LOWER DUWAMISH WATERWAY
SLIP 4 EARLY ACTION AREA

Sampling and Analysis Plan for Boundary Definition

Final

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AOC	Administrative Order on Consent
ARI	Analytical Resources Inc.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
CSL	Cleanup Screening Levels
DGPS	Differential Global Positioning System
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
EQuIS	Environmental Quality Information Systems
FSP	field sampling plan
HSP	health and safety plan
LDW	Lower Duwamish Waterway
MTCA	Model Toxics Control Act
NAD	North American Datum
NOAA	National Oceanic and Atmospheric Administration
PCBs	polychlorinated biphenyls
PSEP	Puget Sound Estuary Program
QA	quality assurance
QC	quality control
QAPP	quality assurance project plan
RI	remedial investigation
SAP	sampling and analysis plan
SMS	Sediment Management Standards
TOC	total organic carbon

1.0 INTRODUCTION

This sampling and analysis plan (SAP) addresses site characterization work that is needed to define the boundary for an early removal action in Slip 4, which is located approximately 2.8 miles from the mouth of the Duwamish River in Seattle, WA (Figure 1). The Slip 4 characterization is being performed by the City of Seattle and King County under Tasks 9 and 10 of the existing Administrative Order on Consent (AOC) Statement of Work for the Lower Duwamish Waterway (LDW), and per requirements of the Slip 4 Work Plan (SEA 2003). This SAP has been prepared according to U.S. Environmental Protection Agency (EPA) (1988) and Washington Department of Ecology (Ecology 2003) guidance, and is consistent with work being performed for the LDW Remedial Investigation (RI).

Slip 4 was identified as a candidate early action site[1] by EPA and Ecology (Windward 2003), as part of the Phase 1 RI for the LDW, based primarily on elevated concentrations of polychlorinated biphenyls (PCBs). The process used by Windward (2003) followed both the National Contingency Plan, which requires that threats to human or animal populations, sensitive ecosystems or other significant factors affecting the health or welfare of the public or environment be considered when identifying removal actions (40 CFR§300.415), and the Washington State Model Toxics Control Act (MTCA). MTCA defines interim actions as “a remedial action that is technically necessary to reduce a threat to human health or the environment by eliminating or substantially reducing one or more pathways for exposure to a hazardous substance at a facility" (WAC 173-340-430). Existing data collected by multiple parties since 1990 confirm PCB concentrations that exceed Washington State Sediment Management Standards (SMS) (WAC 173-204) Cleanup Screening Levels (CSL) in the inner portion of the slip (SEA 2004).

This SAP presents the sampling design and rationale for the collection of data needed to finalize the Slip 4 early removal action boundary. It also includes the field sampling plan (FSP), which provides specific guidance for field procedures that will be followed by Integral Consulting and its subcontractors during the site investigation.

The following documents are provided as appendices to this SAP:

- **Quality assurance project plan (QAPP).** This document describes the organization, functional activities, and quality assurance and quality control (QA/QC) protocols necessary to achieve the

[1] Windward (2003) used the term “early action” to refer to short-term cleanups that are called “removal actions” under CERCLA, “interim actions” under MTCA, or “partial cleanup actions” under the Washington State Sediment Management Standards. This document uses the term “removal action”.

program-specific data quality objectives for sample collection and analysis.

- **Health and safety plan (HSP).** This document describes the requirements and procedures that will be implemented to ensure the safety of personnel that carry out the field sampling program.

This SAP and associated appendices fulfill the requirements of part of Task 1 of the Slip 4 Work Plan (SEA 2003).

Additional Slip 4 sampling and analyses beyond what is described in this document may be necessary to support a subsequent engineering evaluation/cost analysis (EE/CA) for the early removal action that is anticipated to occur following the completion of the tasks stipulated in the Slip 4 Work Plan (SEA 2003). Iterative sampling may also occur pursuant to this SAP. The EE/CA would be performed under a modified or separate Work Plan. A decision has not been reached on the legal action that will be used for preparing and implementing the EE/CA.

1.1 OBJECTIVES

The objective of the Slip 4 site characterization is to fill data gaps identified in SEA (2004) to allow for the identification of the boundary of an early removal action of contaminated sediments. Data collection will occur within the Slip 4 Early Action Study Area (Figure 2) and will focus on identifying the boundary between sediments that will be remediated as an early removal action area and sediments that will continue to be addressed through the LDW RI process. This objective will be met by sampling surface sediments in intertidal and subtidal areas and evaluating the results together with other existing data, and by sampling subsurface sediments to better understand the vertical extent of chemicals in sediments. The data quality objective is to generate appropriate data to meet these project objectives.

Data gaps were identified in the *Slip 4 Summary of Information and Identification of Data Gaps* report (SEA 2004) and are shown in Table 1. Data gaps that are addressed in this SAP include:

- Surface sediment quality
- Subsurface sediment quality
- Intertidal sediment quality
- Geotechnical data.

Other data gaps listed in Table 1 that require additional data collection are being addressed through the LDW RI (bathymetric survey completed in December 2003) or by City of Seattle, King County and Washington Department of Ecology source control programs (pollutant source information). The sediment toxicity data gap may be addressed, if necessary, in a future sampling iteration.

The data that will be collected per this SAP, as well as other existing data, will be jointly evaluated to identify the proposed boundary of the removal action. The data evaluation and proposed boundary will be documented in a technical memorandum to the EPA as called for by the Slip 4 Work Plan (SEA 2003).

1.2 SITE DESCRIPTION AND HISTORY

The following information was extracted from the *Slip 4 Summary of Information and Identification of Data Gaps* report (SEA 2004). Slip 4 is located approximately 2.8 miles from the mouth of the Duwamish River on the east bank of the river. The slip itself is an arc-shaped portion of a pre-channelized Duwamish River meander. It is approximately 1,400 feet long, with an average width of 200 feet. The slip encompasses approximately 5.7 acres.

A number of structures occur along Slip 4, the most notable of which is the dock and berthing area at Crowley Marine Services (Figure 3). The bank beneath this dock structure is covered with riprap. Riprap also covers the shoreline owned by The Boeing Company. Eleven outfalls discharge to the slip, with the most significant discharges occurring at the head of the slip. Parts of the inner portions of the slip are exposed at very low tides.

The uplands surrounding Slip 4 have supported industrial uses since at least the 1920s. [See SEA (2003) for an extensive discussion of potential sources of chemicals to Slip 4.]

1.3 DOCUMENT ORGANIZATION

Section 2 describes the sampling design and rationale for defining the removal boundary for the Slip 4 Early Action Area. The FSP, which includes all field operations, chain-of-custody requirements, and sample packing and handling, is discussed in Section 3. Finally, Section 4 provides the data management procedures.

Forms and checklists that will be used during field sampling are contained in Appendix A. The QAPP is provided in Appendix B, and the HSP is found in Appendix C.

2.0 SAMPLING DESIGN AND RATIONALE

This section describes the rationale for the sampling design that will generate data to be used to develop an appropriate boundary for a cleanup action in the Slip 4 early action area. Conditions encountered in the field may result in a modification to the sampling design; however, EPA will be contacted whenever changes in the sampling design occur.

Three types of samples are proposed: subtidal surface sediments, subtidal subsurface sediments, and intertidal surface samples. The overall sampling strategy is discussed below followed by data needs, considerations for selecting sampling locations, sampling rationale, sample types, and sample analyses for each of the three sample types.

2.1 OVERALL SAMPLING STRATEGY

As described in the *Summary of Existing Information and Identification of Data Gaps* report (SEA 2004), a significant amount of historical surface sediment data and a smaller amount of subsurface data exist for Slip 4. Review of the maps provided in that report shows that total PCBs exceed CSLs over a larger area than any other analyte, and the magnitude of the exceedances is greater than any other analyte (Figure 4). With the exception of one sample of bis(2-ethylhexyl)phthalate along the southern shoreline at the outer part of the slip, the distributions of analytes other than PCBs are both less extensive and show the same general trend of highest concentrations at the head of the slip near the outfalls [see Figures 5-7 through 5-11 in SEA (2004)].

The overall sampling strategy for Slip 4 is to generate new data from all parts of Slip 4 and to place the sampling stations in areas that have little or no historical data, such as along the northern shoreline where dredging has occurred in the past, or at locations that fill smaller spatial data gaps based on the existing information presented in SEA (2004)[2]. As required by EPA, the existing National Oceanic and Atmospheric Administration (NOAA) data will not be used to establish the proposed cleanup boundary because these data were generated using non-standard methods. However, the NOAA (1998) data were considered during placement of the proposed stations. Also, QA/QC data from Landau (1990) have not been located, and unless these data are obtained and demonstrate an appropriate data quality, then the Landau (1990) data will not be used in the boundary definition.

Sampling stations were located based on consideration of several factors. Where feasible, stations were located in transects that run from the Crowley side of the

[2] Since completion of the existing information report (SEA 2004), the 1998 Exponent data set has been reviewed and approved for use by EPA (Hiltner 2004).

slip to the Boeing side of the slip. This station distribution will help define the proposed boundary through contouring or other spatial analysis techniques. Station locations were also placed with consideration of the existing data presented in SEA (2004). This analysis included comparison of historic chemical data to the SMS to identify previous sampling locations exceeding the SQS and CSL. These chemical concentrations were contoured and areas potentially exceeding criteria identified. Areas with no existing data (e.g., dredged areas), or with existing data of uncertain quality, were also identified and stations were located in these areas. Finally, some station locations were adjusted based on proximity to sources (e.g., outfalls) or previously sampled stations with appropriate data quality.

A tiered analysis approach will be implemented that allows a preliminary boundary to be determined by PCB concentrations and the final boundary to be determined by all SMS analytes. To support this approach, an adequate volume of sediment will be collected at each station to facilitate analysis of all SMS analytes, as appropriate.

Surface and subsurface samples will initially be analyzed for PCB Aroclors, total organic carbon (TOC), percent solids, and grain size. Following the receipt of these data from the laboratory, the City of Seattle and King County will recommend to EPA the samples that will be analyzed for some or all of the remaining suite of SMS analytes. The primary goal of this iteration will be to characterize concentrations of the remaining SMS analytes in the area immediately outside of where PCBs exceed the CSL. A secondary goal will be to analyze select organic compounds near potential sources. The following will be considered in the selection of surface samples for full SMS analysis:

- Proximity to sources that may influence chemical distributions
- Proximity to existing data points that may be used in the evaluation of the boundary
- Proximity to the area where PCB concentrations exceed the CSL
- Proximity to existing data Station SL4-12 (Landau 1990) that exceeded the CSL for bis(2-ethylhexyl)phthalate (see SEA 2004).

Following EPA approval of the list of recommended samples, the recommended SMS analytes will be analyzed in the selected samples. Note that additional samples may be collected and analyzed in the future for the full SMS suite after the proposed boundary has been determined and design of the cleanup action is underway.

A similar iteration will occur for subsurface samples. Subsurface samples will initially be analyzed for PCB Aroclors, TOC, percent solids, and grain size. For each core, all SMS analytes will be characterized in either the sediment horizon below the horizon containing the deepest PCBs CSL exceedance pending approval by EPA. These data will help to determine the appropriate depth of a removal action. The recommended horizons for full SMS analysis will be forwarded to EPA along with the recommendations for SMS analyses of surface sediments.

2.2 SURFACE SEDIMENT SAMPLING

2.2.1 Data Needs

Existing intertidal and subtidal surface sediment data occur in many areas of Slip 4 though few data exist along the Crowley pier due primarily to previous dredging events. Some historic surveys generated data for a limited number of analytes, and, in a few cases, also used non-standard analytical procedures in attaining the chemical results (e.g., NOAA 1998). Additional intertidal and subtidal surface data are needed to provide a defensible boundary for an early removal action in Slip 4.

2.2.2 Sampling Location Considerations

Historical sampling locations, point sources, and areas lacking data were considered when selecting new sampling locations. Some samples were placed in areas that had previously been sampled, but relatively more samples were placed in potential source areas and areas that had not already been well characterized.

2.2.3 Station Selection Rationale

A total of 30 stations were selected for analysis of intertidal and subtidal surface sediment chemistry (Figure 5). Where feasible, stations were located in transects that run from the Crowley side of the slip to the Boeing side of the slip. Station locations were also placed with consideration of the spatial analysis of existing data presented in SEA (2004) and the proximity to sources and previously sampled stations with appropriate data quality. This design will facilitate the identification of the removal area boundary. The rationale for each sample is described in Table 2.

2.2.4 Sample Types

Sediment samples will be collected from the top 10 cm at each sampling station. For the samples that will be collected from the sampling vessel (i.e., Stations SG01 through SG29), samples will be composited from both sides of a double van Veen sampler to more appropriately represent the sampled area. Station IC01 is an intertidal composite sample. Sediment will be collected from the five locations shown on Figure 5 and composited into one sample for analysis.

2.2.5 Sample Analyses

PCB Aroclors, TOC, total solids, and grain size will be analyzed immediately following the sampling program. Following the receipt of these data, the City of Seattle and King County will provide EPA with a recommended list of stations for analysis of other SMS analytes (see Section 2.1 for the approach for station selection).

2.3 SUBSURFACE SEDIMENT SAMPLING

2.3.1 Data Needs

Additional subsurface data are needed in Slip 4 to evaluate the vertical extent of contamination. Also, in the event that dredging is selected as the preferred removal option, the depth of contamination needs to be determined. These data will assist in designing the remediation project and will also augment the surface sediment data set that is being generated for this project.

2.3.2 Sampling Location Considerations

Subsurface data are available that provide preliminary information on subsurface contamination, especially near the head of the slip. Cores from both intertidal and subtidal areas will be collected. The locations of outfalls and existing core data were also considered in the selection of station locations.

2.3.3 Station Selection Rationale

Cores will be collected from 11 locations within Slip 4 (Figure 6). In the head of the slip where PCB concentrations are highest, core samples were placed along the axis of the slip (i.e., Stations SC01, SC02, and SC05) as well as closer to the shoreline (i.e., Stations SC03 and SC04). These new stations will supplement existing core data generated by Landau (1990). As described in Section 2.1, the quality of the Landau (1990) data has not yet been confirmed. Unless the quality of the Landau (1990) data is found to be acceptable, additional subsurface cores could be required during design. From the middle of the slip to the mouth, cores were placed in pairs to facilitate determining the removal action boundary. Sampling locations were sometimes adjusted slightly (e.g., Station SC07) so that they were near outfalls to assess the potential impacts of historic releases. The rationale for each core location is provided in Table 2. Of these locations, samples from the cores sited in the outer third of the slip (Stations SC08 – SC11) will initially be archived. These samples will be analyzed if the preliminary evaluation of surface sediments indicates that the removal boundary may occur in this area or if requested by EPA.

2.3.4 Sample Types

Individual core samples will be analyzed from the following horizons: 0-2 feet, 2-4 feet, and 4-6 feet. Additional samples representing 6-8 feet and 810 feet will be prepared and archived. Two-foot horizons were selected for analysis because the existing Landau (1990) data were generally collected in 2-foot intervals (see SEA 2004). Also, this is a typical depth that can be removed during a single pass of a clamshell dredge. The archived samples will be analyzed if elevated PCBs (i.e., greater than the CSL) are observed in the 4- to 6-foot interval. Based on existing data (SEA 2004), it is less likely that elevated PCBs will be identified in subsurface sediments in the outer third of the slip (i.e., Stations SC08 – SC11).

2.3.5 Sample Analyses

Core samples from the 0- to 2-foot, 2- to 4-foot and 4- to 6-foot intervals will initially be analyzed for PCBs, TOC, percent solids, and grain size. Additional sediment from each sample interval (including 6-8 feet and 8-10 feet) will be archived for possible future analysis of the remaining SMS analytes (and PCBs if not previously analyzed), as appropriate. The City and County will evaluate the total PCBs data and recommend to EPA the samples that should be analyzed for the full suite of SMS analytes so that the selection of the final removal depth includes consideration of all SMS analytes.

In addition, water content, specific gravity and Atterberg limits will be analyzed on a minimum of 10% of all core samples (including archived samples) to provide preliminary engineering information. The samples that will be chosen for analysis of these geotechnical properties will be identified during core processing so that a range of sediment types or conditions will be evaluated. The purpose of these analyses is described below:

- **Water Content**: Ratio of the mass of water to the mass of solid. This is used to calculate other key properties of sediment (e.g., void ratio, saturated wet unit weight) required to predict sediment behavior (e.g., how much dewatering would be required if the sediments are dredged).
- **Specific Gravity**: Ratio of the weight of solids to the weight of an equal volume of water. This is used to calculate key properties of the sediment (e.g., void ratio) and assess sediment fall velocities that are important with respect to potential turbidity generation and transport of suspended sediments during dredging.
- **Atterberg Limits**: Indicate the behavior of cohesive soil under various water contents. These are quantified by specific tests to determine the liquid limit, plastic limit, and shrinkage limits. They indicate sediment behavior under varying water contents and are

used to assess dewatering needs and ease of sediment handling if sediments are dredged.

3.0 FIELD SAMPLING PLAN

The following sections describe the procedures and methods that will be used during sample collection and handling, including field operations, core processing and subsampling, sample chain-of-custody, and sample packing and transport. Field logbooks and forms (including a description of how deviations from the FSP will be addressed), waste disposal, field quality control samples, and laboratory analyses are also discussed below. The Slip 4 site characterization elements include intertidal and subtidal surface sediment sampling and subsurface sediment coring. All field activities will be conducted in accordance with the site-specific HSP that is provided in Appendix C.

3.1 PROJECT ORGANIZATION

This section presents the organizational structure for sampling and analysis activities associated with the Slip 4 sediment investigation (Figure 7).

3.1.1 Team Organization and Responsibilities

Ms. Karen Keeley, U.S. EPA Region 10, is the Project Coordinator for Slip 4. Ms. Keeley is responsible for approving this SAP and any subsequent modifications, and will meet with City and County staff to select samples for full analysis of SMS analytes. Mr. Rick Huey is Ecology's Project Coordinator for the LDW AOC.

Ms. Ginna Grepo-Grove, U.S. EPA Region 10, is EPA's Quality Assurance Manager for this project. Ms. Grepo-Grove will review and provide final approval of the QAPP and data quality report.

Ms. Jennie Goldberg is the Project Coordinator and the City of Seattle's project manager, responsible for providing strategic and policy direction to Integral.

Integral is responsible for implementing the sampling program and preparing the associated reports for EPA Region 10 on behalf of the City of Seattle and King County.

3.1.2 Integral Project Manager

Ms. Betsy Day will manage this project and will coordinate the overall administrative efforts. In this role, she will oversee the technical work, participate in agency meetings, and respond to client requests. Ms. Day will work closely with Integral's deputy project manager to ensure that the objectives of the project are achieved. In the event that changes in the FSP are needed, she will discuss proposed changes with the project coordinator and personnel designated by Integral (see below). Changes to the FSP will not be made without prior approval from the EPA Project Coordinator and the City's Project Coordinator unless conditions in the field or laboratory require immediate response.

3.1.3 Integral Deputy Project Manager

Ms. Vicki Fagerness will be responsible for day-to-day management of the project and will be responsible for all facets of the sampling and analysis programs. She will report directly to Integral's project manager. Her specific responsibilities include the following:

- Oversee the development of the field sampling, health and safety, and laboratory quality assurance plans
- Coordinate the field and laboratory analyses
- Ensure that laboratory capacity is sufficient to undertake the required analyses in a timely manner
- Ensure adherence to the schedule by tracking sampling, laboratory analysis, validation, and data management tasks
- Provide solutions to problems if they occur
- Inform Integral's project manager of any decisions that involve changes to the FSP or QAPP.

3.1.4 Field Coordinator / Safety Officer

Mr. Joe Thompson or Ms. Susan Fitzgerald will be the Field Coordinator. Joe Thompson will be the Site Safety Officer and Susan Fitzgerald will be the Deputy Site Safety Officer. They will be responsible for overall coordination of the following field sampling tasks:

- Oversee the planning and coordination for all sampling efforts (site mobilization, equipment and containers procurement, equipment decontamination)
- Coordinate field support between Integral's staff and chartered research vessel staff
- Coordinate the subsequent processing of core samples and ensure that all sample handling, processing, and homogenization procedures are conducted according to project requirements
- Oversee sample chain-of-custody procedures, packing, and shipping.
- Correct any work practices or conditions that may result in personnel injury or exposure to hazardous materials
- Determine appropriate personal protection levels and necessary clothing and equipment, and oversee its proper use

- Verify that the field crew is aware of the provisions of the health and safety plan and instructed in safe work practices
- Verify that the field crew has received the required safety training
- Ensure that all field activities adhere to the FSP and QAPP
- Inform the deputy project manager of any decisions that involve changes to the FSP
- Mobilize and prepare for field work
- Ensure sample custody seals, including chain-of-custody forms, have been correctly logged and completed.

3.1.5 Field Crew

Field crew for the sampling activities will be drawn from Integral. The operator of the research vessel and equipment (Marine Sampling Systems, Burley, WA) will supply additional staff to assist with coring operations. Documentation of station positioning associated with grab and coring operations will also be the responsibility of the research vessel with oversight provided by Integral.

Various field staff from Integral will assist in sample collection, handling, core processing and storage activities. They will maintain the field sampling logs and notebooks and will be responsible for properly labeling sample containers. It is the responsibility of all field staff to report any problems or potential changes to the FSP and QAPP to the field coordinator. For example, during grab sampling and/or coring, obstructions may preclude collecting a sample at the planned location. The deputy project manager will contact the City's project coordinator and EPA, if available, regarding any proposed revised sampling location. If EPA is not available for immediate approval of the change, then sampling will continue and EPA will be notified as soon as possible.

3.1.6 Integral Project Quality Assurance Coordinator

Ms. Pamela Sparks is the Project QA Coordinator for the project. Responsibilities of the QA coordinator include review of the field, laboratory, and data management procedures associated with the project and review of data products. Review findings will be presented to Integral's deputy project manager.

3.1.7 Integral Laboratory Coordinator and QA Manager

Ms. Maja Tritt will be the QA Manager for analytical chemistry tasks. She will perform laboratory oversight for the analytical laboratories and will direct the validation of chemical data.

3.1.8 Integral Data Management

Mr. Tom Schulz (Integral) will have primary responsibility for data management. Integral will utilize the EQuIS™ (Environmental Quality Information System) database as the primary repository of environmental data. Mr. Schulz currently works directly with this database and is familiar with its structure and operation. Use of this system will also ensure the easy transfer of data in the required format to EPA Region 10, the City of Seattle, and King County.

3.1.9 Laboratory Services

Analytical Resources, Inc. (ARI) of Tukwila, WA, will perform all sediment chemistry analyses. ARI has special expertise in the analysis of sediments for organic and inorganic parameters. ARI staff have participated in the development and review of methods found in Puget Sound Estuary Program guidance (PSEP 1986, 1997a,b). Project experience is demonstrated by participation in the EPA Contract Laboratory Program (CLP), numerous RI/FS projects under CERCLA, and the Puget Sound Dredged Material Management Program monitoring projects. Ms. Sue Dunnihoo will be the ARI Project Manager.

3.2 FIELD SAMPLING SCHEDULE

The actual start date for field sampling will be determined following EPA and Ecology approval of this SAP, and pending property access permission from property owners. Currently, it is anticipated that field sampling will begin on April 5, 2004, to take advantage of low daylight spring tides during that week in case intertidal samples can not be collected from the sampling vessel at high tide. Collection of sediment samples is anticipated to take about 5 days as shown below:

- Surface grab stations (29 stations): 2-3 days
- Intertidal composite station (1 station): to be completed during the grab sampling
- Subsurface cores (11 stations): 1-2 days. Core processing will take another 2 days.

3.3 FIELD SAMPLING METHODS

This section describes the methods that will be implemented while conducting both surface and subsurface sediment sampling. Note that the preferred sampling approach for intertidal surface samples is to collect them during high tides from the sampling vessel. In the event that obstructions interfere with sample acquisition from the vessel in intertidal areas, samples will be collected during low tides by field staff walking the beach area. Methods are provided below for sediment acquisition by field staff working from shore and using hand cores if necessary.

3.3.1 Station Positioning

Latitude and longitude coordinates will be obtained during on-water sediment sampling operations using a Differential Global Positioning System (DGPS). The standard projection method to be used during field activities is Horizontal Datum: North American Datum of 1983 (NAD83), State Plane Coordinate System, Washington North Zone. The positioning objective is to accurately determine and record the positions of all sampling locations to within ±2 meters.

Station positioning from the sampling vessel will be accomplished using a DGPS, which consists of a GPS receiver on the sampling platform and a differential receiver located at a horizontal control point. At the control point, the GPS-derived position is compared with the known horizontal location, offsets or biases are calculated, and the correction factors are telemetered to the GPS receiver located on the sampling platform. Positioning accuracies on the order of ±1-3 meters can be achieved by avoiding the few minutes per day when the satellites are not providing the same level of signal. The GPS system provides the operator with a listing of the time intervals during the day when accuracies are decreased. Avoidance of these time intervals permits the operator to maintain better positioning accuracy. The GPS receiver routes latitude and longitude to an integrated navigation system, which displays the platform's position in plan view. Navigation data, such as range and bearing from the target sampling location, are provided at a user-defined scale to help the vessel pilot navigate to the desired location.

Station positioning and recording of actual hand-coring coordinates for the intertidal composite sampling will be accomplished using a handheld DGPS. The handheld DGPS will be used to record position coordinates at each of the sampled locations. The handheld DGPS unit operates using principles similar to those described in the previous paragraph. The unit will record the intertidal sampling areas by line data consisting of “vertices,” or points of inflection, collected every 5 seconds and “nodes” collected at the beginning and end of each intertidal sampling transect.

Water depths will also be recorded at each sampling locations. Thus, when the sampling device makes contact with sediment the depth from surface water to mudline will be measured using a lead line or fathometer. These measurements will be recorded to the nearest 0.1 foot.

3.3.2 Field Equipment and Supplies

Field equipment and supplies include sampling equipment, utensils, decontamination supplies, sample containers, coolers, logbooks and forms, personal protection equipment, and personal gear. Protective wear (e.g., hard hats, gloves) that are required to ensure the health and safety of field personnel are specified in the HSP (Appendix C).

Sample containers and preservatives, as well as coolers and packing material, will be supplied by the analytical laboratory. Commercially available pre-cleaned jars will be used, and the laboratory will maintain a record of certification from the suppliers. The bottle shipment documentation will record batch numbers for the bottles. With this documentation, bottles can be traced to the supplier, and bottle wash analysis results can be reviewed. The bottle wash certificate documentation will be archived in the Integral project file. Field personnel will not obstruct these stickers with sample labels.

Sample containers will be clearly labeled at the time of sampling. Labels will include the project name, sample location and number, sampler's initials, analysis to be performed, date, and time.

3.3.3 Equipment Decontamination Procedures

The van Veen grab sampler and handcores will be rinsed with site water and washed with Alconox™ detergent between sampling stations. Decontamination of stainless-steel bowls and utensils will also be performed before deploying sampling equipment at each station, using the following process:

- Rinse with site water
- Wash with brush and Alconox™ or other phosphate-free detergent
- Double rinse with distilled water
- Rinse with 0.1 N nitric acid
- Rinse with deionized water
- Rinse with methanol
- Final rinse with deionized water.

If a residual petroleum-sheen remains on the sampling equipment or is difficult to remove using the standard decontamination procedures above, a final hexane rinse may be added.

Sample handling equipment will be kept wrapped in aluminum foil until time for use, at which time they will be rinsed again with deionized water before removing sediment from samplers. To minimize sample contamination, disposable gloves will be replaced between stations.

3.3.4 Collection of Subtidal Surface Sediments

A stainless-steel, double 0.1 m^2 van Veen grab sampler will be used to collect subtidal surface sediments. Sample collection methods will follow PSEP (1986) guidance as updated by EPA (2001). The sampler will be deployed from the sampling vessel using a hydraulic winch to minimize the twisting forces on the sampler during operations. The grab will be deployed and retrieved at a rate of approximately 1 ft/sec to minimize contacting the bottom at an angle and potential disturbance of the sediment surface within the sampler.

Following the retrieval of the grab, it will be braced in an upright position using wooden blocks. The flaps will be opened and the overlying water will be slowly removed using a siphon. If excessive water leakage is indicated by the lack of an overlying water layer, or if overlying water contains suspended particulate material (i.e., turbidity), the sample will be rejected. Each grab sample will be visually characterized using the following additional criteria to determine if the sample is acceptable:

- Sediment is not leaking through flaps
- Sediment surface appears to be relatively undisturbed (i.e., minimal winnowing)
- Minimum penetration depths are achieved:
  - Medium-coarse sand – 4 to 5 cm
  - Fine sand – 6 to 7 cm
  - Silt and/or clays – 10 cm.

Samples that do not meet any one of the above criteria will be rejected, and the sample will be recollected. Corrective actions that may be used in the field to address constant overfilling or under-penetration of the grab include removal of weights from the grab sampler or adding weights or buoys to the sampler. If samples to a depth of 10 cm can not be obtained after repeated attempts then the field crew will accept a lesser penetration depth. However, this is unlikely in Slip 4 where the sediments are generally greater than 50 percent fine-grained sediment (i.e., silt and clay).

Once a grab is deemed acceptable, the following field observations will be recorded on field record forms (Appendix A):

- Sediment penetration depth (nearest 0.5 cm) based on sediment depth at the center of grab

- Physical characteristics of the sediment surface, including color, texture, presence of anthropogenic material, and presence and type of biological structures, other debris, oil sheens, and odors.

Sediment will be removed to a depth of 10 cm from both sides of the double van Veen grab using decontaminated, stainless-steel spoons, placed into a decontaminated, stainless-steel bowl and homogenized using a stainless-steel spoon until the sediment attains a uniform color and texture. Care will be taken to ensure that sediment in contact with the walls of the van Veen, as well as any large items or debris, are excluded from the sample.

Sediment will then be placed in labeled, laboratory-cleaned sample containers (Table 3). Each sample container will be clearly labeled with the project name, sample identification, type of analysis to be performed, date and time, and initials of person(s) preparing the sample. Containers will be filled, leaving 0.5 – 1 inch of headspace to prevent the jars from breaking during storage. Sediment samples will be stored on ice prior to unloading onshore. At the end of each day, samples will be delivered to the contract laboratory for storage.

Sediment samples will be prepared for analysis of TOC, grain size, percent solids, and analytes listed in the SMS. At approximately 5% of the stations, rinsate blanks will be prepared on the sample handling gear, and these blanks will be submitted to the laboratory for analysis of all SMS analytes.

3.3.5 Collection and Processing of Subsurface Cores

Subsurface sediment coring activities will be conducted using a customized vibracorer deployed from the research vessel operated by Mr. Bill Jaworski of Marine Sampling Systems, Burley, WA. The vibracorer uses a hydraulic system that vibrates and drives a 4-inch (outside diameter), aluminum core tube into the sediment. The corer will be configured so that up to a 12-foot core will be recovered. A continuous sediment sample will be retained within the tubing with the aid of a stainless-steel core cutter/catcher attached to the bottom of each aluminum tube. A core liner is not used with this device.

The vibracorer will be deployed off the rear deck of the vessel using a hydraulic winch system rigged with swivel tackle to minimize twisting forces on sampler during deployment. The descent and retrieval of the vibracorer will be controlled by an onboard winch operator at a rate of 1 ft/sec to minimize the probability of improper orientation upon contact with the bottom and to preserve the integrity of sample, respectively. Depth to sediment, sampling area coordinates, and time will be recorded at the moment the sampler contacts the bottom. Vibracoring will then continue for a length of time necessary to obtain adequate core penetration (sample depth). The core penetration depth will be estimated by means of a transducer attached to the top of the vibracorer rack and will be recorded for each station on the core log sheet. Some vertical sediment compaction during coring is unavoidable. However, compaction is not linear along the length of the core, and sampling depth intervals will not be adjusted. Once the core has reached its maximum penetration depth the vibracorer will be slowly raised to the back deck of the research vessel and braced horizontally by field personnel and stabilized with wooden blocks. Before removing the aluminum core tube from the vibracorer, the core catcher will be visually inspected to determine if sediment has obviously been lost during core retrieval. If a significant amount of sediment is observed flowing from the core catcher, then the core will be discarded and a new core taken. Next, the nosepiece and core catcher will be removed, a section of foil will be placed over the exposed sediment surface at the bottom of the core and a rubber cap will be placed over the foil and secured with tape. If adequate penetration has been attained, the core penetration depth and physical characteristics of the sediment sample (e.g., color, texture, odor) will be recorded on field log sheets (Appendix A). Any presence of noticeable odors or sheen at the end of the tube or on the surface water will also be noted in field forms. If core penetration is less than 8 feet then the station will be re-cored. If an 8-foot-long core can not be obtained after 3 attempts, then the longest core will be retained for processing.

Immediately after their retrieval, collected cores will then be cut onboard the vessel into sections no smaller than 4 feet to minimize impact to the cores between the designated 2-foot sampling intervals. They will then be capped with aluminum foil and rubber caps and sealed with duct tape. Following sectioning, the cores will be stored onboard the vessel in a core box at approximately 4^{o}C and transported, at the end of each field day, to Integral in Olympia where they will be refrigerated at 4^{o}C prior to processing.

Cores will be processed at Integral facilities in Olympia following the completion of all fieldwork. The cores will be laid on an aluminum-lined, 4-foot (minimum length) tray. Cores will be cut along their long axis using a circular saw, and then rotated 180^{o}, and cut again. Care will be taken to ensure that cores are cut as slowly as possible to maintain sample integrity and to prevent the sediment from being contaminated by aluminum shavings. After each core is cut open the following information will be recorded for each core in the processing log:

- Physical sediment description (i.e., sediment type, density/consistency, color)
- Odor (e.g., hydrogen sulfide, petroleum)
- Visual stratification and lenses
- Depth of potential redox layer
- Vegetation
- Debris

- Evidence of biological activity (e.g., detritus, shells, tubes, bioturbation, live or dead organisms)
- Presence of oil sheen
- Other distinguishing characteristics or features.

Clearly labeled cores showing the appropriate sample designation (e.g., SL4-SC01C) will also be photographed before any sediment is removed for processing.

Sediment samples will be prepared from the 0-2, 2-4, 4-6, 6-8 and 8-10 foot core intervals. Sediment from each interval will be removed from the core using decontaminated, stainless-steel spoons (e.g., a spoon will be used to create a “trough” down the center of the entire 2-foot core interval), placed in decontaminated, stainless-steel bowls, and homogenized using a stainless-steel spoon. All sediment within the 2-foot interval will be removed. Care will be taken to ensure that any sediment in contact with the walls of the core, as well as any large pieces of debris and aluminum or shavings, is excluded from the samples. Sediment from each subsection will be individually mixed to a uniform color and texture using a decontaminated, stainless-steel spoon. All samples for laboratory analysis will be placed in labeled, laboratory-cleaned, sample containers (Table 3). Each sample container will be clearly labeled with the project name, sample identification, type of analysis to be performed, date and time, and initials of person(s) preparing the sample. Containers will be filled, leaving 0.5 – 1 inch of headspace to prevent the jars from breaking during storage. Containers will be refrigerated prior to delivery to ARI.

At approximately 5% of the core intervals, rinsate blanks will be prepared on the sample handling gear, and these blanks will be submitted to the laboratory for analysis.

Core samples will initially be analyzed for TOC, grain size, percent solids, and PCB Aroclors. Additional sediment will be prepared for possible future analysis of the other SMS analytes. Samples will also be prepared for analysis of water content, specific gravity and Atterberg limits; these analyses will be conducted on approximately 10% of the samples.

3.3.6 Collection of Intertidal Samples from Shore

The following sample collection methods will be followed for the intertidal composite sample (station IC01) and any intertidal surface sample that cannot be collected during high tide from the sampling vessel.

A hand-held DGPS will be used to identify the correct intertidal sample locations. At station IC01, one hand core will be collected at each of the five subsample locations (see Table 2, Figure 5) and composited. At intertidal stations that cannot be sampled from the sampling vessel, multiple hand cores will be collected at each station to obtain sufficient sample volume. At these locations, the cores comprising a single sample will be located within a 2-m radius (i.e., the accuracy of hand-held DGPS positioning). All hand core samples will be collected to a depth of 10 cm.

Intertidal samples will be collected using a decontaminated, stainless-steel, hand-coring device that is 4 inches in diameter by 6 inches in length. The corer will be gently pushed into the sediment using a twisting motion to facilitate penetration. A valve on top of the device will be opened to allow air and water to escape as the hand corer is advanced through the sediment, thereby preventing compression of the sediment surface. Care will be taken to ensure that the sediment surface does not come into contact with the top of the sampler. A retention plate will then be placed under the corer to prevent the sediment from falling out of the corer, and the valve will be closed. The corer will then be slowly extracted and the retained sediment will be placed into a decontaminated, stainless-steel bowl. The following observations will then be recorded in a field log: color, texture, presence of anthropogenic material, and presence and type of biological structures, other debris, sheens or odors. Once all cores have been taken and the observations recorded, the sample will be composited following the procedures discussed in Section 3.3.4.

3.3.7 Chain-of-Custody Procedures

Samples are in custody if they are in the custodian's view, stored in a secure place with restricted access, or placed in a container secured with custody seals. A chain-of-custody record will be signed by each person who has custody of the samples and will accompany the samples at all times. Copies of the chain-of-custody will be included in laboratory and QA/QC reports.

At minimum, the form will include the following information:

- Site name
- Field coordinator's name and team members responsible for collection of the listed samples
- Collection date and time of each sample
- Sampling type (e.g., composite or grab)
- Sampling station location
- Number of sample containers shipped
- Requested analysis
- Sample preservation information

- Name of the carrier relinquishing the samples to the transporter, noting date and time of transfer and the designated sample custodian at the receiving facility.

The field coordinator, as the designated field sample custodian, will be responsible for all sample tracking and chain-of-custody procedures for samples in the field. The sample custodian will be responsible for final sample inventory and will maintain sample custody documentation. The custodian will complete chain-of-custody forms prior to removing samples from the sampling vessel. Upon transferring samples to the laboratory sample custodian, the field coordinator will sign, date, and note the time of transfer on the chain-of-custody form.

The original chain-of-custody form will be transported with the samples to the laboratory. Each laboratory will also designate a sample custodian who will be responsible for receiving samples and documenting their progress through the laboratory analytical process. Each custodian will ensure that the chain-of-custody and sample tracking forms are properly completed, signed, and initialed upon transfer of the samples.

Chemistry samples will be shipped to the laboratory in ice chests sealed with custody seals. Each ice chest will have three seals - one on the front of the chest and one on each side. The laboratory sample custodian will establish the integrity of the seals at the laboratory.

Upon receipt of the samples by the laboratory, the laboratory sample custodian will inventory the samples by comparing sample labels to those on the chain-of-custody document. The custodian will enter the sample number into a laboratory tracking system by project code and sample designation. The custodian will assign a unique laboratory number to each sample and will be responsible for distributing the samples to the appropriate analyst or for storing samples in an appropriate secure area.

3.3.8 Sample Handling and Transport

Sample coolers and packing materials will be supplied by the analytical laboratories. Individual sample containers will be placed into a sealed plastic bag. Samples will then be packed in a cooler lined with a large plastic bag. Glass jars will be packed to prevent breakage and separated in the shipping container by bubble wrap or other shock-absorbent material. Ice in sealed plastic bags or “blue ice” will then be placed in the cooler to maintain a temperature of approximately 4ºC. When the ice chest is full, the chain-of-custody form will be placed into a zip-locked bag and taped on the inside lid of the cooler. A temperature blank will be added to each cooler. Each ice chest will be sealed with three chain-of-custody seals. On each side of the cooler a *This End Up* arrow label will be attached; a *Fragile* label will be attached to the top of the cooler.

These packaging and shipping procedures are in accordance with U.S. Department of Transportation regulations as specified in 49 CFR 173.6 and 49 CFR 173.24. Coolers containing sediment for chemical analyses may be transported to the laboratory by courier or overnight shipping service, or will be hand-delivered by Integral personnel to the analytical laboratory. Cores will be transported from the sampling vessel to Integral's facility in Olympia by Integral field personnel and will remain in their custody at all times.

The coolers will be clearly labeled with sufficient information (i.e., name of project, time and date container was sealed, person sealing the cooler, and company name and address) to enable positive identification.

3.4 FIELD LOGBOOK AND FORMS

All field activities and observations will be noted in a field logbook during fieldwork. The field logbook will be a bound document containing individual field and sample log forms. Information will include personnel, date, time, station designation, sampler, types of samples collected, and general observations. Any changes that occur at the site (e.g., personnel, responsibilities, deviations from the FSP) and the reasons for these changes will be documented in the field logbook. The logbook will identify onsite visitors (if any) and the number of photographs taken at the sampling location (if any). The field coordinator is responsible for ensuring that the field logbook and all field data forms are correct.

All field activities and observations will be noted in a field logbook during fieldwork. The descriptions will be clearly written with enough detail so that participants can reconstruct events later if necessary. Field logbooks will describe any changes that occur at the site, in particular, personnel and responsibilities or deviations from the FSP as well as the reasons for the changes. Requirements for logbook entries will include the following:

- Logbooks will be bound, with consecutively numbered pages.
- Removal of any pages, even if illegible, will be prohibited.
- Entries will be made legibly with black (or dark) waterproof ink.
- Unbiased, accurate language will be used.
- Entries will be made while activities are in progress or as soon afterward as possible (the date and time that the notation is made should be noted, as well as the time of the observation itself).

- Each consecutive day's first entry will be made on a new, blank page.
- The date and time, based on a 24-hour clock (e.g., 0900 a.m. for 9 a.m. and 2100 for 9 p.m.), will appear on each page.
- When field activity is complete, the logbook will be entered into the project file.

In addition to the preceding requirements, the person recording the information must initial and date each page of the field logbook. If more than one individual makes entries on the same page, each recorder must initial and date each entry. The bottom of the page must be signed and dated by the individual who makes the last entry. The field team and task leader, after reading the day's entries, also must sign and date the last page of each daily entry in the field logbook.

Logbook corrections will be made by drawing a single line through the original entry allowing the original entry to be read. The corrected entry will be written alongside the original. Corrections will be initialed and dated and may require a footnote for explanation.

The type of information that may be included in the field logbook and/or field data forms includes the following:

- Names of all field staff
- Sampling vessel
- A record of site health and safety meetings, updates, and related monitoring
- Station name and location
- Date and collection time of each sample
- Observations made during sample collection, including weather conditions, complications, and other details associated with the sampling effort
- Sample description
- Depth of mudline below water surface
- Any deviation from the FSP.

Field data sheets and sample description forms will be completed for all samples and kept in the project file. Examples of the types of forms that may be used are provided in Appendix A.

3.5 WASTE DISPOSAL

Any excess water or sediment remaining after processing will be returned to the slip in the vicinity of the collection site. Any water or sediment spilled on the deck of the sampling vessel will be washed into the surface waters at the collection site before proceeding to the next station. Excess sediment remaining in the core tubes following processing will be collected in 5-gallon buckets, labeled, and kept at Integral in Olympia for future appropriate disposal.

All disposable materials used in sample collection and processing, such as paper towels and disposable coveralls and gloves, will be placed in heavyweight garbage bags or other appropriate containers. Disposable supplies will be removed from the site by sampling personnel and placed in a normal refuse container for disposal at a solid waste landfill. Phosphate-free, detergent-bearing, liquid wastes from decontamination of the sampling equipment will be washed overboard or disposed into the sanitary sewer system as will rinsates from the decontamination process.

3.6 FIELD QUALITY CONTROL SAMPLES

Quality control requirements will be instituted during field sampling, laboratory analysis, and data management to ensure that the data quality objectives are met. Detailed information on QA/QC procedures, limits, and reporting are described in detail in the QAPP (Appendix B). Field quality control requirements are described in the following sections. If quality control problems are encountered, they will be brought to the attention of the QA coordinator. Corrective actions, if appropriate, will be implemented to meet the project's data quality objectives.

3.6.1 Field QC Samples

Field QC samples will be used to assess sample variability and evaluate potential sources of contamination. The types of QC samples that will be collected for this project are described in this section. The estimated numbers of field and QC samples are listed in Table 4.

Field Replicates

Field replicates are additional samples collected in a sampling area at designated stations. These samples will be used to determine the natural variability associated with the sampling area, sample handling, and laboratory operations. Blind field replicates will be collected at 5% of the surface sampling stations. Samples will be assigned unique numbers and will not be identified as replicates to the laboratory.

Field replicate samples will be collected following collection of the primary sample. After the primary sample is obtained, the vessel will reposition at the same sampling station and the replicate sample will be collected. If the appearance of sediment in the grab sampler indicates that the replicate is located on a previously sampled location, the grab will be rejected and vessel repositioned.

Field Splits

Field split samples are designed to monitor overall sampling and analytical precision. Blind field splits will consist of a homogenized sample that is split into two sample aliquots. Field splits will be prepared where field replicates are prepared. Samples will be assigned unique numbers and will not be identified as splits to the laboratory.

3.6.2 Other Field QC Samples

Introduction of chemical contaminants during sampling and analytical activities will be assessed by the analysis of blanks. Rinsate blanks, consisting of sampling equipment rinsates, will be generated for all chemical parameter groups at approximately 5% of the sediment sampling stations. These rinsate blanks will be collected at the same stations as the field replicates and splits, thus maximizing the amount of information available to distinguish laboratory and environmental variability.

The rinsate blanks will be collected by pouring deionized water over all sampling equipment that comes in contact with the sediment. Specifically, after decontamination, the deionized water will be poured over the sampling spoon and bowl. One of the rinsate blanks will also include the hand-corer. The rinsate water will be collected in the bowl and transferred into sample bottles provided by the laboratory. Rinsate blanks will not be collected for the subsurface core tubes because sediment in contact with the core tube walls will not be sampled.

3.7 LABORATORY ANALYSIS

Surface and subsurface samples will be analyzed for PCB Aroclors, TOC, percent solids, and grain size. A subset of these samples will also be analyzed for the remaining analytes listed in the SMS as discussed above. Approximately 10% of the subsurface core samples will be analyzed for geotechnical parameters.

Laboratory analysis details are provided in the project QAPP (Appendix B).

4.0 DATA MANAGEMENT AND REPORTING

During field, laboratory, and data evaluation operations, effective data management is the key to providing consistent, accurate, and defensible data and data products. Data management and reporting are discussed in the following sections.

4.1 FIELD DATA

Daily field records (a combination of field and core logbooks data sheets) and navigational records will make up the main documentation for field activities. As soon after collection as possible, field notes, data sheets, core logs, and chain-of-custody forms will be scanned to create an electronic record for use in creating the cruise report. Field data will be hand-entered into the database. One-hundred percent of the transferred data will be verified based on hard copy records. Electronic QA checks to identify anomalous values will also be conducted following entry.

4.2 SAMPLE NUMBERING

All samples will be assigned a unique identification code based on a sample designation scheme designed to suit the needs of the field personnel, data management, and data users. Sample identifiers will consist of two components separated by dashes. The first component is SL4 to identify the data as originating in Slip 4. The second part will contain the following abbreviations for the sample type followed by the sample number:

SG = surface grab sample

SC = surface core sample

IC = intertidal composite sample

Subtidal subsurface core samples will also have a letter that is placed after the sample number to designate the sample horizon in the core. “A” will be used to indicate the top interval (i.e., 0- to 2-foot horizon). All subsequent (deeper) sample intervals will be indicated in alphabetical order (“B”, 2-4 feet; “C”, 4-6 feet, etc.).

Example sample labels are:

SL4-SG22: surface grab sample from Station 22

SL4-SC02C: core sample from the 4- to 6-foot horizon at Station 2

4.3 LABORATORY DATA

The contract laboratory will submit data in both electronic and hard-copy format as described in Section B10.2 of the QAPP (Appendix B). The Laboratory Project Manager (Ms. Dunnihoo) will contact the Project QA Coordinator (Ms. Sparks) prior to data delivery to discuss specific format requirements. Written documentation will also be used to clarify how field and laboratory duplicates and QA/QC samples were recorded in the data meta-tables and to provide explanations of other issues that may arise. The data management task will include keeping accurate records of field and laboratory QA/QC samples so that project managers and technical staff who use the data will have appropriate documentation. Data management files will be stored on a secure computer or on a removable hard drive that can be secured.

In addition to placing all data and identifiers in an electronic database, hard copies of all original analytical data or study records will be placed in a filing system. Each analytical data set (or extraneous lab documents) will be given a unique documentation code based on the original source of the data or information, and filed based on that code. A master list of all filed documents, sorted in order by filing code, will be maintained for easy retrieval from the library.

4.4 DATA MANAGEMENT

Integral will use the Environmental Quality Information System (EQuIS™) in conjunction with the ArcView 8.1 geographic information system (GIS) tools to manage, summarize, and report the generated data. In addition, data will be submitted electronically to EPA in the SEDQUAL format.

From within the EQuIS-ArcView GIS interface, data stored in the warehouse (data and reference tables) may be integrated to allow the production of shape files with relevant site features such as property names, land use, bathymetry, or outfalls. This greatly reduces the number of files to manage and allows the primary database manager to focus on refreshing the central database. The system also allows for the project data to refresh each time the ArcView interface is invoked. Accessing an updated common repository ensures that users are working with the same data as well as using same conventions.

The system's data dictionary contains conversion formulas so that any of the previously mentioned coordinate types can be recalculated to facilitate the use of location objects in ARCView GIS interfaces. To ensure proper documentation and consistency in chemical nomenclature, methodologies, and the standardization of analytical reporting of results, the system contains reference tables that store federal and state guidelines and terminology adopted for EPA remedial investigative projects. These reference tables are used to verify that chemical facts being projected into the graphic system are authentic. They are also used to ensure that queries of specific data facts out of the system are done using reputable sources.

4.5 DATA REVIEW AND REPORTING SCHEDULE

The deliverable schedule will be as generally described in the project workplan; however, the workplan did not contemplate tiering of sample analyses. The deliverables and schedule described in this section incorporate additional requirements resulting from the tiered analyses. As the project progresses, the reporting and schedule requirements may be altered, if necessary.

Data validation reports will be prepared by an independent validator following receipt of the complete laboratory data package for each analytical round. A draft cruise and data report will be prepared by Integral and submitted to EPA within 25 working days after receipt of the final validation report for the first tier analyses (i.e., PCBs and conventionals). The cruise and data report will include a description of the field sampling effort (e.g., procedures, sample and station locations and depths, field sample observations), descriptions and rationale for any deviations from the SAP and QAPP; a detailed discussion of any data quality issues; and tabulated field and laboratory data. A data report addendum(s) will be prepared for later (e.g., second tier) analyses. Electronic data will be provided to EPA once all analyses and data validation have been completed. Following preparation of the data report and addendum, the next deliverable provided to EPA will be a technical memorandum on proposed boundaries of the removal action.

5.0 REFERENCES

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APPENDIX A

FIELD FORMS AND CHECKLISTS

APPENDIX B

QUALITY ASSURANCE PROJECT PLAN

APPENDIX C

HEALTH AND SAFETY PLAN