., wood chips or fibers, paint chips, concrete, sand blast grit, and metal debris)
- Presence of oily sheen
- Odor (e.g., hydrogen sulfide)

Surface sediment samples collected for chemical and physical analysis will be securely packed and hand delivered to Analytical Resources, Inc. (ARI) in Tukwila, Washington. Archived samples will be held at the laboratory.

4 Sample Handling Procedures

This section addresses the sampling program requirements for maintaining custody of the samples throughout the sample collection and shipping process. It also provides specific procedures for sample shipping.

4.1 Sample Custody Procedures

Samples are considered to be in one's custody if they are: 1) in the custodian's possession or view; 2) in a secured location (under lock) with restricted access; or 3) in a container that is secured with an official seal such that the sample cannot be reached without breaking the seal.

The COC procedures will be followed for all samples throughout the collection, handling, and analysis process. The principal document used to track possession and transfer of samples is the COC form (see Attachment A-1). Each sample will be represented on a COC form the day it is collected. 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 and spaces on the COC form will be lined-out and dated and initialed by the individual maintaining custody.

A COC form will accompany each cooler of samples to the analytical laboratories, ARI and EcoAnalysts, Inc. 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. Copies of all COC forms will be retained in the project files.

4.2 Sample Shipping and Receipt Requirements

All samples initially will be shipped or hand-delivered to ARI no later than the day after collection. After selection of the bioaccumulation test samples, they will be shipped or hand-delivered to EcoAnalysts, Inc. Specific sample shipping procedures are as follows:

- Each cooler or container of samples for analysis will be hand delivered or shipped via overnight delivery to the appropriate analytical laboratory. In the event that Saturday delivery is required, the FC will contact the analytical laboratory before 3:00 p.m. on Friday to ensure that the laboratory is aware of the number of coolers shipped and the air waybill tracking numbers for those coolers. Laboratories will provide a copy of the COC form and a sample receipt summary form within 48 hours of sample receipt.
- Coolant ice will be sealed in separate double plastic bags and placed in the shipping containers.
- Individual sample containers will be placed in a sealable plastic bag, packed to prevent breakage, and transported in a sealed ice chest or other suitable container.
- Glass jars will be separated in the shipping container by shock absorbent material (i.e., bubble wrap) to prevent breakage.

- The shipping containers will be clearly labeled with sufficient information (name of project, time and date container was sealed, person sealing the container, and consultant's office name and address) to enable positive identification.
- The shipping waybill number will be documented on all COC forms accompanying the samples.
- A sealed envelope containing COC forms will be enclosed in a plastic bag and taped to the inside lid of the cooler.
- A minimum of two signed and dated COC seals will be placed on adjacent sides of each cooler prior to shipping.
- Each cooler will be wrapped securely with strapping tape and labeled "Glass – Fragile" and "This End Up." In addition, each cooler will be clearly labeled with the laboratory's shipping address and the consultant's return address.

Upon transfer of sample possession to the analytical laboratory, the persons transferring custody of the sample container will sign the COC form. Upon receipt of samples at the laboratory, the shipping container seal will be broken and the receiver will record the condition of the samples on a sample receipt form. The COC forms will be used internally in the laboratory to track sample handling and final disposition.

4.3 Field Equipment Decontamination

Sample containers, instruments, working surfaces, technician protective gear, and other items that may come into contact with sediment sample material must meet high standards of cleanliness. All equipment and instruments used that are in direct contact with the sediment collected for analysis must be made of glass, stainless steel, or high-density polyethylene (HDPE). These items will be cleaned prior to each day's use and between sampling or compositing events. Decontamination of all items will follow PSEP protocols. The decontamination procedure is as follows:

1. Pre-wash rinse with distilled water.
2. Wash with solution of distilled water and Alconox soap (brush).
3. Rinse with distilled water.
4. Rinse three additional times with distilled water.
5. Cover (no contact) all decontaminated items with aluminum foil.
6. Store in clean, closed container for next use.

4.4 Investigation Derived Waste Management

Sediment remaining after sample processing and sampling on the boat will be discarded on-station at the collection location. Excess sediment remaining after sample processing will be discarded by lowering it to the sediment surface from where it was collected and releasing it slowly to minimize turbidity. If sediments display any evidence of contamination (e.g., oily droplets, sheen, paint chips,

sandblast grit, other wastes), they will not be returned to the water. Instead they will be retained in a watertight drum on board the vessel for appropriate disposal on shore.

All disposable sampling materials and personal protective equipment used in sample processing, such as disposable coveralls, gloves, and paper towels, will be placed in heavy-duty garbage bags or other appropriate containers. Disposable supplies will be placed in a normal refuse container for disposal as solid waste.

5 Chemical and Physical Analytical Testing

This section summarizes the target physical and chemical analyses for project sediment samples. All sample analyses will be conducted in accordance with Ecology-approved methods and the QAPP (Appendix B to the Work Plan). Prior to analysis, all samples will be maintained according to the appropriate holding times and temperatures for each analysis (Tables A-2 and A-3). The analytical laboratory will prepare a detailed report in accordance with the QAPP.

Prior to the analysis of the samples, the laboratory will calculate MDLs for each analyte of interest, where applicable. MDLs and RLs are specified in the QAPP (Appendix B to the Work Plan). To achieve the required detection and quantitation limits, some modifications to the methods may be necessary. These modifications from the specified analytical methods will be provided by the laboratory at the time of establishing the laboratory contract. The modifications must be approved by Ecology prior to implementation.

With the exception of conventionals, detected results will be reported down to the MDL. The laboratory should provide the MDL for each analyte in the laboratory report and electronic data deliverable, when possible. Reported values between the MDL and RL will be qualified with a "J." Non-detects should be reported at the lowest calibration level (typically the RL).

Chemical and physical testing will be conducted at ARI. ARI is an Ecology-accredited laboratory and is also accredited under the National Environmental Laboratories Accreditation Program. All chemical and physical testing will adhere to the most recent SCUM II quality assurance and quality control (QA/QC) procedures (Ecology 2017) and analysis protocols.

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

- Adhere to the methods outlined in the QAPP (Appendix B to the Work Plan).
- Deliver PDF and electronic data as specified.
- Meet reporting requirements for deliverables.
- Meet turnaround times for deliverables.
- Implement QA/QC procedures discussed in the QAPP including DQOs, laboratory quality control requirements, and performance evaluation testing requirements.
- Notify the project QA/QC manager 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 Bioaccumulation Testing

Bioaccumulation testing will be conducted by EcoAnalysts, Inc., located in Port Gamble, Washington, with one reference and five selected DSI samples to measure the relationship between sediment and test animal tissue burdens. The test will expose an adult marine clam (*Macoma nasuta*) and an adult polychaete (*Nepthys caecoides*) to test sediment using standard methods from the EPA *Guidance Manual: Bedded Sediment Bioaccumulation Tests* (EPA 1993b), the *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual: Inland Testing Manual* (EPA 1998), the ASTM *Standard Guide for Determination of the Bioaccumulation of Sediment-Associated Contaminants by Benthic Invertebrates,* Method No. E-1688-10 (ASTM 2016), and the *Dredged Material Evaluation and Disposal Procedures User Manual* (USACE et al. 2018). The test will also apply the methods that lengthen the test duration to 45 days to allow sufficient time for tissue steady-state to be reached (Ecology 2017). The test procedures are summarized in Table A-4.

Bioaccumulation testing will be conducted using a flow-through testing system, calibrated to mimic a typical Puget Sound tidal cycle and provide a continuous flow rate of four volume exchanges over a 24-hour period. The bioaccumulation test replicate exposure chambers will be 10-gallon glass aquaria. Five replicates will be run for each test and reference sample. The test will start with 6 liters of sediment and 18.5 liters of overlying water; 175 milliliters of sediment will be added weekly to each replicate chamber to refresh the carbon source and mitigate potential contaminant loss. The layered test chambers will be allowed to equilibrate under flow and aeration overnight before starting the test (test organism introduction).

At the start of the test, *Macoma* and *Nepthys* subsamples will be weighed and time-zero (T0) tissue chemistry samples will be collected. The subsamples will consist of individuals of each species randomly selected from the batches of test organisms sufficient to achieve the minimum target tissue mass of 35 grams. The organisms will be depurated in laboratory culture dilution water for 24 hours. Once weighed, the *Nepthys* subsample will be placed in a jar for T0 tissue analysis. The *Macoma* clams will be weighed in the shell, and then soft tissue will be weighed separately (to estimate the ratio of total weight to soft tissue weight) and placed in jars for T0 tissue analyses. All samples will be frozen and shipped to ARI after the end of the experiment.

The test organisms will be exposed for 45 days unless noticeable organism stress (i.e., clam gaping or immobilization) is observed during the last week, in which case the test may be terminated. In this case, this determination to end the test before 45 days will be made in consultation with Ecology. At test termination, the replicate sediment samples will be sieved and the numbers of *Macoma* and *Nepthys* survivors will be documented. The surviving organisms will be depurated separately in laboratory culture dilution water for 24 hours. *N. caecoides* will be depurated in the presence of a thin layer of clean control sand (native control) in order to facilitate gut content transport. Once

weighed, the *Nepthys* replicate samples will be placed in separate sample jars for tissue analysis. The *Macoma* clams will be weighed in the shell and then soft tissue will be weighed separately and placed directly in separate jars for chemical analyses. All samples will be frozen and shipped to ARI.

7 Data Management

Site data are stored, checked for quality, managed, and reported using an EQuIS database platform. Software and procedures are in place to effectively and efficiently handle data generated during the RI. These systems and processes ensure that data (e.g., sample numbers, methods, qualifications, and locations,) are readily accessible and accurately maintained. The primary steps/elements in the data management process are as follows:

- EarthSoft EQuIS 6 environmental chemistry database setup
- Sample and analysis planning
- Sample collection
- Field measurements
- Documentation of location of field activities (e.g., GPS, survey)
- Laboratory analytical data management
- Preliminary reporting and data quality assurance QA/QC
- Formal data validation (details provided in the QAPP [Appendix B to the Work Plan]) and associated database updates
- Development of maps and tables from EQuIS database, integrated with GIS software as appropriate, to support RI/feasibility study reporting requirements
- Analytical data submittals in accordance with Ecology Environmental Information Management (EIM) system

Data will be collected and recorded in a variety of ways during this project. These include standard field forms (e.g., grab collection logs and COC forms) and laboratory-generated analytical data. Information about exploration locations, samples, laboratory tests, field measurements, and analytical results will be maintained. These data will be loaded to EQuIS from electronic data deliverables (EDDs) and preliminarily checked for completeness and fidelity against associated reports and documentation. Access to the EQuIS database will be limited to trained project personnel, and the ability to add or change data will be granted to only those trained, professional data managers, chemists, and scientists.

Laboratory reports and other source documents (including original laboratory EDDs) will be filed electronically. All electronic data will be backed up nightly in accordance with industry practices. Data validation will be performed in accordance with the QAPP (Appendix B to the Work Plan). Data validation reports will be filed electronically (along with other source documents) and any associated updates to analytical data (including qualifiers and other validation notes) will be added/updated in EQuIS, as appropriate.

EQuIS summary products generated from the database include cross-tabularized tables that compare result values to screening levels and nature and extent preliminary remediation goals, as well as supporting summary tables that provide descriptive statistics for each chemical by media.

8 References

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Tables

Table A-1
Surface Sediment Sampling Design: Bioaccumulation Test Locations

Station ID	Proposed Coordinates[1,2]		Sample Method	Target Sampling Interval	Sample ID	Surface Sediment Testing			
	Easting (X)	Northing (Y)				Chemistry	Physical	Biological	Archive
DSISUP-BT-01	1268199.47	204338.08	Van Veen Grab	0 to 10 cm below mudline	DSISUP-BT-01	Bulk TBT (Archive for Site COCs)	TS, TOC, GS	Archive pending sample selection	4°C under nitrogen
DSISUP-BT-02	1268125.08	204594.40	Van Veen Grab	0 to 10 cm below mudline	DSISUP-BT-02	Bulk TBT (Archive for Site COCs)	TS, TOC, GS	Archive pending sample selection	4°C under nitrogen
DSISUP-BT-03	1268073.50	204647.46	Van Veen Grab	0 to 10 cm below mudline	DSISUP-BT-03	Bulk TBT (Archive for Site COCs)	TS, TOC, GS	Archive pending sample selection	4°C under nitrogen
DSISUP-BT-04	1268046.75	204676.31	Van Veen Grab	0 to 10 cm below mudline	DSISUP-BT-04	Bulk TBT (Archive for Site COCs)	TS, TOC, GS	Archive pending sample selection	4°C under nitrogen
DSISUP-BT-05	1268006.39	204759.66	Van Veen Grab	0 to 10 cm below mudline	DSISUP-BT-05	Bulk TBT (Archive for Site COCs)	TS, TOC, GS	Archive pending sample selection	4°C under nitrogen
DSISUP-BT-06	1268076.81	204765.34	Van Veen Grab	0 to 10 cm below mudline	DSISUP-BT-06	Bulk TBT (Archive for Site COCs)	TS, TOC, GS	Archive pending sample selection	4°C under nitrogen
DSISUP-BT-07	1268041.97	204822.45	Van Veen Grab	0 to 10 cm below mudline	DSISUP-BT-07	Bulk TBT (Archive for Site COCs)	TS, TOC, GS	Archive pending sample selection	4°C under nitrogen
DSISUP-BT-08	1267990.48	204835.19	Van Veen Grab	0 to 10 cm below mudline	DSISUP-BT-08	Bulk TBT (Archive for Site COCs)	TS, TOC, GS	Archive pending sample selection	4°C under nitrogen
DSISUP-BT-09	1268048.98	204887.44	Van Veen Grab	0 to 10 cm below mudline	DSISUP-BT-09	Bulk TBT (Archive for Site COCs)	TS, TOC, GS	Archive pending sample selection	4°C under nitrogen
DSISUP-BT-10	1267981.08	204935.01	Van Veen Grab	0 to 10 cm below mudline	DSISUP-BT-14	Bulk TBT (Archive for Site COCs)	TS, TOC, GS	Archive pending sample selection	4°C under nitrogen

Notes:
1. Coordinates will be determined based on finalization of sampling locations.
2. Washington State Plane North, North American Datum of 1983 (NAD 83), U.S. Survey Feet.
cm: centimeters
COC: contaminants of concern
GS: grain size
TBT: tributyltin
TOC: total organic carbon
TS: total solids

Table A-2
Sediment Sample Handling Requirements

Parameter	Sample Size	Container Size and Type[a]	Holding Time	Sample Preservation Technique
Sediment				
Total solids/total organic carbon/total volatile solids	375 g	8-oz Glass or HDPE	14 days	Cool/4°C
			6 months	Freeze -18°C
Grain size	500 g	16-oz Glass or HDPE	6 months	Cool/4°C
SVOCs/PAHs/PCBs/Bulk TBT	750 g	2 x 16-oz Glass	14 days until extraction	Cool/4°C
			1 year until extraction	Freeze -18°C
			40 days after extraction	Cool/4°C
Dioxins/furans	100 g	8-oz Amber Glass	14 days until extraction	Cool/4°C
			1 year until extraction	Freeze -18°C
Total metals[b]	100 g	4-oz Glass	6 months	Cool/4°C
			2 years; 28 days for mercury	Freeze -18°C
Bioaccumulation test	30 L (~8 gallons)	2 x 5 gallon HDPE buckets	56 days	Cool/4°C/Zero headspace
Chemistry archive	500 g	16-oz Glass	1 year until extraction	Freeze -18°C

Notes:
a. All sample containers will have lids with Teflon inserts.
b. Samples will be analyzed for mercury immediately or frozen.
g: gram
HDPE: high-density polyethylene
L: liter
mL: milliliter
oz: ounce
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
SVOC: semivolatile organic compound
TBT: tributyltin

Table A-3
Tissue Sample Handling Requirements

Parameter	Minimum Sample Size	Container Size and Type	Holding Time	Sample Preservation Technique
Tissue				
Moisture content	10 g	8-oz jar	6 months	Cool/4°C
Lipid	10 g		6 months	Cool/4°C
Tissue tributyltin	15 g	16-oz glass	14 days until extraction	Cool/4°C
			1 year until extraction	Freeze -18°C
			40 days after extraction	Cool/4°C

Notes:
All sample containers will have lids with Teflon inserts.
g: gram
HDPE: high-density polyethylene
L: liter
mL: milliliter
oz: ounce

Table A-4
Bioaccumulation Test Procedures Summary

Parameter	Conditions
Organisms	*Macoma nasuta* (marine clam) and *Nepthys caecoides* (marine polychaete)
Test type	Flow-through testing system
Test duration	45 days
Sediment loading rate	~50 g wet sediment/1 g wet tissue
Age of test organisms	*Macoma*: adult, >35 mm shell length, ~3 g wet tissue weight/clam
	Nepthys: adult ~0.3 g wet weight/worm
Number of organisms per aquarium (Dependent on mass requirement of targeted analytes)	*Macoma*: ~15
	Nepthys: ~85
Test chamber	10-gallon aquaria
Number of replicate chambers	Five replicate test chambers per sediment
Volume of sediment per replicate	6 L initial and 175 mL additional per week (total of 7.1 L)
Volume of seawater per replicate	18.5 L
Renewal of overlying water	Four volume exchanges over a 24-hour period. Cycle mimics a typical Puget Sound tidal cycle.
Renewal of sediment	175 mL added to each replicate every week (i.e., days 7, 14, 21, 28, 35, and 42)
Seawater source	Natural seawater from Northern Hood Canal
Treatment of seawater	Sand Filtered (25 µm),
Overlying water quality	Daily: Temperature and dissolved oxygen in one alternating replicate, daily per treatment Start and end of test and weekly: salinity, pH, and overlying ammonia in one replicate per treatment
Negative control sediment	Native sediment collected from the organism collection sites: *M. nasuta* – Discovery Bay, Washington, *N. caecoides* – Dillon Beach, California. A blend of the two native sediments is prepared when the two test organisms are exposed in the same chamber.
Reference area sediment	Sediments from Carr Inlet
Test temperature	14 ± 2°C
Test illumination	50–100 foot-candle; 16 hours light/8 hours dark
Food	None
Aeration	Gently (maximum 100 bubbles per minute)
Salinity	28–35 ppt
Dissolved oxygen	>5 mg/L
Test acceptability	There are no SMS criteria established for the bioaccumulation test; the purpose of the test is to provide sufficient tissue for analytical chemistry of tissue residues.

Notes:
µm: micrometer
g: gram
L: liter
mg/L: milligrams per liter
mL: milliliter
mm: millimeter
ppt: parts per thousand

Figures

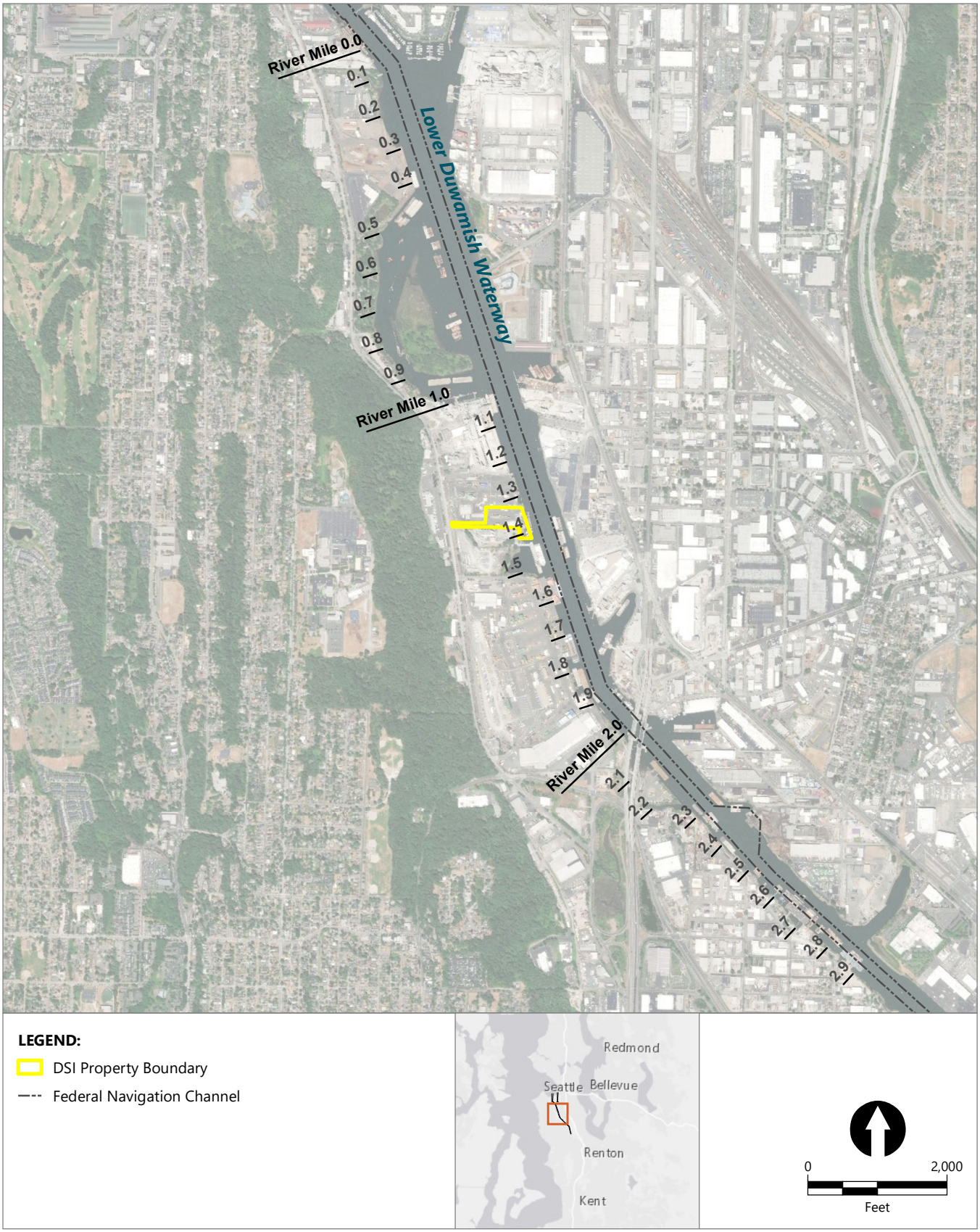

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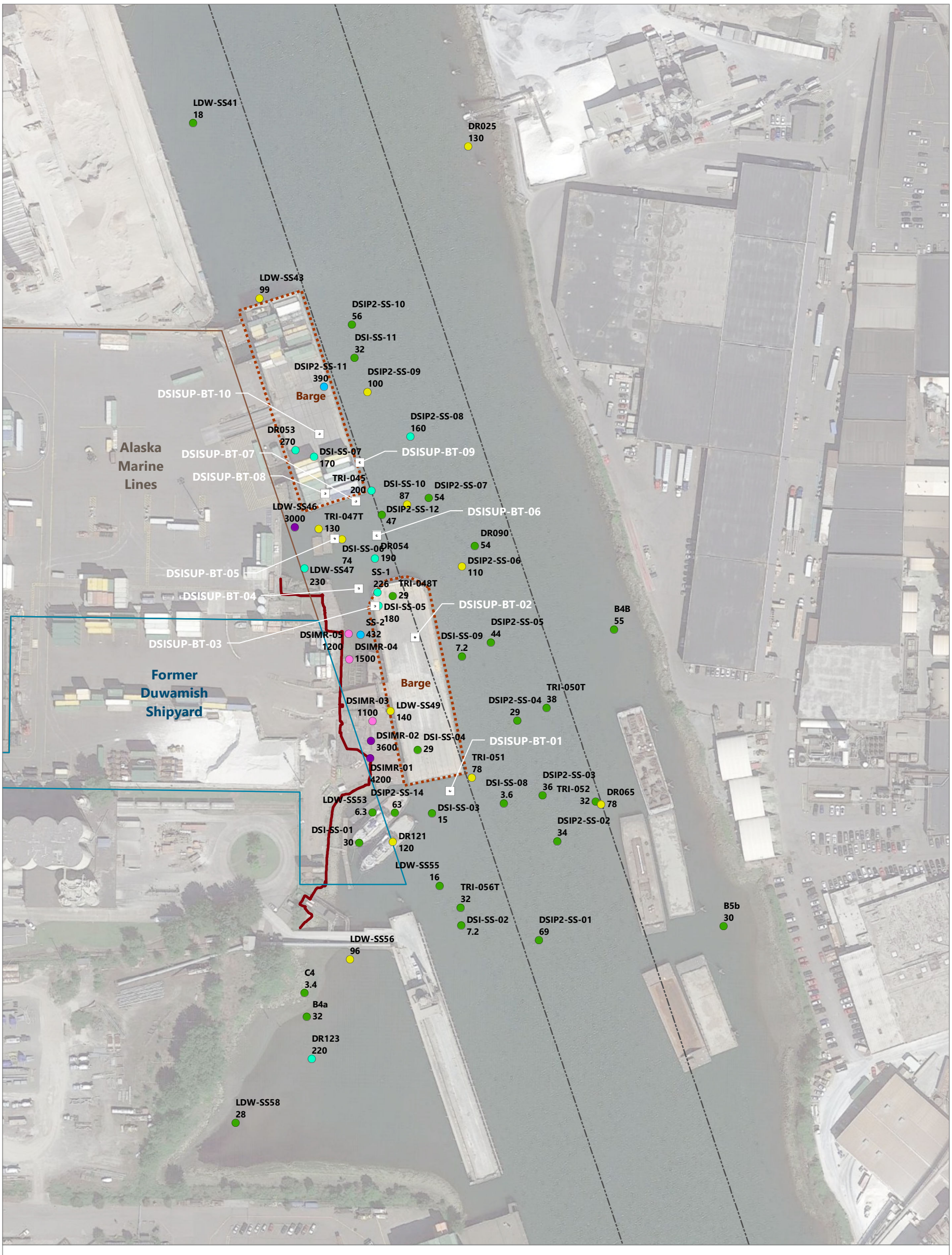
Figure A-1
Vicinity Map

Remedial Investigation Addendum: Sampling and Analysis Plan
Duwamish Shipyard, Inc. Tributyltin Bioaccumulation Study



LEGEND:

- Proposed Bioaccumulation Test Sample Location
- Top of Bank (Approximate)
- DSI Property Boundary
- AML Property Boundary
- Barge
- Federal Navigation Channel

Tributyltin in Surface Sediment (µg/kg), 0 to 10 cm

- <73
- 73 to 150
- 150 to 365
- 365 to 730
- 730 to 1,825
- >1,825

NOTES:
µg/kg: micrograms per kilogram
AML: Alaska Marine Lines
cm: centimeter
DSI: Duwamish Shipyards, Inc.

0 150
Feet

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Figure A-2
Proposed Bioaccumulation Test Sample Locations
Remedial Investigation Addendum: Sampling and Analysis Plan
Duwamish Shipyard, Inc. Tributyltin Bioaccumulation Study

Attachment A-1
Field Forms and Logs

Daily Log

Anchor QEA, LLC
1201 3rd Avenue, Suite 2600
Seattle, WA 98101
Phone 206.287.9130 Fax 206.287.9131

PROJECT NAME: _____ **DATE:** _____

SITE ADDRESS: _____ **PERSONNEL:** _____

WEATHER: **WIND FROM:**

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

LIGHT	MEDIUM	HEAVY

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

TIME	COMMENTS

Signature: _____

Surface Sediment Field Log

Project Name: Duwamish Shipyard, Inc. TBT Study	**Station ID:**
Project No: 080111-01.01	**Date:**
Field Staff:	**Sample Method:**
Contractor:	**Logged By:**
Vertical Datum: ft MLLW	**Horizontal Datum: NAD83 WA SP North**

Water Height	**Tidal Elevations**	**Mudline Elevation (ft MLLW)**
DTM Depth Sounder:	Time:	(-) Water Depth + Tidal Elevation
DTM Lead Line:	Height:	

Notes:

Sample Acceptability Criteria:
1) Overlying water is present
2) Water has low turbidity
3) Sampler is not overfilled
4) Surface is flat
5) Desired penetration depth

Grab #	Time	Field Collection Coordinates		Sample Accept (Y/N)	Recovery Depth (in)	Comments: jaws close, good seal, winnowing, overlying water, surface intact, etc
		Northing/Latitude	Easting/Longitude			

Sample Description: surface cover, (density), moisture, color, minor modifier, MAJOR modifier, other constituents, odor, sheen, layering, anoxic layer, debris, plant matter, shells, biota

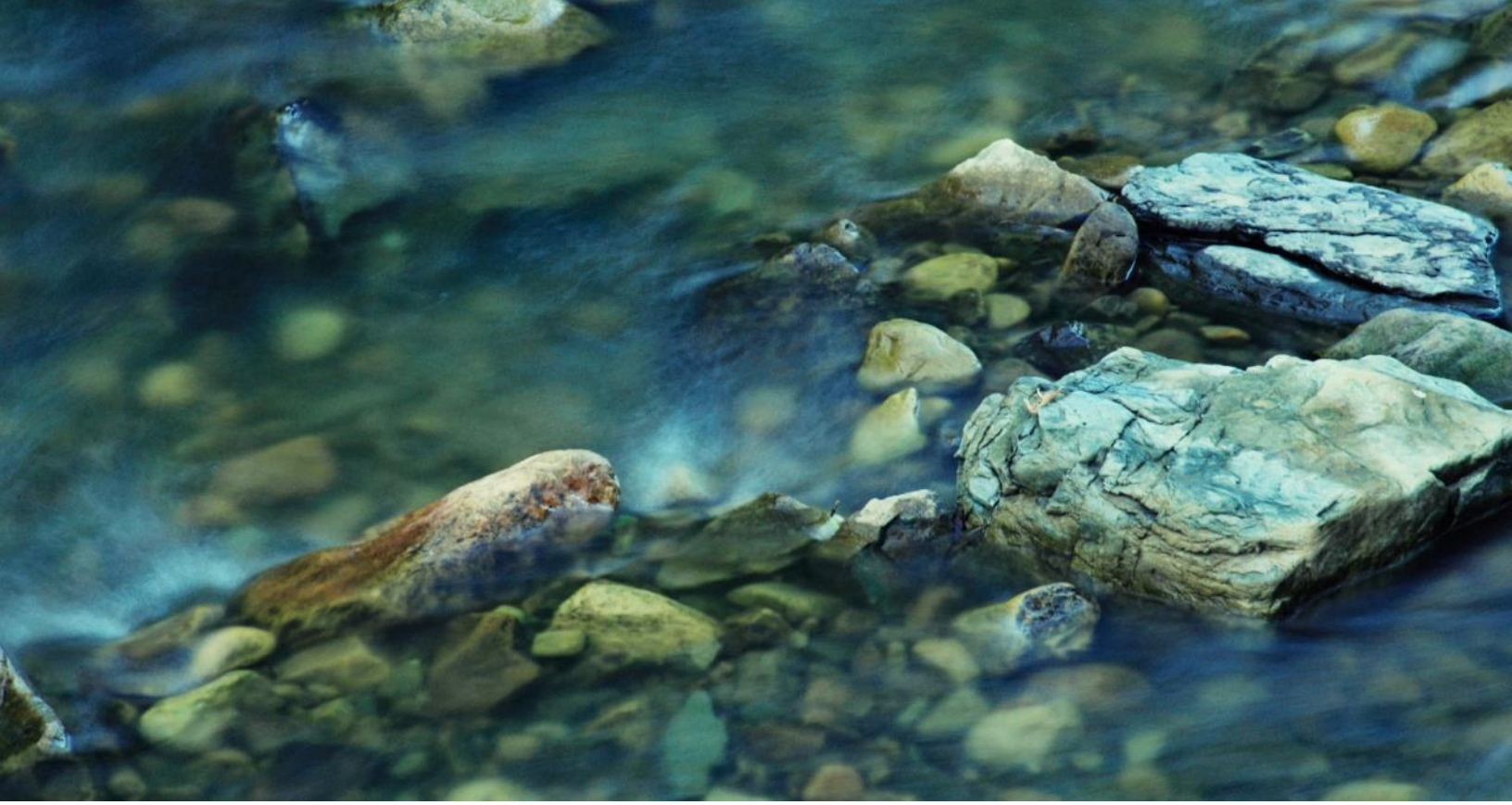
Sample Identification and Time:

Sample Containers:

Analyses: Grain size, TOC/TS, TBT

Archive: Freeze -18°C

Appendix B
Quality Assurance Project Plan



July 2019
Duwamish Shipyard, Inc. Tributyltin Bioaccumulation Study

ANCHOR QEA

Remedial Investigation Addendum Quality Assurance Project Plan

Prepared for Washington Department of Ecology

July 2019
Duwamish Shipyard, Inc. Tributyltin Bioaccumulation Study

Remedial Investigation Addendum Quality Assurance Project Plan

Prepared for
Washington Department of Ecology

Prepared on behalf of
Duwamish Shipyard, Inc.
5658 West Marginal Way Southwest
Seattle, Washington 98106

Prepared by
Anchor QEA, LLC
1201 3rd Avenue, Suite 2600
Seattle, Washington 98101

Project Number: 080111-01.01

TABLE OF CONTENTS

TABLES

ABBREVIATIONS

%R	percent recovery
ASTM	ASTM International
CCV	continuing calibration verification
CFR	Code of Federal Regulations
COC	chain-of-custody
DQO	data quality objective
DSI	Duwamish Shipyard, Inc.
Ecology	Washington Department of Ecology
EIM	Environmental Information Management
EPA	U.S. Environmental Protection Agency
FC	field coordinator
HAZWOPER	Hazardous Waste Operations and Emergency Response
LDC	Laboratory Data Consultants
LDW	Lower Duwamish Waterway
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
OSHA	Occupational Safety and Health Administration
PSEP	Puget Sound Estuary Program
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
RBTC	risk-based threshold concentration
RI	Remedial Investigation
RL	reporting limit
RPD	relative percent difference
SAP	Sampling and Analysis Plan
SCUM II	*Sediment Cleanup User's Manual II*
site	Duwamish Shipyard, Inc. property located at 5658 West Marginal Way Southwest and portions of the adjacent Lower Duwamish Waterway sediments in Seattle, Washington
SOP	standard operating procedure
TBT	Tributyltin
Work Plan	*Remedial Investigation Addendum: Tributyltin Bioaccumulation Study Work Plan*

1 Introduction

This Quality Assurance Project Plan (QAPP) establishes the quality assurance objectives for conducting sampling and evaluation activities described in the *Remedial Investigation Addendum: Tributyltin Bioaccumulation Study Work Plan* (Work Plan) for Duwamish Shipyard, Inc. (DSI) at the DSI property at 5658 West Marginal Way Southwest and portions of the adjacent Lower Duwamish Waterway sediments in Seattle, Washington (collectively, site). This QAPP is included as Appendix B to the Work Plan. The methods and quality assurance procedures described here will be followed by DSI and its contractors during the bioaccumulation study data collection activities described in the Work Plan and in the Sampling and Analysis Plan (SAP; Appendix A to the Work Plan).

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

The QAPP was prepared following Washington Department of Ecology (Ecology) *Guidance for Preparing Quality Assurance Project Plans for Environmental Studies* (Lombard and Kirchmer 2004) and Ecology's *Sediment Cleanup User's Manual II* (SCUM II) *Guidance for Implementing the Cleanup Provisions of the Sediment Management Standards, Chapter 173-204 WAC* (Ecology 2017). Analytical quality assurance/quality control (QA/QC) procedures were also developed based on the analytical protocols and quality assurance guidance of the Puget Sound Estuary Program (PSEP; PSEP 1986, 1997a, 1997b, 1997c), U.S. Environmental Protection Agency (EPA) *Test Methods for the Evaluation of Solid Waste: Physical/Chemical Methods*, 3rd Edition (EPA 1986), and the Contract Laboratory Program National Functional Guidelines for Data Review (EPA 2017a, 2017b).

1.1 Project Overview

A detailed project overview and Vicinity Map is provided in the Work Plan (Work Plan, Figure 1) and supporting field sampling details are provided in the SAP (Appendix A to the Work Plan).

1.2 Document Organization

This QAPP was prepared in accordance with Ecology guidance for developing QAPPs (Lombard and Kirchmer 2004). Ecology's guidance specifies four groups of information that must be included in a QAPP (Project Management, Data Generation and Acquisition, Assessment and Oversight, and Data Validation and Usability). Each group comprises several QAPP elements. Ecology's guidance provides a suggested outline for the QAPP elements; however, the guidance indicates that certain elements may not be applicable to a given project and that the elements need not be presented in the order presented in the guidance.

The remainder of this QAPP is organized into the following sections:

- Section 2 – Project Management
- Section 3 – Overview of Data Generation and Acquisition
- Section 4 – Assessments and Response Actions
- Section 5 – Data Validation and Usability
- Section 6 – References

This QAPP is Appendix B to the Work Plan; the SAP is Appendix A to the Work Plan and provides details for the sample collection and analysis procedures.

2 Project Management

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

2.1 Project/Task Organization

Responsibilities of the team members, as well as laboratory project managers, are described in the following paragraphs.

Anchor QEA, LLC, has the primary role of project manager to ensure compliance with the Agreed Order No. DE-6735 requirements.

The Ecology project manager and sediment specialist for Ecology will lead technical review of the project and will be responsible for compliance with the Model Toxics Control Act and Ecology's Sediment Management Standards.

Anchor QEA Project Manager David Templeton will act as the direct line of communication between contractors and DSI, and will be responsible for implementing activities described in this QAPP. He will also be responsible for the production of work plans and all project deliverables and for performing the administrative tasks needed to ensure timely and successful completion of these studies. The project manager will provide the overall programmatic guidance to support staff and will ensure that all documents, procedures, and project activities meet the objectives in this QAPP. The project manager will also be responsible for resolving project concerns or conflicts related to technical matters. The project manager will notify DSI of any long-term changes in core personnel.

The task manager for Anchor QEA is Julia Fitts. She is responsible for the direction and supervision of all Remedial Investigation (RI; Anchor QEA, 2019) activities, including the supplemental work described in the Work Plan.

The field coordinator (FC) is responsible for day-to-day technical and QA/QC oversight. The FC will ensure that appropriate protocols for sample collection, preservation, and holding times are observed and will submit environmental samples to the designated laboratories for chemical and physical analyses.

The QA/QC manager will provide quality assurance oversight for both the field sampling and laboratory programs, ensuring that samples are collected and documented appropriately, coordinating with the analytical laboratories, ensuring data quality, overseeing data validation, and supervising project quality assurance coordination and data validation.

The data manager will compile field observations and analytical data into a database, review the data for completeness and consistency, append the database with qualifiers assigned by the data validator, and ensure that the data obtained are in a format suitable for inclusion in the appropriate databases and delivery to Ecology.

The laboratory manager will oversee all laboratory operations associated with the receipt of the environmental samples, chemical and physical analyses, and laboratory report preparation for this project. The laboratory manager will review all laboratory reports and prepare case narratives describing any anomalies and exceptions that occurred during analysis.

The analytical testing laboratory will be responsible for the following:

- Performing the methods outlined in this QAPP, including those methods referenced for each analytical procedure
- Following documentation, custody, and sample logbook procedures
- Implementing QA/QC procedures required by PSEP (1986, 1997a, 1997b, 1997c) or other guidelines
- Meeting all reporting and QA/QC requirements
- Delivering electronic data files as specified in this QAPP
- Meeting turnaround times for deliverables as described in this QAPP
- Allowing Ecology and the QA/QC contractor to perform laboratory and data audits

Laboratory Data Consultants (LDC) is anticipated to serve as the primary contact to perform all applicable data validation.

2.2 Problem Definition/Background

Addressing the nature and extent and potential bioaccumulation of tributyltin (TBT) in sediments adjacent to DSI is to determine a site-specific risk-based threshold concentration (RBTC) for TBT in sediment.[1] The RBTC is designed for the protection of bioaccumulation risk to the benthic community, including gastropods, in the Lower Duwamish Waterway (LDW) Superfund Site adjacent to and in the vicinity of the DSI upland property. Ultimately, the information generated by the Work Plan will be used to develop a site-specific sediment cleanup level for TBT consistent with Washington's Sediment Management Standards. Refer to the Work Plan for details.

[1] On September 27, 2018, October 1, 2018, and October 26, 2018, Anchor QEA held meetings with Ecology and EPA to discuss the extent and potential ecological effects of TBT in sediments adjacent to the DSI property. During these meetings, Ecology indicated that additional site-specific investigations related to sediment TBT effects would be needed to finalize the RI (e.g., as a supplemental RI).

2.3 Project/Task Description and Schedule

Sampling activities described in the SAP (Appendix A to the Work Plan) will be initiated following Ecology's approval of this QAPP and as outlined in the schedule in the Agreed Order.

2.4 Data Quality Objectives and Criteria

The DQOs for this project are to ensure that the data collected are of known and acceptable quality so that the project objectives described in the Work Plan can be achieved. The quality of the laboratory data is assessed by precision, accuracy, representativeness, comparability, and completeness (the "PARCC" parameters) and sensitivity. Definitions of these parameters and the applicable quality control procedures are given below. Applicable quantitative goals for these DQOs are listed or referenced in Table B-1. Laboratory and field QA/QC sample and analysis requirements are summarized in Table B-2.

2.4.1 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 analysis. ASTM International (ASTM) recognizes two levels of precision: 1) repeatability—the random error associated with measurements made by a single test operator on identical aliquots of test material in a given laboratory, with the same apparatus, under constant operating conditions; and 2) reproducibility—the random error associated with measurements made by different test operators, in different laboratories, using the same method but different equipment to analyze identical samples of test material (ASTM 2002).

In the laboratory, "within-batch" precision is measured using replicate sample or quality control 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 analysis of standard solutions or laboratory control samples from multiple analytical batches.

Field precision will be evaluated by the collection of blind field duplicates for chemistry samples at a frequency of 1 in 20 samples. Field chemistry duplicate precision will be screened against an RPD of 50% for sediment samples. However, no data will be qualified based solely on field homogenization duplicate precision.

Precision measurements can be affected by the nearness of a chemical concentration to the method detection limit (MDL), where the RPD increases. The equation used to express precision is as follows:

Equation 1

$$\text{RPD} = \frac{(C_1 - C_2) \times 100\%}{(C_1 + C_2)/2}$$

where:

RPD	=	relative percent difference
C_1	=	larger of the two observed values
C_2	=	smaller of the two observed values

2.4.2 Accuracy

Accuracy is a measure of the closeness of an individual measurement (or an average of multiple measurements) to the true or expected value. Accuracy is determined by calculating the mean value of results from ongoing analyses of laboratory-fortified blanks, standard reference materials, and standard solutions. In addition, laboratory-fortified (i.e., matrix-spiked) samples are also measured; this indicates the accuracy or bias in the actual sample matrix. Accuracy is expressed as percent recovery (%R) of the measured value, relative to the true or expected value. If a measurement process produces results for which the mean is not the true or expected value, the process is said to be biased. Bias is the systematic error either inherent in a method of analysis (e.g., extraction efficiencies) or caused by an artifact of the measurement system (e.g., contamination). Analytical laboratories use several quality control 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 against quantitative matrix spike (MS) and surrogate spike recovery performance criteria provided by the laboratory. Accuracy can be expressed as a percentage of the true or reference value, or as a %R in those analyses where reference materials are not available and spiked samples are analyzed. The equation used to express accuracy is as follows:

Equation 2

$$\%R = 100\% \times (S - U)/C_{sa}$$

where:

$\%R$	=	percent recovery
S	=	measured concentration in the spiked aliquot
U	=	measured concentration in the unspiked aliquot
C_{sa}	=	actual concentration of spike added

Field accuracy will be controlled by adherence to sample collection procedures outlined in the SAP (Appendix A to the Work Plan).

2.4.3 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent an environmental condition. For the site, the list of analytes has been identified to support the development of a site-specific RBTC.

2.4.4 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 through the use of standard analytical methodologies and reporting formats, and of common traceable calibration and reference materials.

2.4.5 Completeness

Completeness is a measure of the amount of data that is determined to be valid in proportion to the amount of data collected. Completeness will be calculated as follows:

Equation 3

$$C = \frac{(Number\ of\ acceptable\ data\ points) \times 100}{(Total\ number\ of\ data\ points)}$$

The DQO for completeness for all components of this project is 95%. Data that have been qualified as estimated because the quality control criteria were not met will be considered valid for the

purpose of assessing completeness. Data that have been qualified as rejected will not be considered valid for the purpose of assessing completeness.

2.4.6 Sensitivity

Analytical sensitivities must be consistent with or lower than the regulated criteria values in order to demonstrate compliance with this QAPP. When they are achievable, the target detection limits specified will be at least a factor of 2 less than the analyte's corresponding regulated criteria value.

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 reporting limits (RLs) are defined as the lowest level that produces a quantitative result within specified limits of precision and accuracy during routine laboratory operating conditions. Laboratory MDLs and RLs (Table B-3) will be used to evaluate method sensitivity or applicability prior to the acceptance of a method for this program.

The sample-specific MDL and RL will be reported by the laboratory and will take into account any factors relating to the sample analysis that might decrease or increase the RL (e.g., dilution factor, percent moisture, and sample volume). If the MDL and RL are elevated for a sample due to matrix interferences and subsequent dilution or reduction in the sample aliquot, the data will be evaluated by Anchor QEA and the laboratory to determine whether an alternative course of action is required or possible. If this situation cannot be resolved readily (i.e., detection limits less than criteria are achieved), Ecology will be contacted to discuss an acceptable resolution. The sample-specific RL will be the value provided in the project database and subsequent Environmental Information Management (EIM) deliverable.

2.5 Special Training Requirements/Certifications

For sample preparation tasks, it is important that field crews are trained in standardized data collection requirements, so that the data collected are consistent among the field crew. All field crew members must be fully trained in the collection and processing of surface sediment, decontamination protocols, visual inspections, and chain-of-custody (COC) procedures.

In addition, the Occupational Safety and Health Administration (OSHA) regulations found in the Code of Federal Regulations (CFR) at 29 CFR 1910.120 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 sampling personnel will have completed the 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training course and 8-hour refresher courses, as necessary, to meet the OSHA regulations.

2.6 Documentation and Records

This project will require central project files to be maintained at Anchor QEA. Project records will be stored and maintained in a secure manner. Each project team member is responsible for filing 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 they must provide such files to the central project files upon completion of each task. Hard copy documents will be kept on file at Anchor QEA or at a document storage facility throughout the duration of the project, and all electronic data will be maintained in the database at Anchor QEA.

2.6.1 Field Records

All documents generated during the field effort are controlled documents that become part of the project file.

2.6.1.1 Field Forms

Field team members will keep a daily record of significant events, observations, and measurements on field forms. They will record all field activities on forms specific to the collection activity. The FC will maintain the field forms. The field forms will be the main source of field documentation for all field activities. The on-site field representative will record information pertinent to the investigation program on the field log form. The sampling documentation will contain information on each sample collected and will include, at a minimum, the following information:

- Project name
- Field personnel on site
- Facility visitors
- Weather conditions
- Field observations
- Maps or drawings
- Date and time sample collected
- Sampling method and description of activities
- Identification or serial numbers of instruments or equipment used
- Deviations from the QAPP and SAP

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

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

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

2.6.2 Analytical and Chemistry Records

The laboratory will retain analytical data records. In addition, Anchor QEA will retain the analytical data records in its central project files. For all analyses, the data reporting requirements will include those items necessary to complete data validation, including copies of all raw data. The analytical laboratory will be required, where applicable, to report the following:

- **Project Narrative.** This summary, in the form of a cover letter, will discuss problems, if any, encountered during any aspect of analysis. This summary should discuss, but not be limited to, quality control, sample shipment, sample storage, and analytical difficulties. Any problems encountered, actual or perceived, and their resolutions will be documented in as much detail as appropriate.
- **Chain-of-Custody Records.** Legible copies of the COC forms will be provided as part of the data package. This documentation will include the time of receipt and condition of each sample received by the laboratory. Additional internal tracking of sample custody by the laboratory will also be documented on a sample receipt form. The form must include all sample shipping container temperatures measured at the time of sample receipt.
- **Sample Results.** The data package will summarize the results for each sample analyzed. The summary will include the following information when applicable:
  - Field sample identification code and the corresponding laboratory identification code
  - Sample matrix
  - Date of sample extraction
  - Date and time of analysis
  - Weight or volume used for analysis
  - Final dilution volumes or concentration factor for the sample
  - Identification of the instrument used for analysis
  - MDLs
  - 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 follow; additional information may be requested:
  - **Calibration Data Summary.** This summary will report the concentrations of the initial calibration and daily calibration standards, and the date and time of analysis. The response factor, percent relative standard deviation, percent difference, and retention time for each analyte will be listed, as appropriate. Results for standards to indicate instrument sensitivity will be documented.
  - **Internal Standard Area Summary.** The stability of internal standard areas will be reported.
  - **Method Blank Analysis.** The method blank analyses associated with each sample and the concentration of all compounds of interest identified in these blanks will be reported.
  - **Surrogate Spike Recovery.** This will include all surrogate spike recovery data for organic compounds. The name and concentration of all compounds added, percent recoveries, and range of recoveries will be listed.
  - **Matrix Spike Recovery.** This will report all MS recovery data for organic and metal compounds. The name and concentration of all compounds added, percent recoveries, and range of recoveries will be listed. The RPD for all duplicate analyses will be included.
  - **Matrix Duplicate.** This will include the percent recovery and associated RPD for all matrix duplicate analyses.
  - **Laboratory Control Sample.** All laboratory control sample recovery data for organic and metal compounds will be reported. The name and concentration of all compounds added, percent recoveries, and range of recoveries will be listed. The RPD for all duplicate analyses will be included.
  - **Relative Retention Time.** This will include a report of the relative retention time of each analyte detected in the samples for both primary and conformational analyses.
- **Original Data.** Legible copies of the original data generated by the laboratory will include the following:
  - Sample extraction, preparation, identification of extraction method used, and cleanup logs
  - Instrument specifications and analysis logs for all instruments used on days of calibration and analysis
  - Calculation worksheets for inorganic analyses
  - Reconstructed ion chromatograms for all samples, standards, blanks, calibrations, spikes, replicates, and reference materials

- Original printouts of full scan chromatograms and quantitation reports for all gas chromatography or gas chromatography/mass spectrometry samples, standards, blanks, calibrations, spikes, replicates, and reference materials
- Enhanced spectra of detected compounds with associated best-match spectra for each sample

All instrument data shall be fully restorable at the laboratory from electronic backup. The laboratory will be required to maintain all records relevant to project analyses for a minimum of 10 years. Data validation reports will be maintained in the central project files with the analytical data reports.

2.6.3 Data Reduction

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

3 Overview of Data Generation and Acquisition

The rationale for the sampling design and design assumptions for locating and selecting environmental samples is detailed in the SAP (Appendix A to the Work Plan). The methods and procedures for collection of field samples are also provided in the SAP.

All sampling will be conducted following standard procedures documented in the SAP (Appendix A to the Work Plan). In general, all sampling procedures will comply with PSEP protocols or other approved sample collection standards established for the study area.

3.1 Analytical Methods

Analytical methods, MDLs, and RLs for proposed sample media are presented in Table B-3. Associated laboratory sample handling requirements are identified in the SAP (Tables A-2 and A-3; Appendix A to the Work Plan).

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

- Adhere to the methods outlined in this QAPP, including methods referenced for each analytical procedure.
- Provide a detailed discussion of any modifications made to approved analytical methods.
- Deliver Adobe PDF and electronic data as specified.
- Meet reporting requirements for deliverables.
- Meet turnaround times for deliverables.
- Implement QA/QC procedures, including the QAPP data quality requirements, laboratory quality assurance requirements, and performance evaluation testing requirements.
- Allow laboratory and data audits to be performed, if deemed necessary.

Table B-2 presents the field and laboratory QA/QC samples.

3.2 Quality Assurance and Quality Control

Field and laboratory activities must be conducted in such a manner that the results meet specified quality objectives and are fully defensible. Guidance for QA/QC is derived from the protocols in SCUM II (Ecology 2017), EPA SW-846 (EPA 1986), the EPA Contract Laboratory Program (EPA 2017a, 2017b), and the cited methods.

3.2.1 Field Quality Control

Anchor QEA personnel will identify and label samples in a consistent manner to ensure that field samples are traceable and that labels provide all information necessary for the laboratory to properly

conduct required analyses. Samples will be placed in appropriate containers and preserved for shipment to the laboratory.

3.2.1.1 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. Specific container requirements will be subject to the sample design as described in the SAP (Tables A-2 and A-3; Appendix A to the Work Plan).

3.2.1.2 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

Samples will be uniquely identified with a sample identification that, at a minimum, specifies the sample matrix, sample number, sample location, and type of sample. Specific sample nomenclature is provided in the SAP (Appendix A to the Work Plan).

3.2.1.3 Sample Custody and Shipping Requirements

Samples are considered to be in one's custody if they are: 1) in the custodian's possession or view; 2) in a secured location (under lock) with restricted access; or 3) in a container that is secured with 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 analysis process. The principal document used to track possession and transfer of samples is the COC form. Each sample will be represented on a COC form the day it is collected. 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 or spaces on the COC form will be lined-out, dated, and initialed by the individual maintaining custody.

A COC form will accompany each cooler of samples to the analytical laboratories. Each person who has custody of the samples will sign the COC form and ensure that the samples are not left unattended unless properly secured. Copies of all COC forms will be retained in the project files.

All samples will be hand delivered or shipped to the analytical laboratory as soon as possible after collection. Specific sample shipping procedures are as follows:

- Each cooler or container containing the samples for analysis will be hand-delivered the day of sample collection or shipped via overnight delivery to the appropriate analytical laboratory. If Saturday delivery is required, the FC will contact the analytical laboratory before 3:00 p.m. on Friday to ensure that the laboratory is aware of the number of containers shipped and the air waybill tracking numbers for those containers. Following each shipment, the FC will call the laboratory to verify the shipment from the day before has been received and is in good condition.
- Coolant ice will be sealed in separate double plastic bags and placed in the shipping containers.
- Individual sample containers will be placed in a sealable plastic bag, packed to prevent breakage, and transported in a sealed ice chest or other suitable container.
- Glass jars will be separated in the shipping container by shock-absorbent material (e.g., bubble wrap) to prevent breakage.
- The shipping containers will be clearly labeled with sufficient information (name of project, time and date the container was sealed, person sealing the container, and consultant's office name and address) to enable positive identification.
- The shipping air waybill number will be documented on all COC forms accompanying the samples.
- A sealed envelope containing COC forms will be enclosed in a plastic bag and taped to the inside lid of the cooler.
- A minimum of two signed and dated COC seals will be placed on adjacent sides of each cooler prior to shipping.
- Each cooler will be wrapped securely with strapping tape, labeled "Glass – Fragile" and "This End Up," and clearly labeled with the laboratory's shipping address and the consultant's return address.

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 shipping container seal will be broken 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.

3.2.1.4 Field Quality Assurance Sampling

Field quality assurance procedures will consist of acceptable practices for collecting and handling of samples. Adherence to these procedures will be complemented by periodic and routine equipment inspection.

Field quality assurance samples will be collected along with the environmental samples. Field quality assurance samples are useful in identifying possible problems resulting from sample collection or sample processing in the field. The collection of field quality assurance samples includes sediment equipment rinsate blanks and sediment field duplicates. Field quality assurance samples will be collected at a frequency of 1 per sampling event or 1 in 20 sediment sample locations processed, whichever is more frequent.

Field quality assurance samples will also include the collection of additional sample volume to ensure that the laboratory has sufficient sample volume to run the program-required analytical QA/QC (MS/MS duplicate [MSD]) samples for analysis as specified in Table B-2. Additional sample volume to meet this requirement will be collected at a frequency of 1 per sampling event or 1 in 20 samples processed, whichever is more frequent. Tissue mass may be limited. In this case, the full sample aliquot will be taken from the sample with the highest mass first, and then mass for quality control samples will be taken if enough mass remains. The samples designated for MS/MSD analyses will be clearly marked on the COC form.

All field quality assurance samples will be documented on the field forms and verified by the QA/QC manager or designee.

3.2.2 Laboratory Quality Control

Laboratory quality control procedures, where applicable, include initial and continuing instrument calibrations, standard reference materials, laboratory control samples, matrix replicates, MSs, surrogate spikes (for organic analyses), and method blanks. Table B-1 summarizes the DQOs of solid phase testing for precision, accuracy, and completeness, and Table B-2 lists the frequency of analysis for laboratory QA/QC samples.

An analyst will review the results of the quality control samples from each sample group immediately after a sample group has been analyzed. The quality control sample results will then be evaluated to determine whether control limits have been exceeded. If control limits are exceeded in the sample group, the QA/QC manager 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.

3.2.2.1 Laboratory Instrument Calibration and Frequency

An initial calibration will be performed on each laboratory instrument to be used at the beginning of analyses, after each major interruption to the analytical instrument, and when any ongoing calibration does not meet method control criteria. A calibration verification sample will be analyzed following each initial calibration and will meet method criteria prior to analysis of samples. Continuing calibration verifications (CCVs) will be analyzed at required frequencies to track

instrument performance. The frequency of CCVs varies with method. For gas chromatography/mass spectrometry methods, one will be analyzed every 12 hours. For inorganic methods, one will be analyzed for every 10 field samples analyzed and at the end of each run. If the ongoing continuing calibration is out of control, the analysis must come to a halt until the source of the control failure is eliminated or reduced to meet control specifications. All project samples analyzed while instrument calibration was out of control will be reanalyzed.

Instrument blanks or continuing calibration blanks provide information on the stability of the baseline established. Continuing calibration blanks will be analyzed immediately prior to CCV at the instrument for each type of applicable analysis.

3.2.2.2 Laboratory Duplicates/Replicates

Analytical duplicates provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Analytical duplicates and replicates are subsamples of the original sample that are prepared and analyzed as a separate sample.

3.2.2.3 Matrix Spikes and Matrix Spike Duplicates

Analyses of MS samples provide information on the extraction efficiency of the method on the sample matrix, as well as any interferences introduced by the sample matrix. By performing duplicate MS analyses, information on the precision of the method is also provided for organic analyses.

3.2.2.4 Method Blanks

Method blanks are analyzed 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 RL of any single target analyte or compound. If a laboratory method blank exceeds this criterion for any analyte or compound, and the concentration of the analyte or compound in any of the samples is less than five times the concentration found in the blank (10 times for common contaminants), analyses must stop and the source of contamination must be eliminated or reduced.

3.2.2.5 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 and the MS. The laboratory control sample will provide information on the accuracy of the analytical process and, when analyzed in duplicate, will provide precision information as well.

3.2.2.6 Laboratory Deliverables

Data packages will be checked for completeness immediately upon receipt from the laboratory to ensure that data and QA/QC information requested in Section 2.6.2 are present.

3.2.3 Bioaccumulation Test Laboratory Quality Control

The bioaccumulation tests apply standard methods including the EPA *Guidance Manual: Bedded Sediment Bioaccumulation Tests* (EPA 1993), ASTM *Standard Guide for Determination of the Bioaccumulation of Sediment-Associated Contaminants by Benthic Invertebrates,* Method No. E-1688-10 (ASTM 2016), and the *Dredged Material Evaluation and Disposal Procedures User Manual* (USACE et al. 2018). The test will also apply the methods that lengthen the test duration to 45 days to allow sufficient time for tissue steady-state to be reached (Ecology 2017). The following sections describe the QA/QC measures to ensure test performance requirements are met.

Negative control sediments are used in the test to check laboratory performance. Negative control sediments are clean sediments in which the test organism normally lives and are expected to produce low mortality. There are not specified survival thresholds for the bioaccumulation test, but mean mortality in reference sediments that is greater than 25% of the control sediment would raise concerns about the health of the organisms. If mortality is observed prior to the 45-day test termination, the task manager will be notified.

Reference sediment from Carr Inlet will be included with each bioaccumulation test. Reference sediments provide data that can be used to separate toxicant effects from unrelated effects, such as those of sediment grain size and total organic carbon. The test sediments will be matched and tested simultaneously with an appropriate reference sediment to factor out sediment grain size effects on organisms.

Laboratory replicates of test sediments, reference sediments, and negative controls will be run for each bioaccumulation test in accordance with the test methodology.

The bioaccumulation tests require that proper water quality conditions be maintained to ensure survival of the organisms, and to ensure that undue stress is not exerted on the organisms unrelated to test sediments. Water quality measurements include temperature and dissolved oxygen and will be made in accordance with the test methodology. Monitoring will be conducted for all tests and reference sediments and negative controls. Parameter measurements must be within the limits specified for each bioassay. Measurements for each treatment will be made on a separate beaker set up to be identical to the other replicates within the treatment group, including the addition of test organisms.

3.3 Instrument and Equipment Testing, Inspection, and Maintenance Requirements

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

3.3.1 Field Instruments and Equipment

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

The Anchor QEA FC will be responsible for the preparation, documentation, and implementation of the preventative maintenance program. The equipment maintenance information will be documented in the instrument's calibration log. The frequency of maintenance is dependent on the type and stability of the equipment, the methods used, the intended use of the equipment, and the recommendations of the manufacturer. Detailed information regarding the calibration and frequency of equipment calibration is provided in specific manufacturer's instruction manuals.

All maintenance records will be verified prior to each sampling event. The FC will be responsible for verifying that required maintenance has been performed prior to using the equipment in the field.

The subcontractor responsible for navigation will confirm proper operation of the navigation equipment daily. This verification may consist of internal diagnostics or visiting a location with known coordinates to confirm the coordinates indicated by the navigation system. No other field equipment requires testing or calibration. The winch line and grab sampler will be inspected daily for fraying, misalignment of jaws, loose connections, and any other applicable mechanical problems. Any problems will be noted in the field logbook and corrected prior to continuing sampling operations.

3.3.2 Laboratory Instruments and Equipment

In accordance with the quality assurance program, the laboratory shall maintain an inventory of instruments and equipment and the frequency of maintenance will be based on the manufacturer's recommendations and previous experience with the equipment.

The laboratory preventative maintenance program, as detailed in the laboratory quality assurance 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 has been overloaded, mishandled, gives suspect results, or has been determined to be defective will be taken out of service, tagged with the discrepancy noted, and stored in a designated area until the equipment has been repaired. After repair, the equipment will be tested to ensure that it is in proper operational condition. The client will be promptly notified in writing if defective equipment casts doubt on the validity of analytical data. The client will also be notified immediately regarding any delays due to instrument malfunctions that could impact holding times.

Laboratories will be responsible for the preparation, documentation, and implementation of the preventative maintenance program. All maintenance records will be checked according to the schedule on an annual basis and recorded by the responsible individual. The laboratory manager, or designee, shall be responsible for verifying compliance.

3.4 Instrument Calibration

Proper calibration of equipment and instrumentation is an integral part of the process that provides quality data. Instrumentation and equipment used to generate data must be calibrated at a frequency that ensures sufficient and consistent accuracy and reproducibility.

3.4.1 Field Instrument and Equipment Calibration

Field equipment will be calibrated prior to each sampling event according to manufacturer's recommendations using manufacturer's standards. A calibration check will be performed at the end of the day. The equipment, calibration, and maintenance information will be documented in the instrument calibration log. The frequency of calibration is dependent on the type and stability of the equipment, the methods used, the intended use of the equipment, and the recommendations of the manufacturer. Detailed information regarding the calibration and frequency of equipment calibration is provided in specific manufacturer's instruction manuals.

Equipment that fails calibration or becomes inoperable during use will be removed from service and tagged (time and date of action) to prevent inadvertent use. Such equipment will be satisfactorily recalibrated or repaired and tagged (date and time of return to service) prior to use.

3.4.2 Laboratory Instrument and Equipment Calibration

As part of their quality control program, laboratories perform two types of calibrations. A periodic calibration is performed at prescribed intervals (i.e., balances, drying ovens, refrigerators, and thermometers), and operational calibrations are performed daily, at a specified frequency, or prior to analysis (i.e., initial calibrations) according to method requirements. Calibration procedures and frequency are discussed in the laboratory quality assurance plan.

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

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

The calibration requirements for each method and respective corrective actions shall be accessible, either in the laboratory standard operating procedures (SOPs) or the laboratory's quality assurance plan for each instrument or analytical method in use. All calibrations shall be preserved on electronic media.

3.5 Inspection and Acceptance Requirements for Supplies and Consumables

Inspection and acceptance of field supplies, including laboratory-prepared sampling bottles, will be performed by the FC. All primary chemical standards and standard solutions used in 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.

3.6 Data Management

Field data sheets will be checked for completeness and accuracy by the FC prior to delivery to the data manager. All data generated in the field will be documented on hard copy and provided to the data manager, who is responsible for the data's entry into the database. All manually entered data will be checked by a second party. Field documentation will be filed in the main project file after data entry and checking are complete.

Laboratory data will be provided to the data manager in the EQuIS electronic format. Laboratory data that are electronically provided and loaded into the database will undergo a 10% 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 by a second party. Data tables and reports will be exported from EQuIS to Excel tables.

4 Assessments and Response Actions

Once data are received from the laboratory, a number of quality control procedures will be followed to provide an accurate evaluation of the data quality. Specific procedures will be followed to assess data precision, accuracy, and completeness.

4.1 Compliance Assessments

Laboratory and field performance audits consist of on-site reviews of quality assurance 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/QC manager upon request. The laboratory is required to have written procedures addressing internal QA/QC. These procedures have been submitted and the project QA/QC manager will review them to ensure compliance with the QAPP. The laboratory must ensure that personnel engaged in sampling and analysis tasks have appropriate training. The laboratory will, as part of the audit process, provide for consultant's review of written details of any and all method modifications planned.

4.2 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 to protocols identified in this document.

4.2.1 Field Activities

The FC will be responsible for correcting equipment malfunctions during the field sampling effort. The project QA/QC manager will be responsible for resolving situations identified by the FC that may result in noncompliance with this QAPP. All corrective measures will be immediately documented in the field logbook.

4.2.2 Laboratory

The laboratory is required to comply with its SOPs. The laboratory 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 manager will be notified if any quality control sample grossly exceeds the project-specified control limits. The analyst will identify and correct the anomaly before continuing with the sample analysis. If the anomaly cannot be corrected, the laboratory manager will document the corrective action taken in a memorandum submitted to the QA/QC manager within 5 days of the initial notification. A narrative describing the anomaly, how the anomaly was identified, the steps

taken to 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 case narrative.

4.3 Reports to Management

Quality assurance reports to management include verbal status reports, written reports on field sampling activities and laboratory processes, data validation reports, and final project reports. These reports shall be the responsibility of the QA/QC manager.

The FC will prepare progress reports following each sampling event. The project QA/QC manager also will prepare progress reports after the sampling is completed and samples have been submitted for analysis, when information is received from the laboratory, and when analysis is complete. The status of the samples and analysis will be indicated with emphasis on any deviations from the QAPP. A data report will be written after validated data are available for each sampling event. These reports will be delivered electronically to the project manager.

5 Data Validation and Usability

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

5.1 Data Review, Validation, and Verification

During the validation process, analytical data will be evaluated for method and laboratory quality control compliance, and their validity and applicability for program purposes will be determined. Based on the findings of the validation process, data validation qualifiers may be assigned. The validated project data, including qualifiers, will be entered into the project database, thus enabling this information to be retained or retrieved, as needed.

5.2 Validation and Verification Methods

Data validation includes signed entries by the field and laboratory technicians on field data sheets and laboratory datasheets, respectively; review for completeness and accuracy by the FC and laboratory manager; review by the data manager for outliers and omissions; and the use of quality control criteria to accept or reject specific data. All data will be entered into the EQuIS database and a raw data file generated. A second data manager or designee will perform a 10% verification of the database raw data file. One hundred percent of manually entered qualifiers will be verified. Any errors found in the raw data file will be corrected and the database established.

All laboratory data will be reviewed and verified to determine whether all DQOs have been met, and that appropriate corrective actions have been taken, when necessary. The project QA/QC manager or designee will be responsible for the final review of all 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 quality control measurements with pre-established criteria as a measure of data acceptability.

A Stage 2B (EPA 2009) quality review will be performed by LDC, in accordance with EPA National Functional Guidelines (EPA 2017a, 2017b). The data will be evaluated in accordance with this QAPP. All chemical data will be reviewed with regard to the following, as appropriate to the particular analysis:

- Holding times
- Initial calibrations
- Continuing calibrations
- Method blanks
- Surrogate recoveries
- Detection limits

- RLs
- Laboratory control samples
- MS/MSD samples
- Standard reference material results

The results of the data quality review, including text assigning qualifiers in accordance with the EPA National Functional Guidelines (EPA 2017a, 2017b) and a tabular summary of qualifiers, will be generated by the data manager and submitted to the project QA/QC manager for final review and confirmation of the validity of the data. The QA/QC manager will submit a copy of the LDC validation report.

5.3 Reconciliation with User Requirements

The QA/QC manager will review data after each survey to determine if DQOs have been met. If data do not meet the project's specifications, the QA/QC manager will review the errors and determine if the problem is due to calibration/maintenance, sampling techniques, or other factors and will suggest corrective action. It is expected that the problem would be able to be corrected by retraining, revision of techniques, or replacement of supplies or equipment; if not, the DQOs will be reviewed for feasibility. If specific DQOs are not achievable, the QA/QC manager will recommend appropriate modifications. Any revisions will require approval by Ecology.

6 References

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Tables

Table B-1
Data Quality Objectives

Parameters	Precision	Accuracy	Completeness
Sediment			
Grain Size	± 20% RPD	NA	95%
Total Solids/Total Volatile Solids	± 20% RPD	NA	95%
Total Organic Carbon	± 20% RPD	75–125% R	95%
Total metals	± 20% RPD	75–125% R	95%
Dioxin/Furans	± 30% RPD	50–150% R	95%
Semivolatile organic compounds	± 35% RPD	50–150% R	95%
Pesticides	± 35% RPD	50–150% R	95%
Polychlorinated biphenyls	± 35% RPD	50–150% R	95%
Tributyltin	± 35% RPD	50–150% R	95%
Percent Moisture	± 35% RPD	50–150% R	95%
Lipids	± 35% RPD	NA	95%
Bioaccumulation Tissues			
Tributyltin	± 35% RPD	50–150% R	95%
Percent Moisture	± 35% RPD	50–150% R	95%
Lipids	± 35% RPD	NA	95%

Notes:
NA: not applicable
R: recovery
RPD: relative percent difference

Table B-2
Laboratory and Field Quality Assurance/Quality Control Sample and Analysis Summary

Analysis Type	Field Quality Assurance Samples			Laboratory Quality Control Elements[a]							
	Rinsate Blank	Field Duplicates	Temperature Blank	Initial Calibration	Ongoing Calibration	Replicates	Matrix Spikes	SRM/LCS/ Blank Spike	Matrix Spike Duplicates	Method Blanks	Surrogate Spikes
Sediment											
Grain Size	NA	1 per sampling event or 1 per 20 samples	1 per cooler	Each batch [b]	NA	1 per batch or 1 per 20 samples	NA	NA	NA	NA	NA
Total Solids/Total Volatile Solids	NA	1 per sampling event or 1 per 20 samples	1 per cooler	Each batch [b]	NA	1 per batch or 1 per 20 samples	NA	NA	NA	NA	NA
Total Organic Carbon	NA	1 per sampling event or 1 per 20 samples	1 per cooler	Daily or each batch	1 per 10 samples	1 per batch or 1 per 20 samples	1 per batch or 1 per 20 samples	1 per batch or 1 per 20 samples	NA	1 per batch or 1 per 20 samples	NA
Metals	1 per equipment type	1 per sampling event or 1 per 20 samples	1 per cooler	Daily	1 per 10 samples	Matrix spike duplicate may be used	1 per batch or 1 per 20 samples	1 per batch or 1 per 20 samples	1 per batch or 1 per 20 samples	1 per batch or 1 per 20 samples	NA
SVOCs/PAHs	1 per equipment type	1 per sampling event or 1 per 20 samples	1 per cooler	As needed[c]	Every 12 hours[d]	Matrix spike duplicate may be used	1 per batch or 1 per 20 samples	1 per batch or 1 per 20 samples	1 per batch or 1 per 20 samples	1 per batch or 1 per 20 samples	Every sample
Dioxin/Furans	1 per equipment type	1 per sampling event or 1 per 20 samples	1 per cooler	As needed[c]	Every 12 hours[d]	1 per batch or 1 per 20 samples	NA[e]	1 per batch or 1 per 20 samples	NA[e]	1 per batch or 1 per 20 samples	Every sample
PCBs[f]	1 per equipment type	1 per sampling event or 1 per 20 samples	1 per cooler	As needed[c]	1 per 10 samples[d]	Matrix spike duplicate may be used	1 per batch or 1 per 20 samples	1 per batch or 1 per 20 samples	1 per batch or 1 per 20 samples	1 per batch or 1 per 20 samples	Every sample
Pesticides[f]	1 per equipment type	1 per sampling event or 1 per 20 samples	1 per cooler	As needed[c]	1 per 10 samples[d]	Matrix spike duplicate may be used	1 per batch or 1 per 20 samples	1 per batch or 1 per 20 samples	1 per batch or 1 per 20 samples	1 per batch or 1 per 20 samples	Every sample
Tributyltin	1 per equipment type	1 per sampling event or 1 per 20 samples	1 per cooler	As needed [c]	Every 12 hours	NA	1 per batch or 1 per 20 samples	1 per batch or 1 per 20 samples	1 per batch or 1 per 20 samples	1 per batch or 1 per 20 samples	Every sample
Tissue											
Tributyltin	NA	NA	1 per cooler	As needed [c]	Every 12 hours	NA	1 per batch or 1 per 20 samples	1 per batch or 1 per 20 samples	1 per batch or 1 per 20 samples	1 per batch or 1 per 20 samples	Every sample
Percent Moisture	NA	NA	1 per cooler	Each batch [a]	NA	1 per batch or 1 per 20 samples	NA	NA	NA	NA	NA
Lipids	NA	NA	1 per cooler	Each batch [a]	NA	1 per batch or 1 per 20 samples	NA	NA	NA	NA	NA

Table B-2
Laboratory and Field Quality Assurance/Quality Control Sample and Analysis Summary

Notes:
a. Tissue quality control sample frequency for replicates, matrix spikes and matrix spike duplicates is dependant on sufficient sample mass.
b. Calibration and certification of drying ovens and weighing scales are conducted bi-annually.
c. Initial calibrations are considered valid until the ongoing continuing calibration no longer meets method specifications. At that point, a new initial calibration is performed.
d. Ongoing calibrations at the beginning and end of each batch.
e. Isotope dilution with labeled compounds required in every sample.
f. Pesticides and PCBs will have all detects confirmed via second column confirmation. The second column must be of a dissimilar stationary phase from the primary column and meet all method requirements for acceptance.
LCS: laboratory control sample
NA: not applicable
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
SRM: standard reference materials
SVOC: semivolatile organic compound

Table B-3
Analytical Methods and Laboratory Reporting Limits

Parameter	Analytical Method	Method Detection Limit[a]	Reporting Limit
Conventional Sediment Parameters – %			
Grain size (PSEP or ASTM modified)	PSEP/ASTM Mod	—	0.1
Total solids	SM2540G/PSEP	—	0.1
Total volatile solids	SM2540G/PSEP	—	0.1
Total organic carbon	Plumb (1981)/EPA 9060 Mod	—	0.1
Conventional Tissue Parameters – %			
Percent Moisture	PSEP, 1997	—	0.01
Lipids	Bligh/Dyer	—	0.01
Metals – mg/kg dry weight			
Arsenic	6010C/6020A	2.8	5.0
Cadmium	6010C/6020A	0.0124	0.2
Chromium	6010C/6020A	0.0471	0.5
Copper	6010C/6020A	0.0247	0.2
Lead	6010C/6020A	0.13	2.0
Mercury	7471B	0.0021	0.025
Nickel	6010C/6020A	0.199	0.5
Selenium	6010C/6020A	0.816	0.5
Silver	6010C/6020A	0.0439	0.3
Zinc	6010C/6020A	0.16	1.0
Organometallic Compounds – µg/kg dry weight			
Tributyltin ion (bulk)	EPA 3546/Krone/8270D-SIM	0.45	3.86
Polycyclic Aromatic Hydrocarbons – µg/kg dry weight			
Naphthalene	8270D	5.2	20.0
Acenaphthylene	8270D	4.8	20.0
Acenaphthene	8270D	5.1	20.0
Fluorene	8270D	5.0	20.0
Phenanthrene	8270D	4.7	20.0
Anthracene	8270D	5.9	20.0

Table B-3
Analytical Methods and Laboratory Reporting Limits

Parameter	Analytical Method	Method Detection Limit[a]	Reporting Limit
2-Methylnaphthalene	8270D	5.7	20.0
Total LPAH	Calculated	—	—
Fluoranthene	8270D	4.5	20.0
Pyrene	8270D	5.6	20.0
Benzo(a)anthracene	8270D	5.2	20.0
Chrysene	8270D	5.2	20.0
Total benzo(b,j,k)fluoranthenes	8270D	10.2	40.0
Benzo(a)pyrene	8270D	6.5	20.0
Indeno(1,2,3-cd)pyrene	8270D	6.0	20.0
Dibenz(a,h)anthracene	8270D	6.2	5.0
Benzo(g,h,i)perylene	8270D	5.8	20.0
Total HPAHs	Calculated	—	—
Carcinogenic PAHs	Calculated	—	—
Chlorinated Hydrocarbons – µg/kg dry weight			
1,4-Dichlorobenzene	8270D SIM Dual Scan	0.6	5.0
1,2-Dichlorobenzene	8270D SIM Dual Scan	0.7	5.0
1,2,4-Trichlorobenzene	8270D SIM Dual Scan	2.7	5.0
Hexachlorobenzene (HCB)	8270D SIM Dual Scan	0.7	5.0
Phthalates – µg/kg dry weight			
Dimethyl phthalate	8270D SIM Dual Scan	1.0	5.0
Diethyl phthalate	8270D SIM Dual Scan	4.8	20.0
Di-n-butyl phthalate	8270D	5.3	20.0
Butyl benzyl phthalate	8270D SIM Dual Scan	0.7	5.0
Bis(2-ethylhexyl) phthalate	8270D	28.8	50.0
Di-n-octyl phthalate	8270D	8.7	20.0
Phenols – µg/kg dry weight			
Phenol	8270D	8.2	20.0
2-Methylphenol	8270D SIM Dual Scan	1.1	5.0

Table B-3
Analytical Methods and Laboratory Reporting Limits

Parameter	Analytical Method	Method Detection Limit[a]	Reporting Limit
4-Methylphenol	8270D SIM Dual Scan	0.9	5.0
2,4-Dimethylphenol	8270D SIM Dual Scan	2.2	25.0
Pentachlorophenol	8270D SIM Dual Scan	2.1	20.0
Miscellaneous Extractables – µg/kg dry weight			
Benzyl Alcohol	8270D SIM Dual Scan	2.5	20.0
Benzoic Acid	8270D SIM Dual Scan	13.4	50.0
Dibenzofuran	8270D	4.6	20.0
Hexachlorobutadiene	8270D SIM Dual Scan	0.7	5.0
N-Nitrosodiphenylamine	8270D SIM Dual Scan	1.3	5.0
Polychlorinated Biphenyls – µg/kg dry weight			
Total Aroclor PCBs	8082	3.9	10.0
Dioxin/Furans – ng/kg dry weight			
Dioxins			
2,3,7,8-TCDD	1613B	0.170	0.500
1,2,3,7,8-PeCDD	1613B	0.500	1.000
1,2,3,4,7,8-HxCDD	1613B	0.540	1.000
1,2,3,6,7,8-HxCDD	1613B	0.560	1.000
1,2,3,7,8,9-HxCDD	1613B	0.890	1.000
1,2,3,4,6,7,8-HpCDD	1613B	1.200	1.000
OCDD	1613B	2.700	10.000
Furans			
2,3,7,8-TCDF	1613B	0.120	0.500
1,2,3,7,8-PeCDF	1613B	0.690	1.000
2,3,4,7,8,-PeCDF	1613B	0.570	1.000
1,2,3,4,7,8-HxCDF	1613B	0.810	1.000
1,2,3,6,7,8-HxCDF	1613B	0.660	1.000
1,2,3,7,8,9-HxCDF	1613B	0.680	1.000
2,3,4,6,7,8-HxCDF	1613B	0.590	1.000

Table B-3
Analytical Methods and Laboratory Reporting Limits

Parameter	Analytical Method	Method Detection Limit[a]	Reporting Limit
1,2,3,4,6,7,8-HpCDF	1613B	1.000	1.000
1,2,3,4,7,8,9-HpCDF	1613B	0.880	1.000
OCDF	1613B	2.000	2.000
Total TEQ	1613B	0.500	2.000

Notes:

a. Method Detection Limits (MDLs) are determined by 40 Code of Federal Regulations (CFR) Part 136 and included for informational purposes.

All detected concentrations between the MDL and the reporting limit (RL) will be reported as estimated.

Non-detected concentrations will be reported at the RL, with the exception of dioxin/furans, which will be reported at the sample and compound specific estimated detection limit.

Final MDL and RL values may differ slightly based on sample dry weight correction, adjustment for sample size, and sample dilution due to matrix interference or non-target analytes.

—: not applicable

µg/kg: micrograms per kilograms

ASTM: ASTM International

EPA: U.S. Environmental Protection Agency

ng/kg: nanograms per kilogram

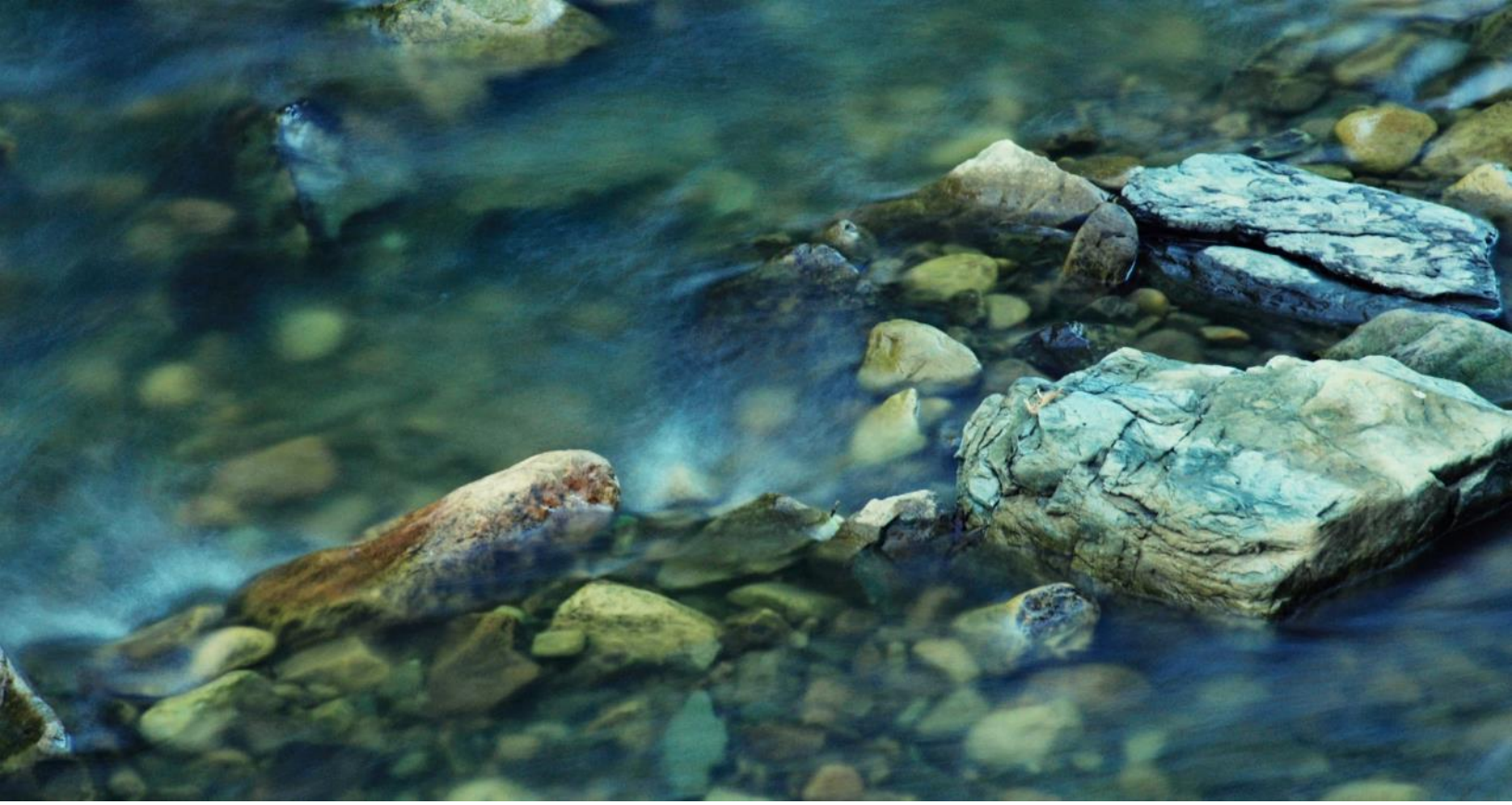
PAH: polycyclic aromatic hydrocarbons

PCB: polychlorinated biphenyl

PSEP: Puget Sound Estuary Program

TEQ: toxic equivalency factor

Appendix C
Health and Safety Plan



July 2019
Duwamish Shipyard, Inc. Tributyltin Bioaccumulation Study

ANCHOR QEA

Remedial Investigation Addendum Health and Safety Plan

Prepared for Washington State Department of Ecology

PLAYING IT SAFE

Responsibility Is Taken, Not Given
Take Responsibility For Safety

July 2019
Duwamish Shipyard, Inc.

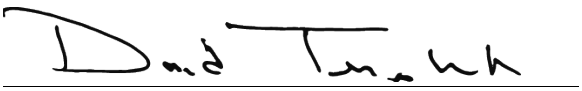
Remedial Investigation Addendum Health and Safety Plan

Prepared for
Washington State Department of Ecology

Prepared on behalf of
Duwamish Shipyard, Inc.
5658 West Marginal Way Southwest
Seattle, Washington 98106

Prepared by
Anchor QEA, LLC
1201 3rd Avenue, Suite 2600
Seattle, Washington 98101

Certification Page

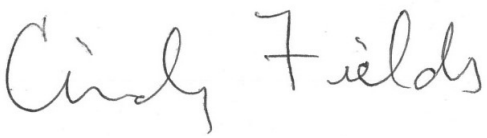


David Templeton

Project Manager

Anchor QEA, LLC

Date: July 11, 2019



Cindy Fields

Field Lead

Anchor QEA, LLC

Date: July 11, 2019

The information in this Health and Safety Plan (HASP) has been designed for the *Remedial Investigation Addendum: Tributyltin Bioaccumulation Work Plan* (Work Plan) presently contemplated by Anchor QEA, LLC. Therefore, this document may not be appropriate if the work is not performed by or using the methods presently contemplated by Anchor QEA. In addition, as the work is performed, conditions different from those anticipated may be encountered and this document may have to be modified. Therefore, Anchor QEA only intends this plan to address currently anticipated activities and conditions and makes no representations or warranties as to the adequacy of the HASP for all conditions encountered.

Health and Safety Plan Acknowledgement Form

Project Number: 080111-01-01

Project Name: Duwamish Shipyard, Inc. Tributyltin Bioaccumulation Study

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, LLC employees, this HASP may include company-specific attachments 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.

Date	Name (print)	Signature	Company

Date	Name (print)	Signature	Company

Liability Waiver

Release from Liability, Waiver of Claims, and Indemnification

This liability release, waiver, and indemnification is required for participation in our field trips and site tours. Each participant must sign his/her own form.

In return for receiving permission from **Anchor QEA, LLC** (**"Anchor QEA"**), a Washington State Limited Liability Company, to participate in the field trip that is to take place at Duwamish Shipyard (location) on _____ (date) (collectively, the **"Activities"**), the undersigned participant (**"Participant"**), acting through and/or with the consent of his/her parent or legal guardian (if Participant is a minor or the subject of a guardianship), hereby agrees as follows:

1. I fully recognize the dangers of participating in the Activities, and I voluntarily assume all risks associated with my participation in the Activities. I understand that the dangers that I may encounter at the site(s) where the Activities take place (in each case, a **"Site"**) include, by way of example only and without limitation: exposure to contaminants; exposure to aerosol vapors; wild animals, poisonous snakes, and harmful insects; poisonous vegetation; drowning, sea sickness, and boating accidents; falling from steep slopes, cliffs, or narrow trails; landslides; rough terrain; lightning; wildfire; extremes of temperatures; and storms. I realize that there is also a risk of my becoming seriously ill or injured in an area remote from medical care and that Anchor QEA cannot guarantee the availability of emergency medical services or emergency transportation to medical facilities.
2. I agree that neither Anchor QEA nor any of its agents, representatives, partners, contractors, consultants, or employees: (a) shall have any liability for any defect or dangerous natural or artificial condition relating to any Site or any of the Activities; or (b) have made or are making any representation or warranty, expressed or implied, regarding: (i) the conditions of any Site; (ii) the safety of the Activities or any of the equipment to be used in connection with the Activities; (iii) any means of transportation to or from any Site; or (iv) any other aspect of any Site or any of the Activities.
3. I agree to take the responsibility to familiarize myself with the rules and regulations applicable to the Sites and the Activities, and to verify that I have been properly instructed in and understand the use of any equipment I am to use in the Activities. I realize that my participation in the Activities may require sustained strenuous physical activity. I am in good health, and am not aware of any physical or medical condition that might endanger myself or other participants in the Activities.
4. Acting for myself and my heirs, executors, personal representatives, and assigns, I forever release and discharge Anchor QEA and its agents, representatives, partners, contractors, consultants, or employees, and the successors and assigns of each of them (in each case, a **"Released Party"**), of and from all claims, losses, damages, costs, expenses, and other liabilities, including (but not limited to) reasonable attorneys' fees (in each case, a **"Claim"**), whether known or unknown,

foreseen or unforeseen, relating to property damage or the death, injury, pain, or mental trauma of myself or any other person, and resulting, directly or indirectly, from my participation in the Activities or my travel to or from any Site. Without limiting the above, I agree not to sue any of the Released Parties for any such Claims, to waive any such Claims that I may have at any time against any of the Released Parties, and to indemnify and defend each of the Released Parties against, and to hold each of the Released Parties harmless of and from any Claims resulting from my acts or omissions during the Activities or while at any Site.

5. I have read and understand the policies and procedures specified in the Health and Safety Plan (HASP) for this Site. This HASP may include company-specific attachments developed by entities other than Anchor QEA.

The undersigned Participant acknowledges and agrees that he/she has carefully read this Release from Liability, Waiver of Claims, and Indemnification and fully understands all of its contents, and their legal effect, and agrees that this Release from Liability, Waiver of Claims, and Indemnification (of which I have been given a copy to keep, with any attachments) is contractually binding, and is being signed by the undersigned Participant of his/her own free will.

Signature: _____ Date: _____

Printed Name: _____ Email: _____

Street Address: _____

(street address — no PO Boxes)

City: _____ State: _____ Zip: _____

Phone Number: _____

Emergency Contact Name: _____

Emergency Contact's Phone Number: _____

Consent and Release for Publications of Photographs

I, the undersigned, hereby grant Anchor QEA permission to take photographs of me, and irrevocably consent to and authorize the use and reproduction by Anchor QEA, or anyone duly authorized by Anchor QEA, of any and all such photographs, for any legitimate purposes, including for advertising, trade, and editorial purposes, at any time in the future in all media now known or hereafter developed, throughout the world. I also consent to the use of my name in connection with such photographs.

I hereby release, indemnify, and hold harmless Anchor QEA and its agents, representatives, partners, contractors, consultants, or employees from any and all claims that may result at any time by reason of the use of my image and name, including, without limitation, claims of privacy. My heirs, executors, administrators, and assigns shall be bound by this consent and release. I am over the age of 18 years.

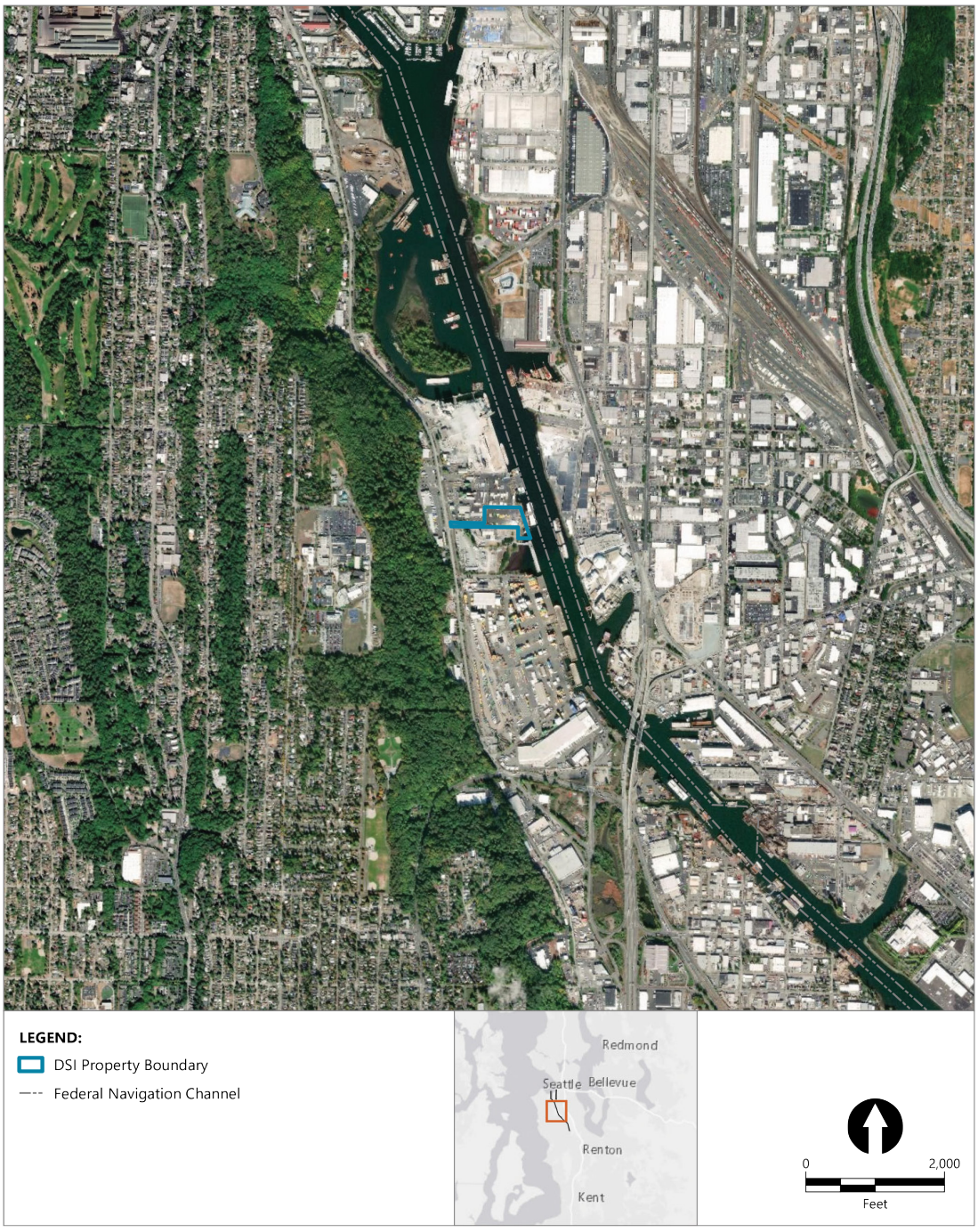
Signature: _____ Date: _____

Printed Name: _____

Site Emergency Procedures

Site Map

Figure A
General Site Location Overview



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Emergency Contact Information

Table A
Site Emergency Form and Emergency Phone Numbers*

Category	Information	
Possible Chemicals of Concern	Semivolatile organic compounds, polychlorinated biphenyls (PCBs), metals, tributyltin, dioxins	
Minimum Level of Protection	Level D	
Site(s) Location Address	5658 West Marginal Way Southwest, Seattle, Washington	
Emergency Phone Numbers		
Ambulance	911	
Fire	911	
Police	911	
Poison Control	(800) 222-1222	
Client Contact	Kyle McCleary	Office: (206) 767-4880
Task Manager	Julia Fitts	Office: (360) 715-2708 Cell: (719) 659-6308
Field Lead (FL)	Cindy Fields	Office: (206) 903-3394 Cell: (206) 326-8170
Corporate Health and Safety Manager (CHSMs)	David Templeton	Office: (206) 287-9130 Cell: (206) 910-4279
State Emergency Response System	911	
EPA Emergency Response Team,[1] Region 10	(206) 553-1200 or (800) 424-4372 (within AK, ID, OR, and WA only)	

Notes:

* In the event of any emergency, contact the PM and FL.

1. For local resources, please visit: http://www2.epa.gov/emergency-response/emergency-response-my-community. The National Response Center hotline is (800) 424-8802.

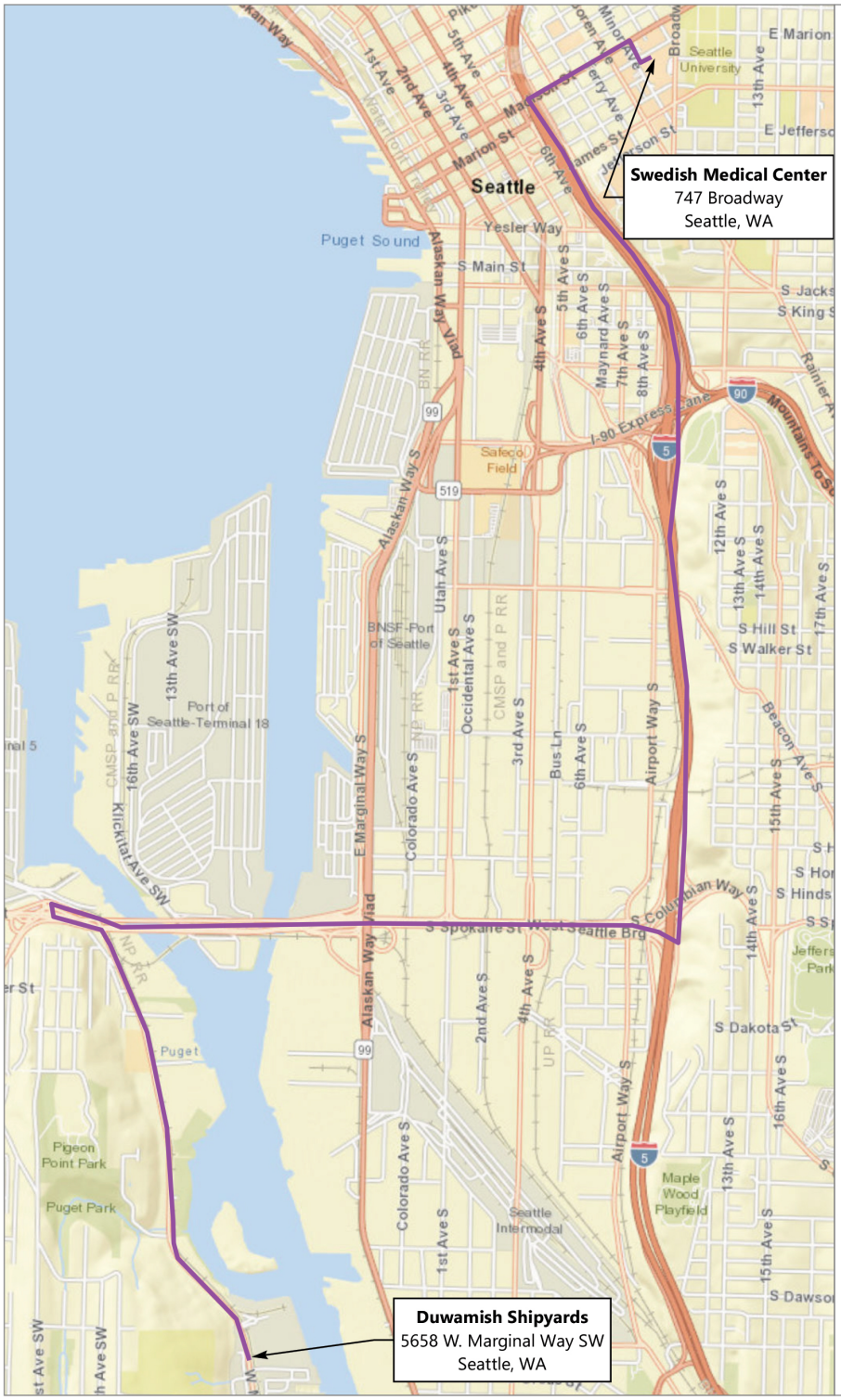
Table B
Hospital Information

Category	Information
Hospital Name	Swedish Medical Center
Address	700 Minor Avenue (Emergency Room entrance)
City, State	Seattle, Washington 98122-4307
Phone	(206) 386-6000
Emergency Phone	911

Hospital Route Map and Driving Directions

1. Head north on West Marginal Way Southwest toward Southwest Hudson Street (1.6 miles).
2. Turn left at Southwest Spokane Street (0.7 miles).
3. Take the WA-99/Seattle Freeway ramp on the left to I-5/Columbian Way (0.2 miles).
4. Slight right at Seattle Freeway (0.9 miles).
5. Take the exit on the left toward I-5 (0.4 miles).
6. Merge onto I-5 North (0.7 miles).
7. Take exit 164A for James Street/Dearborn Street toward Madison Street (0.5 miles).
8. Continue toward 7th Avenue (0.5 miles).
9. Keep left at the fork, follow signs for Madison Street and merge onto 7th Avenue (0.5 miles).
10. Turn right at Madison Street (0.3 miles).
11. Turn right at Minor Avenue (315 feet). Emergency room will be on the left between Columbia Street and Cherry Street (0.1 miles).
12. For non-emergency hospital entrance, turn left at Marion Street (213 feet).

Figure B
Hospital Route Map



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Care Management—WorkCare Incident Intervention

Anchor QEA has an additional Incident Intervention resource from WorkCare to help answer questions, alleviate uncertainty and stress in a potential injury situation, and maintain the health and safety of our employees. Incident Intervention is an injury and illness management tool that provides employees with 24 hours a day/7 days a week (24/7) immediate telephone access to a member of WorkCare's clinical staff of nurses and physicians who intervene at the time of a workplace injury or illness. Contact information is provided below:

- **Access WorkCare 24/7 from anywhere using the toll-free number: 1-888-449-7787**

At the time of a workplace injury or illness, the employee, manager, or another employee at the scene notifies WorkCare using the toll-free number listed above. The caller provides information on the type of incident, possible cause, and the scope of the situation. With the details of the incident recorded, an experienced nurse or physician provides the following:

- Responsive evaluation of the incident
- Direction on the appropriate course of action
- Consultation with the employee's treating physician to design a quality care treatment plan that meets the needs of the employee and Anchor QEA

All employees are encouraged to use this service should a workplace injury or illness occur.

Key Safety Personnel

The following people share responsibility for health and safety at the site. See Section 4 of this Health and Safety Plan (HASP) for a description of the role and responsibility of each.

Client Contact: Kyle McCleary	Office: (206) 767-4880
Project Manager (PM): David Templeton	Office: (206) 287-9130 Cell: (206) 910-4279
Task Manager: Julia Fitts	Office: (360) 715-2708 Cell: (719) 659-6308
Field Lead (FL): Cindy Fields	Office: (206) 903-3394 Cell: (206) 326-8170
Corporate Health and Safety Manager (CHSMs): David Templeton	Office: (206) 287-9130 Cell: (206) 910-4279

Personal Incident Response Procedures

In the event of an emergency, immediate action must be taken by the first person to recognize the event. Use the following steps as a guideline and refer to Figure C:

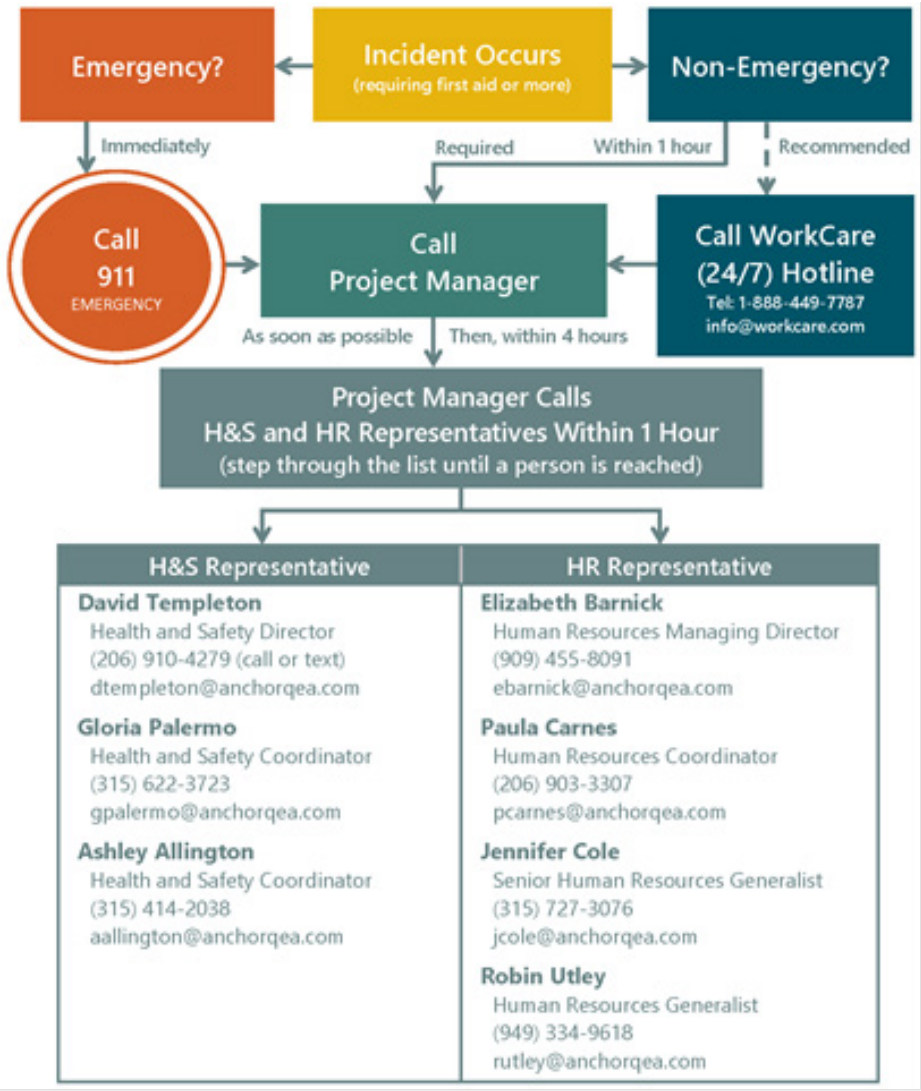
1. Survey the situation to verify that it is safe for you and the victim. Do not endanger your own life. Do not enter an area to rescue someone who has been overcome unless properly equipped

and trained. Verify that all protocols are followed. If applicable, review Safety Data Sheets (SDS) to evaluate response actions for chemical exposures.

2. Call the appropriate emergency number (911, if available) or direct someone else to do this immediately (see Table A). Explain the physical injury, chemical exposure, fire, or release and location of the incident.
3. Have someone retrieve the nearest first aid kit (containing appropriate items for the particular work scope) and Automated External Defibrillator (AED), if available. Note: Only use an AED if you have been properly trained and are currently certified to do so.
4. Decontaminate the victim without delaying life-saving procedures (see Section 8).
5. Administer first aid and cardiopulmonary resuscitation (CPR), if properly trained, until emergency responders arrive.[1]
6. In the event that evacuation is required, the Field Lead (FL) must perform a head count to verify that all Anchor QEA personnel are accounted for.
7. Notify the FL and Project Manager (PM) or Task Lead; the PM (or Task Lead) will notify the client contact. The PM will also contact the Corporate Health and Safety Manager (CHSM). The CHSM will facilitate the incident investigation. All client requirements pertinent to personal incident reporting will also be adhered to.
8. Complete the appropriate incident investigation reports.

[1] Personnel qualified and currently certified in basic first aid or CPR are protected under Good Samaritan policies as long as they only perform the basic tasks that they were taught. Do not perform first aid or CPR tasks if you have not been trained in first aid or CPR.

Figure C
Incident Flowchart



Non-Personal Incident Response Procedures

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

Spills and Releases of Hazardous Materials

When required, notify the National Response Center and local state agencies. The following information should be provided to the National Response Center:

- Name and telephone number
- Name and address of incident location
- Time and type of incident
- Name and quantity of materials involved, if known
- Extent of injuries
- Possible hazards to human health or the environment outside the facility

The emergency telephone number for the National Response Center is (800) 424-8802. If hazardous waste is released or produced through control of the incident, verify the following:

- Waste is collected and contained
- Containers of waste are removed or isolated from the immediate site of the emergency
- Treatment or storage of the recovered waste, contaminated soil or surface water, or any other material that results from the incident or its control is provided
- No waste that is incompatible with released material is treated or stored in the facility until cleanup procedures are completed

Verify that all emergency equipment used is decontaminated, recharged, and fit for its intended use before operations are resumed.

Near-Miss Reporting

All near-miss incidents (i.e., those that could have reasonably led to an injury, environmental release, or other incident) must be reported to the FL and PM immediately, so action can be taken to verify that such conditions that led to the near-miss incident are readily corrected to prevent future occurrences.

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ABBREVIATIONS

AED	Automated External Defibrillator
AML	Alaska Marine Lines
ANSI	American National Standards Institute
APR	Air-Purifying Respirator
ASTM	ASTM International
CFR	Code of Federal Regulations
CHSM	Corporate Health and Safety Manager
COC	chemical of concern
CPR	cardiopulmonary resuscitation
CRZ	Contamination Reduction Zone
dbA	A-weighted decibel
dB	decibel
DSI	Duwamish Shipyard, Inc.
EPA	U.S. Environmental Protection Agency
eV	electron volts
EZ	Exclusion Zone/Hot Zone
FID	flame ionization detector
FL	Field Lead
GFCI	ground-fault circuit interrupter
H:V	horizontal to vertical
HASP	Health and Safety Plan
HAZMAT	Hazardous Materials
HAZWOPER	Hazardous Waste Operations and Emergency Response
HEPA	high-efficiency particulate air
JSA	Job Safety Analysis
kV	kilovolt
LDW	Lower Duwamish Waterway
LEL	lower-explosive limit
LO/TO	lockout/tagout
mg/m^3	milligram per cubic meter
MHR	maximum heart rate
NIOSH	National Institute for Occupational Safety and Health
NPL	National Priorities List
OSHA	Occupational Safety and Health Act or Administration
OV	organic vapor
PCB	polychlorinated biphenyl

PEL	Permissible Exposure Limit
PFD	personal flotation device
PID	photoionization detector
PM	Project Manager
Port	Port of Seattle
PPE	personal protective equipment
ppm	parts per million
Property	Duwamish Shipyard, Inc. property located at 5658 West Marginal Way Southwest in Seattle, Washington
RCRA	Resource Conservation and Recovery Act
RPP	Respiratory Protection Program
SDS	Safety Data Sheets
site	5658 West Marginal Way Southwest and portions of adjacent Lower Duwamish Waterway sediments
SZ	Support Zone/Clean Zone
TLV	Threshold Limit Value
TWA	time-weighted average
USCG	U.S. Coast Guard
UV	ultraviolet
VOC	volatile organic compound
WBGT	wet bulb globe temperature
Work Plan	*Remedial Investigation Addendum: Tributyltin Bioaccumulation Study Work Plan*

1 Introduction

This Health and Safety Plan (HASP) was prepared on behalf of Duwamish Shipyard, Inc. (DSI) and presents health and safety requirements and procedures that will be followed by Anchor QEA, LLC, personnel and at a minimum by Anchor QEA, LLC subcontractors during work activities at Duwamish Shipyard (the site). This HASP was developed in accordance with Title 29 of the Code of Federal Regulations (CFR), Part 1910.120(b), and will be used in conjunction with Anchor QEA's Corporate Health and Safety Program. See Section 1.1 for 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 HASP documents that the workplace has been evaluated for hazards. A hazard assessment was performed, and the adequacy of the personal protective equipment (PPE) selected was evaluated as required by 29 CFR 1910.132(d)—Personal Protective Equipment, General Requirements (General Industry); 29 CFR 1910.134—Respiratory Protection; 29 CFR 1926.28—Personal Protective Equipment (Construction Industry); and 29 CFR 1926.55—Gases, Vapors, Fumes,

Dusts and Mist, and is duly noted by the signature(s) and date appearing on the certification page of this document.

1.1 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 Attachment C-1. 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 DSI property is located at 5658 West Marginal Way Southwest in Seattle, Washington (Property), along the western shoreline of the Lower Duwamish Waterway (LDW). The Property includes approximately 5 acres of land owned by DSI located on the west bank of the LDW. The majority consists of upland property, but aquatic areas are also located in the southeast corner of the Property.

The berth and waterway areas adjacent to the Property are owned by the Port of Seattle (Port) as successor to Commercial Waterway District No. 1. The berth area is 150 feet wide. The waterway is 200 feet in width and has a project depth of -30 feet relative to mean lower low water. The U.S. Army Corps of Engineers maintains the waterway channel for navigation in conjunction with the Port. Portions of former shipyard activities extended into the berth area owned by the Port.

The Property is currently being used for container storage and truck access by Alaska Marine Lines (AML). It is bordered to the north by the AML container facility and to the south by the CalPortland Facility and Terminal 115. DSI previously leased a graving dock from AML located directly adjacent to the northern DSI/AML property boundary. However, that lease has been terminated, and AML has filled the graving dock with clean fill for upland reuse. West Marginal Way is located immediately west of the Property, and AML owns additional property used for staging across this roadway.

The Property is located in a highly industrialized area and is currently zoned for General Industrial (IG1 U/85) use. The eastern Property boundary abuts the LDW. The LDW was placed on the National Priorities List (NPL) by the U.S. Environmental Protection Agency (EPA) in September 2001. The preliminary boundaries of the LDW extend from the Turning Basin downstream to Harbor Island. The Property is located within this initial delineation (approximately between River Miles [RM] 1.3 and 1.4). In addition, the Property is listed on the Washington State Department of Ecology's Contaminated Sediment Sites List, which was first published in 1996. That list documents sites potentially subject to investigation and cleanup requirements under the Model Toxics Control Act.

2.2 Site Background Information

A brief history of the DSI site is described as follows:

- 1936 to early 1940s: The site was a vacant lowland property located along the western shoreline of the Duwamish River.
- Early 1940s to 1956: DSI engaged in the repair and maintenance of floating vessels and equipment, including tugboats, barges, dredges, fishing vessels, small passenger vessels, and other types of commercial vessels. The marine railway was constructed at this time.

- 1956: Expansion of the graving dock took place. The completed graving dock was 410 feet long and 138 feet wide. Repairs in the graving dock took place below the surface level of the river. Vessels were floated into the graving dock, after which the tide gates were shut and the water was pumped out to create a dry work environment. Pumps were used to continuously keep the concrete floor of the graving dock dry due to leaking from the tide gates.
- 1967: DSI acquired a floating steel drydock. This floating drydock was a small, steel dock that was used until March 2007.
- 1969: DSI acquired a second, larger wooden drydock. After this time, most of the vessel dockings were made on the drydocks.
- 1990: DSI sold the large wooden drydock and replaced it with a 1,000-ton steel drydock that remained in use until March 2007. Both drydocks were updated to provide containment for pressure wash wastewater during the 1990s. Wastewater flowed to one end of the drydock, where it was captured in a collection sump and pumped onshore to a Delta Pollution Control flocculation pretreatment system prior to discharge to the King County sanitary sewer.
- 2007 to present: DSI ceased use of the Property for any industrial-related activity in April 2007. All former shipyard buildings and the two drydocks have been removed from the Property. The upland portion of the Property is currently being used by AML for container storage and truck access, with DSI marketing the Property for sale for industrial use.

3 Scope of Work

3.1 Project Scope of Work

This plan addresses health and safety issues associated with surface sediment sampling in the LDW. Surface sediment samples will be collected from the 0- to 10-centimeter biologically active zone at approximately 10 locations in the LDW. Surface sediment samples will be collected using a hydraulic Van Veen grab.

4 Authority and Responsibilities of Key Personnel

This section describes the authority and responsibilities of key Anchor QEA project personnel. The names and contact information for the following key safety personnel are listed in the Site Emergency Procedures section at the beginning of this 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 verify that appropriate health and safety procedures are implemented into each project task.

The PM has authority to direct response operations; the PM assumes total control over project activities but may assign responsibility for aspects of the project to others. In addition, the PM performs the following tasks:

- Overseeing the preparation and organization of background review of the project, the sampling, and the field team
- Verifying that the team obtains permission for site access and coordinates activities with appropriate officials
- Briefing the FL and field personnel on specific assignments
- Together with the FL, seeing that health and safety requirements are met
- Consulting with the CHSM regarding unsafe conditions, incidents, or changes in site conditions or the scope of work

4.2 Field Lead

The FL reports to the PM, has authority to direct response operations, and assumes control over on-site activities. The FL will direct field activities, will coordinate the technical and health and safety components of the field program, and is responsible in general for enforcing this site-specific 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 functions of the FL related to this HASP include, but are not necessarily limited to, the following:

- Conducting and documenting daily safety meetings or designate an alternate FL in his or her absence
- Executing the *Sampling and Analysis Plan* and schedule
- Conducting periodic field health and safety inspections to verify compliance with this HASP
- Overseeing implementation of safety procedures
- Implementing site personnel protection levels
- Enforcing site control measures to help verify that only authorized personnel are allowed on site
- Notifying, when necessary, local public emergency officials (all personnel on site may conduct this task as needed)
- Following up on incident reports to the PM
- Periodically inspecting protective clothing and equipment for adequacy and safety compliance
- Verifying that protective clothing and equipment are properly stored and maintained
- Performing or overseeing air monitoring (if required) in accordance with this HASP
- Maintaining and overseeing operation of monitoring equipment and interpretation of data from the monitoring equipment
- Monitoring site personnel for signs of stress, including heat stress, overexertion, cold exposure, and fatigue
- Requiring participants to use the "buddy" system in performing tasks
- Providing (via implementation of this HASP) emergency procedures, evacuation routes, and telephone numbers for the local hospital, poison control center, fire department, and police department
- Communicating incidents promptly to the PM
- Maintaining communication with the CHSM regarding on-site activities
- If applicable, verifying that decontamination and disposal procedures are followed
- Maintaining the availability of required safety equipment
- Advising appropriate health services and medical personnel of potential exposures
- Notifying 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. The FL must have a valid Transportation Worker Identification Credential (TWIC) card. 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:

- Providing technical input into the design and implementation of this HASP
- Advising on the potential for occupational exposure to project hazards, along with appropriate methods and/or controls to eliminate site hazards
- Verifying 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
- Consulting with the FL on matters relating to suspending site activities in the event of an emergency
- Verifying that all on-site Anchor QEA personnel and subcontractors have read and signed the HASP Acknowledgement Form
- Verifying that corrective actions resulting from deficiencies identified by audit and observations are implemented and effective

The CHSM or designee will have completed the required OSHA 40-hour HAZWOPER training and annual updates as well as the 8-hour Supervisor training (or a minimum of 5 years of supervisory experience).

4.4 Project Field Team

All project field team members will attend a project-specific meeting conducted by the FL concerning safety issues and project work task review before beginning work on site. All field team members, including subcontractors, must be familiar with and comply with this 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 on-site tasks required to fulfill the scope of work
- Complying with the HASP
- Attending and participating in daily safety meetings
- Notifying the FL of existing or potential safety conditions at the site
- Reporting all incidents to the FL
- Demonstrating safety and health-conscious conduct

Per OSHA 1910.120(e)(3)(i),[2] newly assigned HAZWOPER 40-hour trained field team members must have at least 3 days of field work supervised by an experienced FL (preferably an individual with HAZWOPER Supervisor training). It is the responsibility of the PM to identify such "short service" personnel and verify that their supervised field experience occurs (or has occurred) and is documented in the project field notes and on the Daily Safety Briefing form (Attachment C-1).

[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 *Remedial Investigation Addendum: Tributyltin Bioaccumulation Study Work Plan* (Work Plan) and the chemicals of concern (COCs).

5.1 Activity-Specific Level of Protection Requirements

Refer to Section 10 for general requirements for PPE. Level D is the minimum acceptable level for most sites. An upgrade to Modified Level D occurs when there is a possibility that contaminated media can come in contact with the skin or work uniform. An upgrade to Level C occurs when there is a potential for exposure to airborne COCs (i.e., if the results of air monitoring reveal that action levels have been exceeded). Hearing protection must be worn when there are high noise levels. Site personnel must maintain proficiency in the use and care of PPE that is to be worn.

Table 5-1 describes the specific means of protection needed for each identified work activity.

5.2 Project Air Monitoring Requirements

Upgrade from Level D and/or Modified Level D to Level C when the results of air monitoring reveals that action levels have been exceeded. Use of Level C by Anchor QEA staff requires participation in Anchor QEA's Respiratory Protection Program (RPP).

Table 5-2 describes the specific air monitoring required for each identified work activity.

Table 5-1
Project Job Tasks and Required PPE

Job Tasks		PPE Requirements
EXAMPLES: • Loading and unloading sample coolers, boat equipment, general non-sampling activities onboard a marine vessel • Operation of sampling vessel and equipment from inside boat house • Operation of sampling equipment with minimal anticipated direct contact with sediments or decontamination chemicals • Sampling and characterizing surface sediment samples	☒	Standard work uniform/coveralls
	☒	Work boots with safety toe conforming to ASTM International (ASTM) F2412-05/ASTM F2413-05
	☐	High-visibility traffic safety vest
	☒	Chemical-resistant clothing <u>check appropriate garments</u>: ☐ One-piece coverall ☐ Hooded one- or two-piece chemical splash suit ☐ Disposable chemical coveralls ☐ Chemical-resistant hood and apron ☒ Bib-style overalls and jacket with hood **Fabric Type**: Tyvek or PVC coated NOTE: Thick rain pants and coveralls may be substituted for coated Tyvek if sediments are not obviously contaminated with polycyclic aromatic hydrocarbons (PAHs) or related petroleum products. Rain slickers cannot be effectively decontaminated of tar/petroleum contamination.
	☐	Disposable inner gloves (latex or equivalent "surgical")
	☒	Disposable chemical-resistant outer gloves **Material Type**: Nitrile
	☒	Chemical-resistant boots with safety toe conforming to ASTM F2412-05/ASTM F2413-05 or disposable boot covers for safety toe/work boots **Material Type**: Waterproof rubber or leather
	☐	Puncture-resistant shanks in safety shoes conforming to ASTM F2412-05/ASTM F2413-05
	☐	Metatarsal guards conforming to ASTM F2412-05/ASTM F2413-05
	☐	Sleeves to be duct-taped over gloves and pants to be duct-taped over boots
	☐	Splash-proof safety goggles
	☒	Safety glasses
	☒	Hard hat
	☐	Hard hat with face shield
	☒	Hearing protectors (**REQUIRED** if site noise levels are greater than 85 decibels [dB] based on an 8-hour time-weighted average [TWA]). **Type**: Disposable ear plugs
	☐	Two-way radio communication (intrinsically safe, if explosive atmosphere is a potential)
	☐	Long cotton underwear

Job Tasks		PPE Requirements
	☒	High-visibility, U.S. Coast Guard (USCG)-approved personal flotation device (PFD) (if working on any water vessel or without fall protection within 10 feet of water)
	☐	USCG-approved float coat and bib-overalls (e.g., full two-piece "Mustang" survival suit or similar) or one-piece survival suit if combined air and water temperature is below 90°F
	☐	Half-face Air-Purifying Respirator (APR) (OSHA/NIOSH-approved)
	☐	Full-face APR (OSHA/NIOSH-approved)
	☐	**Type of Cartridges to be Used**: ☐ **OV or** ☐ **OV/HEPA (if samples are dry)**

Table 5-2
Project Air Monitoring Requirements

Instrument*	Job Tasks/Functions	Measurement	Monitoring Schedule[3]	Actions[1]
FID and/or PID (11.7*eV Lamp; Measures Total Organic Vapors)	Conduct air monitoring for volatile organic compounds (VOCs) during activities where contaminated media are present. Make sure that a background reading is taken before the start of activities and periodically thereafter.	0 to 5 ppm above background in breathing zone	Periodically (every 15 to 30 minutes)	Acceptable, continue work.
		> 5 to 25 ppm above background	Periodically (every 15 minutes)	Upgrade to Level C[4] protection. Monitor for vinyl chloride, hydrogen cyanide, and benzene using colorimetric detector tubes.
		> 25 ppm above background in breathing zone		Stop work required.[2] Leave work area and contact PM and CHSM for guidance.

Notes:
*Note: Instruments must be calibrated according to manufacturer's recommendations.

1. For VOCs, a sustained reading for greater than 2 minutes in excess of the action level will trigger a protective measure.
2. Contact with the CHSM and PM must be made prior to continuance of work. A hazard review must be conducted before proceeding with work. Corrective actions may include temporary work stoppage to allow vapors to dissipate, and then returning to work if air monitoring data permits.
3. Monitoring frequency is from the beginning of each task and at specified intervals thereafter, or when detectable soil contamination is encountered (as indicated by strong, sustained odor, visual evidence of product, or petroleum-discolored soils).
4. Work must be conducted in accordance with Anchor QEA's RPP. Contact the CHSM for respiratory protection fit testing and air purifying cartridge change-out requirements.

6 Risk Analysis and Control

The following sections discuss the potential health and safety hazards associated with the field tasks described in the Work Plan. 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 Work Plan 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 Work Plan 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 conduct them in a safe manner.

The PM and FL are responsible for identifying work tasks and project site conditions that are beyond the previously developed JSA documents and for communicating such information to the CHSM. The CHSM will provide support, as needed, to the PM and the FL, who will have primary responsibility to develop project-specific JSAs.

The contents of the JSA documents shall be communicated to project personnel during the site orientation meeting and during daily safety meetings when conducting work where the specific JSAs are applicable.

JSA documents applicable to this project are located in Attachment C-2 and include the following field tasks:

- Field Activities
- Motor Vehicle Operation
- Boat Activities
- Sediment Grab Sampling
- Personnel Decontamination
- Tool and Equipment Decontamination

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 Attachment C-2, then a task-specific JSA document must be developed prior to conducting the work. The PM and FL shall develop this document(s) with

input from the CHSM, as needed, and this 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. Attachment C-2 of this HASP includes a blank JSA form that can be used to create a new task-specific JSA.

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.
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.

6.2.2 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 Attachment C-3).

Table 6-1
Chemicals of Concern Profile

Chemical	Exposure Routes	Symptoms	Target Organs	OSHA PEL	Odor Threshold (ppm)	LEL (%)	Ionization Potential (eV)
PAHs (as Benzo(a)pyrene)	Inhalation, contact	Dermatitis, bronchitis (potential occupational carcinogen)	Respiratory system, skin, bladder, kidneys (lung, kidney, and skin cancer)	TWA 0.2 mg/m^3	-- (slightly aromatic)	--	--
PCBs	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritant to eyes, chloracne, liver damage, reproductive effects (potential occupational carcinogen)	Skin, eyes, liver, reproductive system	TWA 0.5 mg/m^3	-- (mild hydrocarbon odor)	--	--
Dioxins/Furans	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation to eyes; allergic dermatitis; chloracne; porphyria; gastrointestinal disturbance; possible reproductive/teratogenic effects; in animals: liver, kidney damage, hemorrhage (potential occupational carcinogen)	Eyes, skin, liver, kidneys, reproductive system	--	--	--	--
Arsenic	Inhalation, skin absorption, skin and/or eye contact, ingestion	Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin (potential occupational carcinogen)	Liver, kidneys, skin, lungs, lymphatic system	TWA 0.01 mg/m^3	-- (odorless)	--	--
Cadmium	Inhalation, ingestion	Pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; emphysema; proteinuria; anosmia (loss of the sense of smell) mild anemia (potential occupational carcinogen)	Respiratory system, kidneys, prostate, blood	TWA 0.005 mg/m^3	-- (odorless)	--	--

Chemical	Exposure Routes	Symptoms	Target Organs	OSHA PEL	Odor Threshold (ppm)	LEL (%)	Ionization Potential (eV)
Copper	Inhalation, ingestion, skin and/or eye contact	Irritation of eyes, nose, pharynx; nasal septum perforation; metallic taste; dermatitis; in animals: lung, liver, kidney damage; anemia	Eyes, skin, respiratory system, liver, kidneys (increased risk with Wilson's disease)	TWA 1 mg/m^3	-- (odorless)	--	--
Lead	Inhalation, ingestion, skin and/or eye contact	Lassitude (weakness, exhaustion); insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis of wrist, ankles; encephalopathy; kidney disease; irritation of eyes; hypertension	Eyes, gastrointestinal tract, central nervous system, kidneys, blood, gingival tissue	TWA 0.05 mg/m^3	--	--	--
Mercury	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation of eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria	Eyes, skin, respiratory system, central nervous system, kidneys	TWA 0.1 mg/m^3	-- (odorless)	--	--
Zinc	Inhalation, skin and/or eye contact	Irritation of eyes, skin, nose, throat; cough, copious sputum; dyspnea (breathing difficulty), chest pain, pulmonary edema, pneumonitis; pulmonary fibrosis, cor pulmonale; fever; cyanosis; tachypnea; skin burns	Eyes, skin, respiratory system, cardiovascular system	TWA 1 mg/m^3	--	--	--

Chemical	Exposure Routes	Symptoms	Target Organs	OSHA PEL	Odor Threshold (ppm)	LEL (%)	Ionization Potential (eV)
BEHP (bis-2-ethylhexyl phthalate)	Inhalation, ingestion, skin and/or eye contact	Irritation of eyes, skin, nose, throat; headache, dizziness, nausea; possible polyneuropathy, vestibular dysfunction, pain, numbness, weakness, exhaustion, spasms in arms and legs; in animals: reproductive effects	Eyes, respiratory system, central nervous system, liver, reproductive system, gastrointestinal tract	5 mg/m^3	--	0.3%	--
Tributyltin	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation of eyes, skin; headaches; weakness; respiratory difficulty	Eyes, skin, respiratory system	TWA 0.1 mg/m^3	--	--	--

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 monitoring 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 immediately dismissed.
- 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.

The site work zones will be defined as follows:

- **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 from a boat, in a roadway, or at an excavation site.

7.4.1 Sediment Sampling Work Zones

This subsection contains guidelines concerning health and safety aboard marine sampling vessels. The vessel captain, onshore coring operator, and the FL will delineate the boundaries of the work zones aboard the vessel and will inform the field team of the arrangement. The purpose of the zones is to limit the migration of sample material out of the zones and to restrict access to active work areas.

Two work zones will be observed aboard the vessel. One will encompass the "moonhole" of the vessel where the samplers will be deployed and recovered. Only the coring team may enter this zone unless assistance is required by other personnel. The second work zone will be a sample processing area on the vessel. The contractor team will deliver sediment core tubes to this zone and open them. Anchor QEA personnel will log and process the sediment cores either on the boat or on shore.

Both the collection and processing areas on the vessel and onshore will have a SZ outside the CRZ to stage clean equipment, don PPE, take rest breaks, or perform any other site activities that do not involve potentially contaminated materials.

7.4.1.1 Vessel Decontamination Area

A station will be set up for decontaminating sample processing equipment and personnel gear such as boots or PPE. The station will have the buckets, brushes, soapy water, rinse water, or wipes necessary to perform decontamination operations. Plastic bags will be provided for expendable and disposable materials. Decontamination fluids will be stored in sealable containers and will be properly disposed of.

7.4.1.2 Access Control

Security and control of access to the sampling vessel and onshore area will be the responsibility of the captain and FL. Additional security measures may be placed into effect by the client, or as required by national security threat levels determined by the federal government. Access to the vessel and onshore areas will only be granted to necessary project personnel and authorized visitors. Any security or access control problems will be reported to the client or appropriate authorities.

7.4.1.3 Safety Equipment

In addition to PPE that will be worn by shipboard personnel, basic emergency and first aid equipment will also be provided. Equipment will include:

- U.S. Coast Guard (USCG)-approved personal flotation devices (PFDs)
- First aid kit adequate for the number of personnel
- Emergency eyewash

Anchor QEA and/or subconsultants will provide this equipment, which must be at the location(s) where field activities are being performed. Equipment will be checked daily to verify its readiness for use.

7.5 Field Communications

Communications between all Anchor QEA employees and subcontractors at the work site can be verbal and/or non-verbal. Verbal communication can be affected by the on-site background noise and various PPE. See Table 7-1 for a list of the types of communication methods and equipment to use, depending on site conditions. Communication equipment must be checked daily to verify proper operation. All project personnel must be initially briefed on the communication methods prior to starting work; communication methods should be reviewed in daily safety meetings.

Table 7-1
Field Communication Methods

Type of Communication	Communication Device	Signal
Emergency notification	On-site Telephone or Cellular Telephone	Initiate phone call using applicable emergency numbers
Emergency notification among site personnel	Two-way Radio	Initiate radio communication with Code Red message
Hailing site personnel for non-emergency	Compressed Air Horn	One long blast, one short blast
Hailing site personnel for emergency evacuation	Compressed Air Horn	Three long, continuous blasts
Hailing site personnel for distress, need help	Visual	Arms waved in circle over head
Hailing site personnel for emergency evacuation	Visual	Arms waved in criss-cross over head
Contaminated air/strong odor	Visual	Hands clutching throat
Break, lunch, end of day	Visual	Two hands together, break apart

8 Decontamination Procedures and Practices

8.1 Minimization of Contamination

The following measures will be observed to prevent or minimize exposure to potentially contaminated materials:

Personnel

- Do not walk through spilled materials.
- Do not handle, touch, or smell sample media directly.
- Make sure PPE has no cuts or tears prior to use.
- Protect and cover any skin injuries.
- Stay upwind of airborne dusts and vapors.
- Do not eat, drink, chew tobacco, or smoke in the work zones.

Sampling Equipment and Vehicles/Vessels

- Use care to avoid getting sampled media on the outside of sample containers.
- If necessary, bag sample containers before filling with sampled media.
- Place clean equipment on a plastic sheet to avoid direct contact with contaminated media.
- Keep contaminated equipment and tools separate from clean equipment and tools.
- Fill sample containers over a plastic tub to contain spillage.
- Clean up spilled material immediately to avoid tracking around the vehicle/vessel.

8.2 Decontamination Equipment

All vehicles, vessels, and equipment that have entered potentially contaminated areas will be visually inspected and, if necessary, decontaminated prior to leaving the area. 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
- Deck pump with pressurized freshwater hose (aboard the vessel)
- Pressure washer/steam cleaner, if appropriate
- Paper towels and plastic garbage bags

8.3 Personnel Decontamination

The FL will verify that all site personnel are familiar with personnel decontamination procedures as listed below. All personnel wearing PPE in a work area (EZ) must undergo decontamination prior to entering the SZ. Personnel will perform the following decontamination procedures:

- Wash and rinse outer gloves and boots in portable buckets to remove gross contamination.
- If suit is heavily soiled, rinse it off.
- Remove outer gloves; inspect and discard if damaged. Leave inner gloves on. Personnel will remove their outer garment and gloves, dispose of them, and properly label container or drum. Personnel will then decontaminate their hard hats and boots with an aqueous solution of detergent or other appropriate cleaning solution. These items then will be hand-carried to the next station. Remove inner gloves.
- Thoroughly wash hands and face before leaving CRZ.
- Sanitize respirators and place in a clean plastic bag.

8.4 Sampling and Processing Equipment Decontamination

To prevent sample cross-contamination, sampling and processing equipment in contact with soil, sediment, or water samples will undergo the following decontamination procedures when work is completed in the CRZ and prior to additional use:

1. Rinse with potable water and wash with scrub brush.
2. Wash with phosphate-free detergent (Alconox).
3. Visually inspect the sampler and repeat the scrub and rinse step, if necessary. If scrubbing and rinsing with Alconox is insufficient to remove visually observable tar-related contamination on equipment, the equipment will be scrubbed and rinsed using hexane (or similar type solution) until all visual signs of contamination are absent.
4. Rinse external sampling equipment with potable water three times prior to use. Rinse homogenizing equipment once with potable water and three times with distilled water prior to and between sample processing.

8.5 Handling of Investigation-Derived Waste

All remaining soil or sediment, fluids used for decontamination of sampling equipment, and sample collection disposable wastes (e.g., gloves, paper towels, foil, or others) will be placed into appropriate containers and staged on site for disposal.

8.5.1 Disposable Personal Protective Equipment

Disposable PPE may include Tyvek suits, inner latex gloves, and respirator cartridges. Dispose of PPE according to the requirements of the client and state and federal agencies.

8.5.2 Non-Disposable Personal Protective Equipment

Non-disposable PPE may include respirators and boots and gloves. When decontaminating respirators, observe the following practices and procedures:

- Wipe out the respirator with a disinfecting pad prior to donning.
- Decontaminate the respirator on site at the close of each day with an approved sanitizing solution.

When decontaminating boots and gloves, observe the following practices and procedures:

- Decontaminate the boots or gloves outside with a solution of detergent and water; rinse with water prior to leaving the site.
- Protect the boots or gloves from exposure by covering with disposable covers such as plastic to minimize required decontamination activities.

8.6 Sanitizing Personal Protective Equipment

Respirators, reusable protective clothing, and other personal articles must be not only decontaminated before being reused, but also sanitized. The insides of masks and clothing become soiled due to exhalation, body oils, and perspiration. Manufacturer's instructions should be used to sanitize respirator masks. If practical, reusable protective clothing should be machine-washed after a thorough decontamination; otherwise, it must be cleaned by hand.

8.7 Emergency Personnel Decontamination

Personnel with medical problems or injuries may also require decontamination. There is the possibility that the decontamination may aggravate or cause more serious health effects. If prompt lifesaving, first aid, and medical treatment are required, decontamination procedures will be omitted. In either case, a member of the site management team will accompany contaminated personnel to the medical facility to advise on matters involving decontamination.

8.8 Containment of Decontamination Fluids

As necessary, spill control measures will be used to contain contaminated runoff that may enter into clean areas. Use plastic sheeting, hay bales, or install a spill control system to prevent spills and contain contaminated water.

9 Health and Safety Training and Informational Programs

This section describes the health and safety training and informational programs with which Anchor QEA project site personnel must comply. All certifications required in this section are provided in Attachment C-4 and will be kept on internal file.

9.1 Initial Project Site Orientation

Work on all Anchor QEA project sites requires participation in an initial health and safety orientation presented by the PM or FL that will consist of, at a minimum, the following topics:

- A review of the contents of this HASP, including the scope of work and associated site hazards and control methods and procedures.
- Provisions of this plan are mandatory for all Anchor QEA personnel assigned to the project.
- Anchor QEA subcontractors are also expected to follow the provisions of this plan unless they have their own 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 Attachment C-1 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 Transportation Worker Identification Credential

All Anchor QEA field personnel will maintain current TWIC status, pursuant to the Maritime Transportation Security Act of 2002, unless this requirement is waived specifically in writing by relevant property owners.

9.6 Hazard Communication Program

The purpose of hazard communication (Employee Right-to-Know) is to verify that the hazards of all chemicals located at the field project site are communicated to all Anchor QEA personnel and subcontractors according to 29 CFR 1926.59. Refer to the Anchor QEA Hazard Communication Program document for additional information.

Every container of hazardous materials must be labeled by the manufacturer, who must also provide a SDS upon initial order of the product and upon request thereafter. The actual format may differ from company to company (e.g., National Fire Protection Association, Hazardous Material Information System, 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 Attachment C-3 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 for site-specific job task and level-of-protection requirements.

10.1 Minimum Requirements: Level D Protection

The minimum level of protection on project sites will be Level D protection, which consists of the following equipment:

- Standard work uniform/coveralls
- Work boots with safety toe conforming to ASTM International (ASTM) F2412-05/ASTM F2413-05
- Approved safety glasses or goggles (meets ANSI Z87.1—2010 requirements for eye protection)
- Hard hat (meets ANSI Z89.1—1986 requirements for head protection)
- High-visibility traffic safety vest
- Hearing protection when there are high noise levels

Level D protection will be used only when:

- The atmosphere contains no known hazards
- Work functions preclude splashes, immersions, or the potential for unexpected inhalation of, or contact with, hazardous concentrations of chemicals
- Atmospheric concentrations of contaminants are less than the Permissible Exposure Limit (PEL) and/or Threshold Limit Value (TLV)

10.1.1 Modified Level D Protection Requirements

Depending on the scope of work and the potential hazards to be encountered, Level D protection shall be modified to include additional protective equipment such as USCG-approved PFDs, face shields/goggles, chemical-resistant clothing, and disposable gloves of varying materials depending on the chemical substances involved. An upgrade to Modified Level D occurs when there is a possibility that contaminated media can contact the skin or work uniform, or if unique, site-specific hazards exist.

11 Health and Safety Procedures and Practices

In addition to the task-specific JSAs listed in Section 6.1 and presented in Attachment C-2, 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.
- Certain project sites may have newly finished work (e.g., concrete, paving, framing, habitat reconstruction, or sediment caps) that may be damaged by unnecessary contact, or that could cause dangerous conditions for personnel (e.g., slipping, sinking, or tripping). Personnel working in or around these areas shall communicate with the PM, FL, and client contact as needed to prevent damaging new work or entering dangerous conditions.
- Generally, all on-site activities will be conducted during daylight hours. If work after dusk is planned or becomes necessary due to an emergency, adequate lighting must be provided.
- Hazardous work, such as handling hazardous materials and heavy loads and operating equipment, should not be conducted during severe storms.
- All temporary electrical power must have a ground-fault circuit interrupter (GFCI) as part of its circuit if the circuit is not part of permanent wiring. All equipment must be suitable and approved for the class of hazard present.

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 Underground or Overhead Utility Line Contact Prevention

Observe the following underground/overhead utility line contact prevention procedures and practices:

- Prior to conducting work, the PM or FL shall verify that all existing underground or overhead utilities in the work area are located per the state or local mark-out methods and subcontract. Documentation of utility mark-out shall be completed using the Utility Contact Prevention Checklist form (see Attachment C-1). No excavation work is to be performed until all utility mark-outs are verified.
- The PM or FL shall conduct a site survey to search for signs of other buried or overhead utilities. The results of such surveys shall be documented on the Utility Mark-out documentation form.
- The Property owner or facility operator shall be consulted on the issue of underground utilities. As-built drawings shall be reviewed, when available, to verify that underground utility

locations are consistent with the utility location mark-outs. All knowledge of past and present utilities must be evaluated prior to conducting work.

- If on-site subsurface utility locations are in question, a private locating service shall be contacted to verify locations. If the investigation calls for boreholes in an area not covered by the municipal One-Call system, then a private utility locate firm shall be contacted to determine the location of other underground utilities.
- The PM shall have documented verbal contact and an agreement with the fiber optic company for all work within 50 feet of any fiber optic cables.
- **Only non-destructive excavation, such as hand digging or hydro excavation, is permitted within 3 feet of underground high voltage, product, or gas lines.** Once the line is exposed, heavy equipment can be used, but must remain at least 3 feet from the exposed line.
- Elevated superstructures (e.g., drill rig, backhoe, scaffolding, ladders, and cranes) shall remain a distance of 10 feet away from utility lines and 20 feet away from power lines. Distance from utility lines may be adjusted by the FL depending on actual voltage of the lines.
- Overhead utility locations shall be marked with warning tape or flags where equipment has the potential for contacting overhead utilities.

Table 11-1 shows the minimum clearances required for energized overhead electrical lines.

Table 11-1
Overhead Utility Clearance Requirements

Minimum Clearance from Energized Overhead Electric Lines	
Nominal System Voltage	**Minimum Required Clearance**
0 to 50 kV	10 feet
51 to 100 kV	12 feet
101 to 200 kV	15 feet
201 to 300 kV	20 feet
301 to 500 kV	25 feet
501 to 750 kV	35 feet
751 to 1,000 kV	45 feet

Notes:
Whenever equipment operations must be performed closer than 20 feet from overhead power lines, the FL must be notified. When clearance to proceed is received from the FL, the electric utility company must be contacted to turn the power off or physically insulate (protect) the lines if the operation must be performed closer to the power line than is allowed in this table. For voltages not listed on this table, add 0.4 inches per kilovolt (kV) to obtain the safe distance between equipment and power lines.

11.1.5 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.
- Specific
  - If unsure if a task requires specific electrical training, err on the side of caution and contact the PM and FL prior to proceeding.
  - If subsurface work is to be performed, follow the guidelines in Section 11.1.4 and conduct utility locating prior to work and in accordance with local ordinances.
  - If lockout/tagout (LO/TO) procedures are required (i.e., de-energizing machinery or equipment so work may be performed), the equipment owner must provide LO/TO procedures and training. By default, the equipment owner should perform any LO/TO. If it becomes necessary for Anchor QEA personnel to perform LO/TO tasks, contact the PM and FL prior to doing so.
  - Maintain appropriate distance from overhead utilities (see Table 11-1).
  - If unexpected electrical equipment is encountered (i.e., buried wire) assume it is live, stop work, and contact the PM and FL immediately.
  - If working in enclosed or restricted areas where electrical hazards may be present, contact a licensed electrician or other suitably trained party to provide barriers, shields, or insulating materials to prevent electric shock.
  - If working in areas where electrical hazards are present, verify that conductive clothing and jewelry is replaced with non-conductive clothing, or removed.

11.1.6 General Falls and Ladder Usage

Observe the following general falls and ladder usage 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.
- Verify 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.

11.1.7 Hand and Power Tools

Observe the following procedures and practices when working with hand and power tools:

- Keep hand tools sharp, clean, oiled, dressed, and not abused.
- Worn tools are dangerous. For example, the "teeth" in a pipe wrench can slip if worn smooth, an adjustable wrench will slip if the jaws are sprung, and hammerheads can fly off loose handles.
- Tools subject to impact (e.g., chisels, star drills, and caulking irons) tend to "mushroom." Keep them dressed to avoid flying spalls, and use tool holders.
- Do not force tools beyond their capacity.
- Flying objects can result from operating almost any power tool, so always warn people in the vicinity and use proper eye protection.
- Each power tool should be examined before use for damaged parts, loose fittings, and frayed or cut electric cords. Tag and return defective tools for repairs. Verify that there is adequate lighting, inspect tools for proper lubrication, and relocate tools or material that could "vibrate into trouble."
- Compressed air must be shut off or the electric cord unplugged before making tool adjustments. Air must be "bled down" before replacement or disconnection.
- Proper guards or shields must be installed on all power tools before issue. Do not use improper tools or tools without guards in place.
- Replace all guards before startup. Remove cranks, keys, or wrenches used in service work.

11.1.8 Motor Vehicle Operation

All drivers are required to have a valid driver's license, and all vehicles must have appropriate state vehicle registration and inspection stickers. **Anchor QEA prohibits the use of hand-held wireless devices while driving any vehicle for business use at any time, for personal use during business hours, and as defined by law**. Additionally, site-specific motor vehicle requirements must be followed, if any.

When driving to, from, and within the job site, be aware of potential hazards including:

- Vehicle accidents
- Distractions
- Fatigue
- Weather and road conditions

To mitigate these hazards, observe the following procedures and practices regarding motor vehicle operation:

- Before leaving, inspect fuel and fluid levels and air pressure in tires, and adjust mirrors and seat positions appropriately.
- Wear a seat belt at all times and make sure that clothing will not interfere with driving.
- Plan your travel route and check maps for directions or discuss with colleagues.
- Clean windows and mirrors as needed throughout the trip.
- Wear sunglasses as needed.
- Fill up when the fuel level is low (not near empty).
- Follow a vehicle maintenance schedule to reduce the possibility of a breakdown while driving.
- Stop driving the vehicle, regardless of the speed (e.g., even 5 miles per hour) or location (e.g., a private road), when the potential of being distracted by conversation exists.
- Using hand-held communication devices (e.g., cell phones) while operating any motor vehicle is prohibited.
- Get adequate rest prior to driving.
- Periodically change your seat position, stretch, open the window, or turn on the radio to stay alert.
- Pull over and rest if you are experiencing drowsiness.
- Check road and weather conditions prior to driving.
- Be prepared to adjust your driving plans if conditions change.
- Travel in daylight hours, if possible.
- Give yourself plenty of time to allow for slowdowns due to construction, accidents, or other unforeseen circumstances.
- Use lights at night and lights and wipers during inclement weather.

11.1.9 Vehicular Traffic

Observe the following procedures and practices regarding vehicular traffic:

- Wear a high-visibility traffic safety vest when vehicle hazards exist.
- Use cones, flags, barricades, and caution tape to define the work area.
- Use a vehicle to block the work area (if conditions allow).
- Engage a police detail for high-traffic situations.
- Always use a spotter in tight or congested areas for material deliveries.
- As necessary, develop traffic control plans and train personnel as flaggers in accordance with the U.S. Department of Transportation Manual of Uniform Traffic Control Devices and/or local requirements.

11.1.10 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 railway owner/operator.
- Maintain emergency rail yard and railway 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 railway 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.

11.1.11 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 111.1.14)
- 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

Additional Safety Equipment for Sampling Vessel per U.S. Coast Guard Requirements:	
• Proper vessel registration, numbering, and documentation (registered with state, certificate of vessel registration number displayed, and carrying a valid certificate of number) • USCG-approved personal flotation devices (PFDs; or life jackets) for every person on the sampling vessel (Type I, II, III, or V are required). High-visibility required by Anchor QEA. • Appropriate, non-expired, visual distress devices for day and night use from the following: – Three hand-held red flares (day and night), or – One hand-held red flare and two parachute flares (day and night), or – One hand-held orange smoke signal, two floating orange smoke signals (day), and one electric distress light (night only) • Alternate means of propulsion (oars or paddles) • Dewatering device (pump or bailer) • Properly maintained and inspected USCG-approved fire extinguishers (no fixed system = (2) B-1 or (1) B-2 type extinguishers; fixed system = (1) B-1 type extinguisher) • Proper ventilation of gasoline-powered vessels • Sound-producing device (whistle, bell, or horn) • VHF 2-way radio • Proper navigational light display • Throwable life ring with attached line (any vessel larger than 16 feet is required to carry one Type IV [throwable] PFD)	
Additional USCG Recommended Equipment Includes:	
• Extra visual distress signals • Primary and spare anchor • Heaving line • Fenders • First aid kit • Flashlight • Mirror • Searchlight • Sunburn lotion • Tool kit • Spare fuel	• Boat hook • Spare propeller • Mooring line • Food and water • Binoculars • Spare batteries • Sunglasses • Marine hardware • Extra clothing • Spare parts • Pertinent navigational chart(s) and compass

11.1.12 Working Over or Near Water

11.1.12.1 Personal Flotation Devices

PFDs are not required where employees are continuously protected from the hazard of drowning by railings, nets, safety belts, or other applicable provisions.

Type I, II, III or V USCG-approved, high-visibility PFD shall be provided and properly worn by all personnel in the following circumstances:

- On or within 10 feet of water
- On floating pipelines, pontoons, rafts, or stages
- On structures extending over or next to the water, except where guard rails or safety nets are provided for employees
- Working alone at night where there are drowning hazards, regardless of other safeguards provided
- In skiffs, small boats, or launches, unless in an enclosed cabin or cockpit
- Whenever there is a drowning hazard

The following precautions shall be followed when using PFDs:

- Prior to and after each use, the buoyant work vests or life preservers shall be inspected for defects that would alter their strength or buoyancy. Defective devices or devices with less than 13 pounds buoyancy shall be removed from service.
- All PFDs shall be equipped with reflective tape as specified in 46 CFR 25.25-15.
- Thirty-inch USCG-approved ring buoys with at least 150 feet of 600-pound capacity line shall be provided and readily available for emergency rescue operations. The distance between ring buoys shall not exceed 200 feet.
- PFD lights conforming to 46 CFR 161.012 shall be required whenever there is a potential need for life rings to be used after dark. Onshore installations, at least one life ring, and every third one thereafter, shall have a PFD light attached. PFD lights on life rings are required only in locations where adequate general lighting (e.g., floodlights or light stanchions) is not provided.

11.1.12.2 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.

11.1.13 Noise

Excessive noise is hazardous not only because of its potential to damage hearing, but also because of its potential to disrupt communications and instructions. The following procedures and practices shall be followed to prevent noise-related hazards:

- All employees will have access to ear protection with a Noise Reduction Rating of not less than 30.
- Ear protection must be worn in any environment where site personnel must raise their voices to be heard while standing at a distance of 3 feet or less.
- Ear protection must be worn by any personnel observing or operating concrete cutting or sawing equipment, pile driving, or other loud noise-generating activities.

Hearing protection is required for site personnel operating or working near noisy equipment or operations, where the noise level is greater than 85 A-weighted decibels (dbA) (time-weighted average [TWA]), as well as personnel working around heavy equipment. The FL will determine the need and appropriate testing procedures, (i.e., sound level meter and/or dosimeter) for noise measurement.

When needed, a sound level meter will be used to measure noise levels at selected locations in the work area and on the site perimeter. When used, noise monitoring equipment must be calibrated before and after each shift.

If continuous noise levels are found to exceed 85 dbA at any location within the work area, warning signs will be posted. Site personnel and visitors will be notified that hearing protection is required. Appropriate hearing protection (i.e., ear plugs or ear muffs) will be worn whenever personnel or visitors are working in that location. A supply of ear plugs will be maintained on site.

Action levels in Table 11-3 will trigger the use of appropriate hearing protection (plugs or muffs). Hearing protection must be able to attenuate noise below 90 dbA (8-hour TWA). Each hearing protection or device has a Noise Reduction Rating assigned by EPA. The calculation for a hearing protection device's effectiveness is as follows:

Equation 1

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

where:

db	=	decibel
dbA	=	A-weighted decibel
NRR	=	Noise Reduction Rating

Table 11-3
Noise Exposure Action Levels

Instrument	Measurement	Action
Type I or Type II Sound Level Meter or Dosimeter	> 80 dbA to 85 dbA	Hearing protection recommended. Limit work duration to 8-hour shifts.
	> 85 dbA to 90 dbA	Hearing protection required. Limit work duration to 8-hour shifts.
	> 90 dbA to 115 dbA	Hearing protection required. Investigate use of engineering controls. Limit work duration to 8-hour shifts.
	> 115 dbA	Stop work. Consult CHSM.

11.1.14 Lifting and Material Handling

Observe the following procedures and practices for lifting and material handling:

- Use leather gloves when handling metal, wire rope, sharp debris, or transporting materials (e.g., wood, piping, or drums).
- The size, shape, and weight of the object to be lifted must first be considered. No individual employee is permitted to lift any object that weighs more than 60 pounds. Multiple employees or mechanical lifting devices are required for objects heavier than the 60-pound limit.
- Plan a lift before doing it. Bend at the knees and lift with the legs; maintain the natural curves of the back; do not use back muscles.
- Check the planned route for clearance.
- Use the buddy system when lifting heavy or awkward objects.
- Do not twist your body while lifting.
- Know the capacity of any handling device (e.g., crane, forklift, chain fall, or come-along) that you intend to use.
- Use tag lines to control loads.
- Verify that your body, material, tools, and equipment are safe from such unexpected movement as falling, slipping, rolling, tripping, bowing, or any other uncontrolled motion.
- Trucks (i.e., flat beds) hauling equipment or materials must not be moved once rigging has been released.

- Chock all material and equipment (such as pipe, drums, tanks, reels, trailers, and wagons) as necessary to prevent rolling.
- Tie down all light, large-surface-area material that might be moved by the wind.
- When working at heights, secure tools, equipment, and wrenches against falling.
- Do not store materials or tools on ducts, lighting fixtures, beam flanges, hung ceilings, or similar elevated locations.
- Fuel-powered tools used inside buildings or enclosures shall be vented and checked for excessive noise.

11.1.15 Fire Control

Observe the following fire control procedures and practices:

- Smoke only in designated areas.
- Keep flammable liquids in closed containers.
- Keep the work site clean; avoid accumulating combustible debris such as paper.
- Obtain and follow Property owner hot work safety procedures when welding or performing other activities requiring an open flame.
- Isolate flammable and combustible materials from ignition sources.
- Verify fire safety integrity of equipment installations according to National Electrical Code specifications.

11.1.16 Static Electricity and Transfer of Flammable Liquids

Observe the following procedures and practices regarding static electricity when transferring flammable liquids:

- Electrically bond and ground pumps, transfer vessels, tanks, drums, bailers, and probes when moving flammable liquids.
- Electrically bond and ground vacuum trucks and the tanks they are emptying.
- Do not splash fill containers with flammable liquids.
- Pour flammable liquids slowly and carefully.
- Two fire extinguishers (2A20:BC) must be available, charged, inspected, and readily accessible.

11.1.17 Cleaning Equipment

Observe the following procedures and practices when cleaning equipment:

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

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 have 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 11.2.7).
- During hot months, plan work for early morning or evening.
- Use ice vests when necessary.
- Rest in cool, dry areas.
- Verify that employees have access to potable drinking water and shade.
- During conditions exceeding 95°F, verify that the following additional procedures are adhered to:
  - Establish effective communication by voice, observation, or electronic means.
  - Observe employees for alertness and signs or symptoms of heat illness.
  - Designate one or more employees on each work site as authorized to call for emergency medical services.
  - Remind employees to drink water throughout the shift.
  - Conduct pre-shift meetings before beginning work to review the high heat procedures, encourage drinking water, and remind employees of their right to take a cool-down rest when necessary.

11.2.2.1 Signs, Symptoms, and Treatment

The FL will be trained in heat stress prevention, including the following, prior to supervising employees:

- Procedures to prevent heat illness.
- Procedures to follow when an employee exhibits symptoms consistent with possible heat illness, including emergency response procedures.

The information provided below addresses these training requirements.

Adverse climatic conditions are important considerations in planning and conducting site operations. High ambient temperature can result in health effects ranging from transient heat fatigue, physical discomfort, reduced efficiency, personal illness, and increased accident probability to serious illness or death. Heat stress is of particular concern when chemical protective garments are worn because they prevent evaporative body cooling. Wearing PPE places employees at considerable risk of developing heat stress.

Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, and the individual characteristics of the worker. Because heat stress is probably one of the most common (and potentially serious) illnesses, regular monitoring and other preventive precautions are vital.

Heat Rash. Heat rash can be caused by continuous exposure to hot and humid air and skin abrasion from sweat-soaked clothing, rubber boots, or impermeable waders. The condition is characterized by a localized red skin rash and reduced sweating. Heat rash reduces the ability to tolerate heat. To treat, keep skin hygienically clean and allow it to dry thoroughly after using chemical protective clothing. Take measures to prevent heat rash by changing clothes often to maximize use of dry garments, or taking frequent breaks to allow doffing of equipment and drying of skin.

Heat Cramps. Heat cramps are caused by profuse perspiration with inadequate electrolytic fluid replacement. This often robs the larger muscle groups (stomach and quadriceps) of blood, which can cause painful muscle spasms and pain in the extremities and abdomen. To treat, move the employee to a cool place and give sips of water or an electrolytic drink. Watch for signs of heat exhaustion or heat stroke.

Heat Exhaustion. Heat exhaustion is a mild form of shock caused by increased stress on various organs to meet increased demand to cool the body. Onset is gradual and symptoms should subside within 1 hour. Symptoms include a weak pulse; shallow breathing; pale, cool, moist skin; profuse sweating; dizziness; and fatigue. To treat, move the employee to a cool place and remove as much clothing as possible. Give sips of water or electrolytic solution and fan the person continuously to remove heat by convection. Do not allow the affected person to become chilled. Treat for shock if necessary.

Heat Stroke. Heat stroke is the most severe form of heat stress; the body must be cooled immediately to prevent severe injury and/or death. ***This is a medical emergency!*** Symptoms include red, hot, dry skin; a body temperature of 105°F or higher; no perspiration; nausea; dizziness and confusion; and a strong, rapid pulse. Because heat stroke is a true medical emergency, transport the individual to a medical facility immediately. Prior to transport, remove as much clothing as possible and wrap the individual in a sheet soaked with water. Fan the individual vigorously while transporting

to help reduce body temperature. If available, apply cold packs under the arms, around the neck, or any other place where they can cool large surface blood vessels. If transportation to a medical facility is delayed, reduce body temperature by immersing the individual in a cool-water bath (however, be careful not to over-chill the individual once body temperature is reduced below 102°F). If this is not possible, keep the individual wrapped in a sheet and continuously douse with water and fan.

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 should be kept cool, 50°F to 60°F, and it 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 Attachment C-1) 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 regimen in Table 11-4 should be followed.

Table 11-4
Permissible Heat Exposure Threshold Limit Values

Work/Rest Regimen	Workload		
	Light	Moderate	Heavy
Continuous work	86°F (30.0°C)	80°F (26.7°C)	77°F (25.0°C)
75% work, 25% rest each hour	87°F (30.6°C)	82°F (28.0°C)	78°F (25.9°C)
50% work, 50% rest, each hour	89°F (31.4°C)	85°F (29.4°C)	82°F (27.9°C)
25% work, 75% rest, each hour	90°F (32.2°C)	88°F (31.1°C)	86°F (30.0°C)
These TLVs assume that nearly all acclimated, fully-clothed site personnel with adequate water and salt intake should be able to function effectively under the given working conditions without exceeding a deep body temperature of 100.4°F (38°C).			

(From OSHA Technical Manual, Section III: Chapter 4 - Heat Stress)

The TLVs denoted in Table 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

Clothing Type	WBGT Correction
Summer lightweight working clothing	0°F (0°C)
Cotton coveralls	-3.6°F (-2°C)
Winter work clothing	-7.2°F (-4°C)
Water barrier, permeable	-10.8°F (-6°C)
Fully encapsulating	-14.4°F (-10°C)

Physiological. Physiological monitoring can be used in lieu of, or in addition to, WBGT. This monitoring can be self-performed once the health and safety representative demonstrates appropriate techniques to affected employees. Because individuals vary in their susceptibility to heat, this type of monitoring has its advantages. The following two parameters are to be monitored at the beginning of each rest period:

- **Heart Rate:** The maximum heart rate (MHR) is the amount of work (beats) per minute a healthy person's heart can be expected to safely deliver. Each individual will count his/her radial (wrist) pulse for 1 minute as early as possible during each rest period. If the heart rate of any individual exceeds 75% of his/her calculated MHR (MHR = 200 - age) at the beginning of the rest period, then the work cycle will be decreased by one-third. The rest period will remain

the same. An individual is not permitted to return to work until his/her sustained heart rate is below 75% of his/her calculated MHR.

- **Temperature:** Each individual will measure his/her temperature with a thermometer for 1 minute as early as possible in the first rest period. If the temperature exceeds 99.6°F at the beginning of the rest period, then the work cycle will be decreased by one-third. The rest period will remain the same. An individual is not permitted to return to work if his/her temperature exceeds 100.4°F.

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 individual to a warm, dry place. If the individual's clothing is wet, remove it and replace it with dry clothing. Keep the individual warm. Re-warming of the individual should be gradual to avoid stroke symptoms. Dehydration, or the loss of body fluids, may result in a cold injury due to a significant change in blood flow to the extremities. If the individual is conscious and alert, warm sweet liquids should be provided. Coffee and other caffeinated liquids should be avoided because of diuretic and circulatory effects. Extremities affected by frostbite should be gradually warmed up and returned to normal temperature. Moist compresses should be applied; begin with lukewarm compresses and slowly increase the temperature as changes in skin temperature are detected. Keep the individual warm and calm and move them to a medical facility as soon as possible.

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-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.

  - **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 bullets 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 worksite should be evaluated to determine the best practices for risk mitigation. The most effective way to prevent skin damage from UV exposure is to protect bare skin from the exposure. This can be accomplished with shade, clothing (e.g., pants, long sleeves, or hats), sunscreen, and sunglasses. Plan work to either create shade or take advantage of natural shade, and avoid peak UV times during the day when possible.

11.2.5 Inclement Weather

Observe the following procedures and practices regarding inclement weather:

- Evaluate the worksite for hazards that may be amplified during inclement weather, such as traction issues, ingress and egress, slope stability, or wind-driven hazards (e.g., dust, debris, or falling trees).
- Stop outdoor work during electrical storms (lightning strikes), hailstorms, high winds, and other extreme weather conditions such as extreme heat or cold.
- Take cover indoors or in a vehicle that will provide adequate protection. In some cases, this may require exiting the worksite, such as during windstorms in areas with overhead hazards (e.g., trees or power lines).

- Listen to local forecasts for warnings about specific weather hazards such as tornadoes, hurricanes, and flash floods.
- Verify that on-site equipment and resources are adequately protected from inclement weather.
- If working in an unfamiliar geographic location, consult with local resources for unique weather hazards.

11.2.6 The Public at Large

The community residents around worksites may pose their own specific hazards. These conditions may include the following:

- Unintentional disruption of work
- Benign or malicious trespass
- Criminal intent

Scenarios may include the following:

- Pedestrians, cyclists, or motorists disregarding site boundaries due to distraction or willful disobedience.
- Public use of private site facilities for shelter, relief, and other reasons with no ill-intention.
- Public use of private site facilities for mischievous or criminal activity, such as loitering, vandalism, or theft.
- Encounters with community members who are disgruntled with the project activity.
- Encounters with criminal activities on or near a project site.

If any of the 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.

11.2.7 Personal Health and Safety

In addition to hazards associated with chemicals of concern, equipment, operations, or site conditions discussed above, there may be additional personal safety issues to consider at a site, including those related to one or multiple protected classes, such as race, gender, religion, ability, sexual orientation, or gender identity. These conditions may involve the following, perpetrated by the public or those associated with the work:

- Malicious disruption of work
- Harassment, including unwanted comments, gestures, or actions
- Threats of violence, either implied (using derogatory language) or explicit
- Assault

It is critical that the work environment be discussed within the project team to evaluate risks, ways to avoid those risks, and communication protocols. Anchor QEA requires that work be performed in teams.

Specifically, if any of the above are anticipated, take the following precautions as appropriate:

- Alert the PM, FL, CHSM, and Human Resources Department of potential issue(s).
- Formulate a plan of action to verify and maintain a safe working environment prior to field work, which may include the following:
  - Working in pairs and/or within a certain physical distance of other work groups.
  - Coordinated check-ins (calls to or from the office or visual check-ins with other field members).
- Whenever possible, schedule work only within daylight hours (which fluctuate seasonally) or on weekends when questionable scenarios may be 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 as to the event.

In addition, practice active awareness of your environment. Discuss personal health and safety concerns at the daily tailgate meeting. If you feel unsafe based on the potential behavior of others, immediately bring it up to field team coworkers. If the issue is not resolved to your satisfaction, alert the PM, FL, CHSM, and Human Resources Department to assist in resolving any potential issue(s).

12 Medical Monitoring Program

This section describes the medical monitoring program that Anchor QEA field personnel must comply with when working on sites where there is a potential for exposure to hazardous wastes or other hazardous substances.

12.1 General Requirements

Anchor QEA employees shall be enrolled in a medical monitoring program in compliance with OSHA standards (29 CFR 1910.120(f)) under the following circumstances:

- If they are involved with any of the following operations:
  - *Cleanup operations* required by a governmental body, whether federal, state, local, or other involving hazardous substances that are conducted at uncontrolled hazardous waste sites (including, but not limited to, the EPA's NPL sites, state priority list sites, sites recommended for the EPA NPL, and initial investigation of government-identified sites that are conducted before the presence or absence of hazardous substances has been ascertained)
  - *Corrective actions* involving cleanup operations at sites covered by the Resource Conservation and Recovery Act of 1976 (RCRA) as amended (42 United States Code 6901 et seq)
  - *Voluntary cleanup operations* at sites recognized by federal, state, local, or other governmental bodies as uncontrolled hazardous waste sites
  - *Operations involving hazardous wastes* that are conducted at treatment, storage, and disposal facilities regulated by 40 CFR 264 and 40 CFR 265 pursuant to RCRA or by agencies under agreement with the EPA to implement RCRA regulations
  - *Emergency response operations* for releases of, or substantial threats of releases of, hazardous substances without regard to the location of the hazard
- And, if they meet the following criteria:
  - Are or may be exposed to hazardous substances or health hazards at or above the established PEL, above the published exposure levels for these substances, without regard to the use of respirators, for 30 days or more per year
- In addition, employees are required to be enrolled in the medical monitoring program if they meet any of the following conditions:
  - Wear a respirator for 30 days or more per year
  - Are injured, become ill, or develop signs or symptoms due to possible overexposure involving hazardous substances or health hazards from an emergency response or hazardous waste operations
  - Are members of a Hazardous Materials (HAZMAT) team

Anchor QEA employees required to be enrolled in a medical monitoring program under 29 CFR 1910.120(f) shall have medical examinations and consultations made available to them by Anchor QEA on the following schedule:

- Prior to assignment
- At least once every 12 months unless the attending physician believes a longer interval (not greater than biennially) is appropriate
- At termination of employment or reassignment to an area where the employee would not be covered if the employee has not had an examination within the last 6 months
- As soon as possible upon notification that the employee has developed signs or symptoms indicating possible overexposure to hazardous substances or health hazards, or that the employee has been injured or exposed above the PEL or published exposure levels in an emergency situation
- At more frequent times, if the examining physician determines that an increased frequency of examination is medically necessary

The content of medical examinations or consultations made available to employees shall be determined by the attending physician but shall include, at a minimum, a medical and work history with special emphasis on symptoms related to the handling of hazardous substances and health hazards, and to fitness for duty including the ability to wear any required PPE under conditions (i.e., temperature extremes) that may be expected at the work site.

The attending physician shall provide Anchor QEA with a written opinion for each examined employee that contains the following information:

- Whether the employee has any detected medical conditions that would place the employee at an increased risk of impairment of the employee's health from hazardous waste operations work, emergency response, or respirator use
- Any recommended limitations on the employee's assigned work
- A statement that the employee has been informed of the results of the medical examination and any medical conditions that require further examination or treatment

The written opinion obtained by Anchor QEA shall not reveal specific findings or diagnoses unrelated to occupational exposures. Medical monitoring and other employee-related medical records shall be retained for at least the duration of employment plus 30 years.

12.2 Team Self-Monitoring

All personnel will be instructed to look for and inform each other of any deleterious changes in their physical or mental condition during the performance of all field activities. Examples of such changes are as follows:

- Headaches
- Dizziness
- Nausea
- Blurred vision
- Cramps
- Irritation of eyes, skin, or respiratory system
- Skin chafing from damp or wet clothing
- Changes in complexion or skin color
- Changes in apparent motor coordination
- Increased frequency of minor mistakes
- Excessive salivation or changes in papillary response
- Changes in speech ability or speech pattern
- Symptoms of heat stress or heat exhaustion
- Symptoms of hypothermia

If any of these conditions develop, the affected person will be moved from the immediate work location and evaluated. If further assistance is needed, personnel at the local hospital will be notified, and an ambulance will be summoned if the condition is thought to be serious. If the condition is the result of sample collection or processing activities, procedures and/or PPE will be modified to address the problem.

Attachment C-1
Health and Safety Logs and Forms

Daily Air Monitoring Record

Project Name: DSI TBT Bioaccumulation Study **Date:**

Project Number: 080111-01.01 **Location:**

Temperature:

Conditions:

COC	Instrument	S/N	Calibration Date	Calibration Gas/Method	Calibration by
Organic vapors					
Particulates					
Oxygen					
Other:					
Other:					
Other:					

Time	Location/Description	Organic Vapor (ppm)	O_2%	CG %LEL	Other	Other

Notes:

Completed by:

Printed Name Signature Date

PLAYING IT SAFE

Daily Safety Briefing Form

Date: _____

Project No: 080111-01.01

Project Name: DSI TBT Bioaccumulation Study

Person Conducting Meeting: _____ **Health & Safety Officer:** _____ **Project Manager:** _____

TOPICS COVERED:

- ☐ Emergency Procedures and Evacuation Route
- ☐ Directions to Hospital
- ☐ HASP Review and Location
- ☐ Safety Equipment Location
- ☐ Proper Safety Equipment Use
- ☐ Employee Right-to-Know/ SDS Location
- ☐ Fire Extinguisher Location
- ☐ Eye Wash Station Location
- ☐ Buddy System
- ☐ Self and Coworker Monitoring
- ☐ Lines of Authority
- ☐ Communication
- ☐ Site Security
- ☐ Vessel Safety Protocols
- ☐ Work Zones
- ☐ Vehicle Safety and Driving/ Road Conditions
- ☐ Equipment Safety and Operation
- ☐ Proper Use of PPE
- ☐ Decontamination Procedures
- ☐ Near Miss Reporting Procedures
- ☐ Lifting Techniques
- ☐ Slips, Trips, and Falls
- ☐ Hazard Exposure Routes
- ☐ Heat and Cold Stress
- ☐ Overhead and Underfoot Hazards
- ☐ Chemical Hazards
- ☐ Flammable Hazards
- ☐ Biological Hazards
- ☐ Eating/Drinking/Smoking
- ☐ Reviewed Prior Lessons Learned
- ☐ Field Team Medical Conditions for Emergency Purposes (Confidential): _____
- ☐ Other: _____

Weather Conditions: _____

Daily Work Scope: _____

Site-specific Hazards: _____

Safety Comments: _____

Attendees

Printed Name	Signature

End of Day Wellness Check

PLAYING IT SAFE

Employee Exposure/Injury Incident/Spill Report

Employee Name: _____ **Date:** _____

Project Name/No: DSI TBT Bioaccumulation Study; 080111-01.01 **Time:** _____

Type of Occurrence: ☐ employee exposure ☐ injury incident ☐ spill

Site Name and Location: _____

Site Weather: *(clear, rain, snow, etc.)* _____

Nature of Illness/Injury: _____

Symptoms: _____

Action Taken: ☐ rest ☐ first aid ☐ medical

Transported By: _____ **Witnessed By:** _____

Hospital Name: _____

Treatment: _____

Describe in detail how this exposure/injury incident/spill occurred: *(if a spill, list the name of the compounds, quantities, and method of cleanup/containment)* _____

_____

_____

_____

_____

_____

What was the person doing at the time of the accident/incident?: _____

_____

List personal protective equipment worn: _____

_____

What immediate action was taken to prevent recurrence?: _____

_____

Employee:

Printed Name	Signature	Date

Supervisor:

Printed Name	Signature	Date

Site Safety Representative:

Printed Name	Signature	Date

NOTE: Use additional page(s) if necessary.

Field Safety Equipment Checklist

The following is a list of safety-related gear that may be appropriate depending on the type of work being conducted. The purpose of this checklist is twofold: 1) ensure that all field crew members think about appropriate safety gear needs before heading to the worksite; and 2) provide an extensive list of gear to consider in order to serve as a reminder of potential safety gear needs during a field effort.

☐ **Safety Briefing Log or Notebook**

Personal Protective Gear

- ☐ Rain pants and jacket
- ☐ Hard hats
- ☐ Boots (steel-toed, if appropriate)
- ☐ Safety glasses
- ☐ Ear protection
- ☐ Nitrile gloves (inner and outer pair)
- ☐ Tyvek overalls
- ☐ H_2S sensor
- ☐ Flashlight
- ☐ EpiPen (inquire if any field staff use one)
- ☐ Other:

Warm Weather Safety Gear

- ☐ Sunscreen
- ☐ Water
- ☐ Hat
- ☐ Light clothes

Cold Weather Safety Gear

- ☐ Warm clothes (preferably synthetics)
- ☐ Hat
- ☐ Gloves
- ☐ Boot warmers
- ☐ Thermos of warm drink/soup

Communications

- ☐ Notify office staff of day's field plan
- ☐ Walkie Talkies
- ☐ Cell phones
- ☐ Satellite phone (if appropriate)
- ☐ Contact numbers (e.g., for other field crew members, the PM, or others to notify that you are accessing site)

General Gear for Work Near Water

- ☐ Life jacket
- ☐ Boots or waders (hip or chest)
- ☐ Throwline

Boat Safety Gear

U.S. Coast Guard Required Gear:

- ☐ 1. Personal flotation device (PFD), preferably life jacket, for each occupant
- ☐ 2. Fire extinguisher (filled to operable range)
- ☐ 3. Flares (unexpired)
- ☐ 4. Horn
- ☐ 5. Navigation lights

- ☐ First aid kit
- ☐ Bowline and stern line
- ☐ Anchor and anchor line
- ☐ Paddle
- ☐ Spare propeller and linchpin
- ☐ Appropriate personal protective gear (boots or waders) to step onto shore if necessary
- ☐ Drain plug (and spare)
- ☐ Boat fuel and oil
- ☐ Weather radio (if appropriate)
- ☐ Weather, tides, and currents forecasts
- ☐ Warm clothes/blanket in dry bag

Modification to Health and Safety Plan

Date: _____

Project No: 080111-01.01

Project Name: DSI TBT Bioaccumulation Study

Modification: _____

_____

_____

_____

_____

Reason for Modification: _____

_____

_____

_____

_____

_____

Site Personnel Briefed

Name: _____ **Date:** _____

Name: _____ **Date:** _____

Name: _____ **Date:** _____

Name: _____ **Date:** _____

Name: _____ **Date:** _____

Name: _____ **Date:** _____

Name: _____ **Date:** _____

Name: _____ **Date:** _____

Name: _____ **Date:** _____

Name: _____ **Date:** _____

Approvals

Field Lead: _____ _____ _____
Printed Name | Signature | Date

Project Manager: _____ _____ _____
Printed Name | Signature | Date

PLAYING IT SAFE

Heat Stress Monitoring Record

Date:
Project No: DSI TBT Bioaccumulation Study
Project Name: 080111-01.01
Location:

Employee Name	Monitoring Results												
	Initial Reading Time:	First Work Period Time:		Second Work Period Time:		Third Work Period Time:		Fourth Work Period Time:		Fifth Work Period Time:		Sixth Work Period Time:	
	WBGT (°F):	WBGT (°F):		WBGT (°F):		WBGT (°F):		WBGT (°F):		WBGT (°F):		WBGT (°F):	
	Air Temp (°F):	Air Temp (°F):		Air Temp (°F):		Air Temp (°F):		Air Temp (°F):		Air Temp (°F):		Air Temp (°F):	
	Initial Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:	Initial Temp:	Final Temp:
	Initial H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:	Initial H.R.:	Final H.R.:
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Notes:

Completed by:

Printed Name | Signature | Date

PLAYING IT SAFE

Utility Contact Prevention Checklist

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

Purpose: This form is intended to help the Field Lead confirm that underground or overhead utilities are identified to the extent practicable and consistent with applicable regulations **PRIOR** to site work.

INVESTIGATIONS MUST NOT OCCUR UNTIL MULTIPLE LINES OF EVIDENCE INDICATE THAT SUBSURFACE OR OVERHEAD UTILITIES ARE NOT PRESENT IN THE WORK AREA

Project Name/No: DSI TBT Bioaccumulation Study 080111-01.01 **Date:**

Field Lead: **Project Address:** 5658 W. Marginal Way SW, Seattle, Washington

Project Manager: Julia Fitts **Health & Safety Officer:** David Templeton

Emergency Contact Information for One Call:

Duration/Summary of Work to be Performed:

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

Utility Contact Prevention Checklist

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

Consideration	Check		Explanation	Initial
Is other evidence of utilities present? (unknown ground markings, manholes or valve covers, "Call Before You Dig" signs, linear asphalt or concrete repair characteristics, liner subsidence of ground surface, pin flags or stakes, etc.)	☐ Yes	☐ No		
Has a private locating service been contacted?	☐ Yes	☐ No		
Were any utilities identified and marked out through a private locating service? If so, duplicate mark-outs on site drawings.	☐ Yes	☐ No		
Are there any fiber optic cables, fuel lines, or high-pressure lines within 50 feet of work locations?	☐ Yes	☐ No		
If fiber optic cables, fuel lines, or high-pressure lines are within 50 feet, has an agreement with the utility owner been established?	☐ Yes	☐ No		
Can a test borehole be advanced by hand digging, probing, post-hole digging, and/or air knifing to 5 feet below ground surface (bgs)?	☐ Yes	☐ No		
If hand digging, probing, post-hole digging, and/or air knifing to 5 feet bgs is not possible, can a non-invasive geophysical investigation be conducted? If not, why?	☐ Yes	☐ No		
Other considerations:				

NOTE: Please fill in second page and attach additional reports, drawings, or other information, as necessary.

Confirmation Number: _____

Contact Name: _____ **Organization:** _____

Contact Date: _____ **Contact Time:** _____

Response: _____

_____

_____

_____

Completed by:

_____ _____ _____

Printed Name Signature Date

Utility Contact Prevention Checklist

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

Contractor:

Printed Name	Signature	Date

Attachment C-2
Job Safety Analysis (JSA) Documents

Job Safety Analysis

Field Activities

Project Name: DSI TBT Bioaccumulation Study	**Project Number:** 080111-01.01	**JSA Number:** 001	**Issue Date:** May 8, 2019
Location: Seattle, Washington	**Contractor:** Anchor QEA, LLC	**Analysis by:** Cindy Fields	**Analysis Date:** May 5, 2019
Work Operation: Field activities	**Superintendent/Competent Person:** Cindy Fields	**Revised by:**	**Revised Date:**
Required Personal Protective Equipment (PPE): • Modified Level D—Long pants, long sleeves, and/or waterproof coveralls if handling potentially contaminated media, high visibility vest or personal flotation device (PFD) if on water, and steel-toed footwear conforming to ASTM International (ASTM) F2412-05/ASTM F2413-05 • Depending on activity, the following PPE may also be required: safety glasses/splash goggles, hard hat, latex inner gloves, and, if boating, U.S. Coast Guard-approved PFD (see cold stress section for cold-weather PFD information)		**Reviewed by:** Dan Hennessy	**Reviewed Date:** May 5, 2019
		Approved by: Julia Fitts	**Approved Date:** May 8, 2019

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
If boating		• Follow the Job Safety Analysis (JSA) for boating activities.	
Outdoor, physical activity	Slips, trips, and falls	• Avoid walking while writing or texting—maintain a heads-up posture. • Be aware of potentially slippery surfaces and tripping hazards. Use handrails where available. Wear footwear that has sufficient traction. • Maintain good housekeeping practices. Clean up all spills immediately. • Be aware of weather effects on the work area, including wet and/or frozen ground. • Jumping, running, and horseplay are prohibited. • Keep all areas clean and free of debris to prevent any trips and falls. • Be aware of and limit loose clothing or untied shoelaces that may contribute to slips, trip, and falls. • Notify the field team members of any unsafe conditions.	• Routinely inspect work area for unsafe conditions.

Job Safety Analysis

Field Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Outdoor, physical activity (continued)	Heat stress	• Adjust work schedules, as necessary, to avoid the hottest part of the day. • Take rest breaks as warranted. • Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods. • Maintain body fluids at normal levels. • Train workers to recognize the symptoms of heat-related illness.	• Review weather forecast prior to field work. • Monitor workers' physical conditions. • Monitor outside temperature versus worker activity.
	Cold stress	• Provide shelter (enclosed, heated environment) to protect personnel during rest periods. • Educate workers to recognize the symptoms of frostbite and hypothermia. • Use appropriate cold-weather gear, up to and including Mustang-type bib coveralls or jacket/bib combinations. • Consider additional precautions if working near water in cold weather. • Have a dry change of clothing available. • Train workers to recognize the symptoms of cold-related illness.	• Review weather forecast prior to field work. • Monitor workers' physical conditions and PPE. • Monitor outside and water temperature versus worker activity and PPE.
	Rain/snow	• Wear appropriate PPE (rain gear). • Be aware of slip hazards, puddles, and electrical hazards when working in wet conditions. • If extremely cold conditions are forecast, consider additional precautions or postponing work activity.	• Review weather forecast prior to field work. • Inspect PPE daily prior to use. • Routinely inspect work area for deteriorating conditions.
	Sunshine	• Have sunscreen available for ultraviolet protection. • Have abundant water available to prevent dehydration. • Consider wearing wide-brimmed headwear and light-colored, lightweight, sun-blocking clothing.	• Ensure that sunscreen and water are available.
	Lightning	• Do not begin or continue work until lightning subsides for at least 30 minutes. Disconnect and do not use or touch electronic equipment. • Immediately head for shore if on the water and lightning is observed. If not able to get to shore, disconnect and do not use or touch the major electronic equipment, including the radio, throughout the duration of the storm.	• Obtain weather forecast and updates as needed.

Job Safety Analysis

Field Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Outdoor, physical activity (continued)	High winds	• Wear goggles or safety glasses if dust or debris are visible.	• Review weather forecast prior to field work. • Ensure that goggles or safety glasses are available.
	Biological hazards (flora [e.g., poison ivy and poison oak] and fauna [e.g., ticks, bees, spiders, and mosquitoes])	• 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 repellant. • Wear hand and arm protection when clearing plants or debris from the work area. • Be aware of potential wildlife and defensive behavior (e.g., nesting birds, or animals with young).	• Ensure that insect repellent is available. • Inspect clothing and skin for insects (e.g., ticks) after working in insect-prone areas.
	Noise exposure	• Wear hearing protection in high noise environments or when working around heavy machinery or equipment (action level of 85 decibels averaged over an 8-hour day).	• Ensure that hearing protection is available.

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 Code of Federal Regulations (CFR) 1910.120(e), including but not limited to initial 40-hour, 8-hour supervisor, and annual 8-hour refresher trainings.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120(f).
- If boating is involved, and a professional captained vessel is not in use, boat operators must take the appropriate state boater safety courses.
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their supervisor during their daily safety meeting.

Job Safety Analysis

Sediment Sampling

Project Name: DSI TBT Bioaccumulation Study	**Project Number:** 080111-01.01	**JSA Number:** 002	**Issue Date:** May 8, 2019
Location: Seattle, Washington	**Contractor:** Anchor QEA, LLC	**Analysis by:** Cindy Fields	**Analysis Date:** May 5, 2019
Work Operation: Sediment sampling	**Superintendent/Competent Person:** Cindy Fields	**Revised by:**	**Revised Date:**
Required Personal Protective Equipment (PPE): • Modified Level D—Long pants, long sleeves, and/or waterproof coveralls if handling potentially contaminated media, and steel-toed footwear conforming to ASTM International (ASTM) F2412-05/ASTM F2413-05 • Safety glasses/splash goggles, hard hat, latex inner gloves, and, if boating, U.S. Coast Guard-approved personal flotation device (PFD; see cold stress section for cold-weather PFD information)		**Reviewed by:** Dan Hennessy	**Reviewed Date:** May 5, 2019
		Approved by: Julia Fitts	**Approved Date:** May 8, 2019

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
If boating		• Follow the Job Safety Analysis (JSA) for boating activities.	
If using glassware		• Follow the JSA for handling glassware.	
Sediment sample retrieval and processing	Injury from hand and power tool operation (e.g., spatula or drill)	• Be aware of sharp edges on hand tools (e.g., spatulas, knives, drill bits, and saw blades). • Be aware of electrical connections and water hazards when working with electric- or battery-operated tools. • Ensure that all tools are working properly; repair or replace defective tools. Repair when unplugged and off. • Keep guards on power tools when not in use.	• Inspect tools to ensure that they are in good working order. • Inspect electrical connections (if applicable). • Inspect tools periodically to ensure dry and clean operation.
	Noise exposure	• Wear hearing protection in high noise environments or when working around heavy machinery or equipment (action level of 85 decibels averaged over an 8-hour day).	• Ensure that hearing protection is available.

Job Safety Analysis

Sediment Sampling

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Sediment sample retrieval and processing (continued)	Slips, trips, and falls	• Avoid walking while writing or texting—maintain a heads-up posture. • Be aware of potentially slippery surfaces, including boat decks, riprap, muddy or algae-covered rocks, shoreline plants/seaweed, thick mud, and tripping hazards. Use handrails where available. Wear footwear that has sufficient traction. • Maintain good housekeeping practices. Clean up all spills immediately. • Be aware of weather effects on the work area, including wet and/or frozen ground. • Jumping, running, and horseplay are prohibited. • Be cautious when entering or exiting the vessel, and load/unload items onto/off of the pier or shore once boarded. • Keep all areas clean and free of debris to prevent any trips and falls. • Notify the field team members of any unsafe conditions.	• Routinely inspect work area for unsafe conditions.
	Ingestion of contaminants, skin/eye contact with contaminants	• Wear appropriate PPE to prevent/reduce exposure. • Contact 911, as necessary; perform CPR if breathing stops. • Move exposed person away from source of contamination, and rinse mouth. If exposure to skin occurs, promptly wash contaminated skin using soap or mild detergent and water. Rinse eyes with large amounts of water. • Follow decontamination procedures as outlined in the Health and Safety Plan (HASP).	• Ensure that decontamination procedures are on hand and are reviewed. • Ensure that PPE and rinsing water are available.
	Muscle strain or injuries from improper lifting	• Use proper lifting techniques or ask for assistance with heavy objects. • If boating, avoid carrying objects directly onto or off the boat; rather, load/unload objects while on the boat to/from the pier/shore.	• Evaluate weight and center of gravity of heavier items prior to lifting or moving.
	Pinch points	• If boating, secure any unsecured objects on deck; they may shift on deck quickly in wave, current, or engine acceleration conditions. • Maintain a safe distance from closing mechanisms and moving parts on sampling gear. • Avoid placing hands or self between boat and dock/piles.	
Working outdoors	Heat stress	• Adjust work schedules, as necessary, to avoid the hottest part of the day. • Take rest breaks as warranted. • Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods. • Maintain body fluids at normal levels. • Train workers to recognize the symptoms of heat-related illness.	• Review weather forecast prior to field work. • Monitor workers' physical conditions. • Monitor outside temperature versus worker activity.

Job Safety Analysis

Sediment Sampling

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Working outdoors (continued)	Cold stress	• Provide shelter (enclosed, heated environment) to protect personnel during rest periods. • Educate workers to recognize the symptoms of frostbite and hypothermia. • Use appropriate cold-weather gear, up to and including Mustang-type bib coveralls or jacket/bib combinations. • Consider additional precautions if working near water in cold weather. • Have a dry change of clothing available. • Train workers to recognize the symptoms of cold-related illness.	• Review weather forecast prior to field work. • Monitor workers' physical conditions and PPE. • Monitor outside and water temperature versus worker activity and PPE.
	Rain/snow	• Wear appropriate PPE (rain gear). • Be aware of slip hazards, puddles, and electrical hazards when working in wet conditions. • If extremely cold conditions are forecast, consider additional precautions or postponing work activity.	• Review weather forecast prior to field work. • Inspect PPE daily prior to use. • Routinely inspect work area for deteriorating conditions.
	Sunshine	• Have sunscreen available for ultraviolet protection. • Have abundant water available to prevent dehydration. • Consider wearing wide-brimmed headwear and light-colored, lightweight, sun-blocking clothing.	• Ensure that sunscreen and water are available.
	Lightning	• Do not begin or continue work until lightning subsides for 30 minutes. Disconnect and do not use or touch electronic equipment. • Immediately head for shore if on the water and lightning is observed. If not able to get to shore, disconnect and do not use or touch the major electronic equipment, including the radio, throughout the duration of the storm.	• Obtain weather forecast and updates as needed.
	High winds	• Wear goggles or safety glasses if dust or debris are visible.	• Review weather forecast prior to field work. • Ensure that goggles or safety glasses are available.
	Biological hazards (flora [e.g., poison ivy and poison oak] and fauna [e.g., ticks, bees, spiders, and mosquitoes])	• 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 repellant. • Wear hand and arm protection when clearing plants or debris from the work area.	• Ensure that insect repellent is available. • Inspect clothing and skin for insects (e.g., ticks) after working in insect-prone areas.

Job Safety Analysis

Sediment Sampling

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 Code of Federal Regulations (CFR) 1910.120(e), including but not limited to initial 40-hour, 8-hour supervisor, and annual 8-hour refresher trainings.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120(f).
- If boating is involved, and a professional captained vessel is not in use, boat operators must take the appropriate state boater safety courses.
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their supervisor during their daily safety meeting.

Job Safety Analysis

General Boating Activities

Project Name: DSI TBT Bioaccumulation Study	**Project Number:** 080111-01.01	**JSA Number:** 003	**Issue Date:** May 8, 2019
Location: Seattle, Washington	**Contractor:** Anchor QEA, LLC	**Analysis by:** Cindy Fields	**Analysis Date:** May 5, 2019
Work Operation: General boating activities	**Superintendent/Competent Person:** Cindy Fields	**Revised by:**	**Revised Date:**
Required Personal Protective Equipment (PPE): • U.S. Coast Guard (USCG)-approved personal flotation device (PFD; see cold stress section for cold-weather PFD information) • Modified Level D—Long pants, long sleeves, and/or waterproof coveralls if handling potentially contaminated media, high visibility vest or PFD if on water, and steel-toed footwear conforming to ASTM International (ASTM) F2412-05/ASTM F2413-05 • Depending on activity, the following PPE may also be required: safety glasses/splash goggles, hard hat, or latex inner gloves		**Reviewed by:** Dan Hennessy	**Reviewed Date:** May 5, 2019
		Approved by: Julia Fitts	**Approved Date:** May 8, 2019

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Walking on deck	Pinch points	• Secure any unsecured objects on deck; they may shift quickly in wave, current, or engine acceleration conditions. • Maintain a safe distance from closing mechanisms and moving parts, such as on sampling gear. • Avoid placing your hands or yourself between the boat and the dock or piles.	
	Slips, trips, and falls	• Avoid walking while writing or texting—maintain a heads-up posture. • Be aware of potentially slippery surfaces, including boat decks, riprap, muddy or algae-covered rocks, shoreline plants or seaweed, thick mud, and tripping hazards. Use handrails where available. Wear footwear that has sufficient traction. • Maintain good housekeeping practices. Clean up all spills immediately. • Be aware of weather effects on the work area, including wet and/or frozen ground. • Jumping, running, and horseplay are prohibited. • Be cautious when entering or exiting the vessel, and load/unload items onto/off of the pier or shore once boarded. • Keep all areas clean and free of debris to prevent any trips and falls. • Notify the field team members of any unsafe conditions. • Keep rope lines neatly coiled and stowed. Avoid stepping on or over lines.	• Routinely inspect work area for unsafe conditions.

Job Safety Analysis

General Boating Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
	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.
Walking on deck (continued)	Noise exposure	• Wear hearing protection in high noise environments or when working around heavy machinery or equipment (action level of 85 decibels averaged over an 8-hour day).	• Ensure that hearing protection is available.
Working outdoors	Heat stress	• Adjust work schedules, as necessary, to avoid the hottest part of the day. • Take rest breaks as warranted. • Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods. • Maintain body fluids at normal levels. • Train workers to recognize the symptoms of heat-related illness.	• Review weather forecast prior to field work. • Monitor workers' physical conditions. • Monitor outside temperature versus worker activity.
	Cold stress	• Provide shelter (enclosed, heated environment) to protect personnel during rest periods. • Educate workers to recognize the symptoms of frostbite and hypothermia. • If the combined air and water temperature is below 90 degrees Fahrenheit (˚F), wear a USCG-approved float coat, Mustang-type bib coveralls, or one-piece survival suit. • Have a dry change of clothing available. • Train workers to recognize the symptoms of cold-related illness.	• Review weather forecast prior to field work. • Monitor workers' physical conditions and PPE. • Monitor outside and water temperature versus worker activity and PPE.
	Rain/snow	• Wear appropriate PPE (rain gear). • Be aware of slip hazards, puddles, and electrical hazards when working in wet conditions. • If extremely cold conditions are forecast, consider additional precautions or postponing work activity.	• Review weather forecast prior to field work. • Inspect PPE daily prior to use. • Routinely inspect work area for deteriorating conditions.
	Sunshine	• Have 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

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

Job Safety Analysis

General Boating Activities

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

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 Code of Federal Regulations (CFR) 1910.120(e), including but not limited to initial 40-hour, 8-hour supervisor, and annual 8-hour refresher trainings.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120(f).
- If professional captained vessel is not in use, boat operators must take appropriate state boater safety courses.
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their supervisor during their daily safety meeting.

Job Safety Analysis

Decontamination Activities

Project Name: DSI TBT Bioaccumulation Study	**Project Number:** 080111-01.01	**JSA Number:** 004	**Issue Date:** May 8, 2019
Location: Seattle, Washington	**Contractor:** Anchor QEA, LLC	**Analysis by:** Cindy Fields	**Analysis Date:** May 5, 2019
Work Operation: Decontamination activities	**Superintendent/Competent Person:** Cindy Fields	**Revised by:**	**Revised Date:**
Required Personal Protective Equipment (PPE): • Modified Level D—Long pants, long sleeves, and/or waterproof coveralls if handling potentially contaminated media, high visibility vest or personal flotation device (PFD) if on water, and steel-toed footwear conforming to ASTM International (ASTM) F2412-05/ASTM F2413-05 • Depending on activity, the following PPE may also be required: safety glasses/splash goggles, hard hat, latex inner gloves, and, if boating, U.S. Coast Guard-approved PFD (see cold stress section for cold-weather PFD information)		**Reviewed by:** Dan Hennessy	**Reviewed Date:** May 5, 2019
		Approved by: Julia Fitts	**Approved Date:** May 8, 2019

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
If boating		• Follow the Job Safety Analysis (JSA) for boating activities.	
Decontamination area set up	Vehicle, heavy equipment traffic, or boat traffic in work area	• Wear high-visibility safety vest and hard hat PPE. • Be alert when working around heavy equipment and/or other boats, especially if wearing hearing protection.	• Ensure that safety vests are available for staff and visitors.
	Muscle strain or injuries from improper lifting	• Use proper lifting techniques or ask for assistance with heavy objects. • If boating, avoid carrying objects directly onto or off of the boat; rather, load/unload objects while on the boat to/from the pier/shore.	• Evaluate weight and center of gravity of heavier items prior to lifting or moving.
	Biological hazards (flora [e.g., poison ivy, and poison oak] and fauna [e.g., ticks, bees, spiders, and mosquitoes])	• 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. • Inspect clothing and skin for insects (e.g., ticks) after working in insect-prone areas.

Job Safety Analysis

Decontamination Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Decontamination activities	Injury from hand and power tool operation (e.g., spatula or drill)	• Be aware of sharp edges on hand tools (e.g., spatulas, knives, drill bits, and saw blades). • Be aware of electrical connections and water hazards when working with electric- or battery-operated tools. • Ensure that all tools are working properly; repair or replace defective tools. Repair when unplugged and off. • Keep guards on power tools when not in use.	• Inspect tools to ensure that they are in good working order. • Inspect electrical connections (if applicable). • Inspect tools periodically to ensure dry and clean operation.
	Noise exposure	• Wear hearing protection in high noise environments or when working around heavy machinery or equipment (action level of 85 decibels averaged over an 8-hour day).	• Ensure that hearing protection is available.
	Slips, trips, and falls	• Avoid walking while writing or texting—maintain a heads-up posture. • Be aware of potentially slippery surfaces and tripping hazards. Use handrails where available. Wear footwear that has sufficient traction. • Maintain good housekeeping practices. Clean up all spills immediately. • Be aware of weather effects on the work area, including wet and/or frozen ground. • Jumping, running, and horseplay are prohibited. • Keep all areas clean and free of debris to prevent any trips and falls. • Notify the field team members of any unsafe conditions.	• Routinely inspect work area for unsafe conditions.
	Ingestion of contaminants or decontamination fluids, or skin or eye contact with contaminants or decontamination fluids	• Wear appropriate PPE to prevent/reduce exposure. • Contact 911, as necessary; perform CPR if breathing stops. • Move exposed person away from source of contamination, and rinse mouth. If exposure to skin occurs, promptly wash contaminated skin using soap or mild detergent and water. Rinse eyes with large amounts of water. • Follow decontamination procedures as outlined in the Health and Safety Plan (HASP).	• Ensure that decontamination procedures are on hand and are reviewed. • Ensure that PPE and rinsing water are available.
Working outdoors	Heat stress	• Adjust work schedules, as necessary, to avoid the hottest part of the day. • Take rest breaks as warranted. • Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods. • Maintain body fluids at normal levels. • Train workers to recognize the symptoms of heat-related illness.	• Review weather forecast prior to field work. • Monitor workers' physical conditions. • Monitor outside temperature versus worker activity.

Job Safety Analysis

Decontamination Activities

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Working outdoors (continued)	Cold stress	• Provide shelter (enclosed, heated environment) to protect personnel during rest periods. • Educate workers to recognize the symptoms of frostbite and hypothermia. • Use appropriate cold-weather gear, up to and including Mustang-type bib coveralls or jacket/bib combinations. • Consider additional precautions if working near water in cold weather. • Have a dry change of clothing available. • Train workers to recognize the symptoms of cold-related illness.	• Review weather forecast prior to field work. • Monitor workers' physical conditions and PPE. • Monitor outside and water temperature versus worker activity and PPE.
	Rain/snow	• Wear appropriate PPE (rain gear). • Be aware of slip hazards, puddles, and electrical hazards when working in wet conditions. • If extremely cold conditions are forecast, consider additional precautions or postponing work activity.	• Review weather forecast prior to field work. • Inspect PPE daily prior to use. • Routinely inspect work area for deteriorating conditions.
	Sunshine	• Have sunscreen available for ultraviolet protection. • Have abundant water available to prevent dehydration. • Consider wearing wide-brimmed headwear and light-colored, lightweight, sun-blocking clothing.	• Ensure that sunscreen and water are available.
	Lightning	• Do not begin or continue work until lightning subsides for at least 30 minutes. Disconnect and do not use or touch electronic equipment.	• Obtain weather forecast and updates as needed.
	High winds	• Wear goggles or safety glasses if dust or debris are visible.	• Review weather forecast prior to field work. • Ensure that goggles or safety glasses are available.

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 Code of Federal Regulations (CFR) 1910.120(e), including but not limited to initial 40-hour, 8-hour supervisor, and annual 8-hour refresher trainings.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120(f).

Decontamination Activities

- If boating is involved, and a professional captained vessel is not in use, boat operators must take the appropriate state boater safety courses.
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their supervisor during their daily safety meeting.

Job Safety Analysis

Anchor QEA Motor Vehicle Operation

Project Name: DSI TBT Bioaccumulation Study	**Project Number:** 080111-01.01	**JSA Number:** 005	**Issue Date:** May 8, 2019
Location: Seattle, Washington	**Contractor:** Anchor QEA, LLC	**Analysis by:** Cindy Fields	**Analysis Date:** May 5, 2019
Work Operation: Anchor QEA motor vehicle operation	**Superintendent/Competent Person:** Vehicle Driver	**Revised by:**	**Revised Date:**
Required Personal Protective Equipment (PPE): • Wear seat belt at all times • Make sure that clothing will not interfere with driving		**Reviewed by:** Dan Hennessy	**Reviewed Date:** May 5, 2019
		Approved by: Julia Fitts	**Approved Date:** May 8, 2019

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Anchor QEA motor vehicle operation	Unfamiliar with the vehicle	• Allow yourself some time to get familiar with an Anchor QEA vehicle, a rental vehicle, or one not used often. • Test the lights, windshield wipers, hazard lights, horn, parking brake, and other important functions. • Review the dashboard controls, steering radius, and overhead and side clearances. • Allow extra side, front, and back space around the vehicle while driving or parking an unfamiliar vehicle. • Adjust mirrors and the seat while the vehicle is in park. • Drive slowly in confined locations, as in a parking garage, parking lots, or industrial settings. Confirm adequate clearances by sight before turning or backing up in tight or unfamiliar locations. • Use a second person to be a spotter outside the vehicle if needed in tight spaces.	• Inspect fluid levels and air pressure in tires, adjust mirrors and seat positions appropriately, monitor the fuel level, and fill up when the fuel level is low
	Speed and Braking	• Fasten and properly adjust the seat belt. • Obey all posted and designated speed limits. • Radar detectors are prohibited in all company-owned, leased, or rented vehicles. • Reduce travel speed during hazardous conditions (e.g., rain, fog, or snow). • Identify whether your vehicle has Anti-Lock Brakes (ABS). If it does, DO NOT pump the brakes to stop when the vehicle has begun to skid. Apply steady pressure to the brakes. If the vehicle does not have ABS, pump the brakes to stop during slippery conditions.	• Seatbelt • Identify designated speed limits • Determine if vehicle has ABS

Job Safety Analysis

Anchor QEA Motor Vehicle Operation

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Anchor QEA motor vehicle operation (continued)	Distance spacing	• Continually check your rear and side view mirrors. • Use the 3-second rule to keep a safe distance between vehicles. • Increase the 3-second rule as necessary during hazardous travel conditions. • Regularly scan the area you will be entering in the next 10 to 12 seconds. • Always leave yourself an "out" during travel. • When stopping, make sure that you leave enough distance between you and the car in front of you. You should be able to see the rear tires of the vehicle in front when stopped. • Obey the speed limit and traffic regulations. • When at a red light and it turns green, use the "delayed start" technique, by counting to three before you take your foot off the brake. • DO NOT TAILGATE. • Keep headlights (and running lights, if available) on for maximum visibility.	• Seatbelt
	Skids	• If the vehicle has begun to skid out of control, turn the steering wheel in the direction of the skid and re-adjust the wheel, as necessary. • Reduce speed during hazardous travel conditions. • Use 4-wheel drive, if available, when driving vehicles off-road, on steep inclines, or in muddy conditions. • Do not take vehicles off-road if they cannot be operated safely in such conditions.	• Seatbelt
	Blind spots	• Become familiar with any blind spots associated with your vehicle. • Adjust mirrors to give the maximum viewing area. • Use your directional devices to signal all turns and when changing lanes; check rear and side view mirror and glance over your shoulder to check that the lane is clear. • Avoid other driver's blind spots; slow down and let the other vehicle pass. • If parked for an extended period and staying in the vehicle, be sure to inspect the area for changed conditions (e.g., a car that moved in behind you) before leaving.	• Seatbelt • Mirrors
	Backing	• Back into parking spaces upon arrival whenever possible. • Perform a 360-degree walk around the vehicle before backing to identify any new conditions or obstructions. • Use a spotter when backing whenever possible. • Understand hand signals. • Sound the horn prior to backing. • Check the rear and side view mirrors prior to backing. • Back slowly in areas of obstructed vision. • Anticipate others who may be backing out into your pathway and adjust accordingly.	• Seatbelt • Mirrors

Job Safety Analysis

Anchor QEA Motor Vehicle Operation

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Anchor QEA motor vehicle operation (continued)	Distractions (e.g., cell phones, reading maps or directions, eating)	• Do not engage in distracted driving—focus on operating the vehicle, and on your surroundings (e.g., road conditions and other drivers). • Obey state or local laws regarding cell phone use, at a minimum. • Certain clients prohibit cell phone use regardless of the state you are operating in—know your client's policy. • Use hands-free devices (not hand-held cellular phones) while driving. • Pull over to the side of the road when making a call or checking directions.	• Seatbelt • Hands-free devices connected and ready for use
	Accidents	• In the event of an accident, use the following procedures: – Stop, call for medical assistance, notify police, and complete an accident report and submit it to your supervisor. – Notify the Project Manager (PM) and Field Lead (FL). – Complete the appropriate incident investigation reports. – Contact Debbie Ashton, Operations Manager, at (503) 924-6172. – Contact Diana Reynolds, Insurance Liaison, at (302) 236-8403.	• Seatbelt
	Influenced by drugs or alcohol	• NEVER DRIVE UNDER THE INFLUENCE OF DRUGS OR ALCOHOL. • Keep in mind that the person in another vehicle may be under the influence of controlled substances and be prepared for erratic or sudden driving changes on their part.	• Seatbelt
	Driver attitude	• Do not operate any vehicle when abnormally tired, temporarily disabled (i.e., injured), or under the influence of drugs or alcohol. • Keep an even temper when driving. Do not let the actions of others affect your attitude. • Do not allow yourself to become frustrated, rushed, distracted, or drowsy.	• Seatbelt
	Fatigue	• Stop and rest if fatigued. Exit the road and enter a safe area. Rest until fully refreshed. • Be aware that certain medications (such as cold or allergy medicines) may make you drowsy when driving a vehicle.	• Seatbelt
	Vehicle loading	• DO NOT OVERLOAD the vehicle. • Secure all equipment and supplies within the body of the vehicle using proper tie-downs. • Do not block side view mirrors with the load. • Do not transport U.S. Department of Transportation (DOT)-manifested hazardous materials. • Dispatch all equipment and personnel with proper forms and identification.	• Seatbelt

Job Safety Analysis

Anchor QEA Motor Vehicle Operation

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Anchor QEA motor vehicle operation (continued)	Equipment failure	• Perform daily inspections of your vehicle. • Maintain vehicle safety equipment (e.g., mirrors, alarms, horns, wipers, lights, and brakes). • Maintain the vehicle (e.g., tire pressure and fluid levels). • Any vehicle with mechanical defects that may endanger the safety of the driver, passengers, or the public shall not be used. • Ensure that appropriate safety equipment is in the vehicle. Safety equipment should include a spare tire, jack, first-aid kit, fire extinguisher, and flashlight. Flares and/or reflective triangles should be available in larger trucks. • Ensure that the proper documentation is in the vehicle. Documentation should include an operations manual for the vehicle, insurance card, vehicle registration, and accident forms.	• Inspect and maintain the vehicle

Training Requirements:

- All drivers are required to have a valid driver's license, and all vehicles must have appropriate state vehicle registration and inspection stickers. The use of hand-held wireless devices is prohibited while driving any vehicle for business use at any time, for personal use during business hours, and as defined by law.
- **If operating a vehicle or vehicle and trailer with a capacity greater than 10,000 pounds, U.S. Department of Transportation regulations may apply. Contact the PM prior to any travel in this configuration.**
- All assigned employees are required to read, familiarize themselves with the contents of this Job Safety Analysis and review it with their supervisor during their daily safety meeting.

Job Safety Analysis

Sample and Laboratory Glassware Handling

Project Name: DSI TBT Bioaccumulation Study	**Project Number:** 080111-01.01	**JSA Number:** 006	**Issue Date:** May 8, 2019
Location: Seattle, Washington	**Contractor:** Anchor QEA, LLC	**Analysis by:** Cindy Fields	**Analysis Date:** May 5, 2019
Work Operation: Sample and laboratory glassware handling	**Superintendent/Competent Person:** Cindy Fields	**Revised by:**	**Revised Date:**
Required Personal Protective Equipment (PPE): • Modified Level D—Long pants, long sleeves, and/or waterproof coveralls if handling potentially contaminated media, and steel-toed footwear conforming to ASTM International (ASTM) F2412-05/ASTM F2413-05 • Depending on activity, the following PPE may also be required: safety glasses/splash goggles, hard hat, latex inner gloves, and, if boating, U.S. Coast Guard-approved personal flotation device (PFD)		**Reviewed by:** Dan Hennessy	**Reviewed Date:** May 5, 2019
		Approved by: Julia Fitts	**Approved Date:** May 8, 2019

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Transporting and using glassware	Breakage of containers during field activities	• Use appropriately sized tubs or bottle carriers with dividers to prevent bottle-to-bottle contact during transport. • Consider using coated glassware, if practicable. • Carry oversize bottles in tubs or bottle carriers using both hands during transfer to the sampling vessel and whenever the vessel is underway.	• Ensure dividers are sufficient and will remain in place during transport.
	Faulty glassware	• Replace any glassware that is chipped, nicked, or cracked.	• Inspect glassware before use.
	Impact with equipment and other objects	• Use care when loading and unloading sampling equipment. • Minimize the handling of individual containers to the extent possible.	--
Filling sample containers	Over-tightening of bottle lids causing breakage	• Avoid use of excessive force to tighten bottle caps (i.e., finger tight). • Secure lids with clear tape to prevent opening during transport.	--
	Breakage during sample collection	• Place containers in plastic tubs between aliquots to limit contact with hard surfaces. • Place containers on a stable and non-slip surface during collection. • Use the buddy system as needed to hold bottles during filling.	--

Job Safety Analysis

Sample and Laboratory Glassware Handling

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Filling sample containers (continued)	Contact with sample preservatives (generally HCL or H_2SO_4 to lower pH to less than 2)	• Wear nitrile gloves and protective eyewear to prevent skin and eye contact if a container is damaged. • Do not open preserved bottles until necessary.	--
Packing samples for shipment	Breakage during packing and shipment	• Use bottle wraps, foam sleeves, or bubble wrap to prevent bottle contact in the cooler. • Pack coolers snugly, but do not over pack.	• Ensure glass bottles do not touch to minimize potential breakage during transport.

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 Code of Federal Regulations (CFR) 1910.120(e), including, but not limited to initial 40-hour, 8-hour supervisor, and annual 8-hour refresher trainings.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120(f).
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their supervisor during their daily safety meeting.

Job Safety Analysis

Investigation-Derived Waste Management

Project Name: DSI TBT Bioaccumulation Study	**Project Number:** 080111-01.01	**JSA Number:** 007	**Issue Date:** May 8, 2019
Location: Seattle, Washington	**Contractor:** Anchor QEA, LLC	**Analysis by:** Cindy Fields	**Analysis Date:** May 5, 2019
Work Operation: Investigation-derived waste management	**Superintendent/Competent Person:** Cindy Fields	**Revised by:**	**Revised Date:**
Required Personal Protective Equipment (PPE): • Modified Level D—Long pants, long sleeves, and/or waterproof coveralls if handling potentially contaminated media, high visibility vest or personal flotation device (PFD) if on water, and steel-toed footwear conforming to ASTM International (ASTM) F2412-05/ASTM F2413-05 • Depending on activity, the following PPE may also be required: safety glasses/splash goggles, hard hat, latex inner gloves, and, if boating, U.S. Coast Guard-approved PFD (see cold stress section for cold-weather PFD information)		**Reviewed by:** Dan Hennessy	**Reviewed Date:** May 5, 2019
		Approved by: Julia Fitts	**Approved Date:** May 8, 2019

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Containerizing investigation-derived waste (IDW) at the source	Lifting	• Use care when lifting to redistribute IDW from one container (e.g., drums and buckets) to another at the source. • Seek assistance if loads are too heavy, or if you are experiencing fatigue. • Fill containers only to the degree that will be manageable in the future (e.g., half full) and to limit weight.	• Inspect containers for competency (i.e., no cracks, and handles in good repair).
	Pinch points	• Wear hand protection when closing containers. • Use the buddy system when affixing drum rings.	• Inspect drums for rust or sharp edges prior to opening or closing.
Relocating or staging IDW containers	Lifting	• Use task-specific tools whenever possible to move full containers (i.e., hoists, drum caddies or dollies, and vehicles). • When task-specific tools are not available, use the buddy system to move containers that are reasonable to lift. • Never roll drums or containers holding IDW. • Stage containers in areas protected from heavy traffic and weather, if possible.	• Ensure tools are in good repair. • Assess IDW container weight prior to moving.

Job Safety Analysis

Investigation-Derived Waste Management

Work Activity	Potential Hazards	Preventive or Corrective Measures	Inspection Requirements
Relocating or staging IDW containers (continued)	Pinch points or crushing	• Use tools to achieve the final arrangement when staging containers—do not place hands on the edges of containers while moving them into place. • Stand well clear of containers being moved in case they become dislodged from their handling tool during transport. • Do not stack IDW containers, as this poses a risk for container toppling and damage. • Place containers on a wooden pallet for easy transfer using a pallet jack, if possible.	• Inspect drums for evidence of cracks or rust.
IDW management – general	Splash	• Wear the required PPE at all times. • Use care to minimize splashing or smearing of IDW during handling and containerization.	• Inspect PPE upon donning and periodically during tasks.

Training Requirements:

- All personnel working on hazardous waste sites must receive appropriate training as required by 29 Code of Federal Regulations (CFR) 1910.120(e), including but not limited to initial 40-hour, 8-hour supervisor, and annual 8-hour refresher trainings.
- Medical clearance must be received on an annual basis as required by 29 CFR 1910.120(f).
- All assigned employees are required to familiarize themselves with the contents of this JSA before starting a work activity and review it with their supervisor during their daily safety meeting.

Attachment C-3
Safety Data Sheets (SDS)

MSDS Number: **A2052** * * * * * *Effective Date:* ***08/03/07*** * * * * * *Supercedes:* ***02/16/06***

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

J.T.Baker®

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300
National Response In Canada
CANUTEC: 613-996-6666
Outside U.S. And Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

ALCONOX®

1. Product Identification

Synonyms: Proprietary blend of sodium linear alkylaryl sulfonate, alcohol sulfate, phosphates, and carbonates.
CAS No.: Not applicable.
Molecular Weight: Not applicable to mixtures.
Chemical Formula: Not applicable to mixtures.
Product Codes: A461

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Alconox® proprietary detergent mixture	N/A	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

CAUTION! MAY BE HARMFUL IF SWALLOWED OR INHALED. MAY CAUSE IRRITATION TO EYES AND RESPIRATORY TRACT.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 1 - Slight
Flammability Rating: 0 - None
Reactivity Rating: 0 - None
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES; LAB COAT; PROPER GLOVES
Storage Color Code: Green (General Storage)

Potential Health Effects

Inhalation:
May cause irritation to the respiratory tract. Symptoms may include coughing and shortness of breath.
Ingestion:
May cause irritation to the gastrointestinal tract. Symptoms may include nausea, vomiting and diarrhea.
Skin Contact:
No adverse effects expected.
Eye Contact:
May cause irritation, redness and pain.
Chronic Exposure:
No information found.
Aggravation of Pre-existing Conditions:
No information found.

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4. First Aid Measures

Inhalation:
Remove to fresh air. Get medical attention for any breathing difficulty.
Ingestion:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention.
Skin Contact:
Wash exposed area with soap and water. Get medical advice if irritation develops.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

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5. Fire Fighting Measures

Fire:
Not expected to be a fire hazard.
Explosion:
No information found.
Fire Extinguishing Media:
Dry chemical, foam, water or carbon dioxide.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus

with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Pick up and place in a suitable container for reclamation or disposal, using a method that does not generate dust. When mixed with water, material foams profusely. Small amounts of residue may be flushed to sewer with plenty of water.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Moisture may cause material to cake. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
None established.
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures as low as possible. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
For conditions of use where exposure to dust or mist is apparent and engineering controls are not feasible, a particulate respirator (NIOSH type N95 or better filters) may be worn. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P filter. For emergencies or instances where the exposure levels are not known, use a full-face positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:
Wear protective gloves and clean body-covering clothing.
Eye Protection:
Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
White powder interspersed with cream colored flakes.
Odor:
No information found.
Solubility:
Moderate (1-10%)

Specific Gravity:
No information found.
pH:
No information found.
% Volatiles by volume @ 21C (70F):
0
Boiling Point:
No information found.
Melting Point:
No information found.
Vapor Density (Air=1):
No information found.
Vapor Pressure (mm Hg):
No information found.
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
Carbon dioxide and carbon monoxide may form when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
No information found.
Conditions to Avoid:
No information found.

11. Toxicological Information

No LD50/LC50 information found relating to normal routes of occupational exposure.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Alconox®	No	No	None
proprietary detergent mixture			

12. Ecological Information

Environmental Fate:
This product is biodegradable.
Environmental Toxicity:

No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------------------------------

Ingredient	TSCA	EC	Japan	Australia
Alconox®	Yes	No	No	No
proprietary detergent mixture				

--------\Chemical Inventory Status - Part 2\---------------------------------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Alconox®	No	No	Yes	No
proprietary detergent mixture				

--------\Federal, State & International Regulations - Part 1\----------------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Alconox®	No	No	No	No
proprietary detergent mixture				

--------\Federal, State & International Regulations - Part 2\----------------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Alconox®	No	No	No
proprietary detergent mixture			

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: No Fire: No Pressure: No
Reactivity: No (Pure / Solid)

Australian Hazchem Code: None allocated.
Poison Schedule: None allocated.

WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

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16. Other Information

NFPA Ratings: Health: **0** Flammability: **0** Reactivity: **0**
Label Hazard Warning:
CAUTION! MAY BE HARMFUL IF SWALLOWED OR INHALED. MAY CAUSE IRRITATION TO EYES AND RESPIRATORY TRACT.
Label Precautions:
Avoid contact with eyes.
Keep container closed.
Use with adequate ventilation.
Avoid breathing dust.
Wash thoroughly after handling.
Label First Aid:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of eye contact, immediately flush eyes with plenty of water for at least 15 minutes. In all cases, get medical attention.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 3.
Disclaimer:
****

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****

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

Attachment C-4
Certifications

Health & Safety Summary

Cindy Fields

Training	Date	Notes
CPR, AED and First Aid - 2 yrs.	6/3/2019	American Red Cross
Bloodborne Pathogens Course	4/3/2019	In-house Seattle
8 Hour Refresher	4/3/2019	In-house Seattle
Smith System Distracted Driving Course	3/29/2018	in house
8 Hour Refresher	3/29/2018	in house
D&A Client Mandated Testing Policy Letter	3/2/2018	
Background Checks	3/2/2018	
CPR, AED and First Aid - 2 yrs.	5/24/2017	ARC
8 Hour Refresher	3/30/2017	in house
8 HR Initial Supervisor	3/29/2016	in house
8 Hour Refresher	3/28/2016	in house
Five Keys to Safe Driving - SVFM	5/5/2015	in-house training
8 Hour Refresher	3/31/2015	in house
Smith System Distracted Driving Course	3/12/2015	Seattle In-house
Hazard Communication Training	11/21/2013	in-house training
CPR/AED - 2 yr.	4/18/2013	ARC
First Aid - 2 yr	4/18/2013	ARC
Tailgate Safety Meeting	3/11/2013	Port of Olympia Budd Inlet
Initial Field Experience with 40-Hr HAZWOPER	3/6/2013	Supervised 3-day field experience
Tailgate Safety Meeting	3/6/2013	Port of Olympia Budd Inlet
40 Hour Hazwoper	3/2/2013	Safety Unlimited

Certificate of Completion

Cindy Fields
has completed requirements for

Adult First Aid/CPR/AED

conducted by
American Red Cross

Date completed: 06/03/2019
Validity Period: 2 Years

Certificate ID: GXW1WL

American Red Cross

Scan code or visit:
redcross.org/confirm

ANCHOR QEA

CERTIFICATE OF COMPLETION

This certifies that

Cindy Fields

has successfully completed

8-hour HAZWOPER Refresher Training

in accordance with 29 CFR 1910.120(e)

C R Torell

Christopher R. Torell, P.G., CSP
Instructor

April 3, 2019
Issue Date

Certificate of Training

This is to certify that

Cindy Fields

(name of employee)

has successfully completed the training program

Workplace Bloodborne Pathogens

Training was completed on

4/3/19

(date)

Training was conducted by

C.R. Torell P.G., CSP

(name of instructor)

NATIONAL safety COMPLIANCE

www.osha-safety-training.net

Certified by

(Signature of Instructor)

ANCHOR QEA

CERTIFICATE OF COMPLETION

This certifies that

Cindy Fields

has successfully completed

8-hour HAZWOPER Refresher Training

in accordance with 29 CFR 1910.120(e)

C R Torell

Christopher R. Torell, P.G., CSP
Instructor

March 29, 2018
Issue Date

SMITH SYSTEM®

Certificate of Completion

Anchor QEA, LLC
720 Olive Way, #1900, Seattle, WA 98101

Cindy Fields — March 29, 2018

Student — Date

This certifies that this participant has successfully completed the Smith System® Driving Distracted Course

Smith System®
Driver Improvement Institute, Inc.
Arlington, Texas
800-777-7648

Certificate of Completion

Cindy Fields
has completed requirements for
Adult First Aid/CPR/AED
conducted by
American Red Cross
Date completed: 05/24/2017
Validity Period: 2 Years
Certificate ID: GUNWPT

American Red Cross

Scan code or visit:
redcross.org/confirm

ANCHOR QEA

CERTIFICATE OF COMPLETION

This certifies that

CINDY FIELDS

has successfully completed

8-hour HAZWOPER Refresher Training

in accordance with 29 CFR 1910.120(e)

C R Torell

Christopher R. Torell, P.G., CSP
Instructor

March 30, 2017
Issue Date

ANCHOR QEA

CERTIFICATE OF COMPLETION

This certifies that

Cindy Fields

has successfully completed

8-hour HAZWOPER Initial Supervisor Refresher Training

in accordance with 29 CFR 1910.120(e)

C R Torell

Christopher R. Torell, P.G., CSP
Instructor

March 29, 2016
Issue Date

ANCHOR QEA

CERTIFICATE OF COMPLETION

This certifies that

Cindy Fields

has successfully completed

8-hour HAZWOPER Refresher Training

in accordance with 29 CFR 1910.120(e)

C R Torell

Christopher R. Torell, P.G., CSP
Instructor

March 28, 2016
Issue Date

SMITH SYSTEM®

Certificate of Completion

CINDY FIELDS — **MAY 5, 2015**

Student — Date

This certifies that this participant has
successfully completed the Smith System®
Five Keys to Safe Driving - Small Vehicle Forward Motion

Smith System®
Driver Improvement Institute, Inc.
Arlington, Texas
800-777-7648

SMITH SYSTEM®

Certificate of Completion

CINDY FIELDS — MARCH 12, 2015

Student — Date

This certifies that this participant has
successfully completed the Smith System®
Smith System - Distracted Driving

Smith System®
Driver Improvement Institute, Inc.
Arlington, Texas
800-777-7648

ANCHOR QEA

CERTIFICATE OF COMPLETION

This certifies that

Cindy Fields

has successfully completed

8-hour HAZWOPER Refresher Training

in accordance with 29 CFR 1910.120(e)

C R Torell

Christopher R. Torell, P.G., CSP
Instructor

March 31, 2015
Issue Date

Health & Safety Training

Documentation of Field Experience

The 40 Hour HAZWOPER course is specifically designed for workers who are involved in clean-up operations, voluntary clean-up operations, emergency response operations, and storage, disposal, or treatment of hazardous substances or uncontrolled hazardous waste sites. This course covers topics included in 29 CFR 1910.120.

Workers must also have 40 hours of initial training before they may enter the site and at least **three (3) days of actual field experience** under a trained seasoned supervisor. The three days field experience under a trained, experience supervisor is the responsibility of the student, employer, or potential employer.

Trainees must have additional hands-on training in the donning, doffing, and the use of the Personal Protective Equipment (PPE) required for their jobsite(s) in accordance with 29 CFR 1910.120.

Learning Objectives:

- Understand the purpose of OSHA and its role in regulating occupational safety
- Use Site Characterization to establish problems that may exist in your workplace and measures that can be implemented to eliminate hazards
- Identify hazardous materials existent in the workplace and the possible methods, symptoms and preventable measures of exposure
- Encourage the use of Material Safety Data Sheets (MSDS) to identify and properly handle hazardous materials
- Familiarize yourself with materials, compounds and mixtures, that may present flammable, explosive, chemical or radiological hazards
- Emphasize the importance of personal protective equipment in limiting hazardous exposure
- Establish an effective Site Control Program to limit the risk of exposure to only those working in the hazardous work zone
- Implement procedures for treating workers in the event of hazardous exposure

Sign below when training is completed and return to the Health and Safety Manager.

3-DAY FIELD EXPERIENCE AS PER 29 CFR 1910.120				
Employee Name	Supervisor	Date	Hours	Site
Cindy Fields	Joyce Dorsey	3/6/2013	10	Port of Olympia
		3/7/2013	10	
		3/11/2013	11.5	
		3/12/2013	9.5	

American Red Cross

This recognizes that

Cindy Fields

has completed the requirements for

Adult First Aid/CPR/AED

conducted by

American Red Cross

Date completed: 04/18/13

The American Red Cross

recognizes this Certificate is valid from completion date for 2 years

redcross.org

Instructor's Signature

Ashley Pellicano

Chapter

American Red Cross

Holder's Signature

Cindy L Fields

Stock No. 656798

S70211

Certificate of Completion

This certifies that

Cindy Fields

Has Successfully completed

OSHA 40 Hour HAZWOPER Training

Annual Refresher Training Required

In Accordance With Federal OSHA Regulation 29 CFR 1910.120(e)

And State OSHA/EPA Regulations as well including 29 CFR 1926.65(e)

This course is approved for 40 Contact Hours (4 CEUs) of continuing education per the California Department of Public Health for Registered Environmental Health Specialist (REHS) issued by Safety Unlimited, Inc. (Accreditation # 044)

Julius P. Griggs
Julius P. Griggs
Instructor #892

130302173900
Certificate Number

3/2/2013
Issue Date

SAFETY UNLIMITED, Inc.
OSHA Compliant Safety Training Since 1993

2139 Tapo St., Suite 228 Simi Valley, CA 93063
888 309-SAFE (7233) or 805 306-8027 866-869-7097 (fax)
www.safetyunlimited.com

Want to be sure this certificate is valid? Visit safetyunlimited.com/verification

Health & Safety Summary

Daniel Hennessy

Training	Date	Notes
8 Hour Refresher	3/30/2019	Safety Unlimited
Smith System Distracted Driving Course	4/2/2018	in house
8 Hour Refresher	4/2/2018	in house
8 Hour Refresher	4/3/2017	in house
CPR, AED and First Aid - 2 yrs.	3/24/2017	ARC
8 Hour Refresher	4/21/2016	Safety Unlimited
8 Hour Refresher	3/31/2015	IN HOUSE
Smith System Distracted Driving Course	10/7/2014	In-House
8 Hour Refresher	6/6/2014	Safety Unlimited
Hazard Communication Training	12/2/2013	In-house Training
CPR/AED - 2 yr.	3/28/2013	ARC
First Aid - 2 yr	3/28/2013	ARC
8 Hour Refresher	1/3/2013	Safety Unlimited
8 Hour Refresher	12/14/2011	Safety Unlimited
8 Hour Refresher	4/29/2010	Safety Unlimited
8 Hour Refresher	12/8/2008	AdvanceOnline Online Institute
CPR	12/8/2008	American Red Cross
First Aid - 3 yr.	12/8/2008	American Red Cross
8 Hour Refresher	11/5/2007	Safety Unlimited, Inc.
8 Hour Refresher	2/17/2006	AdvanceOnline Online Institute
First Aid - 3 yr.	7/20/2005	ARC
CPR	7/20/2005	American Red Cross
8 Hour Refresher	1/26/2005	AdvanceOnline Online Institute
8 Hour Refresher	9/12/2003	AdvanceOnline Online Institute
8 Hour Refresher	11/14/2001	FOSS Environmental
8 Hour Refresher	11/10/2000	Compliance Safety
8 Hour Refresher	6/7/1999	Compliance Solutions
8 Hour Refresher	1/28/1998	Compliance Solutions
8 Hour Refresher	2/20/1996	Prezant
40 Hour Hazwoper	12/4/1994	Baxter Reilley

Certificate of Completion

This certifies that

Daniel Hennessy

has successfully completed

8 Hour HAZWOPER Refresher Training

Refresher certification does NOT necessarily indicate initial 24 or 40 Hour HAZWOPER certification

In Accordance w/Federal OSHA Regulation 29 CFR 1910.120(e) & (p)

And all State OSHA/EPA Regulations as well including 29 CFR 1926.65 for Construction.

This course (Version 2) is approved for 8 Contact Hours (0.8 CEUs) of continuing education per the California Department of Public Health for Registered Environmental Health Specialist (REHS) (Accreditation # 044).

Julius P. Griggs
Julius P. Griggs
Instructor #892

1903305164712
Certificate Number

3/30/2019
Issue Date

SAFETY UNLIMITED, Inc.
OSHA Compliant Safety Training Since 1993

2139 Tapo St., Suite 228 Simi Valley,CA 93063
(888) 309-SAFE (7233) or 805 306-8027
https://www.safetyunlimited.com

Scan this code or visit www.safetyunlimited.com/v to verify certificate.

Proof of initial certification and subsequent refresher training is NOT required to take refresher training

ANCHOR QEA

CERTIFICATE OF COMPLETION

This certifies that

Dan Hennessy

has successfully completed

8-hour HAZWOPER Refresher Training

in accordance with 29 CFR 1910.120(e)

C R Torell

Christopher R. Torell, P.G., CSP
Instructor

April 2, 2018
Issue Date

SMITH SYSTEM®

Certificate of Completion

Anchor QEA, LLC
1605 Cornwall Avenue, Bellingham, WA 98225

Dan Hennessy — April 2, 2018

Student — Date

This certifies that this participant has successfully completed the Smith System® Driving Distracted Course

Smith System®
Driver Improvement Institute, Inc.
Arlington, Texas
800-777-7648

ANCHOR QEA

CERTIFICATE OF COMPLETION

This certifies that

Dan Hennessy

has successfully completed

8-hour HAZWOPER Refresher Training

in accordance with 29 CFR 1910.120(e)

C R Torell

Christopher R. Torell, P.G., CSP
Instructor

April 3, 2017
Issue Date

American Red Cross

Certificate of Completion

Dan Hennessy
has successfully completed requirements for

Adult First Aid/CPR/AED - valid 2 Years

conducted by
American Red Cross

Date Completed: **03/24/2017**
Instructors: **CHRISTINE CONSTANCE BETCHLEY**

Certificate ID: 0ZIX2V

To verify, scan code or visit:
redcross.org/confirm

American Red Cross

Certificate of Completion

Dan Hennessy

has successfully completed requirements for

Adult First Aid/CPR/AED - valid 2 Years

conducted by

American Red Cross

Date Completed: **03/24/2017**

Instructors: **CHRISTINE CONSTANCE BETCHLEY**

Certificate ID: 0ZIX2V

To verify, scan code or visit: redcross.org/confirm

Certificate of Completion

This certifies that

Daniel Hennessy

Has Successfully completed

8 Hour HAZWOPER Refresher Training

Refresher certification does NOT necessarily indicate initial 24 or 40 Hour HAZWOPER certification

In Accordance w/Federal OSHA Regulation 29 CFR 1910.120(e) & (p)

And all State OSHA and EPA Regulations As Well

This course (Version 1) is approved for 8 Contact Hours (0.8 CEUs) of continuing education per the California Department of Public Health for Registered Environmental Health Specialist (REHS) issued by Safety Unlimited, Inc. (Accreditation # 044)

Julius P. Griggs
Julius P. Griggs
Training Director

1604215164712
Certificate Number

4/21/2016
Issue Date

SAFETY **UNLIMITED, Inc.**
OSHA Compliant Safety Training Since 1993

2139 Tapo St., Suite 228 Simi Valley, CA 93063
888 309-SAFE (7233) or 805 306-8027 866-869-7097 (fax)
www.safetyunlimited.com

Proof of initial certification and subsequent refresher training is NOT required to take refresher training
Want to be sure this certificate is valid? Visit safetyunlimited.com/verification

ANCHOR QEA

CERTIFICATE OF COMPLETION

This certifies that

Daniel Hennessy

has successfully completed

8-hour HAZWOPER Refresher Training

in accordance with 29 CFR 1910.120(e)

C R Torell

Christopher R. Torell, P.G., CSP
Instructor

March 31, 2015
Issue Date

Certificate of Completion

This certifies that

Daniel P Hennessy

Has Successfully completed

8 Hour HAZWOPER Refresher Training

Refresher certification does NOT necessarily indicate initial 24 or 40 Hour HAZWOPER certification

In Accordance w/Federal OSHA Regulation 29 CFR 1910.120(e) & (p)

And all State OSHA and EPA Regulations As Well

This course is approved for 8 Contact Hours (0.8 CEUs) of continuing education per the California Department of Public Health for Registered Environmental Health Specialist (REHS) issued by Safety Unlimited, Inc. (Accreditation # 044)

Julius P. Griggs	140606527702	6/6/2014
Julius P. Griggs Instructor #892	Certificate Number	Issue Date

SAFETY UNLIMITED, Inc.
OSHA Compliant Safety Training Since 1993

2139 Tapo St., Suite 228 Simi Valley, CA 93063
888 309-SAFE (7233) or 805 306-8027 866-869-7097 (fax)
www.safetyunlimited.com

Proof of initial certification and subsequent refresher training is NOT required to take refresher training
Want to be sure this certificate is valid? Visit safetyunlimited.com/verification

SMITH SYSTEM

Certificate of Completion

Dan Hennessy October 7, 2014

Student Date

This certifies that this participant has
successfully completed the Smith System®
Smith System - Distracted Driving

Smith System®
Driver Improvement Institute, Inc.
Arlington, Texas
800-777-7648

CERTIFICATE *of* COMPLETION

This is to certify that:

Dan Hennessy

has attended

Course Title - Adult First Aid/CPR/AED

and has successfully completed the following elements

Adult First Aid/CPR/AED : valid 2 Years

Conducted by Arne Hanna Aquatic Center

Instructor: Justin Shields

on

03/28/2013

Certificate of Completion

This certifies that

Daniel P Hennessy

Has Successfully completed

8 Hour HAZWOPER Refresher Training

Refresher certification does NOT necessarily indicate initial 24 or 40 Hour HAZWOPER certification

In Accordance W/Federal OSHA Regulation 29 CFR 1910.120(e), (p) & (q)

And all State OSHA and EPA Regulations As Well

This course is approved for 8 Contact Hours (0.8 CEUs) of continuing education per the California Department of Public Health for Registered Environmental Health Specialist (REHS) issued by Safety Unlimited, Inc. (Accreditation # 044)

Julius P. Griggs	130103527702	1/3/2013
Julius P. Griggs Instructor #892	Certificate Number	Issue Date

SAFETY UNLIMITED, Inc.
OSHA Compliant Safety Training Since 1993

2139 Tapo St., Suite 228 Simi Valley, CA 93063
888 309-SAFE (7233) or 805 306-8027 866-869-7097 (fax)
www.safetyunlimited.com

Proof of initial certification and subsequent refresher training is NOT required to take refresher training
Want to be sure this certificate is valid? Visit safetyunlimited.com/verification

Certificate of Completion

This certifies that

Daniel P Hennessy

Has Successfully completed

8 Hour HAZWOPER Refresher Training

Refresher certification does NOT necessarily indicate initial 24 or 40 Hour HAZWOPER certification

In Accordance W/Federal OSHA Regulation 29 CFR 1910.120(e), (p) & (q)

And all State OSHA and EPA Regulations As Well

Julius P. Griggs
Julius P. Griggs
Instructor #892

111214527702
Certificate Number

12/14/2011
Issue Date

SAFETY UNLIMITED, Inc.
OSHA Compliant Safety Training Since 1993

690A East Los Angeles Ave Suite 180 Simi Valley, CA 93065
888-309-7233 * 805-306-8027 * 866-869-7097 (F)
www.safetyunlimited.com

Proof of initial certification and subsequent refresher training is NOT required to take refresher training
Want to be sure this certificate is valid? Visit safetyunlimited.com/verification

Certificate of Completion

This certifies that

Daniel P Hennessy

Has Successfully completed

8 Hour HAZWOPER Refresher Training

Refresher certification does not necessarily indicate initial 24 or 40 Hour HAZWOPER certification

In Accordance With Federal OSHA Regulation 29 CFR 1910.120(e)

And all State OSHA and EPA Regulations As Well

Julius P. Griggs
Julius P. Griggs
Instructor #892

100429527702
Certificate Number

4/29/2010
Issue Date

SAFETY UNLIMITED, Inc.
OSHA Compliant Safety Training Since 1993

690A East Los Angeles Ave Suite 180 Simi Valley, CA 93065
888-309-7233 * 805-306-8027 * 866-869-7097 (F)
www.safetyunlimited.com

Proof of initial certification and subsequent refresher training is NOT required to take refresher training
Want to be sure this certificate is valid? Visit safetyunlimited.com/verification

AdvanceOnline Online Institute

Certificate of Completion

Daniel P. Hennessy

has met the online course completion requirements for

Hazardous Waste Operations and Emergency Response 8-Hour Refresher

This student has spent the amount of time listed below towards the annual refresher requirements in OSHA 29 CFR 1910.120 (a)-(q), Hazardous Waste Operation and Emergency Response. If the Course Time shown is less than 8:00 hours, there should be a supervisor's signature on this certificate. This signature indicates that the student has had supplemental training that, together with this course, meets the 8-hour training requirement.

Certificate ID:	222502	**Date:**	08 December 2008
Continuing Education Units:	0.8	**Time Online:**	3:14

On-site Supervisor's Signature:

X _____ Date: _____

AdvanceOnline

AdvanceOnline
5858 Westheimer Rd. Ste. 405
Houston, TX 77057
Toll Free: 1.866.4BRAINS
http://www.advanceonline.com

This education program meets the Criteria for Certification established by the Authorized Provider Commission of the International Association for Continuing Education and Training, 1200 19th St., NW, Suite 300, Washington, DC 20036-2401.

IACET

American Red Cross

This recognizes that

Dan Hennessy

has completed the requirements for

CPR–Adult

conducted by

Mt Baker Chapter

Date Completed 12/8/2008

The American Red Cross recognizes this certificate as valid for 1 year(s) from completion date.

American Red Cross

This recognizes that

Dan Hennessy

has completed the requirements for

Standard First Aid

conducted by

Mt Baker Chapter

Date Completed 12/8/2008

The American Red Cross recognizes this certificate as valid for 3 year(s) from completion date.

✓

SAFETY UNLIMITED, INC.
OSHA Compliant Safety Training & Consulting
690A East Los Angeles Ave.Suite. 180 Simi Valley , CA 93065
888 309-7233 * 805 306-8027 * 805 526-0377
www.SafetyUnlimited.com

Certifies that

Daniel Hennessy

has successfully completed

8 Hour HAZWOPER Refresher Training

In Accordance With Federal OSHA Regulation 29 CFR 1910.120(e)

Julius P. Griggs
Julius P. Griggs
Instructor #892

11/5/2007
Issue Date

07110549588
Certificate Number

TO VERIFY THE VALIDITY OF THIS CERTIFICATE, go to www.SafetyUnlimited.com/certificate.htm

AdvanceOnline Online Institute

Certificate of Completion

Daniel Hennessy

has met the online course completion requirements for

Hazardous Waste Operations and Emergency Response 8-Hour Refresher

This student has spent the amount of time listed below towards the annual refresher requirements in OSHA 29 CFR 1910.120 (a)-(q), Hazardous Waste Operation and Emergency Response. If the Course Time shown is less than 8:00 hours, there should be a supervisor's signature on this certificate. This signature indicates that the student has had supplemental training that, together with this course, meets the 8-hour training requirement.

Certificate ID:	148860	**Date:**	17 February 2006
Continuing Education Units:	0.8	**Time Online:**	3:17

On-site Supervisor's Signature:

x Dennis Hanglick Date: 19 Feb 2006

AdvanceOnline

AdvanceOnline
5858 Westheimer Rd. Ste. 405
Houston, TX 77057
Toll Free: 1.866.4BRAINS
http://www.advanceonline.com

This education program meets the Criteria for Certification established by the Authorized Provider Commission of the International Association for Continuing Education and Training, 1200 19th St., NW, Suite 300, Washington, DC 20036-2401.

IACET

American Red Cross

Together, we can save a life

This recognizes that

DANIEL HENNESSY

has completed the requirements for

STANDARD FIRST AID

conducted by

RED CROSS OF KING-KITSAP

Date completed **07/20/2005**

The American Red Cross recognizes this certificate as valid for 3 year(s) from completion date.

American Red Cross

Together, we can save a ...

This recognizes that

DANIEL HENNESSY

has completed the requirements for

ADULT CPR

conducted by

RED CROSS OF KING-KITSAP

Date completed **07/20/2005**

The American Red Cross recognizes this certificate as valid for 1 year(s) from completion date.

AdvanceOnline Online Institute

Certificate of Completion

Daniel P. Hennessy

has met the online course completion requirements for

Hazardous Waste Operations and Emergency Response 8-Hour Refresher

This student has spent the amount of time listed below towards the annual refresher requirements in OSHA 29 CFR 1910.120 (a)-(q), Hazardous Waste Operation and Emergency Response. If the Course Time shown is less than 8:00 hours, there should be a supervisor's signature on this certificate. This signature indicates that the student has had supplemental training that, together with this course, meets the 8-hour training requirement.

Certificate ID:	107235	**Date:**	26 January 2005
Continuing Education Units:	0.8	**Time Online:**	3:26

On-site Supervisor's Signature:

x Dennis Hanzlick Date: 26 January 2005

AdvanceOnline™

AdvanceOnline
5858 Westheimer Rd. Ste. 405
Houston, TX 77057
Toll Free: 1.866.4BRAINS
http://www.advanceonline.com

This education program meets the Criteria for Certification established by the Authorized Provider Commission of the International Association for Continuing Education and Training, 1200 19th St., NW, Suite 300, Washington, DC 20036-2401.

IACET

AdvanceOnline Online Institute

Certificate of Completion

Daniel Hennessy

has met the online course completion requirements for

Hazardous Waste Operations and Emergency Response 8-Hour Refresher

This student has spent the amount of time listed below towards the annual refresher requirements in OSHA 29 CFR 1910.120 (a)-(q), Hazardous Waste Operation and Emergency Response. If the Course Time shown is less than 8:00 hours, there should be a supervisor's signature on this certificate. This signature indicates that the student has had supplemental training that, together with this course, meets the 8-hour training requirement.

Certificate ID:	64274	**Date:**	12 September 2003
Continuing Education Units:	0.8	**Time Online:**	3:55

On-site Supervisor's Signature:

X _____ Date: _____

AdvanceOnline™

AdvanceOnline
5305 Shilshole Avenue NW, Suite 200
Seattle, WA 98107
http://institute.advanceonline.com
(206) 826-4000

This education program meets the Criteria for Certification established by the Authorized Provider Commission of the International Association for Continuing Education and Training, 1200 19th St., NW, Suite 300, Washington, DC 20036-2401.

IACET

Certificate of Training

this is to certify that

Dan Hennessy

has successfully completed Annual Refresher Training in Hazardous Waste Operations and Emergency Response (HAZWOPER) & refresher in CPR & First Aid.

In Accordance with 29 CFR 1910.120 & WAC 296-62-3040

on

November 13-14, 2001

PPE Level C
Laws & Regulations
Hazard Communications
Toxicology
Site Safety & Health
Decon
First Aid & CPR

Expires: November 14, 2002

FOSS
ENVIRONMENTAL
Always Ready

Instructor

Paul Gallagher
Operations Manager, Marine Services
20500 Richmond Beach Dr. N.W., Seattle, WA 98177

Compliance Solutions

"Today's Training... Tomorrow's Solution"

6515 E 40th Ave, Suite 116, Denver Colorado 80239 Phone: 800-711-2705

Student Affiliation:
Windward Environmental
99059527

Certificate of Completion

This is to certify that

Dan Hennessy

has successfully completed the classroom requirements for

8 Hour HAZWOPER Refresher

29 CFR 1910.120(e)

Presented

Friday, November 10, 2000

Compliance Solutions Occupational Trainers, Inc.

Certificate Number: 29419

Neval Gupta
Vice President

Larry Erwin
National Training Manager

Compliance Solutions

"Today's Training....Tomorrow's Solution"

10515 E 40th Ave, Suite 116, Denver Colorado
80239 Phone: 800-711-2706

Student Affiliation:

EVS Consultants, Inc.

Certificate of Completion

This is to certify that

Dan Hennessy

has successfully completed the classroom requirements for

8 Hour HAZWOPER Refresher

29 CFR 1910.120(e)

Presented

Monday, June 07, 1999

Compliance Solutions Occupational Trainers, Inc.

Certificate Number: 16251

Neval Gupta
Vice President

Kathleen Shingledecker
Instructor

Compliance Solutions

"Today's Training....Tomorrow's Solution"

Certificate of Completion

This is to certify that

Dan Hennessy

has completed the classroom requirements for the

8 Hour HAZWOPER Refresher-1910.120

Course

Presented this

Wednesday, January 28, 1998

Compliance Solutions Occupational Trainers, Inc.

Certificate Number: 5707

Neval Gupta
V.P. Sales and Marketing

John Labadie, CHMM
Instructor

Certificate of Completion

This is to certify that

Dan Hennessy

has satisfactorily completed

8 hours of refresher training in

Hazardous Waste Operations And Emergency Response

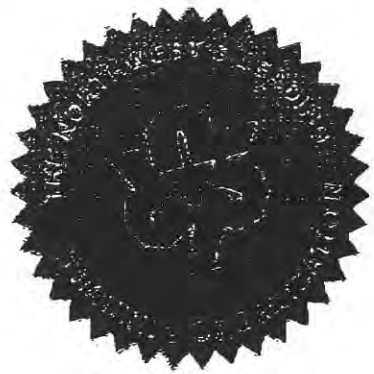
in compliance with OSHA 29 CFR 1910.120

February 20, 1996

Training Administrator

Date Expires 2/20/97

Prezant



Cert. # 96-0379

Prezant Associates, Inc. • 330 Sixth Avenue North, Suite 200 • Seattle, Washington 98109 • (206) 281-8858

BR
Baxter Reilley
Occupational Trainers

BAXTER REILLEY
OCCUPATIONAL TRAINERS

CERTIFY THAT

Daniel P. Hennessy

has successfully completed

40 Hour Hazardous Waste Operations and Emergency Response Course

In compliance with 29 CFR 1910.120

12/2/94

T.W. Reilley
Director of Instruction

Director of Operations

Baxter Reilley Occupational Trainers, 6841 S. Yosemite Rd. Suite 100, Englewood, CO 80112, (800)327-2768

City or Metropolitan Area of class attended: New Jersey

Health & Safety Summary

David Templeton

Training	Date	Notes
8 Hour Refresher	9/28/2018	Safety Unlimited
NASSCO Safety Policy Subcontractor Guidelines	4/30/2018	completed
AQ Internal 4-HR Construction Management H&S Trng	5/5/2017	
Transportation Worker Identification Credential	4/20/2017	Expires 2022
8 Hour Refresher	3/31/2017	in house
8 Hour Refresher	3/30/2016	in house
8 HR Initial Supervisor	3/29/2016	IN HOUSE
8 Hour Refresher	11/4/2015	in house
Railway Safety	4/3/2015	EXPIRES IN THREE YEARS
8 Hour Refresher	4/2/2015	IN HOUSE
Background Checks	3/3/2015	
8 Hour Refresher	8/21/2014	Safety Unlimited
Smith System Distracted Driving Course	5/2/2014	Smith System
Initial Field Experience with 40-Hr HAZWOPER	4/8/2014	24 hours
Hazard Communication Training	11/21/2013	In-House Training
8 Hour Refresher	3/3/2009	RGA Environmental
Transportation Worker Identification Credential	7/4/2008	Expires 2013
Railway Safety	6/23/2008	Union Pacific, BNSF
8 Hour Refresher	9/7/2004	AdvanceOnline Online Institute
8 Hour Refresher	11/14/2002	Foss Environmental
8 Hour Refresher	11/14/2001	Foss Environmental
CPR - 2 yr.	11/13/2001	Foss Environmental
First Aid - 2 yr	11/13/2001	Foss Environmental
8 Hour Refresher	10/12/2000	Foss Environmental
First Aid	8/27/1999	Foss Environmental
CPR	8/27/1999	Foss Environmental
8 Hour Refresher	8/26/1999	Foss Environmental
8 Hour Refresher	4/13/1999	Prezant
8 Hour Refresher Supervisor	10/1/1998	Certificate not in file
40 Hour Hazwoper	10/11/1991	Prezant

ANCHOR QEA

Certificate of Completion

This certifies that

DAVID TEMPLETON

has successfully completed

8 Hour HAZWOPER Refresher Training

Refresher certification does NOT necessarily indicate initial 24 or 40 Hour HAZWOPER certification

In Accordance w/Federal OSHA Regulation 29 CFR 1910.120(e) & (p)

And all State OSHA/EPA Regulations as well including 29 CFR 1926.65 for Construction.

This course (Version 1) is approved for 8 Contact Hours (0.8 CEUs) of continuing education per the California Department of Public Health for Registered Environmental Health Specialist (REHS) (Accreditation # 044).

Julius P. Griggs
Julius P. Griggs
Instructor #892

180928573860
Certificate Number

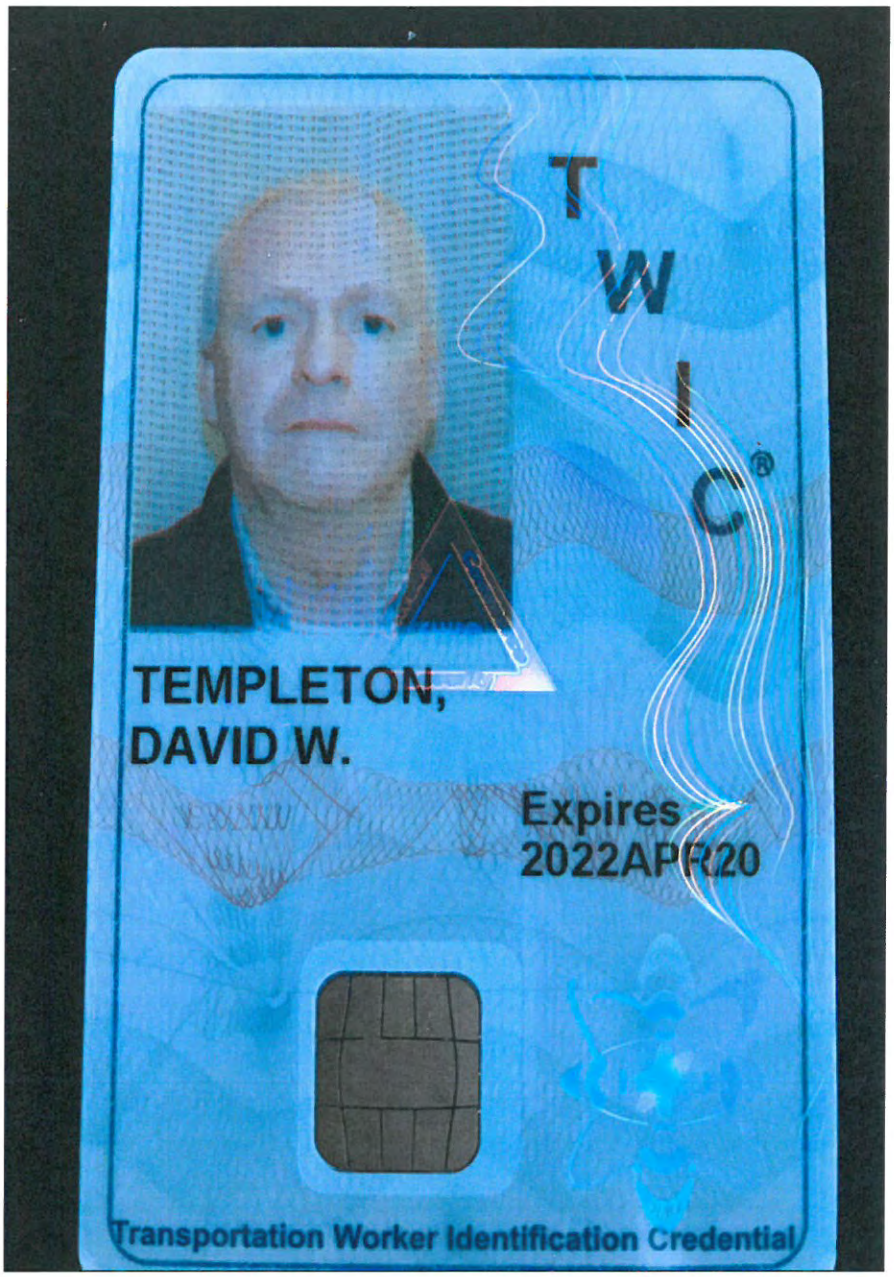
9/28/2018
Issue Date

SAFETY UNLIMITED, Inc.
OSHA Compliant Safety Training Since 1993

2139 Tapo St., Suite 228 Simi Valley,CA 93063
(888) 309-SAFE (7233) or 805 306-8027
https://www.safetyunlimited.com

Scan this code or visit www.safetyunlimited.com/v to verify certificate.

Proof of initial certification and subsequent refresher training is NOT required to take refresher training


TWIC®
TEMPLETON,
DAVID W.
Expires
2022APR20
Transportation Worker Identification Credential

ANCHOR QEA

CERTIFICATE OF COMPLETION

This certifies that

DAVID TEMPLETON

has successfully completed

8-hour HAZWOPER Refresher Training

in accordance with 29 CFR 1910.120(e)

C R Torell

Christopher R. Torell, P.G., CSP
Instructor

March 31, 2017
Issue Date

ANCHOR QEA

CERTIFICATE OF COMPLETION

This certifies that

David Templeton

has successfully completed

8-hour HAZWOPER Refresher Training

in accordance with 29 CFR 1910.120(e)

C R Torell

Christopher R. Torell, P.G., CSP
Instructor

March 30, 2016
Issue Date

ANCHOR QEA

CERTIFICATE OF COMPLETION

This certifies that

David Templeton

has successfully completed

8-hour HAZWOPER Initial Supervisor Refresher Training

in accordance with 29 CFR 1910.120(e)

C R Torell

Christopher R. Torell, P.G., CSP
Instructor

March 29, 2016
Issue Date

ANCHOR QEA

CERTIFICATE OF COMPLETION

This certifies that

David Templeton

has successfully completed

8-hour HAZWOPER Refresher Training

in accordance with 29 CFR 1910.120(e)

C R Torell

Christopher R. Torell, P.G., CSP
Instructor

November 4, 2015
Issue Date

BNSF RAILWAY

UNION PACIFIC

CSX

e-RAILSAFE System Badge

CONTRACTOR

NUMBER	ISSUED	EXPIRES
073132204309	04-03-2015	04-03-2017

David Templeton

PRIMARY EMPLOYER
ANCHOR QEA, LLC.
MAIN OFFICE
1423 Third Avenue Suite 300
Seattle, WA 98101
206-287-9130

ANCHOR QEA

CERTIFICATE OF COMPLETION

This certifies that

David Templeton

has successfully completed

8-hour HAZWOPER Refresher Training

in accordance with 29 CFR 1910.120(e)

C R Torell

Christopher R. Torell, P.G., CSP
Instructor

April 2, 2015
Issue Date

Certificate of Completion

This certifies that

DAVID TEMPLETON

Has Successfully completed

8 Hour HAZWOPER Refresher Training

Refresher certification does NOT necessarily indicate initial 24 or 40 Hour HAZWOPER certification

In Accordance w/Federal OSHA Regulation 29 CFR 1910.120(e) & (p)

And all State OSHA and EPA Regulations As Well

This course is approved for 8 Contact Hours (0.8 CEUs) of continuing education per the California Department of Public Health for Registered Environmental Health Specialist (REHS) issued by Safety Unlimited, Inc. (Accreditation # 044)

Julius P. Griggs	140821573860	8/21/2014
Julius P. Griggs Instructor #892	Certificate Number	Issue Date

SAFETY UNLIMITED, Inc.
OSHA Compliant Safety Training Since 1993

2139 Tapo St., Suite 228 Simi Valley, CA 93063
888 309-SAFE (7233) or 805 306-8027 866-869-7097 (fax)
www.safetyunlimited.com

Proof of initial certification and subsequent refresher training is NOT required to take refresher training
Want to be sure this certificate is valid? Visit safetyunlimited.com/verification

SMITH SYSTEM

Certificate of Completion

David Templeton 5-2-2014

Student Date

This certifies that this participant has
successfully completed the Smith System®
Smith System - Distracted Driving

Smith System®
Driver Improvement Institute, Inc.
Arlington, Texas
800-777-7648

Health & Safety Training

Documentation of Field Experience

The 40 Hour HAZWOPER course is specifically designed for workers who are involved in clean-up operations, voluntary clean-up operations, emergency response operations, and storage, disposal, or treatment of hazardous substances or uncontrolled hazardous waste sites. This course covers topics included in 29 CFR 1910.120.

Workers must also have 40 hours of initial training before they may enter the site and at least **three (3) days of actual field experience** under a trained seasoned supervisor. The three days field experience under a trained, experience supervisor is the responsibility of the student, employer, or potential employer.

Trainees must have additional hands-on training in the donning, doffing, and the use of the Personal Protective Equipment (PPE) required for their jobsite(s) in accordance with 29 CFR 1910.120.

Learning Objectives:

- Understand the purpose of OSHA and its role in regulating occupational safety
- Use Site Characterization to establish problems that may exist in your workplace and measures that can be implemented to eliminate hazards
- Identify hazardous materials existent in the workplace and the possible methods, symptoms and preventable measures of exposure
- Encourage the use of Safety Data Sheets (SDS) to identify and properly handle hazardous materials
- Familiarize yourself with materials, compounds and mixtures, that may present flammable, explosive, chemical or radiological hazards
- Emphasize the importance of personal protective equipment in limiting hazardous exposure
- Establish an effective Site Control Program to limit the risk of exposure to only those working in the hazardous work zone
- Implement procedures for treating workers in the event of hazardous exposure

Coordinator

Sign below when training is completed and return to the Health and Safety ~~Manager~~.

3-DAY FIELD EXPERIENCE AS PER 29 CFR 1910.120				
Employee Name	Supervisor	Date	Hours	Site
Ed Rerchinski		4-8-14	24+	Multiple
MIKE ROBERTS		4-8-14	24+	Multiple
David Templeton	David Templeton	4-8-14	24+	Multiple

ANCHOR QEA

Certificate of Completion

This is to certify that

David Templeton

has satisfactorily completed

8 hours of refresher training in

Hazardous Waste Operations And Emergency Response

in compliance with 29 CFR 1910.120 and WAC 296-843

March 3, 2009

THE NORTHWEST'S LEADING TRAINING ORGANIZATION

Instructor: Cookie Kaufman

Date Expires: March 3, 2010

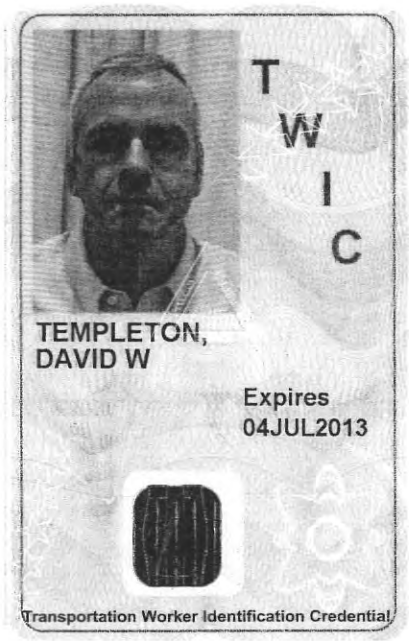
Cert. # 09-0691

Conducted at:

RGA Environmental, Inc. Seattle, WA

RGA ENVIRONMENTAL

1730 Minor Avenue Suite 900 • Seattle, Washington 98101 • (206) 281-8858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W
I
C
TEMPLETON,
DAVID W
Expires
04JUL2013
Transportation Worker Identification Credential

1 4

e-RAILSAFE System Badge

CONTRACTOR

NUMBER	ISSUED	EXPIRES
455550104309	06-23-2008	06-23-2010

David Templeton

PRIMARY EMPLOYER
Anchor Environmental, L.L.C.

1423 Third Avenue Suite 300
Seattle, WA 98101
206-287-9130

New card for UP & BNSF

AdvanceOnline Online Institute

Certificate of Completion

David Wiliam Templeton

has met the online course completion requirements for

Hazardous Waste Operations and Emergency Response 8-Hour Refresher

This student has spent the amount of time listed below towards the annual refresher requirements in OSHA 29 CFR 1910.120 (a)-(q), Hazardous Waste Operation and Emergency Response. If the Course Time shown is less than 8:00 hours, there should be a supervisor's signature on this certificate. This signature indicates that the student has had supplemental training that, together with this course, meets the 8-hour training requirement.

Certificate ID:	93214	**Date:**	07 September 2004
Continuing Education Units:	0.8	**Time Online:**	2:42

On-site Supervisor's Signature: _____ Date: 9.7.04

AdvanceOnline
5858 Westheimer Rd. Ste. 405
Houston, TX 77057
http://www.advanceonline.com
Toll Free: 1.866.4BRAINS

This education program meets the Criteria for Certification established by the Authorized Provider Commission of the International Association for Continuing Education and Training, 1200 19th St., NW, Suite 300, Washington, DC 20036-2401.

AdvanceOnline™

IACET

Certificate of Training

this is to certify that

David Templeton

has successfully completed Annual Refresher Training in Hazardous Waste Operations and Emergency Response (HAZWOPER) & refresher in CPR & First Aid.

In Accordance with 29 CFR 1910.120 & WAC 296-62-3040

on

November 13-14, 2001

PPE Level C
Laws & Regulations
Hazard Communications
Toxicology
Site Safety & Health
Decon
First Aid & CPR

Expires: November 14, 2002

FOSS ENVIRONMENTAL
Always Ready

Instructor

Paul Gallagher
Operations Manager, Marine Services
20500 Richmond Beach Dr. N.W., Seattle, WA 98177

CERTIFICATE OF TRAINING

this is to certify that

David Templeton

has successfully completed training for
Annual HazWoper Refresher
related to hazardous materials safety in accordance with

29 CFR 1910.120 and WAC 296-62-300 on
October 12, 2000

MSMunro

Megan Munro, ASP
Instructor

FOSS
ENVIRONMENTAL & INFRASTRUCTURE
"Always Ready"

CERTIFICATE OF TRAINING

this is to certify that

David Templeton

has successfully completed
First Aid & CPR
in accordance with
29 CFR 1910.151 and WAC 296-24-061 on

August 27, 1999

Megan Woodman, ASP
Instructor

FOSS
ENVIRONMENTAL & INFRASTRUCTURE
"Always Ready"

CERTIFICATE OF TRAINING

this is to certify that

David Templeton

has successfully completed
Annual HazWoper Refresher
in accordance with
29 CFR 1910.120 and WAC 296-62-300 on

August 26, 1999

Megan Woodman, ASP
Instructor

FOSS
ENVIRONMENTAL & INFRASTRUCTURE
"Always Ready"

Certificate of Completion

This is to certify that

David Templeton

has satisfactorily completed

8 hours of refresher training in

Hazardous Waste Operations And Emergency Response

in compliance with OSHA 29 CFR 1910.120

Apr 13, 1998

Training Administrator

Date Expires Apr 13, 1999

Cert. # 98-06789
Conducted at:
Prezant Associates
Seattle, WA

Prezant

Prezant Associates, Inc. • 330 Sixth Avenue North, Suite 200 • Seattle, Washington 98109 • (206) 281-8858

Prezant Associates, Inc.
Environmental Health Sciences and Engineering

CERTIFICATE

This is to certify that

David W. Templeton

has satisfactorily completed
40 hours of training in

Health and Safety at Hazardous Waste Sites

October 11, 1991
Date

Jane N. Maas
Director

Certificate # 01-0528