



# LOWER DUWAMISH WATERWAY SLIP 4 EARLY ACTION AREA

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## 100% DESIGN SUBMITTAL Water Quality Monitoring Plan

*Submitted to*  
U.S. Environmental Protection Agency, Region 10  
1200 Sixth Avenue  
Seattle, WA 98101

*Submitted by*  
City of Seattle  
King County

*Prepared by*



7900 SE 28<sup>th</sup> Street, Suite 410  
Mercer Island, WA 98040

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## ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulations
BMP	Best Management Practice
COC	chemical of concern
CQAP	construction quality assurance plan
CWA	Clean Water Act
DGPS	Differential Global Positioning System
DO	dissolved oxygen
EAA	early action area
EPA	U.S. Environmental Protection Agency
EQ <sub>IS</sub>	Environmental Quality Information System
GIS	geographic information system
HSP	health and safety plan
LDW	Lower Duwamish Waterway
NTU	nephelometric turbidity units
PCB	polychlorinated biphenyl
QA/QC	quality assurance and quality control
QAO	Quality Assurance Officer
QAPP	quality assurance project plan
SAP	sampling and analysis plan
SOP	standard operating procedure
TSS	total suspended solids
WAC	Washington Administrative Code
WQMP	water quality monitoring plan
WQS	water quality standards

# 1 INTRODUCTION

This water quality monitoring plan (WQMP) is a part of the 100% Design Submittal for the removal action of contaminated marine sediments and immediately adjacent bank areas at the Slip 4 Early Action Area (EAA) of the Lower Duwamish Waterway (LDW) Superfund Site located in Seattle, King County, Washington. The City of Seattle and King County are conducting the Slip 4 sediment removal action for early cleanup of contaminated sediments.

Within the Slip 4 EAA, polychlorinated biphenyls (PCBs) are the chemicals of concern (COC) in the contaminated sediments. The defined removal boundaries encompass approximately 3.6 acres. The primary objective of the removal action is to reduce the concentrations of contaminants in post-cleanup surface sediments (biologically active zone [0–10 cm]) to below the Washington State Sediment Quality Standards for PCBs and other chemicals. The sediment removal action will significantly reduce unacceptable risks to the aquatic environment resulting from potential exposure to contaminants in sediments in the slip. This cleanup will also reduce potential human health risks associated with PCBs in sediment within the LDW.

This WQMP is part of the 100% Design Submittal for implementing U.S. Environmental Protection Agency's (EPA's) selected alternative for cleanup in Slip 4 (USEPA 2006). It is a component of the overall approach to quality assurance during construction activities in the project area, including compliance with applicable or relevant and appropriate requirements (Integral 2006). The construction quality assurance plan (CQAP) outlines the overall construction project approach to quality assurance, and the role of the water quality monitoring activities in relation to other project elements.

The purposes of this WQMP are to 1) assess impacts to local surface water in Slip 4 that might result from dredging activities, bank soil excavation, dredged material dewatering and transloading activities, placement of clean capping material, removal of pilings, and pier demolition; and 2) provide real-time feedback to the Contractor, the City, and EPA so that all construction activities remain in compliance with water quality criteria.

Prior to construction, EPA will issue a Clean Water Act (CWA) Section 401 Water Quality Certification that defines required water quality monitoring requirements and applicable water quality criteria as performance standards. The Contractor will be required to conduct all operations in compliance with these performance standards. In the event that any provision of the 401 Certification conflicts with this WQMP, the 401 Certification will take precedence.

## 1.1 OBJECTIVES

This WQMP will be used to obtain information to ensure compliance with water quality criteria during Slip 4 construction activities. The objectives of the plan are as follows:

- Monitor water quality conditions during Slip 4 construction activities including:
  - Demolition of designated structures (Crowley pier)
  - Removal of piles and debris
  - Dredging of contaminated sediments
  - Excavation of bank soils and sediments
  - Return flows associated with dewatering of excavated/dredged materials
  - Transloading of dredged and excavated materials from barge to land (i.e., to trucks), and associated management of return water (if any) from the transloading
  - Placement of a sediment cap on the bed and side slopes of the slip in designated areas
  - Placement of outfall scour protection.
- Verify that water quality conditions are within the prescribed limits of the EPA 401 Water Quality Certification.
- Help determine when to take appropriate action to modify construction activities to ensure protection of the environment if and when exceedances of water quality criteria occur.
- Promptly determine if modifications were effective.
- Define the lines of communication and response procedures in the event of exceedances of water quality criteria.

This WQMP defines field procedures for conducting the water quality monitoring, laboratory analytical methods, and quality assurance procedures; and summarizes the requirements for the timing of monitoring activities relative to specific construction elements.

## 1.2 REPORT ORGANIZATION

The remaining sections of this document describe the field monitoring program and sampling procedures to be used during the activities described above, and constitute the Sampling and Analysis Plan (SAP) for the water quality monitoring efforts. Section 2 provides the data collection activities that will take place during this monitoring program. Section 3 describes the field sampling methods and quality assurance/quality control (QA/QC) samples. Laboratory sample handling and processing are described in Section 4. Finally, references are provided in Section 5.

Supporting information is provided in the following appendices:

- **Appendix A.** Slip 4 Surface Water Quality Monitoring Quality Assurance Project Plan
- **Appendix B.** Slip 4 Surface Water Quality Monitoring Health and Safety Plan
- **Appendix C.** Standard Operating Procedure for YSI 6600 Multi Probe
- **Appendix D.** Standard Operating Procedure for Niskin Bottle
- **Appendix E.** Water Quality Parameters Field Log Forms.

## 2 DATA GENERATION AND ACQUISITION

The water quality monitoring will take place during the removal action activities to monitor surface water quality within Slip 4 and ensure that all construction activities are conducted in compliance with EPA's 401 Water Quality Certification.

### 2.1 SAMPLING DESIGN AND RATIONALE

In-water construction activities include demolition of structures, dredging, excavation of banks, material dewatering, material transloading from barge to truck, and placement of clean capping material. The material to be removed and then disposed of at an approved upland landfill facility includes contaminated sediment that will be dewatered, wood debris and old wood pilings, cement pilings, bank soil, and other debris. Monitoring activities will depend upon the removal action activity being conducted and the type of material being dredged or excavated.

Certain construction activities will occur "in-the-dry," that is, without any disturbance of submerged sediments or the water column. These activities may include demolition, bank excavation, or other construction elements. Activities that occur in-the-dry are not subject to water quality monitoring.

EPA's CWA 401 Water Quality Certification will specify an authorized mixing zone during in-water construction activities, and the point of compliance for meeting the water quality standards will be set at the boundary of this mixing zone. EPA has typically designated the mixing zone as an area extending 100 m (328 ft) radially from ongoing construction activities. For this project, it is anticipated that point of compliance measurements will occur at a fixed point 100 m (328 ft) directly upslip (southwest) of the southern boundary of capping, rather than moving with the construction activities. This approach is favored because of the comparatively small size of the work area, the confined geometry of Slip 4, and the fact that the fixed location is less likely to be affected by turbidity from storm drain discharges. Additional monitoring points include ambient stations and discretionary stations, as discussed in later sections of this plan.

Given the confined space and restricted water flow within Slip 4, two pre-established monitoring/sampling stations will be employed. A compliance sampling station will be located mid-slip at 100 m from the work site boundary line. The compliance station will be located in an area that is unlikely to be influenced by other ongoing activities within the slip that may influence turbidity measurements (e.g., Crowley operations in the berth, storm drain discharges). An ambient sampling station will be located at the entrance of the slip just off the LDW main channel (Figure 2-1). *In situ* water quality measurements

and collection of water samples for chemical analyses will be compared to state water quality standards for compliance, as defined in the 401 Certification.

*In situ* water quality measurements will include turbidity, dissolved oxygen (DO), temperature, and salinity. In general, real-time turbidity measurements will be used to help determine when modifications to construction activities should be made, and whether grab samples should be collected for COC analysis

Water grab samples that will be collected will be submitted for analysis of COCs (total suspended solids [TSS] and PCB Aroclor concentrations). All TSS and PCB analyses will be performed on a rush basis (24–48 hours) in order to provide additional information about possible water quality exceedances in a rapid time frame and allow for appropriate modifications to the construction activities.

Section 4.4 presents the water quality reporting and feedback mechanisms for responding to any exceedances of water quality criteria.

Section 9 of the Design Analysis Report (DAR) (Integral 2007) presents the preliminary estimated construction schedule. A condensed summary of the preliminary estimated construction schedule is shown in Figure 2-2. The various activities, their locations, and their durations were considered in developing the water quality sampling scheme in Section 2.1.2. It is noted that the Contractor's work plan will contain a detailed schedule that will vary from Figure 2-2.

### **2.1.1 Monitoring and Sampling Depths**

*In situ* water quality measurements will be taken at two depths: near-surface (approximately 3 ft below the water surface) and near-bottom (approximately 3 ft above the mudline). Where grab samples are to be collected, the sample will be obtained from the water depth exhibiting the greatest turbidity.

### **2.1.2 Sampling Scheme for Water Quality Monitoring**

Table 2-1 shows the sampling scheme for the water quality monitoring at Slip 4. *In situ* water quality measurements and grab samples will be collected at two pre-designated stations and potentially at discretionary stations, during three project phases: bank excavation, sediment dredging, and capping. If demolition activities cause observable turbidity within or outside the mixing zone, then sampling will also occur during this phase. The sampling frequency and sampling types are described in detail for each type of construction activity in the following subsections.

In addition, water will be generated from the upland transloading operations, including any dewatering liquids generated upland, precipitation into "dirty" work areas, and

decontamination liquids. Section 7 of the DAR describes the procedures and best management practices (BMPs) for the transloading operation. The Contractor will contain and treat this water, for eventual discharge to the municipal sewer system (by permit) or into Slip 4. Sampling, analysis, and disposal of the treated transloading water are described below.

**Note:** For each of the cases described below, if water quality turbidity exceedances are encountered, the reporting and response mechanisms described in Section 4.4 will be followed. Additional discretionary locations may be monitored to assess whether the source of the turbidity exceedance is from Contractor operations or other sources (e.g., stormwater). In addition, EPA may direct modification of any of the activities described below.

#### **2.1.2.1 Sediment Dredging**

It is anticipated that sediment dredging will take approximately 5–9 days to complete (Figure 2-2). An intensive level of monitoring will occur for the first 7 days of the active dredging. *In situ* water quality measurements will be collected twice daily (at slack tide and ebb tide) at both ambient and compliance stations (Table 2-1). On the first and third days after initiation of dredging, one water grab sample (at the depth with maximum turbidity) will be collected from both the ambient and compliance stations and submitted for expedited PCB and TSS analyses. If water turbidity exceedances occur at the compliance station at any other times during this period, one water grab sample will be collected at both the ambient and compliance stations (at the depth with maximum turbidity).

If dredging activities extend longer than 7 days, a moderate monitoring program will take place (Table 2-1). *In situ* water quality measurements will be collected on two non-consecutive days per week, and measurements will be taken twice daily (at slack tide and ebb tide) at the ambient and compliance stations. Water grab samples will be collected at ambient and compliance stations only if exceedances occur. EPA will be consulted as to the need for water grab collection.

#### **2.1.2.2 Bank Excavation (in-water work only)**

It is anticipated that bank excavation will take approximately 14–18 days to complete (Figure 2-2). An intensive monitoring program will occur during the first five days of active excavation. *In situ* water quality measurements will be collected twice daily (at slack tide and ebb tide) at both the ambient and compliance stations (Table 2-1). On the first, third, and fifth days after initiation of excavation, one water grab sample (at the depth with maximum turbidity) will be collected from both the ambient and compliance stations. These grab samples will be collected at the depth with maximum turbidity and

will be submitted for expedited PCB and TSS analyses. If water turbidity exceedances occur at the compliance station at any other times during this period, one water grab sample will be collected at both the ambient and compliance stations (at the depth with maximum turbidity).

After the first 5 days of excavation, a moderate monitoring program will take place (Table 2-1). *In situ* water quality measurements will be taken at two non-consecutive days per week, and measurements will be taken twice daily (at slack tide and ebb tide) at the ambient and compliance stations. Water grab samples will be collected at ambient and compliance stations only if exceedances occur. In this case EPA will be consulted as to the need for water grab collection.

### **2.1.2.3 Demolition (in-water work only)**

It is anticipated that removal of piling and debris from the slip will take approximately 5 days, and pier demolition will take approximately 13–17 days to complete (Figure 2-2). If demolition activities cause observable turbidity or sheen inside or outside the mixing zone, *in situ* water quality measurements will be collected at the ambient and compliance stations. Upon any water turbidity exceedances at the compliance station, EPA will be consulted regarding the potential need for grab sampling.

### **2.1.2.4 Capping**

It is anticipated that capping activities will take approximately 48 days to complete (Figure 2-2). A moderate level of monitoring is appropriate for this activity because the capping material being placed in the waterway is clean, capping generally results in far less resuspension of sediments than dredging, and the methods used for cap placement will minimize turbidity and resuspension of in-place sediments.

A moderate monitoring program will take place during the first 5 days of capping (Table 2-1). *In situ* water quality measurements will be collected on two non-consecutive days during the first 5 days, and measurements will be taken twice daily (at slack tide and ebb tide) at the ambient and compliance stations. After the first 5 days, *in situ* water quality measurements will be collected once per week, at slack and ebb tide, at the ambient and compliance stations. If any water turbidity exceedances occur at the compliance station, EPA will be consulted as to the need for water grab sample collection.

### **2.1.2.5 Return Flows from Dewatering on Barge**

Dredged and excavated materials will be allowed to gravity drain on barges onsite (within the removal area boundaries) for several hours to minimize free draining liquids, prior to being loaded for transportation and disposal. BMPs will be used in the material handling as described in the DAR: overflow of the materials barge will not be allowed, and

the materials barge will be fitted with sideboards and filter fabric or other measures to control turbidity in the drained water.

The dewatering will generally occur concurrent with dredging and excavation activities and in the same work area; therefore, monitoring for the dredging and excavation activities will also assess any impacts from the return water. The monitoring scheme described in Table 2-1 for the dredging and excavation activities may be extended if dewatering continues past the end of the dredging and excavation activities. If any water turbidity exceedances occur at the compliance station, EPA will be consulted as to the need for water grab sample collection.

#### **2.1.2.5 Transloading Return Flows**

Section 7 of the DAR describes the procedures for managing wastewater generated during transloading. The Contractor will collect liquids from upland containment areas (potentially including any dewatering liquids generated upland, precipitation into “dirty” work areas, and decontamination liquids) and filter it, treat it, analyze it, and dispose of it in the municipal sewer system or into Slip 4:

- Discharge of treated water will be to the municipal sanitary sewer system, under permit from King County, if practicable. The Contractor will obtain the permits and conduct all sampling, analysis, reporting, and attain all approvals for discharge. It is anticipated that EPA’s CWA 401 certification will initially specify that no return flows of water from the transloading area to Slip 4 will be permitted. In this case, no water quality monitoring will occur under this WQMP.
- Consistent with CWA 404 requirements, the preference is to avoid any return flow of water from the transloading operations to the slip. However, in the event that the Contractor can demonstrate that discharge to the sanitary sewer is impracticable (i.e., a permit cannot be obtained), discharge will be to Slip 4. In this case, EPA will modify its CWA 401 certification and set the sampling and compliance requirements. Sampling and analysis of the treated water will be conducted by Integral, and this WQMP will be modified to include the additional sampling and analysis requirements. Discharge into Slip 4 would be in accordance with EPA’s CWA 401 Water Quality Certification. It is anticipated that the return flow would need to meet marine acute standards for COCs, and dissolved oxygen/turbidity criteria, at the end-of-pipe.

## **2.2 APPLICABLE AND RELEVANT WATER QUALITY STANDARDS**

During construction, Washington state water quality standards will need to be attained at a specified point of compliance. These criteria include general water use and criteria classes (WAC 173-201A-030) for turbidity, DO, and toxic conditions, and the numeric toxic substances criteria (WAC 173-201A-040).

### **2.2.1 Point of Compliance**

EPA's water quality certification will specify an authorized mixing zone during in-water construction activities, and the point of compliance for meeting the water quality standards will be set at the boundary of this mixing zone. Because of the confined geometry of Slip 4, and the likelihood at any given time of multiple construction activities at various locations within the removal boundaries, a moving point of compliance would likely be unworkable. Therefore, the entire removal area will be considered a zone of activity, and point of compliance measurements will occur at a fixed location 100 m (328 ft) directly upslip (southwest) of the construction boundaries. Additional monitoring points include ambient stations and discretionary stations, as shown on Figure 2-1.

If return flows of transloading wastewaters to Slip 4 are permitted, the point of compliance will be at the end-of-pipe.

### **2.2.2 Specific Criteria**

Water quality standards (WQS) pertaining to the marine waters of Elliott Bay (Class A) (WAC 173-201A-140 Specific Classifications—Marine Waters) and the fresh waters of the Duwamish River (Class B) (WAC 173-201A-130 Specific Classifications—Freshwater) potentially could apply to this project. The lower reach of the Duwamish Waterway is a saltwater wedge estuary with a lower layer of nearly undiluted seawater moving upstream from Puget Sound and a surface layer of riverine fresh water mixed with saltwater. The saltwater wedge is present in the vicinity of Slip 4 throughout the year, and, in the vicinity of Slip 4, the waterway generally remains stratified with a distinct freshwater/low salinity surface layer overlying a saltwater bottom layer.

Circulation in the Duwamish Waterway is controlled by freshwater inflow and tidal action. In general, on a rising tide, water in both the bottom saltwater wedge and surface layer flows upstream. On a falling tide, the flow is downstream. Although water moves upstream and downstream with the tides, circulation in the vicinity of Slip 4 consists of a net downstream flow in the surface layer and a net upstream flow in the salt wedge layer (King County 1999).

Based on previous water quality certifications on the Duwamish River, it is expected that Class B marine water quality standards will apply to this project except within the

authorized mixing zone, unless there is a practical reason why results should be compared to a different standard (e.g., results from the upper water column indicate that turbidity is an issue in the freshwater lens due to project activities—a freshwater standard could potentially be applied at EPA’s discretion). The following are specific water quality standards for Slip 4:<sup>1</sup>

#### **2.2.2.1 Dissolved Oxygen**

At the point of compliance (edge of the mixing zone), DO shall exceed 5.0 mg/L. When natural conditions such as upwelling occur, causing the DO to be depressed near or below 5.0 mg/L, natural DO levels may be degraded by up to 0.2 mg/L by human-caused activities. If for any reason DO should drop below 3.5 mg/L within the dilution zone, in-water work should cease immediately.

#### **2.2.2.2 Turbidity**

At the point of compliance (edge of the mixing zone), turbidity shall not exceed 10 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 20 percent increase in turbidity when the background turbidity is more than 50 NTU.

#### **2.2.2.3 Chemicals of Concern**

At the point of compliance (edge of the mixing zone), chemical concentrations shall not exceed the numeric toxic substances acute criteria for marine water (WAC 173-201A-040).

Class B marine water quality standards are shown in Table 2-2. For chemical analysis of water grab samples, Washington State WQS acute toxic criteria (Table 2-3), as defined in EPA’s 401 Water Quality Certification, will be applied as the benchmark for compliance for total PCB concentrations.

If return flows of transloading wastewaters to Slip 4 are permitted, the water quality certification may identify different standards or additional analytes for COCs.

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<sup>1</sup> EPA’s CWA 401 Water Quality Certification will set the final standards.

## 3 FIELD SAMPLING PLAN

The following sections describe the project organization, anticipated field event schedule, field monitoring and sampling methods, and the laboratory analyses to be conducted.

### 3.1 PROJECT ORGANIZATION

This section presents the organizational structure for sampling and analysis activities associated with the Slip 4 water quality monitoring program, including team organization and responsibilities, fieldwork, data management, and laboratory analyses. Section 4.4 describes the lines of reporting and response mechanisms that will be used to respond to any exceedances of water quality criteria.

#### 3.1.1 Team Organization and Responsibilities

The organization and responsibilities of the investigation team are summarized below:

Ms. Karen Keeley, U.S. EPA Region 10, is EPA's Remedial Project Manager for Slip 4. Ms. Keeley is responsible for approving this WQMP and any subsequent modifications, and for making final agency decisions based on the results of the water quality monitoring.

Ms. Erika Hoffman, U.S. EPA Region 10, represents EPA's Aquatic Resources Unit and will provide technical determinations of the water quality monitoring results. Ms. Hoffman will write the Water Quality Certification for this project.

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 WQMP Quality Assurance Project Plan (QAPP) and data quality report.

Mr. David Schuchardt is the project specifier, responsible for coordinating the remediation activities in the work area and ensuring that all work is conducted in accordance with the EPA approved 100 Percent Design, as amended.

Ms. Chris Woelfel is the City of Seattle's project manager, responsible for providing contract direction to Integral.

The City's resident engineer, Bryan Nicholson, is responsible for directing the Contractor to modify operations or stop work, as needed.

The construction contractor is responsible for conducting all activities in compliance with EPA's 401 Certification, as determined by the results of this water quality monitoring program.

Integral is responsible for implementing the WQMP, reporting exceedances to the Contractor, EPA, and the City's Resident Engineer, and preparing the associated reports for EPA on behalf of the City of Seattle and King County.

### 3.1.2 Integral Personnel

Integral project personnel for the WQMP are identified below.

Position	Personnel
Integral Principal in Charge	Betsy Day
Construction Oversight Manager	Reid Carscadden
Field Supervisor/Safety Officer	TBD
Project QA Officer	Reid Carscadden
Laboratory Coordinator and QA Manager	TBD
Data Manager	Tom Schulz

The organizational structure of the lead sampling and analysis personnel and analytical laboratory is shown in Figure A4-1 of the WQMP QAPP (Appendix A).

## 3.2 FIELD SAMPLING SCHEDULE

Field work for the removal action is limited by the Chinook salmon migration window and is tentatively scheduled to begin in early October 2011 and estimated to be completed in approximately 110–120 days. Many of the field tasks depend on tide levels and will be scheduled accordingly.

## 3.3 FIELD MONITORING AND SAMPLING METHODS

This WQMP includes measurements of water quality parameters with a YSI 6600 multi probe and collection of water samples with a Niskin bottle. The methods to be used for the collection of these field data are described in this section. The results of daily standard measurements of water quality parameters such as turbidity and TSS will be synoptic with the results of water chemistry collected with a Niskin bottle. The water chemistry analytical results will be delayed by a day or two from the instantaneous surface water quality parameters measurements because of required laboratory turnaround times for chemical analyses. For this reason, turbidity will be the primary indicator of potential water quality problems during monitoring.

All field documentation, station positioning, sample handling, equipment decontamination, waste disposal, chain-of-custody, and QC procedures will be described below. All field documentation will be recorded on either water quality parameters log forms or field notebooks (Appendix E).

All field activities will be conducted in accordance with the site-specific health and safety plan (HSP) that is provided in Appendix B.

### **3.3.1 Sampling Vessels**

A sampling vessel will be used that is equipped with a deck large enough to accommodate one to two crewmembers in addition to the captain. One of the crew members will also be a navigator. The vessel will have enough deck space to accommodate a YSI multi probe, a Niskin bottle, two coolers, and sampling equipment boxes containing sample jars, and other ancillary equipment. The vessel will include a capstan (minimum of 350-lb capacity davit [pulling winch]), navigational lights, anchors, and basic sonar.

### **3.3.2 Station Positioning**

Latitude and longitude coordinates will be obtained during surface water 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  $\pm 2$  m.

Station positioning from the sampling vessel will be accomplished using a DGPS, which consists of a GPS antenna and Trimble pro XRS receiver and handheld TSC1 data logger. Positioning accuracies on the order of  $\pm 1-3$  m 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 (in the handheld TSC1), which displays the boat'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.

### **3.3.3 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 B).

Sample containers and preservatives, as well as coolers and packing material, will be supplied by the analytical laboratory. Commercially available, pre-cleaned sample bottles 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.

Real-time *in situ* water quality data for conventional parameters will be obtained with a YSI multiprobe, as described in the QAPP (Appendix A). Because of the critical nature of this data in field decision making, a backup unit will be available at all times.

### **3.3.4 Equipment Decontamination**

The Niskin bottles will be rinsed with site water and washed with Liquinox™ detergent prior to use and between sampling stations using the following process:

- Rinse with site water
- Wash with Liquinox™
- Rinse with methanol
- Final rinse with distilled water at the field lab or site water when in the field.

Niskin bottles will be kept wrapped in plastic bags until time for use. To minimize sample cross-contamination, disposable gloves will be replaced between stations.

### **3.3.5 Collection of Surface Water Samples**

*In situ* water samples will be collected using a Niskin bottle, using the standard operating procedure (SOP) provided in Appendix D. The bottle is attached to a cable and lowered by means of a winch to the desired depth of sampling. The Niskin bottle is a plastic cylinder with stoppers at each end, connected by an elastic cord. The stoppers are held open by plastic cords attached to a release mechanism. Clamps on the side of the cylinder are used to attach the bottle to a hydrographic line (a 3/16-in. steel cable with a 60-lb weight at the end) so that it can be lowered to a discrete depth in the water. When a small weight encircling the hydrographic line, called a "messenger," is released down the line, it strikes the release mechanism resulting in the two stoppers being pulled into the ends of

the cylinder, thereby trapping water from that depth. The Niskin bottles will be retrieved and the water sample transferred to the pre-cleaned sample bottles.

Table 3-1 provides the storage temperatures, preservation, and holding times for surface water samples.

### **3.4 CHAIN-OF-CUSTODY PROCEDURES**

Because samples collected in support of CERCLA activities may be used in litigation, their possession must be traceable from the time of sample collection through laboratory and data analysis to introduction as evidence. To ensure that samples are traceable, chain-of-custody procedures will be used.

Samples will be 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.

### **3.5 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 4° C. 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. If shipment is to be performed by a third-party (i.e., FedEx), 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. 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.

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.

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.

### 3.6 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 WQMP) 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.

The descriptions of all field activities 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 WQMP, 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 WQMP.

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 E.

### **3.7 INVESTIGATION-DERIVED WASTE**

Investigation-derived waste consists mainly of multi probe standard solutions used during calibration procedures and will be disposed of in the sanitary system followed by copious amounts of water.

### **3.8 SPECIAL TRAINING REQUIREMENTS AND CERTIFICATIONS**

All field personnel will be 40-hour certified for hazardous waste operations and current on 8-hour refresher courses to comply with the 29 CFR 1910.120 (e)(3) regulation for working at Superfund sites.

### **3.9 FIELD QUALITY CONTROL SAMPLES**

QC requirements will be instituted during field sampling, laboratory analysis, and data management to ensure that the data quality objectives are met (Appendix A, QAPP). Detailed information on QA/QC procedures, limits, and reporting is described in the QAPP (Appendix A).

The types of field QC samples that will be collected are listed in Table A6-1 of the QAPP (Appendix A). Field QC samples will include field replicate samples and equipment rinsate blank samples. These field QC samples will be generated at a frequency of one set per week, as shown in Table A6-1 of the QAPP.

### **3.10 LABORATORY ANALYSES**

Laboratory analyses will be performed according to the Slip 4 Water Quality Monitoring QAPP (Appendix A). Samples will be analyzed for PCB Aroclors and TSS, as detailed in Table A6-2 of the QAPP.

## 4 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. The management and reporting of field and laboratory data will generally follow the procedures outlined by Integral (2004). Changes or additions to those procedures based on the specific requirements of this WQMP are discussed in the following sections.

### 4.1 SAMPLE NUMBERING

According to Integral (2004), 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, and the second component, SW, indicates that it is a surface water sample. Samples will be collected from two sampling locations (also called the station name): a compliance sampling station (01), and an ambient sampling station (02). Samples will be collected during slack and ebb tides at both stations during three project phases: bank excavation, sediment dredging, and capping. If demolition activities cause observable turbidity, sampling will also occur during this phase. Samples collected at slack and ebb tides will include the letters "A" and "B," respectively, after the station number.

Some examples of sample labels include:

- **SL4-SW01A:** Slip 4 surface water sample collected from Station 1 (compliance station) at slack tide.
- **SL4-SW02B:** Slip 4 surface water sample collected from Station 2 (ambient station) at ebb tide.
- **SL4-SW01B-2:** Slip 4 replicate surface water sample collected from Station 1 at ebb tide.

### 4.2 DATA MANAGEMENT

Integral will use the Environmental Quality Information System (EQuIS) in conjunction with the Arc View 8.1 geographic information system (GIS) tools to manage, summarize, and report the generated data. From within the EQuIS-Arc View 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 Arc View 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 ARC View 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.

### **4.3 DATA REVIEW AND REPORTING SCHEDULE**

Due to the rush nature of all analyses and the need to make immediate real-time decisions about construction activities based on any water quality exceedances, the laboratory results will not undergo data validation by an independent validator prior to reporting of results. The laboratory will, however, provide a data package for each sample delivery group or analysis batch that is comparable in content to a full Contract Laboratory Program package. It will contain all information required for a complete QA review, including all the associated raw data so formal validation could be performed if subsequently required. Further discussion of the data review, reporting, and verification of the laboratory results is included in Sections B, C, and D of the QAPP (Appendix A).

A water quality monitoring report will be prepared by Integral and submitted to EPA within 60 days after completion of construction, as part of the Removal Action Completion Report. The water quality monitoring 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 WQMP and QAPP; a detailed discussion of any data quality issues; and tabulated field and laboratory data. Electronic data will be provided to EPA once all analyses have been completed.

Information to be included in the water quality monitoring report will include but is not limited to:

- Field methods and any deviations from the WQMP
- Field change requests
- Actual sample locations
- Tabulated water quality measurement results

- Laboratory analysis results
- Sample description forms
- Photo documentation.

#### **4.4 WATER QUALITY FEEDBACK AND RESPONSE MECHANISMS**

The primary issue that arises during water quality monitoring is detection of excess turbidity from the construction activities. Freshwater inflows from storm drains also enter Slip 4 and may introduce turbidity not associated with construction, and vessel operations from surrounding areas may also introduce turbidity.

The City has arranged for the middle berth area (where the compliance station is located) to remain free of commercial vessel moorage or traffic. Although the compliance station will be located in an area that will not have other ongoing vessel movements, turbidity measurements could be confounded by vessel movements at Crowley's outer berth. Specific monitoring elements may be included if turbidity exceedances are observed at the point of compliance and are suspected of being associated with other vessel activities or a turbid freshwater lens from stormwater inputs, and not associated with construction.

Based on the monitoring results, if DO or turbidity is exceeded at the point of compliance (boundary of the mixing zone), the following steps will be taken:

- The field supervisor will immediately notify the quality assurance officer (QAO) of the condition, and proceed to verify the result within 20 minutes. Additional discretionary locations may be monitored to assess whether the source of the turbidity exceedance is from contractor operations or other sources (e.g., stormwater).
- If the exceedance is confirmed, the QAO will immediately notify the Contractor's site supervisor, the resident engineer, and EPA.
- The Contractor will modify its operations.
- The field supervisor will conduct additional monitoring to assess the results.
- The QAO will report the results to the Contractor's site supervisor, the resident engineer, and EPA. If exceedances persist, EPA may direct corrective actions such as increased monitoring frequency, monitoring for COCs, specific construction modifications, or EPA may direct construction to cease.

The reporting and feedback loops for this communication are depicted in Figure 4-1.

If a COC acute standard is exceeded at the point of compliance (based on the data which will be received within 2 days from the laboratory), then EPA will be consulted. The general process provided in Figure 4-1 will be followed with the acknowledgement that

real time data are not available and the general response may require modification. Actions will be determined in consultation with EPA and may include the following:

- Analytical results from both the compliance and ambient station will be assessed.
- The construction activities at the time of the grab sample collection will be reviewed and compared to current activities.
- Water quality conventional parameters at the time of the grab sample collection will be reviewed and compared to current and past conventional parameters.
- The need for modification of construction activities, or stopping work, will be reviewed with EPA and the Contractor.
- Intensive monitoring and/or grab sample collection may be conducted.

## 5 REFERENCES

Integral. 2004. Lower Duwamish Waterway Slip 4 early action area: Sampling and analysis plan for boundary definition. Prepared for City of Seattle and King County, WA. Integral Consulting Inc., Mercer Island, WA.

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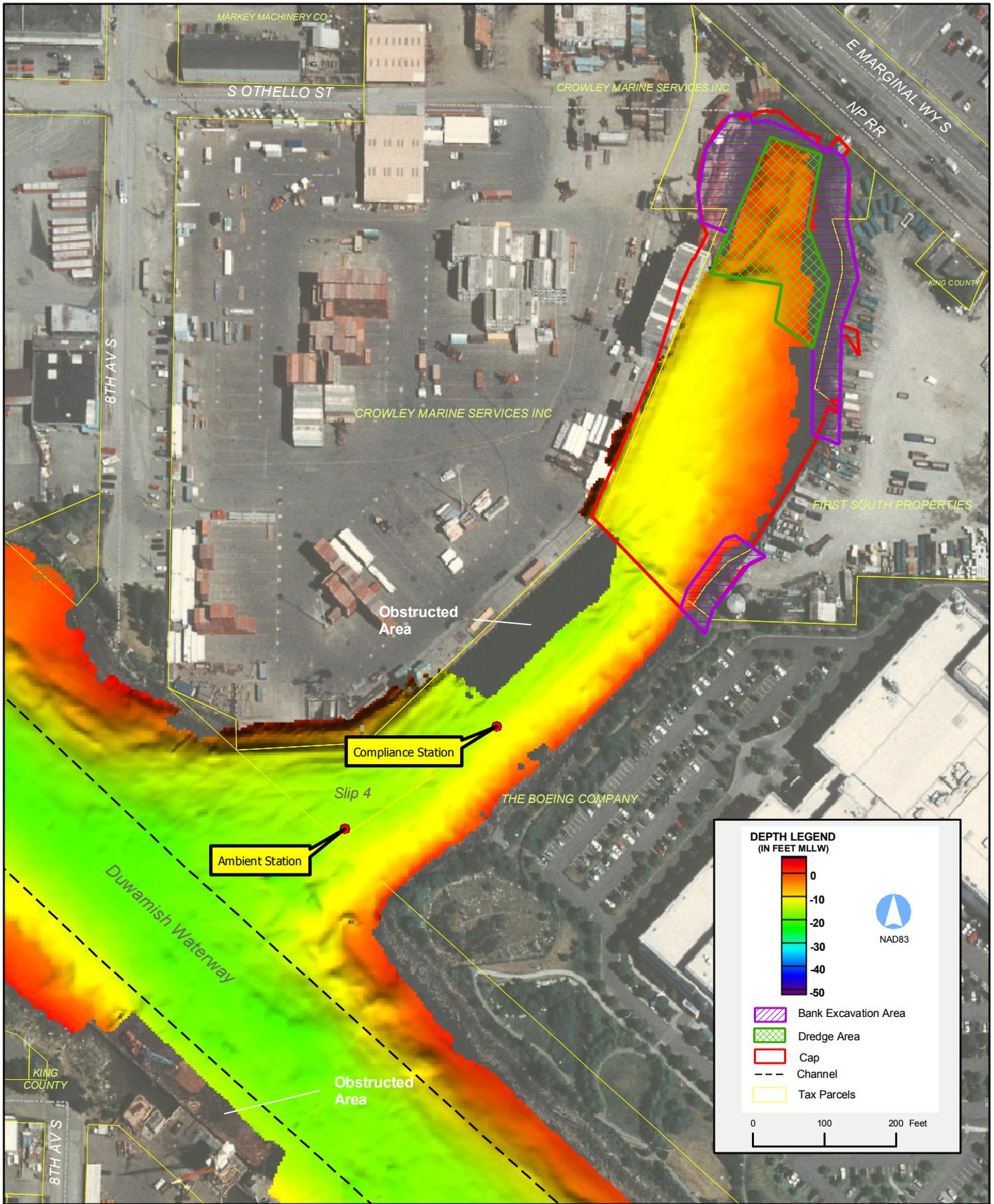
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USEPA. 2006. Action memorandum for non-time critical removal action at the Slip 4 early action area of the Lower Duwamish Waterway Superfund Site, Seattle, Washington, dated May 3, 2006. U.S. Environmental Protection Agency, Region, 10, Seattle, WA.

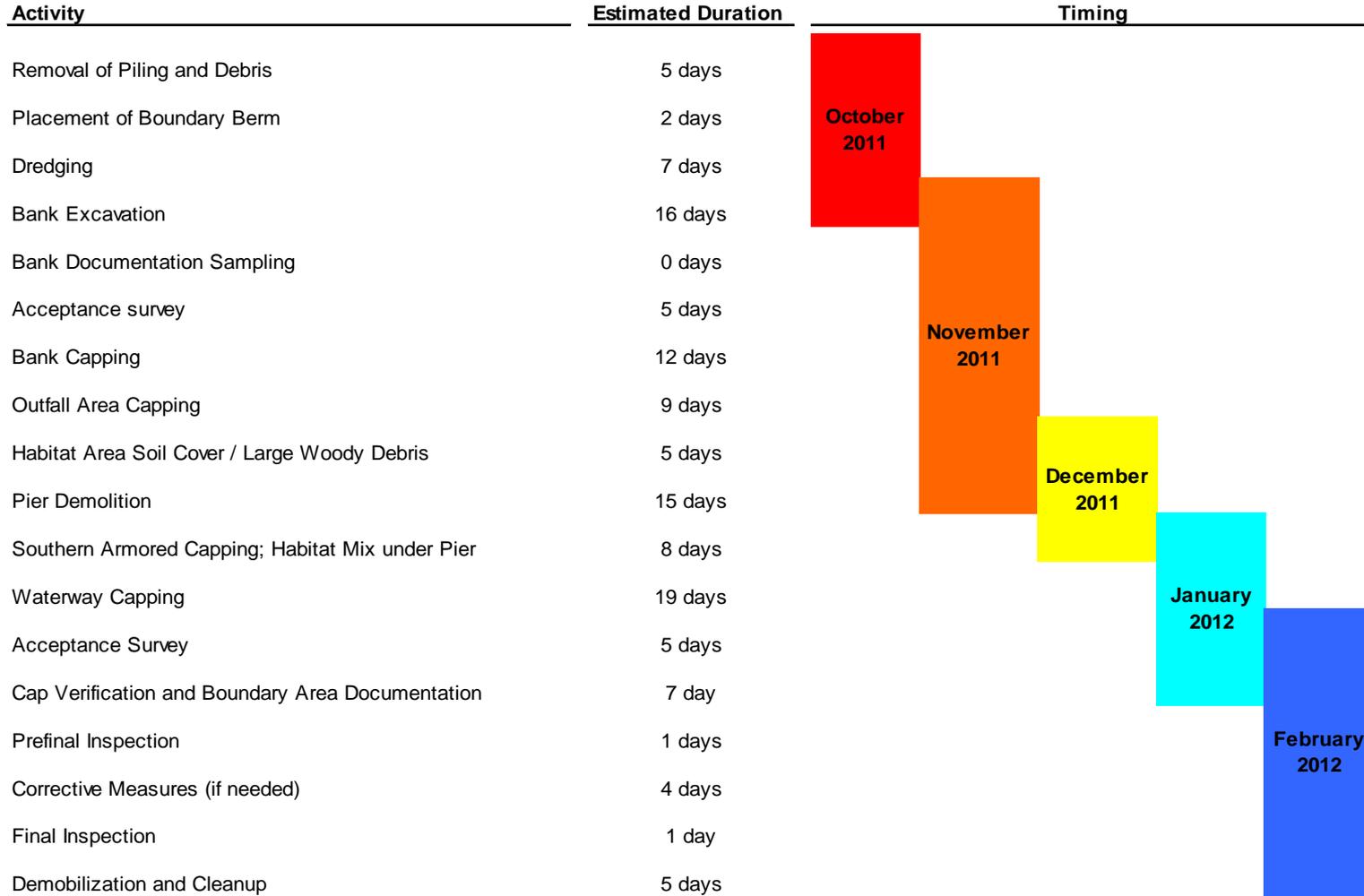
## **FIGURES**

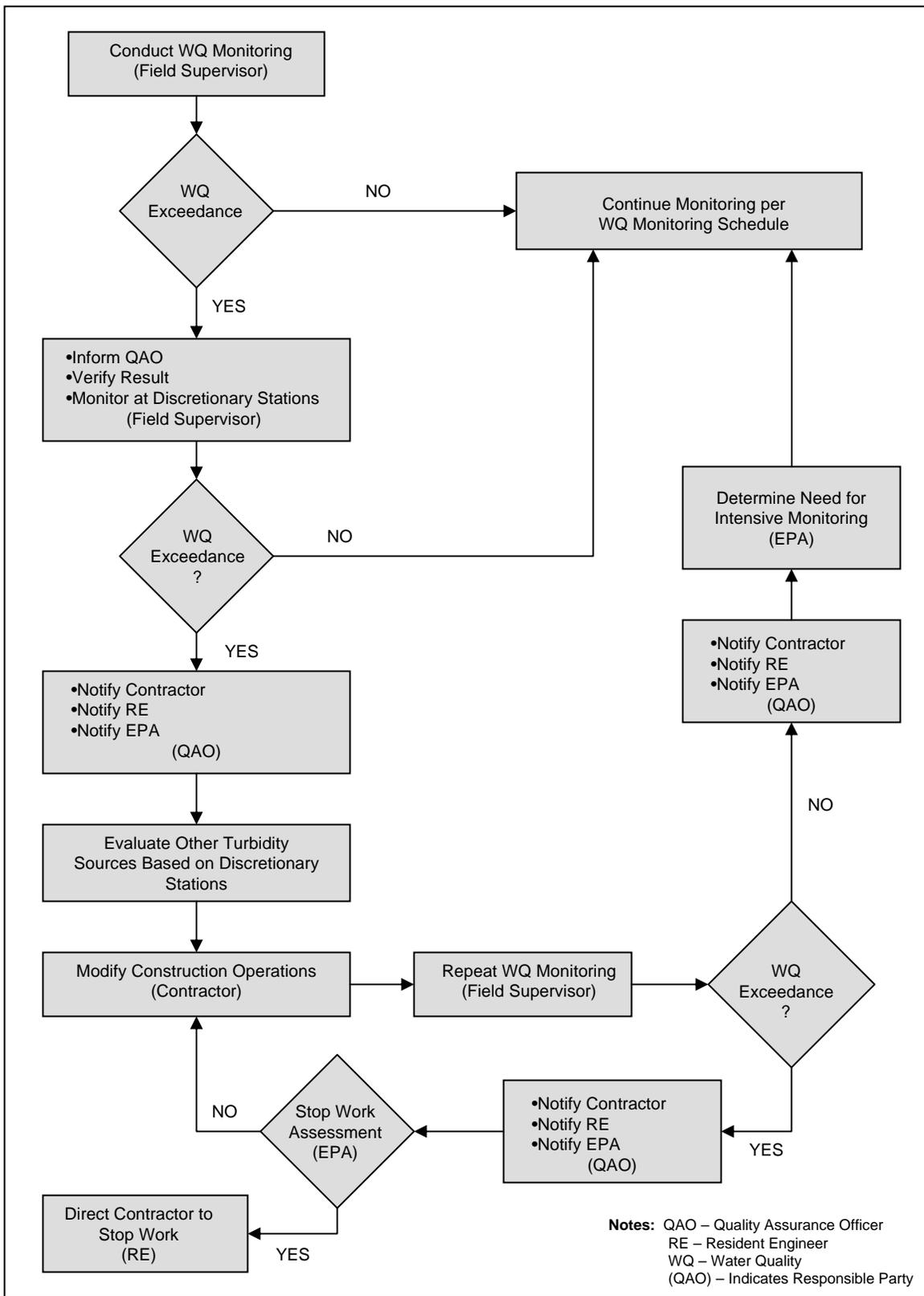
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Figure 2-1  
 Water Quality Monitoring Stations  
 Slip 4 Water Quality Monitoring Plan





## TABLES

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Table 2-1. Slip 4 Water Quality Monitoring Sampling Scheme.

Activity	Estimated Duration	Monitoring Level	<i>In Situ</i> Water Quality Measurements <sup>a</sup>	Grab Samples—COCs and TSS <sup>b</sup>
Sediment Dredging	5-9 days	Intensive	First seven days of dredging: Twice daily (at slack tide and ebb tide). Measure at both ambient and compliance stations.	On the first and third days after initiation of dredging: One water grab sample (at the depth with maximum turbidity). Measure at both ambient and compliance stations. Samples to be submitted for expedited PCB and TSS analysis.
		Moderate	After the first seven days of dredging: Two non-consecutive days per week. Twice daily (at slack tide and ebb tide). Measure at both ambient and compliance stations.	Upon NTU exceedance at compliance station at any other time during this period: One grab sample at both ambient and compliance stations (at depth with maximum turbidity).  Upon NTU exceedance at compliance station: Water grab samples may be collected at both ambient and compliance station. Consult with EPA.
Bank Excavation (in-water work only)	14-18 days	Intensive	First five days of excavation: Twice daily (at slack tide and ebb tide). Measure at both ambient and compliance stations.	On the first, third, and fifth days after initiation of excavation: One water grab sample (at the depth with maximum turbidity). Measure at both ambient and compliance stations. Samples to be submitted for expedited PCB and TSS analysis. If water turbidity exceedances occur at the compliance station at any other time during this period, one water grab sample will be collected at both the ambient and compliance stations (at the depth with maximum turbidity).
		Moderate	After the first five days of excavation: Two non-consecutive days per week. Twice daily (at slack tide and ebb tide). Measure at ambient station and compliance station.	Upon NTU exceedance at compliance station: Water grab samples may be collected at both ambient and compliance station. Consult with EPA.

Table 2-1. (continued)

Activity	Estimated Duration	Monitoring Level	<i>In Situ</i> Water Quality Measurements <sup>a</sup>	Grab Samples—COCs and TSS <sup>b</sup>
Demolition (in-water work only)	13-17 days	Visual	If demolition activities cause observable turbidity: Measure at both ambient and compliance stations.	Upon NTU exceedance at compliance station: Consult with EPA
Capping	48 days	Moderate	First five days of capping: Two non-consecutive days. Twice daily (at slack tide and ebb tide). Measure at ambient and compliance stations.  After the first five days of capping: Measure once per week thereafter (at slack tide and ebb tide). Measure at both ambient and compliance stations.	Upon NTU exceedance at compliance station: Consult with EPA  Upon NTU exceedance at compliance station: Consult with EPA
Return Flows from Dewatering	19-27 days		Occurs concurrent with, and in the same work area, as dredging and excavation. Monitoring of dredging and excavation covers this activity.	
Transloading Return Flows			Transloading liquids to be discharge to sanitary sewer.	

**Notes:** COC = chemicals of concern  
 TSS = total suspended solids

<sup>a</sup> Turbidity, dissolved oxygen, temperature, salinity. Report any exceedances immediately, and consult with CQO on conducting measurements at discretionary stations.

<sup>b</sup> COCs include PCBs as Aroclors. Conduct synoptic water quality measurements with COC samples.

Table 2-2. Washington State Water Quality Standards for Slip 4 Water Quality Monitoring.

Analytes	Standard	Condition
PCB Aroclors (µg/L)	10 µg/L <sup>a</sup>	A 24-hour average not to be exceeded
Dissolved Oxygen	5 mg/L	Lowest 1-day minimum. If natural conditions caused the ambient dissolved oxygen to be 5.0 mg/L or less, degradation by human activities may be no more than 0.2 mg/L
Temperature	< 19 °C	Incremental increases measured at a mixing zone boundary resulting from point source activities shall not exceed 16/(background water temperature)
pH	7.5 to 8.5	Human-caused variation within the above range of less than 0.5 units.
Turbidity	10 NTU over background 20 percent increase in turbidity	if background = 50 NTU or less if background > 50 NTU

**Notes:** NTU = nephelometric turbidity units  
 PCB = polychlorinated biphenyls  
 TSS = total suspended solids

<sup>a</sup> WAC 173-201A-210.

<sup>b</sup> Acute Standard. See Table 2-3.

Table 2-3. Proposed Analytes, Marine Water Quality Criteria, and Target Detection Limits for Water Samples.

Analytes	Class B Marine Water Quality Toxics Substances Criteria <sup>a</sup>		Target Detection limits	Method
	Acute	Chronic		
PCB Aroclors (µg/L)	10	0.03	0.01	EPA 8082
TSS (mg/L)	--	--	5	EPA 160.2

**Notes:** PCB = polychlorinated biphenyls  
TSS = total suspended solids

<sup>a</sup> WAC 173-201A-240

Water Quality Monitoring Plan

Table 3-1. Sample Storage Temperatures, Preservation, and Maximum Holding Times for Chemical Analyses.

Analytes	Matrix	Container	Preservation/Storage	Holding Times
PCB Aroclors	water	Two 1L AG	4°C, dark	7/40 <sup>a</sup>
TSS	water	500 mL HDPE	4°C, dark	7 days

**Notes:** HDPE = high density polyethylene

AG = amber glass

<sup>a</sup> The first holding time is until extraction; the second is until analysis.

## **APPENDIX A**

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### **QUALITY ASSURANCE PROJECT PLAN**

## **APPENDIX A**

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### **QUALITY ASSURANCE PROJECT PLAN**



# LOWER DUWAMISH WATERWAY SLIP 4 EARLY ACTION AREA

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## 100% DESIGN SUBMITTAL Water Quality Monitoring Plan

### Appendix A Quality Assurance Project Plan

*Submitted to*  
U.S. Environmental Protection Agency, Region 10  
1200 Sixth Avenue  
Seattle, WA 98101

*Submitted by*  
City of Seattle  
King County

*Prepared by*  
**integral**  
consulting inc

7900 SE 28<sup>th</sup> Street, Suite 410  
Mercer Island, WA 98040

February 9, 2007  
Revised August 30, 2010

## SECTION A: PROJECT MANAGEMENT

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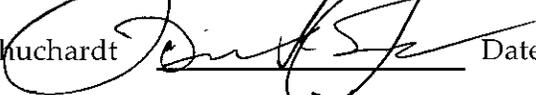
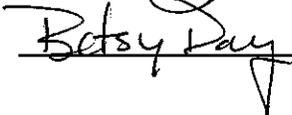
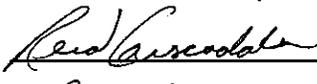
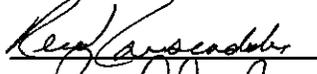
### A1 TITLE AND APPROVAL SHEET

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#### QUALITY ASSURANCE PROJECT PLAN FOR WATER MONITORING PLAN

#### LOWER DUWAMISH WATERWAY SLIP 4 EARLY ACTION AREA SEATTLE, WASHINGTON

##### Quality Assurance Project Plan Approvals

EPA Remedial Project Manager:	Karen Keeley		Date: 9/29/10
EPA QA Manager:	Ginna Grepo-Grove		Date: 9/29/10
City of Seattle Project Specifier:	David Schuchardt		Date: 9/25/10
Integral Principal in Charge:	Betsy Day		Date: 9/29/10
Integral Construction Oversight Manager:	Reid Carscadden		Date: 9/29/10
Integral QA Officer:	Reid Carscadden		Date: 9/29/10
ARI Project Manager:	Sue Dunnihoo		Date: 09/28/10
ARI QA Manager:	Dave Mitchell		Date: 9/28/10

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## LIST OF ACRONYMS

ASTM	American Society for Testing and Materials
ARI	Analytical Resources Inc.
CFR	Code of Federal Regulations
COC	chain-of-custody
DQO	data quality objective
EDD	electronic data deliverable
EPA	U.S. Environmental Protection Agency
EQuIS	Environmental Quality Information System
FSP	field sampling plan
GPC	gel permeation chromatography
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSP	health and safety plan
LCS	laboratory control sample
LDW	Lower Duwamish Waterway
LIMS	laboratory information management system
mg/L	milligrams per liter
µg/L	micrograms per liter
MQO	measurement quality objective
MDL	method detection limit
MRL	method reporting limit
PARCC	precision, accuracy or bias, representativeness, completeness, and comparability
PCBs	polychlorinated biphenyls
PSEP	Puget Sound Estuary Program
QA/QC	quality assurance/quality control
QAPP	quality assurance project plan
RPD	relative percent difference
SAP	sampling and analysis plan
SMS	Sediment Management Standards
SOP	standard operating procedure
TSS	total suspended solids
WQMP	water quality monitoring plan

### **A3 DISTRIBUTION LIST**

---

U.S. EPA Region 10 Remedial Project Manager: Karen Keeley  
U.S. EPA QA Manager: Ginna Grepo-Grove  
City Project Specifier:  
City of Seattle Oversight Contract Manager: Jennie Goldberg  
City Project Manager:  
City Resident Engineer:  
Integral Principal in Charge: Betsy Day  
Integral Construction Oversight Manager: Reid Carscadden  
Integral QA Officer: Reid Carscadden  
Integral Field Supervisor: TBD  
Integral Analytical QA Officer: TBD  
Integral Data Manager: Tom Schulz  
ARI Project Manager: Sue Dunnihoo  
ARI QA Manager: Dave Mitchell

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## **A4 PROJECT AND TASK ORGANIZATION**

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This quality assurance project plan (QAPP) describes quality assurance/quality control (QA/QC) procedures that will be used to complete water quality monitoring during construction activities associated with the sediment removal action at the Slip 4 Early Action Area in the Lower Duwamish Waterway (LDW). The field effort will include collection of surface water samples as detailed in the Slip 4 Early Action Water Quality Monitoring Plan (WQMP).

The purposes of the WQMP are: 1) to assess impacts to local surface water in Slip 4 that might result from dredging activities, dredged material translocation activities, placement of clean capping material, removal of pilings, bank soil excavation and pier demolition; and 2) to provide real-time feedback to the contractor, the City, and the U.S. Environmental Protection Agency (EPA) so that all construction activities remain in compliance with water quality criteria.

The organizational structure for this project is illustrated in Figure A4-1. Contact information related to the construction activities is provided in Table A4-1 of this QAPP. Project and quality assurance responsibilities are described in detail in Section 3.1 of the WQMP. Responsibilities are included for the following project roles:

- Project managers for EPA, the City of Seattle, Integral Consulting, and Analytical Resources, Inc. (ARI)
- Quality assurance managers for EPA, Integral, and ARI
- Task managers for the field effort and laboratory coordination.

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## **A5 PROBLEM DEFINITION AND BACKGROUND**

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The City of Seattle and King County are planning a sediment removal action for cleanup of contaminated sediments in the Slip 4 Early Action Area (EAA) of the LDW Superfund Site in Seattle, Washington. The goal of the removal action is to significantly reduce the unacceptable risks to the aquatic environment that stem from potential exposure to contaminants in sediments in the slip (Integral 2006). Remediation of Slip 4 will also reduce potential human health risks associated with polychlorinated biphenyls (PCBs) in sediment within the LDW (Integral 2006).

The primary purpose of this sampling effort is to monitor water quality during the construction activities. Section 1.1 of the WQMP defines specific project objectives. Section 2 of the WQMP provides a detailed description of the sampling plan, rationale, and guidelines for selecting samples for analysis.

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## **A6 TASK DESCRIPTION**

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The tasks to be completed for this project include fieldwork, laboratory analyses, data quality evaluation, data management, data analysis, and report preparation. Tasks that will be completed in the field, including related documentation and QA/QC activities, are described in detail in Sections 2 and 3 of the WQMP.

The overall sampling program, including a description of the sample collection scheme for both for *in situ* water monitoring and subsequent surface water grab samples, is provided in Table 2-2 of the WQMP. Grab samples for chemical analysis will be collected according to the rationale and frequency described in the WQMP.

The types of field QC samples that will be collected are listed in Table A6-1. Field QC samples will include field replicate samples and equipment rinsate blank samples. These field QC samples will be generated at a frequency of one set for each week during which samples are collected, as shown in Table A6-1. A summary of the sample analysis methods, target analytes, and method reporting limits for the surface water monitoring samples is provided in Table A6-2.

Samples will be analyzed by ARI (Seattle, WA) for total suspended solids (TSS) and PCB Aroclors, as indicated in Table A6-2. Due to the nature of the water monitoring data uses (i.e., to support field decisions during construction), all analyses will be performed on a rush (24–48 hour) basis. Since the analytical results are needed on a time-critical basis in order to make decisions in the field, no formal data validation will be performed.

The full laboratory data reports will be provided in hard copy, and electronic data deliverables (EDDs) will be provided in spreadsheet format as required for importing into the database. The Environmental Quality Information System (EQuIS) database application will be used to manage the field and laboratory data.

Data verification will be completed by Integral for data generated in the field and by ARI for data generated at the laboratory. The accuracy and completeness of the final database will be verified by Integral. A water quality monitoring report will be prepared by Integral after construction is completed, as described in Section 4.3 of the WQMP. The report will include a discussion of field procedures, descriptions, and rationale for any deviations from the WQMP and QAPP; a detailed discussion of any data quality issues; and tabulated field and laboratory data.

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## **A7 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA**

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The overall data quality objective (DQO) for this project is to develop and implement procedures that will ensure the collection of representative data of known and acceptable quality. The QA procedures and measurements that will be used for this project are

based on EPA and Puget Sound Estuary Program (PSEP) guidance (EPA 2002a,b, 2003; PSEP 1997a,b). DQOs for the water quality monitoring along with target method reporting limits (MRLs) and method detection limits (MDLs) for this project are summarized in Table A6-2. Results from the surface water samples will be compared to the acute water quality standards for marine waters of the State of Washington where applicable.

PARCC parameters (i.e., precision, accuracy or bias, representativeness, completeness, comparability) are commonly used to assess the quality of environmental data. Measurement quality objectives (MQOs) for the quantitative PARCC parameters, bias, precision, and completeness, are provided in Table A7-1.

Bias represents the degree to which a measured concentration conforms to the reference value. The results for matrix spikes, laboratory control samples, field blanks, and method blanks will be reviewed to evaluate bias of the data. The following calculation is used to determine percent recovery for a matrix spike sample:

$$\%R = \frac{M - U}{C} \times 100$$

- %R = percent recovery
- M = measured concentration in the spiked sample
- U = measured concentration in the unspiked sample
- C = concentration of the added spike

The following calculation is used to determine percent recovery for a laboratory control sample or reference material:

$$\%R = \frac{M}{C} \times 100$$

- %R = percent recovery
- M = measured concentration in the reference material
- C = established reference concentration

Results for field and method blanks can reflect systematic bias that results from contamination of samples during collection or analysis. Any analytes detected in field or method blanks will be evaluated as potential indicators of bias.

Precision reflects the reproducibility between individual measurements of the same property. Precision will be evaluated using the results of matrix spike duplicates (for PCB analyses), laboratory duplicates (for TSS analyses), and field replicates. Precision is

expressed in terms of the relative standard deviation for three or more measurements and the relative percent difference (RPD) for two measurements. The following equation is used to calculate the RPD between measurements:

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

$C_1$  = first measurement  
 $C_2$  = second measurement  
RPD = relative percent difference

The relative standard deviation is simply the ratio of the standard deviation of three or more measurements to the average of the measurements, expressed as a percentage.

Completeness will be calculated as the ratio of usable data (i.e., unqualified data and J-qualified data) to requested data, expressed as a percentage.

Additional laboratory QC procedures will be evaluated to provide supplementary information regarding overall quality of the data, performance of instruments and measurement systems, and sample-specific matrix effects.

QC samples and procedures are specified in each method protocol and in the laboratory standard operating procedures. All QC requirements will be completed by the laboratory as described in the protocols, including the following (as applicable to each analysis):

- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration
- Calibration or instrument blanks
- Method blanks
- Laboratory control samples
- Internal standards
- Surrogate spikes
- Serial dilutions
- Matrix spikes
- Matrix spike duplicates.

To alert the data user to possible bias or imprecision, data qualifiers will be applied to reported analyte concentrations by the laboratory when associated QC samples or procedures do not meet control limits. Laboratory control limits for the methods that will be used for this site investigation are provided in Appendix J of ARI's quality assurance plan (Attachment 1 of this QAPP).

MRLs reflect the sensitivity of the analysis. Target MRLs for this study are summarized in Table A6-2.

MDLs have been determined by ARI for each analyte, as required by EPA (2003). MDLs are statistically derived and reflect the concentration at which an analyte can be detected with 99 percent confidence that a false positive result has not been reported. ARI has established MRLs at levels above the MDLs for the project analytes. These values are based on ARI's experience analyzing environmental samples and reflect the typical sensitivity obtained by the analytical system. The concentration of the lowest standard in the initial calibration curve for each analysis is at the level of the MRL. This allows reliable quantification of concentrations to the MRL. Analyte concentrations for this site investigation will be reported to the MDL. Analytes detected at concentrations between the MRL and the MDL will be reported with a J qualifier to indicate that the value is an estimate (i.e., the analyte concentration is below the calibration range). Non-detects will be reported at the MDL. The MDL will be adjusted by the laboratory as necessary to reflect sample dilution or matrix interference.

Representativeness and comparability are qualitative QA/QC parameters. Representativeness is the degree to which data represent a characteristic of an environmental condition. In the field, representativeness will be addressed primarily in the sampling design, by the selection of sampling sites and sample collection procedures. In the laboratory, representativeness will be ensured by the proper handling and storage of samples and initiation of analysis within holding times.

Comparability is the qualitative similarity of one data set to another (i.e., the extent to which different data sets can be combined for use). Comparability will be addressed through the use of field and laboratory methods that are consistent with methods and procedures recommended by EPA and PSEP and are commonly used for water quality studies.

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## **A8 SPECIAL TRAINING/CERTIFICATION**

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The City of Seattle and King County have assembled a project team with the requisite experience and technical skills to successfully complete this investigation. All consultant team personnel involved in sample collection have extensive environmental sampling experience. Minimum training and certification requirements for laboratory personnel are described in the laboratory QA plan (Attachment 1 to this QAPP).

The Superfund Amendments and Reauthorization Act of 1986 required the Secretary of Labor to issue regulations providing health and safety standards and guidelines for workers engaged in hazardous waste operations. In response to this requirement, the U.S. Occupational Safety and Health Administration developed regulation

29 CFR§1910.120, the “Hazardous Waste Operations and Emergency Response” standard (HAZWOPER). This standard includes requirements for workers engaged in hazardous waste operations to complete a 40-hour training course and annual 8-hour refresher courses. The training provides employees with knowledge and skills that enable them to perform their jobs safely and with minimum risk to their personal health. All sampling personnel will have completed the 40-hour HAZWOPER training course and 8-hour refresher courses, as necessary. Documentation of course completion will be maintained in personnel files.

## **A9 DOCUMENTS AND RECORDS**

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Records will be maintained documenting all activities and data related to field sampling and chemical analysis at the laboratory. Results of data verification and validation activities will also be documented. Procedures for documentation of these activities are described in this section. The components of the water quality monitoring report are discussed in Section 4.3 of the WQMP.

The full WQMP, including this QAPP and the health and safety plan (HSP), will be provided to every project participant listed in Section A3. Any revisions or amendments to any of the documents that comprise the WQMP will also be provided to these individuals.

### **A9.1 Field Documentation**

The deputy project manager will ensure that the field team receives the final approved version of the WQMP prior to the initiation of field activities. Field records that will be maintained include field logbooks, core logs, and sample chain-of-custody forms. The content and use of these documents are described in Section 3 of the WQMP.

### **A9.2 Laboratory Documentation**

All activities and results related to sample analysis will be documented at the laboratory. Internal laboratory documentation procedures are described in the laboratory QA plan (Attachment 1 to this QAPP).

The laboratory will provide a data package for each sample delivery group or analysis batch that is comparable in content to a full Contract Laboratory Program package. It will contain all information required for a complete QA review, including the following:

- A cover letter discussing analytical procedures and any difficulties that were encountered

- A case narrative referencing or describing the procedures used and discussing any analytical problems and deviations from standard operating procedures (SOPs) and this QAPP
- Chain-of-custody and cooler receipt forms
- A summary of analyte concentrations (to two significant figures, unless otherwise justified), method reporting limits, and method detection limits
- Laboratory data qualifier codes appended to analyte concentrations, as appropriate, and a summary of code definitions
- Sample preparation, extraction, dilution, and cleanup logs
- Instrument tuning data
- Initial and continuing calibration data, including instrument printouts and quantification summaries, for all analytes
- Results for method and calibration blanks
- Results for all QA/QC checks, including surrogate spikes, internal standards, laboratory control samples (LCSs), matrix spike samples, matrix spike duplicate samples, and laboratory duplicate or triplicate samples
- Original data quantification reports for all analyses and samples
- All laboratory worksheets and standards preparation logs.

Data will be delivered in both hard-copy and electronic format to the Integral laboratory coordinator. Electronic data deliverables will be compatible with Integral's EQUIS database.

### **A9.3 Data Quality Documentation**

All database entries provided by the laboratory will be verified against the hard copy data in the data package. All changes to the database will be documented on database printouts. Any data tables prepared from the database for data users will include all qualifiers that were applied by the laboratory. Due to the time-critical nature of the results, no validation will be performed.

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## **SECTION B: DATA GENERATION AND ACQUISITION**

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### **B1 SAMPLING PROCESS DESIGN**

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Section 2.1 of the WQMP outlines the sampling design and rationale. In general:

- *In situ* water quality measurements will include turbidity, dissolved oxygen, temperature, and salinity. In general, real-time turbidity measurements will be used to help determine when modifications to construction activities should be made, and whether grab samples should be collected for chemical of concern analysis
- Water grab samples that will be collected will be submitted for analysis of chemicals of concern (TSS and PCB Aroclor concentrations). All TSS and PCB analyses will be performed on a rush basis (24–48 hours) in order to provide additional information about possible water quality exceedances in a rapid time frame and allow for appropriate modifications to the construction activities.

Table 2-1 of the WQMP shows the sampling scheme for the water quality monitoring at Slip 4. Overall, the number of analytical samples that are collected will vary based on field construction activities and the results of field water quality measurements.

Field replicates and equipment rinse blanks will be collected at a frequency of one set per week during which samples are collected. Field QC samples are described in Table 6-1 and Section 3.9 of the WQMP.

### **B2 SAMPLING METHODS**

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Sampling methods are described in Section 3 of the WQMP and include the following activities:

- Vessel navigation and positioning
- Sample collection procedures
- Sample packing and transport to the laboratory.

Requirements for sample containers, storage temperature, and holding times are summarized in Table B2-1. All sample containers will have screw-type lids to ensure adequate sealing of the bottles. Lids of the glass containers will have Teflon™ inserts to prevent sample reaction with the plastic lid and to improve the quality of the seal.

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 rinse blank results can be reviewed. The bottle documentation from the laboratory will be archived in the Integral project file.

### **B3 SAMPLE HANDLING AND CUSTODY**

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The principal documents used to identify samples and to document possession will be field logbooks and chain-of-custody (COC) records. Custody will be documented for all samples at all stages of the analytical or transfer process. COC procedures for sample handling prior to delivery to the laboratory are outlined in Section 3.5 of the WQMP.

Upon receipt of samples at the laboratory, the sample manager will check for physical integrity of the containers and seals, and inventory the samples by comparing sample labels to those on the COC forms. The laboratory will include the COC and cooler receipt forms in the data package. Any breaks in the COC or non-conformances will be noted and reported in writing to the Integral laboratory coordinator within 24 hours of receipt of the samples. The laboratory QA plan (Attachment 1 to this QAPP) includes procedures used for accepting custody of samples and documenting samples at the laboratory. The laboratory project manager will ensure that a sample-tracking record is maintained that follows each sample through all stages of sample processing at the laboratory.

The laboratory will not dispose of the samples for this project until authorized to do so by the Integral laboratory coordinator. The laboratory will dispose of samples, as appropriate, based on matrix, analytical results, and information received from the client. If determined to be hazardous, remaining samples will enter the appropriate laboratory waste streams.

### **B4 FIELD AND LABORATORY METHODS**

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#### **B4.1 Field Measurements**

*In situ* measurements of general water quality characteristics will be taken at all sampling stations, including turbidity, dissolved oxygen, temperature, and salinity. Measurements will be taken using a YSI 650/6600 Multi Probe lowered into the water column. Details regarding the operation of this instrument, including calibration, measurement, quality control procedures, and decontamination, are provided in the Standard Operating Procedure for YSI 650/6600 Multi Probe, provided as Appendix C of the WQMP.

Because of the critical nature of this data in field decision making, a backup unit will be available at all times.

## **B4.2 Laboratory Analyses**

Surface water grab samples will be analyzed using EPA SW-846 method 8082 for PCB Aroclors and method 160.2 for TSS. EPA method 8082 also includes provisions for acid cleanup of sample extracts, which will be used, if necessary, to meet reporting limit requirements.

All quality control procedures specified for EPA method 8082 will be employed by the laboratory, including the following items of concern to EPA:

- The surrogate compound, decachlorobiphenyl, will be included in every sample and standard to monitor extraction efficiency and retention time shifts as required by EPA method 8082; tetrachloro-m-xylene will be used as an additional surrogate.
- For every Aroclor identified in each sample, a standard will be analyzed within 72 hours of analysis of the sample; the standard will be analyzed within a valid 12-hour analysis sequence.
- The laboratory will provide a summary of retention times, retention time windows, and retention time shifts for every sample in a format similar to CLP Form 10B. Retention time shifts for the surrogate compounds will be included with the run log (CLP Form 8D).

## **B5 QUALITY CONTROL**

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Quality control samples will be prepared in the field and at the laboratory to monitor the bias and precision of the sample collection and analysis procedures.

### **B5.1 Field Quality Control Samples**

Field QC samples for this study will include field replicates and equipment rinse blanks. These field QC samples will minimally be collected at a frequency of one set per week as listed in Table A6-1. The procedures for preparing field replicates and rinse blanks are presented in Section 3.9 of the WQMP.

### **B5.2 Laboratory Quality Control**

Extensive and detailed requirements for laboratory QC procedures are provided in the EPA protocols that will be used for this study (Table A6-2). Every method protocol includes descriptions of QC procedures, and many incorporate additional QC requirements by reference to separate QC chapters. QC requirements include control limits and requirements for corrective action in many cases. QC procedures will be completed by the laboratory, as required in each protocol and as indicated in this QAPP.

The frequency of analysis for laboratory control samples, matrix spike samples, matrix spike duplicates or laboratory duplicates, and method blanks will be one for every 20 samples or one per extraction batch, whichever is more frequent. Surrogate spikes and internal standards will be added to every field sample and QC sample, as required. Calibration procedures will be completed at the frequency specified in each method description. As required for EPA SW-846 methods, performance-based control limits have been established by the laboratory. These and all other control limits specified in the method descriptions will be used by the laboratory to establish the acceptability of the data or the need for reanalysis of the samples. Laboratory control limits for recoveries of surrogate compounds, matrix spikes, and laboratory control samples, and for relative percent difference of matrix spike duplicates and laboratory duplicates, are provided in Appendix J of the laboratory QA manual (Attachment 1 to this QAPP).

## **B6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE**

Maintenance of the YSI 650/6600 Multi Probe that will be used for field measurements will be completed as described in the manufacturer's instructions and the SOP for its use (Appendix C of the WQMP).

Analytical instrument testing, inspection, maintenance, setup, and calibration will be conducted by the laboratory in accordance with the requirements identified in the laboratory SOPs and manufacturer instructions. In addition, each of the specified analytical methods provides protocols for proper instrument setup and tuning, and critical operating parameters. Instrument maintenance and repair will be documented in maintenance log or record books.

## **B7 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY**

A YSI 650/6600 Multi Probe will be used for field measurements (i.e., turbidity, temperature, dissolved oxygen, and salinity). This instrument will be shipped to the field pre-calibrated by Hoskin Scientific, Vancouver, BC. Calibration checks will be performed on the Multi Probe prior to use each day that measurements will be made, as described in the SOP for use of the YSI 650/6600 Multi Probe (Appendix C of the WQMP) and in the manufacturer's instructions. Calibration checks will be completed twice daily at a minimum. The unit will be checked for calibration before each daily sampling begins and again at the end of the day. If measurements are made at more than 10 stations in a single day, calibration checks will be made after every 10 stations are measured and at the end of the day. Calibration information will be recorded in the field logbook.

Because of the critical nature of this data in field decision making, a backup unit will be available at all times. If the primary instrument cannot be properly calibrated per the SOP, the backup unit will be calibrated and used.

Laboratory instruments will be properly calibrated, and the calibration will be verified with appropriate check standards and calibration blanks for each parameter before beginning each analysis. Instrument calibration procedures and schedules will conform to analytical protocol requirements and descriptions provided in the laboratory's QA plan.

All calibration standards will be obtained from either the EPA repository or a commercial vendor, and the laboratory will maintain traceability back to the National Institute of Standards and Technology. Stock standards will be used to make intermediate standards and calibration standards. Special attention will be given to expiration dating, proper labeling, proper refrigeration, and prevention of contamination. Documentation relating to the receipt, mixing, and use of standards will be recorded in a laboratory logbook. All calibration and spiking standards will be checked against standards from another source.

## **B8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES**

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The quality of supplies and consumables used during sample collection and laboratory analysis can affect the quality of the project data. All equipment that comes into contact with the samples and extracts must be sufficiently clean to prevent detectable contamination, and the analyte concentrations must be accurate in all standards used for calibration and quality control purposes.

During sample collection, solvents of appropriate, documented purity will be used for decontamination. Solvent containers will be dated and initialed when they are opened. The quality of laboratory water used for decontamination will be documented at the laboratory. As discussed in Section B2, cleaned and documented sample containers will be provided by the laboratory. All containers will be visually inspected prior to use, and any suspect containers will be discarded.

Reagents of appropriate purity and suitably cleaned laboratory equipment will also be used for all stages of laboratory analyses. Details for acceptance requirements for supplies and consumables at the laboratories are provided in the laboratory SOPs and QA plan. All supplies will be obtained from reputable suppliers with appropriate documentation or certification. Supplies will be inspected to confirm that they meet use requirements, and certification records will be retained by Integral (i.e., for supplies used in the field) or the laboratory.

## **B9 DATA MANAGEMENT**

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Data for this project will be generated in the field and at the laboratory. The final repository for all sample information will be an EQUIS database. Procedures to be used to

transfer data from the point of generation to the EQulS database are described in this section.

### **B9.1 Field Data**

Data that are generated during sample collection and preparation will be manually entered into the field logbook and COC forms. Data from these sources will be entered into the EQulS database directly from the field logbook and COC forms. These data include station location coordinates, station names, sampling dates, sample identification codes, and additional station and sample information (e.g., water depth, sample type, field replicate number). All entries will be reviewed for accuracy and completeness by a second individual, and any errors will be corrected before the data are approved for release to data users.

### **B9.2 Laboratory Data**

A variety of manually entered and electronic instrument data are generated at the laboratory. Data are manually entered into:

- Standard logbooks
- Storage temperature logs
- Balance calibration logs
- Instrument logs
- Sample preparation and analysis worksheets
- Maintenance logs
- Individual laboratory notebooks
- Results tables for conventional analyses (e.g., total suspended solids).

All manual data entry into the laboratory information management system (LIMS) is proofed at the laboratory. All data collected from each laboratory instrument, either manually or electronically, are reviewed and confirmed by analysts before reporting. The sample information is electronically loaded to temporary files in LIMS and submitted for further review. Forms IV-X for validated data packages are generated in the laboratory and reviewed for correctness in interpretation, conformance with QA requirements, and completeness. Once the data have been accepted, the final results are released to the LIMS for reporting.

The LIMS is used to generate the EDD as well as Forms I-III for the data package, providing a single source for reporting of chemical data. The EDD is further spot-checked against the hard copy to ensure that the correct data set is reported for both. A detailed

description of procedures for laboratory data management and data review and verification are provided in the laboratory QA plan (Attachment 1).

Laboratory data will be entered directly into the EQuIS database from the EDD. A database printout will be used to verify database entries against the hard-copy laboratory data packages.

## **SECTION C: ASSESSMENT AND OVERSIGHT**

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This project will rely heavily on the knowledge and experience of the project team. The field team and laboratory will stay in close verbal contact with the Integral project manager and QA coordinator during all phases of the project. This level of communication will serve to keep the management team apprised of activities and events, and will allow for informal but continuous project oversight. Few scheduled assessment activities are planned for this project because the scope of the sampling and analysis effort and the size of the project team are relatively small.

### **C1 ASSESSMENTS AND RESPONSE ACTIONS**

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Assessment activities will include a readiness review prior to sampling and internal review while work is in progress. An informal technical systems audit may be conducted if problems are encountered during any phase of this project.

Readiness reviews will be conducted to ensure that all necessary preparations have been made for efficient and effective completion of the sample collection tasks. Prior to field sampling, the field coordinator will verify that all field equipment is ready for transfer to the site. The field coordinator will also verify that the field team and subcontractor have been scheduled and briefed and that the contract for the subcontractor has been signed by both parties. Any deficiencies noted during this readiness review will be corrected prior to initiation of sampling activities.

Technical review of intermediate and final work products generated for this project will be completed throughout the course of all sampling, laboratory analysis, data management, and data interpretation activities to ensure that every phase of work is accurate and complete and follows the QA procedures outlined in this QAPP. Any problems that are encountered will be resolved between the reviewer and the person completing the work. Any problems that cannot be easily resolved or that affect the final quality of the work product will be brought to the attention of the Integral and City of Seattle project managers. EPA will be notified of any problems that may affect the final outcome of the project.

The laboratory has implemented a review system that serves as a formal surveillance mechanism for all laboratory activities. Each phase of work is reviewed by a supervisor

before it is approved for release. Details are provided in the laboratory QA plan (Attachment 1 to this QAPP).

Technical system audits may be conducted if serious problems are encountered during sampling or analysis operations. If completed, these audits will be conducted by the Integral QA coordinator or her designee or by the ARI QA manager. These audits may consist of onsite reviews of any phase of field or laboratory activities or data management. Results of any audits will be provided in the final data report.

Any project team member who discovers or suspects a non-conformance is responsible for reporting the non-conformance to the project manager, the Integral QA coordinator, or the ARI project or QA manager, as applicable. The project manager will ensure that no additional work dependent on the non-conforming activity is performed until a confirmed non-conformance is corrected.

## **C2 REPORTS TO MANAGEMENT**

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Corrective actions will be required if deviations from the methods or QA requirements established in the WQMP or this QAPP are encountered. When a non-conformance is identified, corrective action will be taken immediately, if possible. The project manager will be contacted and, if necessary, will provide assistance in resolving the issue. A formal corrective action plan is not likely to be required for a project of this limited scope. However, any non-conformance issue that ultimately affects the quality of the data or results in a change of scope in the work described in the WQMP, including this QAPP, will be documented in the field log or in a memorandum to the project manager. This documentation will serve as a Corrective Action Report. A description of the non-conformance issue, the attempted resolution, and any effects on data quality or usability will be provided in the final report.

The laboratory has implemented a routine system of reporting non-conformance issues and their resolution. These procedures are described in the laboratory QA plan (Attachment 1 to this QAPP). Laboratory non-conformance issues will also be described in the final report if they affect the quality of the project data.

## **SECTION D: DATA VALIDATION AND USABILITY**

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Due to the time-critical nature of the analytical data generated for this project and the need to make immediate real-time decisions about construction activities based on any water quality exceedances, the laboratory results will not undergo data validation. The laboratory will, however, provide a data package for each sample delivery group or analysis batch that is comparable in content to a full CLP package. It will contain all information required for a complete QA review, including all associated raw data so formal validation could be performed if subsequently required. Data quality and usability will be evaluated by the laboratory prior to releasing results, as outlined in the laboratory QA plan (Attachment 1 to this QAPP).

## **SECTION E: REFERENCES**

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## **FIGURES AND TABLES**

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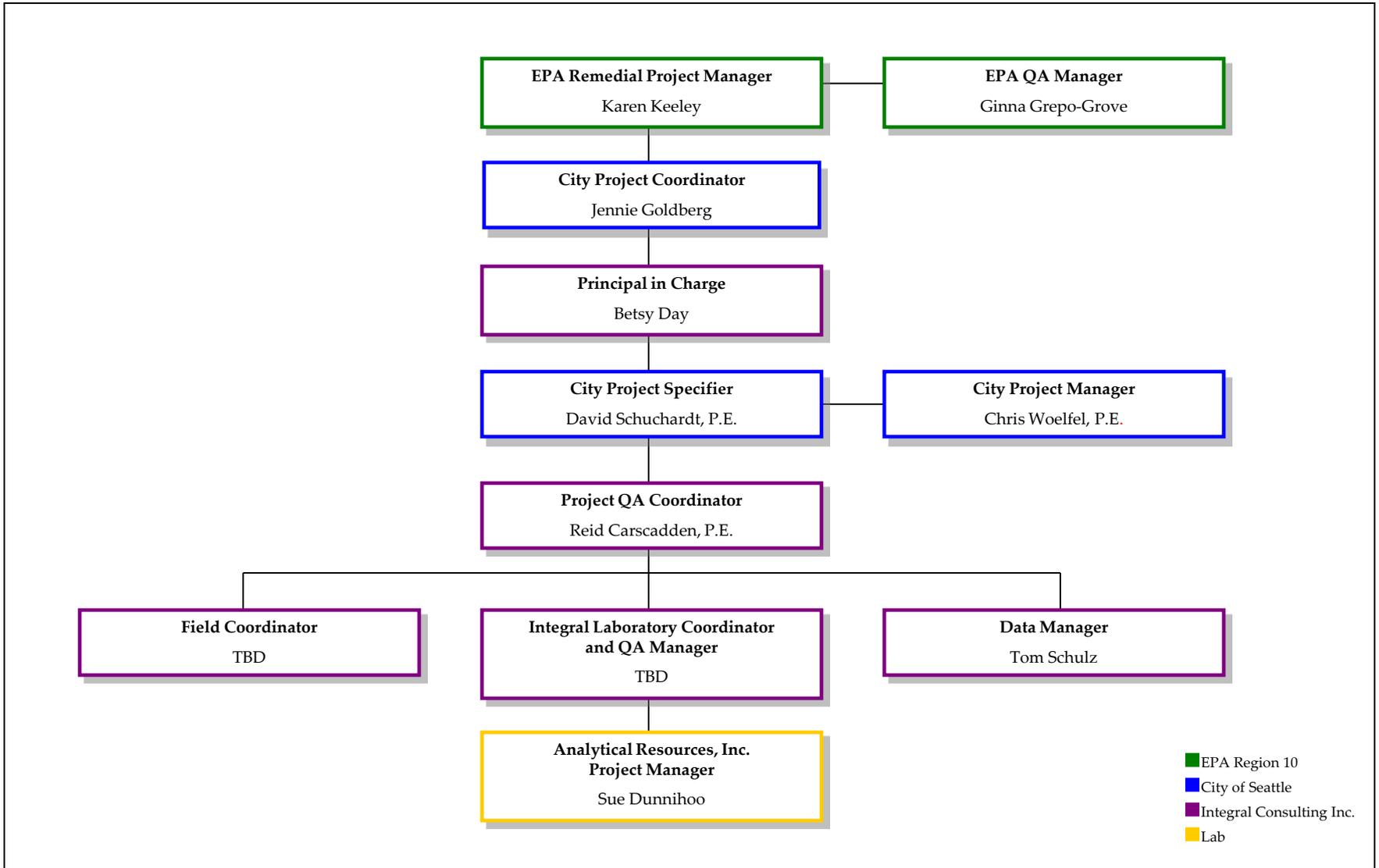


Table A4-1. Project Team Contact Information.

Organization	Individual	Project Role	Phone	Fax	Email
EPA Region 10	Karen Keeley	Remedial Project Coordinator	206-553-2141	206-553-0124	Keeley.Karen@epa.gov
	Ginna Grepo-Grove	QA Manager	206-553-1632	206-553-8210	Grepo-Grove.Gina@epa.gov
City of Seattle	David Schuchardt	City Project Specifier	206-615-1642	206-684-4631	david.schuchardt@seattle.gov
	Jennie Goldberg	City Oversight Contract Manager	206-684-3167	206-386-4589	jennie.goldberg@seattle.gov
	Chris Woelfel	City Project Manager	206-684-7599	206-233-1532	chris.woelfel@seattle.gov
Integral Consulting	Betsy Day	Principal in Charge	206-957-0346	206-230-9601	bday@integral-corp.com
	Reid Carscadden	Construction Oversight Manager	206-957-0350	206-230-9601	rcarscadden@integral-corp.com
	Reid Carscadden	QA Officer	206-957-0350	206-230-9601	rcarscadden@integral-corp.com
	TBD	Field Coordinator			
	TBD	Field Staff			
	TBD	Laboratory Coordinator/QA Manager			
Analytical Resources, Inc. (ARI)	Sue Dunnihoo	Laboratory Project Manager	206-695-6207	206-621-7523	sued@arilabs.com
	Dave Mitchell	Laboratory QA Manager	206-695-6205	206-621-7523	davem@arilabs.com

Table A6-1. Description of Field QC Samples and Frequency of Collection.

Sample Type and Analysis	Field Samples	Field Replicates	Equipment Rinse Blanks	MS/MSD Aliquot	Frequency of QC Sample Collection
<b>Surface Water</b>					
PCB Aroclors	varies <sup>a</sup>	1	1	1	weekly
TSS	varies <sup>a</sup>	1	0	0	weekly

**Notes:** PCB = polychlorinated biphenyl  
 TSS = total suspended solids  
 MS/MSD = matrix spike/matrix spike duplicate

<sup>a</sup> Total number of field samples is determined by turbidity exceedances as per Table 2-1, WQMP.

Table A6-2. Target Analytes, Methods, and Method Reporting Limits for Water Quality Construction Monitoring Samples.

Analyte	Sample Preparation Method	Sample Cleanup Method	Analysis Method	Units	MDL	MRL	Marine acute water quality criteria <sup>a</sup>
<b>Surface Water</b>							
PCB Aroclors	ARI Low Level (Modified EPA 3510)	EPA 3660B (sulfur) optional <sup>b</sup> EPA 3665A (acid) optional <sup>b</sup>	GC/ECD (EPA 8082) <sup>c</sup>	µg/L	0.006	0.01	10
Total Suspended Solids	EPA 160.2	NA	EPA160.2	mg/L	NA	5	--

<sup>a</sup>Water quality standards for surface waters of the State of Washington, WAC 173-201A

<sup>b</sup>The need for cleanup to be based on screens and the color of extracts.

<sup>c</sup>If more than one Aroclor is detected in a sample, the laboratory will choose unique peaks to quantitate each individual Aroclor (i.e., a peak can only be used in the quantitation of one Aroclor).

Table A7-1. Measurement Quality Objectives.

Analysis	Bias (percent)	Precision (RPD)	Completeness (percent)
TSS	--	±20	100
PCB Aroclors	50-150	±50	100

**Notes:** RPD = relative percent difference  
PCB = polychlorinated biphenyl

Table B2-1. Sample Containers, Preservation, Holding Times, and Sample Volume.

Analysis	Container Type	Container Size	Approximate Laboratory Subsample	Preservation	Holding Time
<b>Surface Water Samples for Chemical Analysis</b>					
Total Suspended Solids	HDPE	500 mL	100 mL	cool, 4°C	7 days
PCB Aroclors	AG	Two 1,000 mL <sup>a</sup>	1,000 mL <sup>b</sup>	4±2°C	7 days/40 days <sup>c</sup>

**Notes:** AG = amber glass

HDPE = high-density polyethylene

<sup>a</sup> Includes additional volume if needed for laboratory re-analysis.

<sup>b</sup> Additional volume for laboratory MS/MSD ( 2,000 mL) will be collected required at a 5 percent frequency or at least once per week.

<sup>c</sup> Holding time is 7 days to extraction, and extracts must be analyzed within 40 days from extraction.

## **ATTACHMENT A1**

ANALYTICAL RESOURCES, INC.  
QUALITY ASSURANCE PLAN

PROVIDED IN CQAP,  
APPENDIX B.

## **APPENDIX B**

---

HEALTH AND SAFETY  
PLAN FOR WATER  
QUALITY MONITORING  
AND VERIFICATION  
SEDIMENT SAMPLING



# LOWER DUWAMISH WATERWAY SLIP 4 EARLY ACTION AREA

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## **100% DESIGN SUBMITTAL Water Quality Monitoring Plan**

### **Appendix B Health and Safety Plan for Water Quality Monitoring and Verification Sediment Sampling**

*Submitted to*  
U.S. Environmental Protection Agency, Region 10  
1200 Sixth Avenue  
Seattle, WA 98101

*Submitted by*  
City of Seattle  
King County

*Prepared by*  
**integral**  
consulting inc.

7900 SE 28<sup>th</sup> Street, Suite 410  
Mercer Island, WA 98040

February 9, 2007

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## ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
CFR	Code of Federal Regulations
CPR	cardio-pulmonary resuscitation
CQAP	construction quality assurance plan
CRZ	contamination reduction zone
EPA	U.S. Environmental Protection Agency
HSP	health and safety plan
LDW	Lower Duwamish Waterway
MLLW	mean lower low water
NIOSH	National Institute of Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
PAH	polycyclic aromatic hydrocarbon
PCBs	polychlorinated biphenyls
PEL	permissible exposure limit
PPE	personal protective equipment
PSEP	Puget Sound Estuary Program
QAPP	quality assurance project plan
SAP	sampling and analysis plan
SCBA	self-contained breathing apparatus
SEA	Striplin Environmental Associates
SMS	Sediment Management Standards
SOP	standard operating procedure
SQS	Sediment Quality Standards
STEL	short-term exposure limit
TLV	threshold limit value
TSS	total suspended solids
TWA	time-weighted average
WAC	Washington Administrative Code
WISHA	Washington Industrial Safety and Health Administration
WQMP	water quality monitoring plan

# 1 INTRODUCTION

The protective practices and information provided in this 100% Design Submittal Health and Safety Plan (HSP) for the Water Quality Monitoring Plan (WQMP) and Removal Action Sampling and Analysis Plan (SAP) will be followed by personnel employed or contracted by Integral Consulting Inc. for work in Slip 4, Lower Duwamish Waterway, Seattle, Washington. Monitoring activities, potential hazards, and procedures to control and minimize potential hazards are described in this plan.

This HSP has been prepared in accordance with the following federal and state regulations:

- Occupational Safety and Health Administration (OSHA): 29 CFR 1910 and 29 CFR 1926
- U.S. Environmental Protection Agency's (EPA's) *Standard Operating Safety Guides* (EPA 1992)
- Washington Industrial Safety and Health Administration (WISHA): WAC 296-62 and 296-24.

The following subjects are addressed in the plan: existing site characteristics, description of sampling activities, hazard evaluation, hazard monitoring and control procedures, worker training requirements, and emergency procedures. Other health and safety requirements (e.g., confined space entry, trenching) are not applicable to this site and are not discussed in this plan.

A copy of this HSP will be maintained on the field vessel at all times. The HSP will also be maintained onsite by any personnel who may collect samples during low tides by walking the beach area. All individuals performing fieldwork must read, understand, and comply with this plan. Visitors must also read and comply with the plan. The plan must be read before a participant undertakes field activities. If any part is unclear, the individual should seek clarification from one of the safety officers prior to commencing fieldwork. Once the information has been read and understood, the individual must sign the *Acknowledgment* form (Form 1, Attachment A), which will then be placed in the project file. Failure to comply with the requirements of the HSP is grounds for immediate dismissal from the fieldwork program.

This plan may be modified at any time, based on the judgment of the site safety officer or the project safety officer. Any modification will be presented to the onsite team during a safety briefing and will be entered on the *Modification to Health and Safety Plan* form (Form 2, Attachment A), which will be posted in a designated area on the sampling vessel. Form 2 must be acknowledged by all sampling and sample processing personnel.

## 2 SITE CHARACTERISTICS

The Lower Duwamish Waterway (LDW) was placed on the National Priorities List on September 13, 2001, in response to elevated concentrations of chemicals in sediments and some fish tissues. Slip 4 was identified as a candidate early action site (Windward 2003) during the first phase of the LDW remedial investigation. Slip 4 is located on the east bank of the Duwamish Waterway at river mile 2.8 (Figure 1).

Within Slip 4, polychlorinated biphenyls (PCBs) are the chemical of concern and exceed the Sediment Quality Standards (SQS) of the Washington State Sediment Management Standards (SMS) (WAC 173-204) over a larger area than any other analyte. The magnitude of the PCB exceedances is also greater than any other analyte.

This project's field effort will be conducted from a research vessel and will include collection of surface water grab samples using a Niskin bottle and measurements of water quality parameters using a YSI 6600 Multi Probe to monitor the activities of the early action removal area. The purpose of the WQMP is to assess local surface water quality in Slip 4 during dredging activities, dredged material translocation activities, placement of clean capping material, removal of pilings, bank soil excavation, and pier demolition. The WQMP is part of the 100% Design Submittal and is an element of the overall construction quality assurance approach as defined in the 100% Design Construction Quality Assurance Plan (CQAP) for Slip 4. The water quality data that are generated during construction activities will be used to assure that water quality impacts are in compliance with EPA's Clean Water Act Section 401 Water Quality Certification for the project.

In-water construction activities include demolition of structures, dredging, excavation of banks, material dewatering, material transloading from barge to truck, and placement of clean capping material. The material to be removed and then disposed of at an approved upland landfill facility includes contaminated sediment that will be dewatered, wood debris and old wood pilings, cement pilings, bank soil, and other debris. Monitoring activities will depend upon the removal action activity being conducted and the type of material being dredged or excavated.

The main objective of this HSP is to provide the safest working environment for field personnel during construction activities in Slip 4 by monitoring activities, identifying potential hazards, and determining procedures to control and minimize potential hazards. This HSP is divided into two separate activities:

1. Water Quality Monitoring
2. Verification Sediment Sampling

These activities are explained in detail in Sections 2.1 and 2.2.

## **2.1 WATER QUALITY MONITORING**

Water quality parameters will be measured and samples will be collected from two pre-defined locations within Slip 4 (see Figure 2-1 of the WQMP) and potentially at additional discretionary locations determined in the field. Compliance will be monitored with onsite water quality measurements (i.e., turbidity, dissolved oxygen, temperature and salinity), and collection of grab samples for total suspended solids (TSS) and PCB Aroclor analyses. Instantaneous turbidity measurements will help determine when modifications to construction activities should be made.

The WQMP describes the detailed the sampling scheme for the water quality monitoring at Slip 4.

## **2.2 VERIFICATION OF SEDIMENT SAMPLING**

Verification sampling will be conducted on the sediments for the following purposes: pre- and post-construction boundary area sampling, post-excavation documentation; and confirmation of sediment quality on cap surface. Sampling locations are shown in the Removal Action SAP (Appendix A to the CQAP).

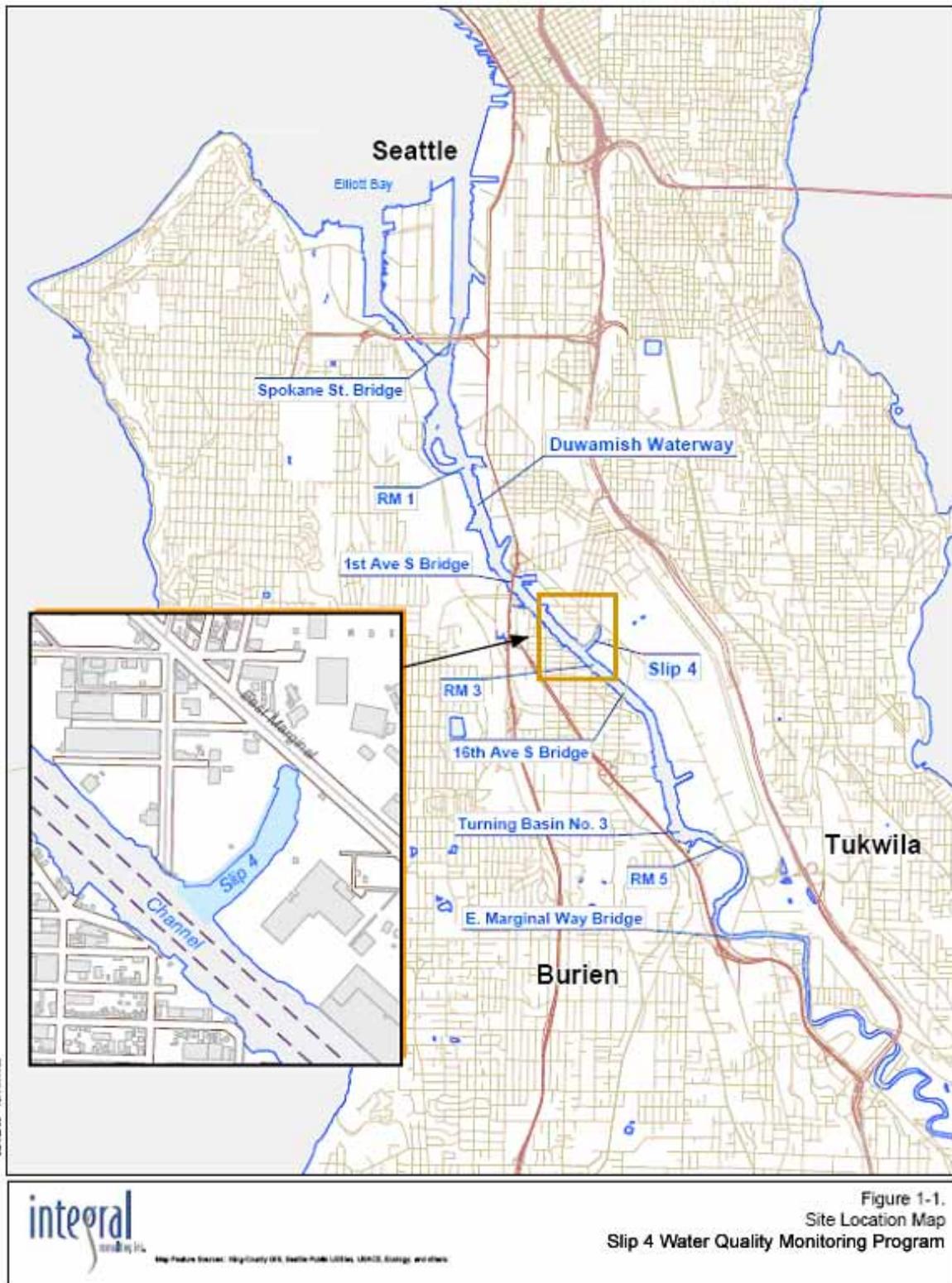


Figure 1. Site Location Map (Integral 2006)

### **3 MONITORING ACTIVITIES**

Integral's responsibilities include planning, conducting field surveys, and collecting samples; storing and transferring samples to participating laboratories; and reporting analytical results. Field activities include water quality monitoring and verification sediment sampling.

It is anticipated that field sampling will be conducted in fall 2007 through winter 2008. Qualified field personnel from Integral will participate in monitoring and sample collection activities. A brief description of each task is described below. A more detailed description of sample locations and sampling methods is provided in the WQMP and in the Removal Action SAP (Appendix A to the CQAP).

#### **3.1 WATER QUALITY MONITORING**

Water quality parameters will be measured with an YSI 6600 Multi Probe, and surface water grab sample collection will be performed with a Niskin bottle. The measurements of surface water quality parameters and sampling of surface water grabs will follow methods as described in the YSI 6600 Multi Probe Standard Operating Procedures (SOP) in Appendix C, and as described in the Niskin Bottle SOP in Appendix D.

#### **3.2 PRE- AND POST CONSTRUCTION BOUNDARY AREA SAMPLING**

Sediment samples will be collected from the removal boundary before initiation and after completion of removal action construction. Sediment samples below approximately 0 ft mean lower low water (MLLW) will be collected from a boat using a van Veen grab. Sediment samples above approximately 0 ft MLLW will be collected by hand with a stainless-steel bowl and spoon. Handling of the van Veen grabs will follow methods as described in Integral SOPs.

#### **3.3 POST-EXCAVATION DOCUMENTATION OF BANK SLOPES**

Bank samples will be collected from an interval of 0–10 cm after excavation and before placement of the slope caps. Bank samples will be collected with a decontaminated, stainless-steel bowl and spoon.

### **3.4 WATERWAY CAP AND SLOPE CAP CONFIRMATION SAMPLES**

Confirmation samples will be collected after the placement of the final lift of capping material in the slip to confirm that the sediment cap meets the SQS. Surface (0–10 cm) sediment samples will be collected in representative areas using a van Veen grab or a bowl and spoon.

All sediment samples described above will be analyzed for SMS-list constituents, in accordance with the SAP and quality assurance project plan (QAPP) documents in Appendix A and B of the CQAP.

## 4 HAZARD EVALUATION

The overall hazard level associated with the activities described in Section 3 is low. Potential hazards while working at the site include but are not limited to the following:

- Exposure to potentially toxic and/or hazardous chemicals (ACGIH 1996)
- Physical hazards from use of sampling equipment
- Physical hazards from working conditions (e.g., slips, bank slopes, heat/cold stress)
- Physical hazards from working in the vicinity of heavy construction equipment, including dredge, barges, work tugs, and survey vessels, and concurrent commercial navigation of tugs and barges.
- Hazards associated with working on open water.

As described below, protective equipment and safe working procedures will help prevent accidents caused by these hazards. Exposure to harmful microbial organisms or other organisms in the sediments is not expected during this program; therefore, biological hazards are not discussed here.

### 4.1 DEFINITIONS

Chemical hazards are defined by the following terms and apply to acronyms used in the material safety data sheets (Attachment B):

**Time-weighted Average (TWA):** The recommended exposure limits for a hazardous chemical in the workplace, typically during an 8-hour workday over a 40-hour work week. TWAs are recommended by the National Institute for Occupational Safety and Health (NIOSH) under the authority of OSHA.

**Permissible Exposure Limit (PEL):** The legal maximum air concentration of a hazardous chemical to which workers may be exposed on an 8-hour basis as established by OSHA and WISHA. The PEL is a time-weighted-average value (PEL-TWA), and for all chemical discussed below, the corresponding PEL-TWA is the same for OSHA and WISHA.

**Threshold Limit Value (TLV):** The recommended maximum air concentration of a hazardous chemical to which workers may be exposed on an 8-hour basis. TLVs are time-weighted-average values (TLV-TWA) and are recommended by the American Conference of Governmental Industrial Hygienists (ACGIH).

**Short-term Exposure Limit (STEL):** A 15-minute TWA exposure that should not be exceeded at any time during a workday.

**Ceiling Limit:** Employee's exposure that should not be exceeded during any part of the workday.

## **4.2 CHEMICAL HAZARDS**

### **4.2.1 Potential Hazards of Chemicals in Sediments**

Sediments characterized as part of this sampling program are not expected to contain chemicals at concentrations considered to be hazardous or that require extraordinary precautions (Integral 2006). Protective measures will be instituted if evidence of contamination (i.e., odor, excessive organic enrichment, etc.) is detected in the sediment.

Chemicals previously identified in the area of concern primarily include PCBs (Aroclors 1242, 1248, 1254, and 1260), polycyclic aromatic hydrocarbons (PAHs), and bis(2-ethylhexyl) phthalate. These chemicals are relatively nonvolatile and pose a low risk for inhalation. Chemicals will be bound in a wet solid matrix, and personnel will be working in the open. Chemical hazard information for potential hazardous chemicals that may be encountered in the sediment, as well as for chemicals used for decontamination of sampling equipment, is summarized in Table 1. Material safety data sheets for these compounds are provided in Attachment B.

Other metals, semivolatile organic compounds, and volatile organic compounds may also be present, but at concentrations not expected to present a hazard to human health. A summary of the chemicals of concern is presented in Table 1.

Sediments containing PCBs, PAHs, or bis (2-ethylhexyl) phthalate that come in contact with the skin and eyes can cause irritation and burning. As a precautionary measure, gloves will be worn at all times when sampling and processing soil, sediment, and water samples. To avoid accidental ingestion of chemicals present in the sediment or while decontaminating sampling gear, potentially contaminated gloves should not come in contact with the facial area.

Field personnel may be in direct contact with sediments during water sampler handling and decontamination.

Table 1. Chemical Hazard Information (ACIGH 1996; NIOSH 2004).

Chemical of Concern	Max Concentration <sup>a</sup> (mg/kg)	PEL-TWA <sup>b</sup> mg/m <sup>3</sup>	TLV-TWA <sup>c</sup> mg/m <sup>3</sup>	STEL mg/m <sup>3</sup>	Ceiling Limit mg/m <sup>3</sup>	Exposure Routes	Symptoms
PCBs	150	0.001	0.5–1.0	--	--	inh, ing, con, abs	Irritating to eyes, liver damage, carcinogen
PAHs	37	0.2	0.2	--	--	inh, con, abs	Dermatitis, bronchitis
Bis [2-ethylhexyl] phthalate	110	5.0	5	--	10.0	inh, ing, con	Irritating to eyes and mucous membranes, liver damage, teratogen, carcinogen
Methanol	--	260 (200 ppm)	260 (200 ppm)	325 (250 ppm)	--	inh, ing, con, abs	Headache, drowsiness, coughing, skin and eye irritation or burning, blindness, ingestion of 2 ounces can cause death
Nitric Acid	--	5.0 (2.0 ppm)	5.0 (2.0 ppm)	10 (4.0 ppm)	--	inh, ing, con, abs	Severe burns to eye or skin, breathing difficulties

**Notes:** abs = absorption

ACIGH = American Conference of Governmental Industrial Hygienists

con = Contact

HPAH = High-molecular-weight polycyclic aromatic hydrocarbons

ing = Ingestion

inh = Inhalation

NIOSH = National Institute of Occupational Safety and Health

PCBs = polychlorinated biphenyls

PEL = Permissible Exposure Limit

STEL = Short-Term Exposure Limit

TLV = Threshold Limit Value

TWA = Time-Weighted Average

<sup>a</sup>Maximum concentrations from samples collected in the project area (SEA 2004; Integral 2004).

<sup>b</sup>PEL-TWA value from NIOSH/OSHA.

<sup>c</sup>TLV-TWA value (as recommended by ACGIH).

## 4.2.2 Potential Hazards of Chemicals Used During Sample Collection

Precautions should be taken for chemicals that will be used as sample preservatives<sup>1</sup> or for decontamination of sampling gear and implements. The following chemicals<sup>2</sup> will be used during sample collection activities:

**Buffer Solutions for pH 4.0 and 7.0:** Buffer solutions will be used to calibrate the YSI 6600 Multi Probe in the field. Personnel are required to wear protective gloves and goggles whenever handling these solutions.

**Conductivity Calibration Solution (1,000 micromho/cm):** Conductivity solution will be used to calibrate the YSI 6600 Multi Probe in the field. Personnel are required to wear protective gloves and goggles whenever handling these solutions.

**Hexane:** Hexane is a flammable solvent that may be used to remove residual creosote or petroleum-sheen from sampling equipment. Personnel are required to wear protective gloves and goggles whenever handling this chemical. It is to be used in the open-air only and away from any source of ignition (e.g., power generator).

**Liquinox™:** This detergent will be used to remove any organic films from sampling equipment that are easily removed without the aid of solvents, to prevent cross-contamination. It is a pale yellow, viscous liquid. Liquinox™ may irritate the skin on contact. Personnel are required to wear protective gloves and goggles whenever handling this decontaminating agent.

**Methanol:** Methanol is a volatile solvent that will be used to strip organic compounds from sampling equipment. It is a clear, colorless liquid with a strong odor and is highly flammable. Health effects from either inhaling or ingesting the solvent include central nervous system depression, narcosis, lower blood pressure, and vomiting and dizziness. In addition, methanol coming into contact with eyes can result in blindness. Personnel are required to wear protective gloves and goggles whenever handling this decontaminating agent. It is to be used in the open-air only. Respirators will be available but are optional, and may be worn if desired by field personnel.

**Nitric Acid:** Dilute nitric acid (1.6 Normal) will be used to decontaminate sampling equipment. Personnel are required to wear protective gloves and splash-proof goggles whenever handling this decontaminating agent. Dilute nitric acid solution is to be used in open, well-ventilated areas only.

**Zobell Solution for ORP Calibration:** Zobell solution will be used to calibrate the YSI 6600 Multi Probe in the field. The solution contains a mixture of ingredients: potassium

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<sup>1</sup> Sediment samples that will be collected for this sampling project will not require chemical preservation.

<sup>2</sup> Detailed physical information, including MSDS, is provided in Appendix B.

chloride, potassium ferrocyanide trihydrate, and potassium ferricyanide. Personnel are required to wear protective gloves and goggles whenever handling this solution.

### **4.3 PHYSICAL HAZARDS**

On-water sampling activities include:

- Measurements of surface water quality parameters with a YSI 6600 Multi Probe and collection of surface water grabs with a Niskin bottle
- Soil sampling with a stainless-steel shovel
- Sediment sampling with a van Veen grab.

To avoid injuries from deck gear and equipment, all personnel handling large equipment (e.g., van Veen grab, Niskin bottle, and multi probe) on deck will wear hard hats, safety glasses, and steel-toed boots. All personnel will also wear Coast Guard-approved life vests when working on deck. Exercise care when lifting, assembling, and decontaminating Niskin bottles and van Veen grab, as they can be cumbersome to manipulate.

Life vests will be worn by all personnel working on the deck and must be donned when directed by the safety officer or vessel operator. The vessel is also equipped with throwable life rings, and each crewmember will be briefed on their storage location.

#### **4.3.1 Research Vessel Operations for Surface Water Sampling**

The physical hazards associated with the collection of surface water samples result from the use of a Niskin bottle, boat winch, and the conditions onboard the boat.

Monitoring of water quality will be done at least 300 ft (100 m) from the removal area. Nonetheless, field personnel should maintain a constant watch on boat traffic and movement of heavy machinery (such as dredging buckets) around their monitoring area.

#### **4.3.2 Research Vessel Operations for Sediment Sampling**

The physical hazards associated with the deployment and retrieval of large pieces of sampling equipment result from their weight and the method of deployment. Only personnel whose presence is required will be allowed near the winch area during deployment and retrieval of the samplers.

A safety line may be attached to the equipment during deployment and retrieval in rough waters or high winds. Under circumstances of potentially dangerous waves or winds, the vessel pilot and field coordinator will employ best professional judgment to ensure safe field operations. Emergency procedures for a man-overboard are discussed in Section 7.3.

### **4.3.3 Physical Exposure**

Exposure to the elements and fatigue are two major causes of accidents while sampling in potentially hazardous weather conditions. The sampling may include long workdays, and in Puget Sound the weather can be unpredictable. Working in cold, rough conditions can lead to seasickness, fatigue, and exposure. To prevent fatigue and overexposure in adverse weather conditions, field personnel will take regular work breaks. Extra clothing will be brought to accommodate changes in weather. Cold stress can be manifested as both hypothermia and frostbite (discussed further in Section 7.4). Heat-related illnesses can occur at any time when protective clothing is worn. Heat stress can be manifested as both heat stroke and heat exhaustion (discussed further in Section 7.5).

Fatigue also presents a hazard when working at sea. The motion of the vessel, exposure, or heat stress can further compound the onset of fatigue. Personnel should monitor their own condition and capabilities and should be responsible for taking appropriate measures (discussed below) to relieve fatigue, exposure, or heat stress. The field coordinator/site safety officer and vessel operator can also direct any member of the crew to cease working.

## **5 HAZARD MONITORING AND CONTROL**

While sampling from a boat in Slip 4, three work areas, an exclusion zone, a contamination reduction zone, and a support zone, will be established onboard. This procedure will help ensure that sampling personnel are properly protected against the hazards present where they are working, and that work activities and contamination are appropriately confined. All personnel participating in this activity will wear appropriate personal protection equipment (PPE) while collecting, processing, and packaging surface water samples for chemical analyses to ensure that personnel are properly protected from present hazards.

### **5.1 EXCLUSION ZONE**

The exclusion zone is the area where contamination could or does occur. During intrusive sampling (e.g., sediment sample collection), the exclusion zone includes the area of the vessel in which sediments collected from the river bottom are handled. This part of the vessel is designated as the exclusion zone only when sediment is being handled on the vessel. When no sediment is onboard, the entire vessel is considered the support zone. During core processing at the onshore facility, the exclusion zone will be the area in which the core is processed and sampled. The exclusion zone will be clearly marked by the site safety officer.

Only authorized field personnel will be allowed in the exclusion zone. The site safety officer, as conditions change, may adjust the initial level of protection required. Levels of protection are discussed in more detail in Section 6.2.

Given the low hazard associated with river water samples, the area immediately around the sampling activities where surface water will be collected will not be marked with standard Yellow/Black adhesive tape around the sample processing area.

### **5.2 CONTAMINATION REDUCTION ZONE**

The contamination reduction zone (CRZ) is the transition area between the contaminated area and the clean area. The CRZ during sediment sampling is the vessel deck, except as noted in the preceding paragraph. Decontamination of both personnel and equipment will occur in this zone to prevent the transfer of chemicals of concern to the support zone.

This area is not applicable for water quality monitoring. All activities will occur within the exclusion zone.

### **5.3 SUPPORT ZONE**

The support zone is where all personnel will suit-up in specified PPE before entering the exclusion zone. On the sampling vessel, the support zone will be located in the cabin or

holds of the vessel, or on the vessel deck when contaminated sediment is not on deck. The support zone includes storage areas for “clean” equipment and resting and eating facilities for personnel.

This area is not applicable for water quality monitoring. All activities will occur within the exclusion zone.

#### **5.4 INVESTIGATION-DERIVED WASTE MANAGEMENT PLAN**

All standard solutions for the calibration of the multi probe, wash water, or will be discarded in a container at the work sites and disposed of at the local sanitary sewer system. Waste solvents from decontamination procedures (which are expected to be minimal—less than 8 ounces) will be retained for proper disposal by Integral in accordance with WAC 173-303.

## 6 SAFETY PROCEDURES

### 6.1 RESPONSIBLE INDIVIDUALS AND QUALIFICATIONS

Safety during the field investigation will be the responsibility of the project safety officer, the designated site safety officers, and every member of the field investigation team. At least one site safety officer will be present on the site at all times during intrusive field activities related to the investigation. Specific responsibilities of each individual are described in the following sections.

#### 6.1.1 Onsite Personnel and Responsibilities

Project organization and health and safety responsibilities for Integral employees for this sampling program will be as described below.

**Project Safety Officer.** Jane Sund or Ian Stupakoff, Integral, will be the Project Safety Officer for this sampling project. Responsibilities are as follows:

- Ensuring that requirements of the HSP are rigorously followed by all field personnel
- Ensuring that all necessary PPE, health and safety training, and supplies are available to the field team
- Ensuring that all field personnel are up to date with required training and medical monitoring requirements.

If the project safety officer determines that site conditions are unsafe, she has the authority to suspend field operations until the problem is corrected. If warranted, the project safety officer can modify HSP procedures to reflect field conditions. Any changes must be documented using Form 2 (Attachment A), and field staff must be informed of the change.

**Site Safety Officer.** Jane Sund and Susan FitzGerald, Integral, will serve as Site Safety Officer and Deputy Site Safety Officer, respectively. They are responsible for health and safety procedures, including:

- Ensuring that daily work schedules and tasks are appropriate for the required levels of effort and weather conditions
- Ensuring that proper handling of standard solutions are followed for the calibration of the YSI Multi Probe
- Ensuring that all Integral workers follow the HSP
- Confirming local emergency response phone numbers and locations
- Conducting and documenting the initial and daily health and safety briefings

- Evaluating and modifying the level of protective apparel and safety equipment, as necessary, based on site conditions
- Ensuring that the field team observes decontamination procedures
- Initiating corrective action for observed safety violations, and reporting unsuccessful attempts to correct a violation to the project manager.

If the site safety officer determines that site conditions are unsafe, she has the authority to suspend field operations until the problem is corrected. The site safety officer can modify HSP procedures, subject to approval by the project safety officer. Any changes must be documented using Form 2 (Attachment A), and field staff must be informed of the change.

**Field Staff.** All Integral employees will be responsible for knowing and implementing the policies and procedures stated in the HSP, including:

- Complying with proper safety and health practices, as stated in the HSP and described in training
- Using required safety devices and PPE
- Notifying a supervisor of unsafe conditions or acts immediately
- Reporting all accidents to a supervisor promptly, regardless of the severity of injury
- Carrying out all work in a manner not endangering to any employee.

**Principal in Charge and Project Managers.** Betsy Day (Integral) will be the Principal in Charge and David Schuchardt (Integral) will serve as the Project Manager for this project. They will have overall responsibility for safe performance of work throughout the project. The project manager must authorize all field activities. The field crew will contact the project manager whenever necessary to provide updates on the sampling activities.

### **6.1.2 Qualifications of Onsite Personnel**

All personnel participating in fieldwork must meet the training requirements of WISHA (WAC 296-62) and OSHA (29 CFR 1910.120). All field personnel are required to have 40 hours of formal health and safety training or an equivalent amount of training and onsite hazardous waste work experience prior to beginning field activities. Field personnel must also have 3 days of supervised field experience and 8 hours of annual refresher training. Site safety officers must also have 8 hours of supervisory training and be certified in first aid and cardio-pulmonary resuscitation (CPR) by the American Red Cross. Documentation of Integral staff training is presented in Attachment C.

In addition to formal instruction, each team member will be briefed on site-specific conditions during a safety meeting to be conducted before beginning the field program.

This meeting will be conducted by the site safety officer. In addition, there will also be daily "tailgate" safety briefings for all field staff prior to beginning work each day. These meetings may review safety procedures, address anticipated problems or changes in site conditions, or inform field staff of any changes to the HSP and/or new information. A record of the initial and daily safety meetings, including the date and time, name of person providing the briefing, topics covered, and signatures of all attendees, will be maintained using Safety Meeting Records (Form 3, Attachment A).

### **6.1.3 Medical Surveillance Program**

A medical surveillance program is in place for Integral personnel who are potentially exposed to hazardous substances during work activities. Physical exams are given before each assignment, at least every two years during employment when there is potential exposure to hazardous materials, and upon employment termination. Additional exams will be given, if needed, to evaluate specific exposures or unexplained illnesses. An occupational medicine physician determines the content of the exams.

The physical examination verifies that individuals are physically able to use protective equipment, to work in hot or cold environments, to wear respiratory protection, and to not be predisposed to occupationally induced disease. Any limitations are noted in the verification letter provided by the attending physicians to the Integral's project safety officer.

## **6.2 PROTECTIVE EQUIPMENT**

### **6.2.1 Personal Protective Equipment**

The 29 CFR 1910.132 "Personal Protective Equipment" has defined the following levels of PPE:

- **Level A** requires use of a fully encapsulated suit and full face piece, pressure-demand, self-contained breathing apparatus (SCBA) with a 5-minute, supplied air escape pack for the highest level of respiratory, skin, and eye protection. Level A is not anticipated at the site and therefore is not discussed further.
- **Level B** requires maximum respiratory protection by the use of supplied air or a positive pressure SCBA. A 5-minute, supplied air escape pack is required while in Level B. Dermal protection is selected on the basis of anticipated hazards. Level B is not anticipated at the site and therefore is not discussed further.
- **Level C** requires an air-purifying respirator that is specific to the chemicals of concern. The degree of dermal protection depends on anticipated hazards.
- **Level D** is the basic work uniform, described below, as modified for work at the site.

Numerous variations are possible with each level of protection.

Level D has been selected for this fieldwork on the basis of previous site investigations. Previous investigations have included a wide variety of chemical sampling, and all results to date do not indicate potential adverse chemical exposure to site workers. Chemicals of concern included in this sampling are non-volatile (NIOSH 2004) and are bound in a wet sediment matrix or water matrix. No action levels for upgrading PPE based on chemical concentrations in sampled media are therefore defined. If unexpected conditions are encountered (e.g., unusual or unidentifiable odors or oily sheens, etc.), these areas will either be avoided or the health and safety procedures will be reassessed and documented.

Level D protection includes regular work clothes or one-piece disposable Tyvek® or coated rain pants (bib overalls) if contaminant exposure through splashing is anticipated. Splash protection may be upgraded to coated rain jacket and pants, taped at the wrists and ankles if appropriate, as determined necessary by the site safety officer. The following gear is also included:

- Nitrile outer gloves (for intrusive work only)
- Polypropylene, nitrile, or polyethylene inner-disposable gloves (for intrusive work only)
- Neoprene steel-toed, chemically resistant, impermeable outer boots
- Safety glasses or goggles when conditions for splash exposure exist
- U.S. Coast Guard-approved personal flotation devices (e.g., life vests).

## 6.2.2 Safety Equipment

Additional safety supplies to be placed in the vessel include:

- First-aid kit
- Eye wash kit
- Spill cleanup kit
- Drinking water
- Insect repellent
- Sunscreen.

Safety equipment and operating procedures required by the U.S. Coast Guard will be followed on the sampling vessel.

## 6.3 SITE SAFETY PROCEDURES

Safety is the responsibility of every individual involved in project efforts. Whether in the office or in the field, properly followed procedures are essential to maintain personal safety and to minimize injuries or accidents involving equipment.

### 6.3.1 Safety Rules

All personnel working in the field will follow the rules and procedures listed below:

1. Before any field operations take place, all personnel must review this HSP and become familiar with the required safety procedures. The site safety officer will review safety procedures with the field team at the initiation of field operations. Measures to ensure that this HSP is being followed will include daily safety meetings. Periodic inspections or audits may be conducted at the discretion of the project safety officer.
2. The project safety officer will confirm key emergency services prior to the start of sampling activities. The purpose of this information exchange is twofold: 1) to establish final procedures for use in onboard emergencies, and 2) to inform outside help of the activities being performed onsite and the associated potential problems. The U.S. Coast Guard, Seattle marine traffic controllers, and Washington State Ferries, as well as property owners surrounding the shoreline of Slip 4, will be informed of the operations and locations of the research vessel.
3. Copies of this HSP will be available in the field vehicle. A waterproof copy of the completed emergency contacts section (Table 2) will be carried with a member of the field sampling team during sampling. In addition, a waterproof map of the site, including waterways, associated piers, and hospital locations, will also be carried with the sampling team.
4. The site safety officer in conjunction with the vessel operator will continually monitor weather conditions (e.g., storm fronts, lightning, high winds). A radio capable of receiving the National Weather Service frequency for the Seattle/Tacoma area will be onboard or onshore and monitored periodically. The site safety officer will have the responsibility and the authority to halt operations if conditions are deemed to be unsafe.
5. Only the team members meeting the training and medical requirements of WAC 296-62 (Part P, Hazardous Waste Operations and Emergency Response) will be permitted to perform intrusive field operations.

Table 2. Emergency Contacts.

#### *Emergency Services*

Service	Name/Location	Phone Number
Ambulance	---/---	911
Fire	---/---	911
Police	---/---	911
Hospitals *	<b>SEATTLE: Harborview Medical Center</b> 325 Ninth Ave. Seattle, WA 98104	General: (206) 731-3000 Emergency (206) 731-2500

\*See Health and Safety Plan Section 7.2 for Directions to Hospitals.

*First Aid/CPR Certification (certificates provided in Attachment C)*

*Integral employees: Jane Sund and Susan FitzGerald*

*Contact Information*

<u>Integral Employee</u>	<u>Work</u>	<u>Home</u>
Betsy Day, Principal in Charge	(206) 957-0346	(206) 241-6337
David Schuchardt, Project Manager	(206) 957-0350	(425) 765-0017
Eron Dodak, Integral Corporate Health and Safety Officer	(503) 284-5545	(503) 407-2933
Susan FitzGerald, Project and/or Safety Officer	(206) 957-0352	(206) 234-5811
Jane Sund, Deputy Site Safety Officer	(503) 284-5545	(512) 779-3172

**6.3.2 Visitors**

All visitors must be granted written admission to the site by Integral's project manager. Authorized visitors will only be allowed to observe operations from the vessel's cabin, and must obey all instructions of the site safety officers. Exceptions to this are representatives from EPA, Washington Department of Ecology, and Washington Department of Labor and Industries, who establish that they possess training consistent with the requirements of this plan. They must also possess appropriate health and safety equipment at the time of the visit, and have a health and safety plan at least as stringent as this plan, or adopt this plan as their own.

## 7 EMERGENCY PROCEDURES

### 7.1 REPORTING/NOTIFICATION PROCEDURES

In the case of any emergency, the site safety officer is to be notified as soon as possible. If the situation is life-threatening and notification of the site safety officer would delay emergency response, field personnel may initiate the appropriate emergency contacts prior to notifying the site safety officer. Emergency decontamination of injured persons will be accomplished if not injurious to them. The site safety officer will initiate contacts as follows:

1. Call appropriate emergency services numbers if not already done. Provide the following information:
  - Name and location of person reporting
  - Location of accident/incident
  - Name and affiliation of injured party
  - Description of injuries
  - Status of medical aid effort
  - Details on any chemicals involved and description of any personnel or contaminated gear to be sent with the injured party
  - Summary of the accident, including the suspected cause and the time of occurrence
  - Temporary control measures taken to minimize further risk.
2. Call the project manager (Table 2) and provide information noted in Step 1 above.
3. Complete a written accident/incident report using the *Employee Exposure/Injury Incident Report* form (Form 4, Attachment A) within 24 hours, sending copies to the project manager, Ms. Betsy Day and the project safety officer, Mr. Ian Stupakoff.

The following resources are to be used in cases of emergency:

**Emergency Contacts:** Table 2 includes both the appropriate emergency services and the appropriate project contacts.

**Nearest Phone:** A cellular telephone will be carried with the field crew onto the sampling vessel.

**Onsite Emergency Equipment:** An industrial first aid kit and an eyewash kit will be located on the sampling vessel.

**Offsite Emergency Services:** Phone numbers for offsite emergency services are listed in Table 2. Copies of this table must be located on the boat, field vehicle, and core processing area.

After the required emergency contacts are made, the site safety officer should promptly notify the project manager.

## **7.2 HOSPITAL ROUTES**

If an injury requiring immediate medical assistance occurs on the vessel, the injured person should be transported to the hospital by ambulance. If medical care is required, but an ambulance service is not warranted, field vehicles may be used to transport the injured person to the hospital. It is anticipated that field vehicles will be parked at the First Avenue South Bridge Marina.

### **If Ambulance Service is Required:**

If the accident occurs on the water, the sampling vessel should proceed directly to the nearest marina or nearest accessible location. Emergency services should be immediately contacted using the cell phone to arrange pickup at the nearest dock. Harborview Medical Center is the hospital located nearest Slip 4.

### **Directions to Harborview Medical Center from the Duwamish Waterway (Figure 2):**

Take a right onto Spokane St. and head east to the I-5 interchange.

Get onto I-5 north and immediately take the James St. exit.

Take a right onto James St. and go two blocks to 9th Ave.

Take a right onto 9th Ave., and the hospital and emergency room entrance are on the left.

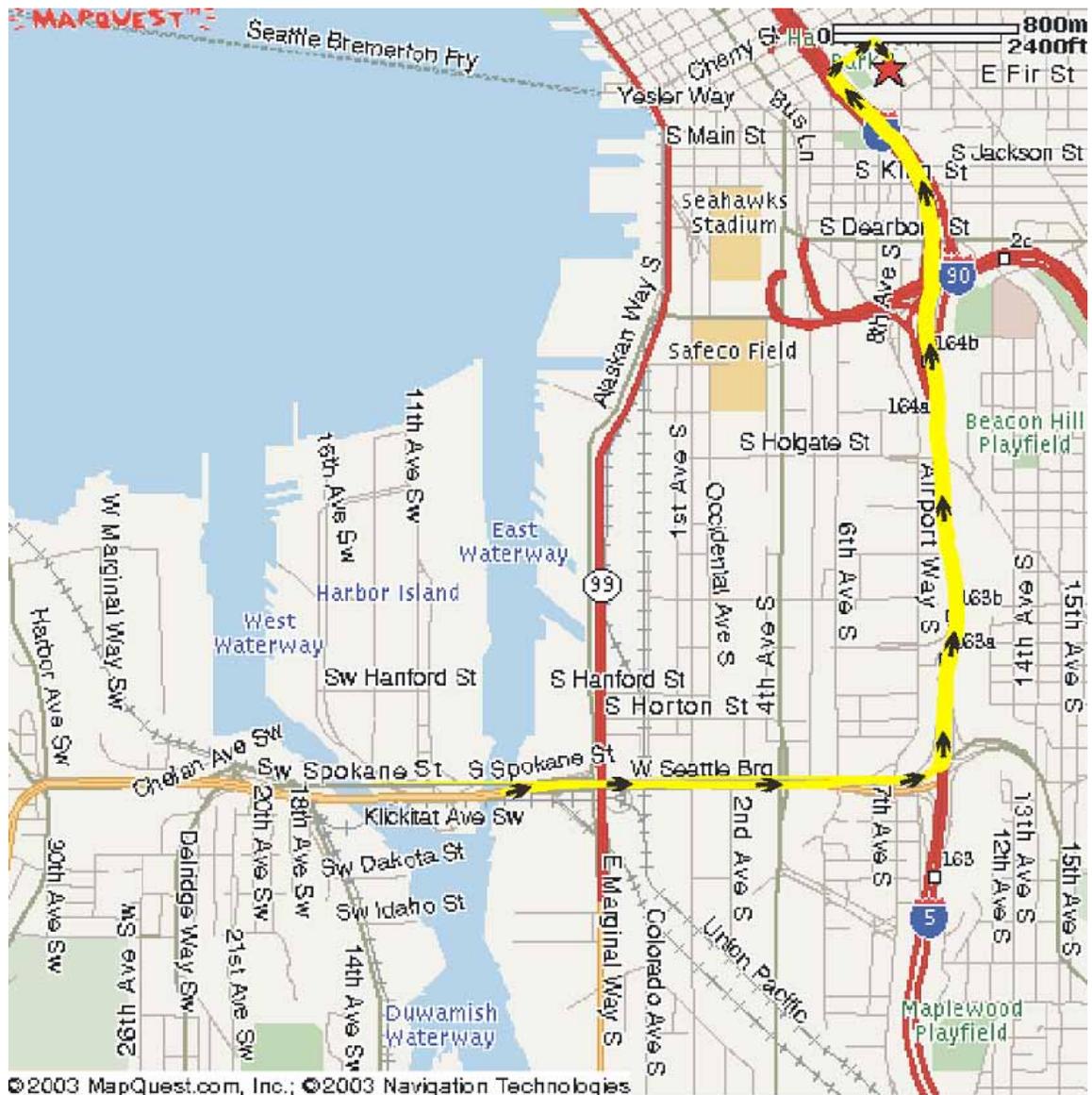


Figure 2. Transportation Route to Harborview Medical Center, Seattle, WA.

### 7.3 MAN OVERBOARD

There is a potential for a man-overboard situation while the team is working over water on the research vessel. This potential is increased when heavy equipment (e.g., HSA drill rig and samplers) is being used, or during stormy weather. If a person falls overboard, all vessel engines will be stopped immediately. Flotation devices (e.g., life rings) attached to lines will be thrown to the victim from the vessel. The victim will then be brought aboard the research vessel or towed to shore; wet clothes will be removed and replaced with dry clothing. The victim may need to be treated for cold stress (discussed below). No other person will enter the water except if the victim is unconscious or seriously injured. Rescuers must wear life preservers and be tethered to the research vessel or shore.

## 7.4 COLD STRESS

Fieldwork will be conducted during September 2007–February 2008. Cold stress can occur when site personnel may be subject to low air temperatures, rain, and winds, or while working under conditions where they may fall into open water. In these conditions, field teams must be prepared to wear proper protective clothing and to recognize symptoms of cold stress. Cold stress can be manifested as both hypothermia and frostbite:

- **Hypothermia** is a cold-induced decrease in the core body temperature and can decrease attentiveness and manual dexterity. Hypothermia produces shivering, numbness, drowsiness, muscular weakness, and, if severe enough, death.
- **Treatment:** A victim of hypothermia should be taken indoors quickly. Provide rapid but gentle re-warming. Remove wet or cold garments and provide warm, dry clothing or covering. Dry the person thoroughly. If the victim reacts and is conscious, give them a hot drink. It may be necessary to wrap the victim together with warm water bottles, or persons in blankets, or a sleeping bag. Call for medical care at once.
- **Frostbite** results from the constriction of blood vessels in the extremities, and decreases the supply of warming blood to these areas. This drop in blood supply may result in the formation of ice crystals in the tissues, causing tissue damage. The symptoms of frostbite are white or grayish skin, blisters, or numbness.
- **Treatment:** Bring the victim indoors and re-warm the areas quickly in water of 102°F to 105°F (39°C to 40.6°C). Give them a warm drink—not hot coffee, tea (or any other caffeine-containing beverage), or alcohol. The victim should not smoke. Smoking tends to constrict the blood vessels in the skin, making the injury slow to heal.

Keep the frozen parts in warm water or covered with warm cloths for 30 minutes. Then elevate the injured area and protect it from injury. Do not allow the blisters to be broken. Use sterile, soft, dry material to cover the injured areas. Keep the victim warm and get immediate medical care.

## 7.5 HEAT STRESS

Heat-related illnesses can occur at any time when protective clothing is worn. If site activities take place when temperatures are 70–75°F or greater, the risk of heat-related illnesses increases. The site safety officers will be trained in monitoring, treating, and recognizing the signs of heat stress. Heat stress can be manifested as both heat stroke and heat exhaustion:

- **Heat Stroke** means a person's temperature control system that causes sweating stops working correctly. The body temperature rises so high that brain damage and death will result if the person is not cooled quickly. The main signs of heat stroke are red or flushed skin; hot, dry skin, although the person may have been sweating earlier; and extremely high body temperature, often to 106°F (41°C). There may be dizziness, nausea, headache, rapid pulse, and unconsciousness.
- **Treatment:** Cool a victim of heat stroke quickly. If the body temperature is not brought down fast, permanent brain damage or death will result. Soak the person in cool but not cold water, sponge the body with rubbing alcohol or cool water, or pour water on the body to reduce temperature to a safe level—about 102°F (39°C). Then stop cooling and observe the victim for 10 minutes. If the temperature starts to rise again, cool the victim again. Do not give coffee, tea, or alcoholic beverages. When the victim's temperature remains at a safe level, put the victim to bed and get medical help.
- **Heat Exhaustion** is much less dangerous than heat stroke. The major signs of heat exhaustion are pale, clammy skin, profuse perspiration, and extreme tiredness or weakness. The body temperature is approximately normal. The person may have a headache, dizziness, and may vomit.
- **Treatment:** For mild heat exhaustion, remove the person to a cool place, loosen clothing and provide bed rest. Give a salt solution (1/2 teaspoon salt in 1/2 glass of water) every 15 minutes for three or four doses. Medical care is needed for severe heat exhaustion.

## 8 PLAN ACCEPTANCE

This site health and safety plan has been written for the use of Integral Consulting Inc. personnel and its subcontractors. Integral Consulting Inc. claims no responsibility for its use by others. The plan is written for the specific site conditions, purposes, dates, and personnel specified, and must be amended if these conditions change.

PLAN PREPARED BY:                      Integral Consulting Inc.

DATE:                                      February 9, 2007

PLAN ACCEPTED BY:	DATE
Integral Consulting Inc. _____	_____
_____	_____

## 9 REFERENCES

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- EPA. 1992. Standard operating safety guides. EPA Publication No. 9285.1-03. U.S Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC.
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- PSEP. 1997a. Puget Sound Estuary Program: Recommended guidelines for measuring metals in Puget Sound water, sediment, and tissue samples. U.S. Environmental Protection Agency, Region 10, Seattle, WA.
- PSEP. 1997b. Puget Sound Estuary Program: Recommended guidelines for measuring organic compounds in Puget Sound sediment and tissue samples. U.S. Environmental Protection Agency, Region 10, Seattle, WA.
- SEA. 2004. Summary of existing information and identification of data gaps. Prepared for City of Seattle and King County Department of Natural Resources. Striplin Environmental Associates, Inc., Olympia, WA.
- Windward. 2003. Lower Duwamish Waterway remedial investigation, Task 5: Identification of candidate sites for early action, technical memorandum: Data analysis and candidate site identification. Prepared for the Lower Duwamish Waterway Group. Windward Environmental, Seattle, WA.

# **ATTACHMENT A**

## **HEALTH AND SAFETY FORMS**

**FORM 1**  
**ACKNOWLEDGMENT**

I have read the attached Health and Safety Plan for the Slip 4 Water Quality Monitoring Program. I have discussed any questions that I have regarding these materials with the appropriate site safety officer, and I understand the requirements of the Health and Safety Plan.

\_\_\_\_\_

Signature \_\_\_\_\_ Date \_\_\_\_\_

\_\_\_\_\_

**FORM 2**  
**MODIFICATION TO HEALTH AND SAFETY PLAN**

DATE \_\_\_/\_\_\_/\_\_\_

Modification: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Reasons for Modification:

Site Personnel Briefed:

NAME	DATE

Approvals:

Site Safety Officer: \_\_\_\_\_

Project Safety Officer: \_\_\_\_\_

Project Manager: \_\_\_\_\_

Others: \_\_\_\_\_

**FORM 3**  
**SAFETY MEETING RECORD**  
**INTEGRAL CONSULTING INC.**

DATE \_\_\_/\_\_\_/\_\_\_

**Project:**

**Date:**

**Time:**

**Person Conducting Meeting:**

**Topics Addressed:**

**Signatures of Persons Attending Meeting:**

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

**FORM 4**  
**EMPLOYEE EXPOSURE/INJURY INCIDENT REPORT**

(Use additional page if necessary)

Date: \_\_\_\_\_ Time: \_\_\_\_\_

Name: \_\_\_\_\_ Employer: \_\_\_\_\_

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's Name: \_\_\_\_\_

Treatment: \_\_\_\_\_

Comments: \_\_\_\_\_

What was the person doing at the time of the accident/incident? \_\_\_\_\_

Personal Protective Equipment Worn: \_\_\_\_\_

Cause of Accident/Incident: \_\_\_\_\_

What immediate action was taken to prevent recurrence? \_\_\_\_\_

Additional comments: \_\_\_\_\_

Employee's Signature \_\_\_\_\_ Date \_\_\_\_\_

Supervisor's Signature \_\_\_\_\_ Date \_\_\_\_\_

Site Safety Representative's Signature \_\_\_\_\_ Date \_\_\_\_\_

## **ATTACHMENT B**

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MATERIAL SAFETY  
DATA SHEETS

## LIQUINOX MSDS

### Section 1: PRODUCT AND COMPANY IDENTIFICATION

**Chemical family:** Detergent.

**Manufacturer:** Alconox, Inc.

30 Glenn St.

Suite 309

White Plains, NY 10603.

### Manufacturer emergency

**phone number:**

800-255-3924.

8 13-248-0585 (outside of the United States).

**Supplier:** Same as manufacturer.

**Product name:** Liquinox

### Section 2 : INGREDIENT INFORMATION

C.A.S. CONCENTRATION

% Ingredient Name T.L.V. LD/50 LC/50

25155-

30-0

10-30 SODIUM

DODECYLBENZENESULFONATE

NOT

AVAILABLE

438

MG/KG

RAT

ORAL

1330

MG/KG

MOUSE

ORAL

NOT

AVAILABLE

### Section 3 : HAZARD IDENTIFICATION

**Route of entry:** Skin contact, eye contact, inhalation and ingestion.

**Effects of acute**

**exposure**

**Eye contact:** May cause irritation.

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

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

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

May cause gastric distress.

**Effects of chronic**

**exposure:**

See effects of acute exposure.

### Section 4 : FIRST AID MEASURES

**Skin contact:** Remove contaminated clothing.

Wash thoroughly with soap and water.

Seek medical attention if irritation persists.

**Eye contact:** Check for and remove contact lenses.

Flush eyes with clear, running water for 15 minutes while holding

eyelids open: if irritation persists, consult a physician.

**Inhalation:** Remove victim to fresh air.

If irritation persists, seek medical attention.

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**Ingestion:** Do not induce vomiting, seek medical attention.

Dilute with two glasses of water.  
Never give anything by mouth to an unconscious person.

#### **Section 5 : FIRE FIGHTING MEASURES**

**Flammability:** Not flammable.

**Conditions of flammability:**

Surrounding fire.

**Extinguishing media:** Carbon dioxide, dry chemical, foam.

Water

Water fog.

**Special procedures:** Self-contained breathing apparatus required.

Firefighters should wear the usual protective gear.

Use water spray to cool fire exposed containers.

**Auto-ignition**

**temperature:**

Not available.

**Flash point (°C),**

**method:** None

**Lower flammability**

**limit (% vol):**

Not applicable.

**Upper flammability**

**limit (% vol):** Not applicable.

**Explosion Data**

**Sensitivity to static**

**discharge:**

Not available.

**Sensitivity to mechanical**

**impact:**

Not available.

**Hazardous combustion**

**products:**

Oxides of carbon (COx).

Hydrocarbons.

**Rate of burning:** Not available.

**Explosive power:** Containers may rupture if exposed to heat or fire.

#### **Section 6 : ACCIDENTAL RELEASE MEASURES**

**Leak/Spill:** Contain the spill.

Prevent entry into drains, sewers, and other waterways.

Wear appropriate protective equipment.

Small amounts may be flushed to sewer with water.

Soak up with an absorbent material.

Place in appropriate container for disposal.

Notify the appropriate authorities as required.

#### **Section 7 : HANDLING AND STORAGE**

**Handling procedures and equipment:**

Protect against physical damage.

Avoid breathing vapors/mists.

Wear personal protective equipment appropriate to task.

Wash thoroughly after handling.

Keep out of reach of children.

Avoid contact with skin, eyes and clothing.

Avoid extreme temperatures.

Laundry contaminated clothing prior to reuse.

**Storage requirements:** Store away from incompatible materials.

Keep containers closed when not in use.

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#### **Section 8 : EXPOSURE CONTROLS / PERSONAL PROTECTION**

##### **Precautionary Measures**

##### **Gloves/Type:**

Wear appropriate gloves.

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

##### **Eye/Type:**

Safety glasses recommended.

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

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

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

Emergency shower should be in close proximity.

##### **Ventilation**

##### **requirements:**

Local exhaust at points of emission.

##### **Exposure limit of**

**material:** None available.

#### **Section 9 : PHYSICAL AND CHEMICAL PROPERTIES**

**Physical state:** Liquid.

**Appearance & odor:** Odourless.

Pale yellow.

**Odor threshold (ppm):** None available.

##### **Vapour pressure**

**(mmHg):**

@ 20°C (68°F).

17

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

##### **Volatiles (%)**

**By volume:** None available.

##### **Evaporation rate**

**(butyl acetate = 1):** < 1.

**Boiling point (°C):** 100 (212F)

**Freezing point (°C):** None available.

**pH:** 8.5

**Specific gravity @ 20 °C:** (water = 1).

1.083

**Solubility in water (%):** Complete.

##### **Coefficient of water/oil**

**dist.:**

None available.

**VOC:** None

**Chemical family:** Detergent.

#### **Section 10 : STABILITY AND REACTIVITY**

**Chemical stability:** Product is stable under normal handling and storage conditions.

**Conditions of instability:** Extreme temperatures.

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##### **Hazardous**

##### **polymerization:**

Will not occur.

##### **Incompatible**

##### **substances:**

Strong acids.

Strong oxidizing agents.

##### **Hazardous**

##### **decomposition products:**

See hazardous combustion products.

**Section 11 : TOXICOLOGICAL INFORMATION**

**LD50 of product, species**

**& route:**

> 5000 mg/kg rat oral.

**LC50 of product, species**

**& route:**

Not available.

**Sensitization to product:** Not available.

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

**Reproductive effects:** Not available.

**Teratogenicity:** Not available.

**Mutagenicity:** Not available.

**Synergistic materials:** Not available.

**Section 12 : ECOLOGICAL INFORMATION**

**Environmental toxicity:** No data at this time.

**Environmental fate:** No data at this time.

**Section 13 : DISPOSAL CONSIDERATIONS**

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

**Section 14 : TRANSPORT INFORMATION**

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

**Special shipping**

**information:**

Not regulated.

**Section 15 : REGULATORY INFORMATION**

**Canadian Regulatory**

**Information**

**WHMIS classification:** Not controlled.

**DSL status:** Not available.

**USA Regulatory**

**Information**

**SARA hazard categories**

**sections 311/312:**

Immediate (Acute) Health Hazard: No.

Delayed (Chronic) Health Hazard: No.

Fire Hazard: No.

Sudden Release of Pressure: No.

Reactive: No.

**SARA Section 313:** None

**TSCA inventory:** All components of this product are listed on the TSCA inventory.

msds\_liquinox\_english\_ansi

MS 01.40.01.01.06.1 Page 5 of 5

**NFPA**

**Health Hazard:** 1

**Flammability:** 0

**Reactivity:** 0

**HMIS**

**Health Hazard:** 1

**Flammability:** 0

**Physical hazard:** 0

**PPE:** A

**Section 16 : OTHER INFORMATION**

**Supplier MSDS date:** 2006/07/14

**Data prepared by:** Global Safety Management

3340 Peachtree Road, #1800  
Atlanta, GA 30326  
Phone: 877-683-7460  
Fax: (877) 683-7462  
Web: [www.globalsafetynet.com](http://www.globalsafetynet.com)  
E mail: [info@globalsafetynet.com](mailto:info@globalsafetynet.com).

**General note:** This material safety data sheet was prepared from information obtained from various sources, including product suppliers and the Canadian Center for Occupational Health and Safety.

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MSDS for **METHANOL**  
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1 - PRODUCT IDENTIFICATION  
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PRODUCT NAME: METHANOL  
FORMULA: CH3OH  
FORMULA WT: 32.04  
CAS NO.: 67-56-1  
NIOSH/RTECS NO.: PC1400000  
COMMON SYNONYMS: METHYL ALCOHOL; WOOD ALCOHOL; CARBINOL; METHYLOL;  
WOOD  
SPIRIT  
PRODUCT CODES:  
9049,9072,9075,9076,9071,5217,5370,9074,P704,9093,5536,9068  
9073,9091,9263,9069,9070  
EFFECTIVE: 09/26/86  
REVISION #04

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA(TM) SYSTEM

HEALTH - 3 SEVERE (POISON)  
FLAMMABILITY - 3 SEVERE (FLAMMABLE)  
REACTIVITY - 1 SLIGHT  
CONTACT - 1 SLIGHT

HAZARD RATINGS ARE 0 TO 4 (0 = NO HAZARD; 4 = EXTREME HAZARD).

LABORATORY PROTECTIVE EQUIPMENT

GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES; CLASS B  
EXTINGUISHER

PRECAUTIONARY LABEL STATEMENTS

POISON DANGER  
FLAMMABLE  
HARMFUL IF INHALED  
CANNOT BE MADE NON-POISONOUS  
MAY BE FATAL OR CAUSE BLINDNESS IF SWALLOWED  
KEEP AWAY FROM HEAT, SPARKS, FLAME. DO NOT GET IN EYES, ON SKIN, ON  
CLOTHING.  
AVOID BREATHING VAPOR. KEEP IN TIGHTLY CLOSED CONTAINER. USE WITH  
ADEQUATE VENTILATION. WASH THOROUGHLY AFTER HANDLING. IN CASE OF FIRE,  
USE ALCOHOL FOAM, DRY CHEMICAL, CARBON DIOXIDE - WATER MAY BE  
INEFFECTIVE.  
FLUSH SPILL AREA WITH WATER SPRAY.

SAF-T-DATA(TM) STORAGE COLOR CODE: RED (FLAMMABLE)

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2 - HAZARDOUS COMPONENTS  
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NO.	COMPONENT	%	CAS
METHANOL 1		90-100	67-56-

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MSDS for METHANOL Page 2  
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3 - PHYSICAL DATA  
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BOILING POINT: 65 C ( 149 F) VAPOR PRESSURE(MM HG): 96  
MELTING POINT: -98 C ( -144 F) VAPOR DENSITY(AIR=1): 1.11  
SPECIFIC GRAVITY: 0.79 EVAPORATION RATE: 4.6  
(H2O=1) (BUTYL ACETATE=1)  
SOLUBILITY(H2O): COMPLETE (IN ALL PROPORTIONS) % VOLATILES BY VOLUME:  
100  
APPEARANCE & ODOR: CLEAR, COLORLESS LIQUID WITH CHARACTERISTIC PUNGENT  
ODOR.

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4 - FIRE AND EXPLOSION HAZARD DATA  
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FLASH POINT (CLOSED CUP 12 C ( 54 F) NFPA 704M RATING: 1-  
3-0  
FLAMMABLE LIMITS: UPPER - 36.0 % LOWER - 6.0 %  
FIRE EXTINGUISHING MEDIA  
USE ALCOHOL FOAM, DRY CHEMICAL OR CARBON DIOXIDE.  
(WATER MAY BE INEFFECTIVE.)

SPECIAL FIRE-FIGHTING PROCEDURES

FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE.

MOVE CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT RISK. USE WATER TO KEEP FIRE-EXPOSED CONTAINERS COOL.

UNUSUAL FIRE & EXPLOSION HAZARDS

VAPORS MAY FLOW ALONG SURFACES TO DISTANT IGNITION SOURCES AND FLASH BACK.

CLOSED CONTAINERS EXPOSED TO HEAT MAY EXPLODE. CONTACT WITH STRONG OXIDIZERS MAY CAUSE FIRE.  
BURNS WITH A CLEAR, ALMOST INVISIBLE FLAME.

TOXIC GASES PRODUCED

CARBON MONOXIDE, CARBON DIOXIDE, FORMALDEHYDE

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5 - HEALTH HAZARD DATA  
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TLV LISTED DENOTES (TLV-SKIN).

THRESHOLD LIMIT VALUE (TLV/TWA): 260 MG/M3 ( 200 PPM)

SHORT-TERM EXPOSURE LIMIT (STEL): 310 MG/M3 ( 250 PPM)

PERMISSIBLE EXPOSURE LIMIT (PEL): 260 MG/M3 ( 200 PPM)

TOXICITY: LD50 (ORAL-RAT)(MG/KG) - 5628  
LD50 (IPR-RAT)(MG/KG) - 9540

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MSDS for METHANOL

Page 3

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-----  
LD50 (SCU-MOUSE)(MG/KG) - 9800  
LD50 (SKN-RABBIT) (G/KG) - 20

CARCINOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO

EFFECTS OF OVEREXPOSURE

INHALATION AND INGESTION ARE HARMFUL AND MAY BE FATAL.

INHALATION MAY CAUSE HEADACHE, NAUSEA, VOMITING, DIZZINESS, NARCOSIS, SUFFOCATION, LOWER BLOOD PRESSURE, CENTRAL NERVOUS SYSTEM DEPRESSION.

LIQUID MAY BE IRRITATING TO SKIN AND EYES. PROLONGED SKIN CONTACT MAY RESULT IN DERMATITIS. EYE CONTACT MAY RESULT IN TEMPORARY CORNEAL DAMAGE.

INGESTION MAY CAUSE BLINDNESS.

INGESTION MAY CAUSE NAUSEA, VOMITING, HEADACHES, DIZZINESS, GASTROINTESTINAL IRRITATION.

CHRONIC EFFECTS OF OVEREXPOSURE MAY INCLUDE KIDNEY AND/OR LIVER DAMAGE.

TARGET ORGANS

EYES, SKIN, CENTRAL NERVOUS SYSTEM

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE

NONE IDENTIFIED

ROUTES OF ENTRY

INHALATION, INGESTION, EYE CONTACT, SKIN CONTACT

EMERGENCY AND FIRST AID PROCEDURES

CALL A PHYSICIAN.

IF SWALLOWED, IF CONSCIOUS, IMMEDIATELY INDUCE VOMITING.

IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.

IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH PLENTY OF WATER FOR

AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES.

WASH CLOTHING BEFORE RE-USE.

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6 - REACTIVITY DATA  
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STABILITY: STABLE

HAZARDOUS POLYMERIZATION: WILL NOT

OCCUR

CONDITIONS TO AVOID: HEAT, FLAME, OTHER SOURCES OF IGNITION

INCOMPATIBLES: STRONG OXIDIZING AGENTS, STRONG ACIDS, ALUMINUM

DECOMPOSITION PRODUCTS: CARBON MONOXIDE, CARBON DIOXIDE, FORMALDEHYDE

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7 - SPILL AND DISPOSAL PROCEDURES  
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STEPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE

WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE CLOTHING.

SHUT OFF IGNITION SOURCES; NO FLARES, SMOKING OR FLAMES IN AREA. STOP LEAK

IF YOU CAN DO SO WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS. TAKE UP

WITH SAND OR OTHER NON-COMBUSTIBLE ABSORBENT MATERIAL AND PLACE INTO CONTAINER FOR LATER DISPOSAL. FLUSH AREA WITH WATER.

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J. T. BAKER SOLUSORB(R) SOLVENT ADSORBENT IS RECOMMENDED  
FOR SPILLS OF THIS PRODUCT.

DISPOSAL PROCEDURE

DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL  
ENVIRONMENTAL REGULATIONS.

EPA HAZARDOUS WASTE NUMBER: U154 (TOXIC WASTE)

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8 - PROTECTIVE EQUIPMENT  
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VENTILATION: USE GENERAL OR LOCAL EXHAUST VENTILATION TO MEET  
TLV REQUIREMENTS.

RESPIRATORY PROTECTION: RESPIRATORY PROTECTION REQUIRED IF AIRBORNE  
CONCENTRATION EXCEEDS TLV. AT CONCENTRATIONS  
ABOVE 200 PPM, A SELF-CONTAINED BREATHING  
APPARATUS IS ADVISED.

EYE/SKIN PROTECTION: SAFETY GOGGLES AND FACE SHIELD, UNIFORM,  
PROTECTIVE SUIT, RUBBER GLOVES ARE RECOMMENDED.

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9 - STORAGE AND HANDLING PRECAUTIONS  
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SAF-T-DATA(TM) STORAGE COLOR CODE: RED (FLAMMABLE)

SPECIAL PRECAUTIONS

BOND AND GROUND CONTAINERS WHEN TRANSFERRING LIQUID. KEEP CONTAINER  
TIGHTLY CLOSED. STORE IN A COOL, DRY, WELL-VENTILATED, FLAMMABLE  
LIQUID  
STORAGE AREA.

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10 - TRANSPORTATION DATA AND ADDITIONAL INFORMATION  
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DOMESTIC (D.O.T.)

PROPER SHIPPING NAME	METHANOL
HAZARD CLASS	FLAMMABLE LIQUID
UN/NA	UN1230
LABELS	FLAMMABLE LIQUID
REPORTABLE QUANTITY	5000 LBS.

INTERNATIONAL (I.M.O.)

PROPER SHIPPING NAME	METHANOL
HAZARD CLASS	3.2, 6.1
UN/NA	UN1230
LABELS	FLAMMABLE LIQUID, POISON

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MSDS for METHANOL

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## Polychlorinated Biphenyls

CAS Number: 1336-36-3  
DOT Number: UN 2315  
Date: May, 1989

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### HAZARD SUMMARY

- \* Polychlorinated Biphenyls can affect you when breathed in and by passing through your skin.
- \* Polychlorinated Biphenyls are CARCINOGENS HANDLE WITH EXTREME CAUTION.
- \* They may be teratogens and may damage the adult reproductive system.
- \* Exposure can cause an acne like skin rash (called chloracne).
- \* They can damage the liver.
- \* High exposure can damage the nervous system, causing numbness, weakness and tingling ("pins and needles") in the arms and legs.

### IDENTIFICATION

Polychlorinated Biphenyls are a mixture of chemicals that are clear to yellow oily liquids or solids. They are used in insulating fluids of electrical systems.

### REASON FOR CITATION

- \* Polychlorinated Biphenyls are on the Hazardous Substance List because they are regulated by OSHA and cited by NIOSH, DOT, IARC, NTP, DEP and EPA.
- \* These chemicals are on the Special Health Hazard Substance List because they are CARCINOGENS and TERATOGENS.
- \* Definitions are attached.

### HOW TO DETERMINE IF YOU ARE BEING EXPOSED

- \* Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under OSHA 1910.20.
- \* If you think you are experiencing any work related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

### WORKPLACE EXPOSURE LIMITS

OSHA: The legal airborne permissible exposure limit (PEL) is 1 mg/m<sup>3</sup> (42% Chlorine) and 0.5 mg/m<sup>3</sup> (54% Chlorine) averaged over an 8 hour workshift.

NIOSH: The recommended airborne exposure limit is 0.001 mg/m<sup>3</sup> averaged over a 10 hour workshift.

- \* The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.
- \* Polychlorinated Biphenyls are PROBABLE CANCER CAUSING AGENTS

in humans. There may be no safe level of exposure to carcinogens, so all contact should be reduced to the lowest possible level.

#### WAYS OF REDUCING EXPOSURE

- \* Where possible, enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
- \* A regulated, marked area should be established where Polychlorinated Biphenyls are handled, used, or stored as recommended by NIOSH.
- \* Wear full body protective work clothing.
- \* Wash thoroughly immediately after exposure to Polychlorinated Biphenyls and on exit from the work area.
- \* Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of Polychlorinated Biphenyls to potentially exposed workers.

This Fact Sheet is a summary source of information of all potential and most severe health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

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#### HEALTH HAZARD INFORMATION

##### Acute Health Effects

The following acute (short term) health effects may occur immediately or shortly after exposure to Polychlorinated Biphenyls:

- \* Exposure to the vapor can irritate the eyes, nose and throat.
- \* High exposures can damage the liver.

##### Chronic Health Effects

The following chronic (long term) health effects can occur at some time after exposure to Polychlorinated Biphenyls and can last for months or years:

##### Cancer Hazard

- \* Polychlorinated Biphenyls are PROBABLE CARCINOGENS in humans. There is some limited evidence that they cause skin cancer in humans and they have been shown to cause liver cancer in animals.
- \* Many scientists believe there is no safe level of exposure to a CARCINOGEN. Such substances may also have the potential for causing reproductive damage in humans.

##### Reproductive Hazard

- \* Polychlorinated Biphenyls may be TERATOGENS in humans since they have been shown to be teratogens in animals.
- \* They may be passed to a child through mother's milk.
- \* Polychlorinated Biphenyls can affect the reproductive system

of adults.

#### Other Long Term Effects

- \* Repeated exposures can cause liver damage.
- \* Polychlorinated Biphenyls can cause a severe acne like rash (chloracne). This may persist for years.
- \* High exposures can damage the nervous system, causing numbness, weakness, and tingling ("pins and needles") in the arms and legs.

#### MEDICAL

##### Medical Testing

Before beginning employment and at regular times after that, the following are recommended:

- \* Liver function tests.
- \* Serum triglycerides level.
- \* Exam of the skin.

If symptoms develop or overexposure is suspected, the following may be useful:

- \* Blood PCB levels.
- \* Nerve conduction studies should be considered.

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under OSHA 1910.20.

##### Mixed Exposures

Because more than light alcohol consumption can cause liver damage, drinking alcohol can increase the liver damage caused by Polychlorinated Biphenyls.

#### WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted for a hazardous substance, ENGINEERING CONTROLS are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In addition, the following controls are recommended:

- \* Where possible, automatically transfer Polychlorinated Biphenyls from drums or other storage containers to process containers.
- \* Specific engineering controls are recommended for this chemical by NIOSH. Refer to the NIOSH criteria document:

Occupational Exposure to Polychlorinated Biphenyls #77 225.

Good WORK PRACTICES can help to reduce hazardous exposures. The following work practices are recommended:

- \* Workers whose clothing has been contaminated by Polychlorinated Biphenyls should change into clean clothing promptly.
- \* Do not take contaminated work clothes home. Family members could be exposed.
- \* Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to Polychlorinated Biphenyls.
- \* If there is the possibility of skin exposure, emergency shower facilities should be provided.
- \* On skin contact with Polychlorinated Biphenyls, immediately wash or shower to remove the chemical. At the end of the workshift, wash any areas of the body that may have contacted Polychlorinated Biphenyls, whether or not known skin contact has occurred.
- \* Do not eat, smoke, or drink where Polychlorinated Biphenyls are handled, processed, or stored, since the chemicals can be swallowed. Wash hands carefully before eating or smoking.
- \* If solid, when vacuuming, a high efficiency particulate absolute (HEPA) filter should be used, not a standard shop vacuum.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

The following recommendations are only guidelines and may not apply to every situation.

Clothing

- \* Avoid skin contact with Polychlorinated Biphenyls. Wear protective gloves and clothing. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/ clothing material for your operation.
- \* All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.
- \* Viton is recommended as a good protective material.

Eye Protection

- \* Eye protection is included in the recommended respiratory protection.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training,

respirator fit testing and medical exams, as described in OSHA 1910.134.

- \* At any exposure level, use a MSHA/NIOSH approved supplied air respirator with a full facepiece operated in the positive pressure mode or with a full facepiece, hood, or helmet in the continuous flow mode, or use a MSHA/NIOSH approved self contained breathing apparatus with a full facepiece operated in pressure demand or other positive pressure mode.

Common Name: Polychlorinated Biphenyls  
DOT Number: UN 2315  
DOT Emergency Guide code: 15  
CAS Number: 1336-36-3

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Hazard rating NJ DOH                      NFPA  
FLAMMABILITY    Not Found                      Not Rated  
REACTIVITY      Not Found                      Not Rated  
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CARCINOGEN  
POISONOUS GASES ARE PRODUCED IN FIRE  
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Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious;  
4=severe

#### FIRE HAZARDS

- \* Polychlorinated Biphenyls may burn, but do not readily ignite.
- \* Use dry chemical, CO<sub>2</sub>, water spray, or foam extinguishers.
- \* POISONOUS GASES ARE PRODUCED IN FIRE, including Dioxin and Chlorinated Dibenzofurans.
- \* If employees are expected to fight fires, they must be trained and equipped as stated in OSHA 1910.156.

#### SPILLS AND EMERGENCIES

If Polychlorinated Biphenyls are spilled or leaked, take the following steps:

- \* Restrict persons not wearing protective equipment from area of spill or leak until clean up is complete.
- \* Ventilate the area of spill or leak.
- \* Absorb liquids in vermiculite, dry sand, earth, or a similar material and deposit in sealed containers.
- \* Collect powdered material in the most convenient and safe manner and deposit in sealed containers.
- \* It may be necessary to contain and dispose of Polychlorinated Biphenyls as a HAZARDOUS WASTE. Contact your State Environmental Program for specific recommendations.

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FOR LARGE SPILLS AND FIRES immediately call your fire department.  
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HANDLING AND STORAGE

- \* Prior to working with Polychlorinated Biphenyls you should be trained on their proper handling and storage.
- \* Store in tightly closed containers in a cool well ventilated area away from STRONG OXIDIZERS (such as CHLORINE, BROMINE, and FLUORINE).
- \* Polychlorinated Biphenyls should be handled only in an established, controlled, regulated area.

FIRST AID

POISON INFORMATION

Eye Contact

- \* Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids.

Skin Contact

- \* Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Breathing

- \* Remove the person from exposure.
- \* Begin rescue breathing if breathing has stopped and CPR if heart action has stopped.
- \* Transfer promptly to a medical facility.

PHYSICAL DATA

Flash Point: 383oF (195oC)  
Water Solubility: Slightly soluble

Other Names and Formulations:

This Fact Sheet can be used for the following substances:

PCB 1242 (Chlorodiphenyl 42% Chlorine) CAS # 53469 21 9;  
PCB 1254 (Chlorodiphenyl 54% Chlorine) CAS # 11097 69 1.

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Not intended to be copied and sold for commercial purposes.  
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NEW JERSEY DEPARTMENT OF HEALTH  
Right to Know Program  
CN 368, Trenton, NJ 08625 0368  
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ECOLOGICAL INFORMATION

Polychlorinated biphenyls are complex mixtures of chlorobiphenyls which have been marketed for uses according to the percentage of chlorine in the mixture. The lesser chlorinated PCBs are colorless mobile liquids. Increased chlorination produces more viscous liquids, with further chlorination producing sticky resins or white powders. Because of their heat stability, PCBs were commonly used in electrical capacitors and transformers, and industrial heat

transfer applications. PCBs may enter the environment from leakage from industrial and electrical equipment, from industrial discharges, spills, leaching from municipal landfills, and from previously contaminated sediments.

#### ACUTE (SHORT-TERM) ECOLOGICAL EFFECTS

Acute toxic effects may include the death of animals, birds, or fish, and death or low growth rate in plants. Acute effects are seen two to four days after animals or plants come in contact with a toxic chemical substance.

Polychlorinated biphenyls have high acute toxicity to aquatic life. Insufficient data are available to evaluate or predict the short-term effects of PCBs to plants, birds, or land animals.

#### CHRONIC (LONG-TERM) ECOLOGICAL EFFECTS

Chronic toxic effects may include shortened lifespan, reproductive problems, lower fertility, and changes in appearance or behavior. Chronic effects can be seen long after first exposure(s) to a toxic chemical.

Polychlorinated biphenyls have high chronic toxicity to aquatic life. Insufficient data are available to evaluate or predict the long-term effects of PCBs to plants, birds, or land animals.

#### WATER SOLUBILITY

Polychlorinated biphenyls are slightly soluble in water. Concentrations of less than 1 milligram will mix with a liter of water.

#### DISTRIBUTION AND PERSISTENCE IN THE ENVIRONMENT

The relative distribution of the various PCBs depends on the level of chlorination. Some PCBs will probably be highly persistent in water, with half-lives greater than 200 days. Potential PCB distribution in the various environmental compartments can have the following ranges, depending on degree of chlorination: air, 0-34%; terrestrial soils, 33-52%; water, 0-1.8%; suspended solids, 0.05-0.08%; aquatic biota, 0.02-0.03%; aquatic sediments, 30-50%.

#### BIOACCUMULATION IN AQUATIC ORGANISMS

Some substances increase in concentration, or bioaccumulate, in living organisms as they breathe contaminated air, drink contaminated water, or eat contaminated food. These chemicals can become concentrated in the tissues and internal organs of animals and humans.

The concentration of polychlorinated biphenyls found in fish tissues is expected to be considerably higher than the average concentration of PCBs in the water from which the fish was taken.

## Polynuclear Aromatic Hydrocarbons

MATERIAL SAFETY DATA SHEET

NSN: 664000N070028

Manufacturer's CAGE: 0MU35

Part No. Indicator: A

Part Number/Trade Name: US-106NS, POLYNUCLEAR AROMATIC HYDROCARBONS  
(SUPDAT)

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### General Information

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Company's Name: ULTRA SCIENTIFIC  
Company's Street: 250 SMITH ST  
Company's City: NORTH KINGSTOWN  
Company's State: RI  
Company's Country: US  
Company's Zip Code: 02852  
Company's Emerg Ph #: 401-294-9400  
Company's Info Ph #: 401-294-9400  
Record No. For Safety Entry: 001  
Tot Safety Entries This Stk#: 001  
Status: SMJ  
Date MSDS Prepared: 18JUL95  
Safety Data Review Date: 23APR96  
MSDS Serial Number: BZSPG

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### Ingredients/Identity Information

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Proprietary: NO  
Ingredient: METHANE, DICHLORO-; (METHYLENE CHLORIDE) (SARA 313) (CERCLA)  
LD50(ORAL,RAT):2136 MG/KG  
Ingredient Sequence Number: 01  
Percent: 48.54  
NIOSH (RTECS) Number: PA8050000  
CAS Number: 75-09-2  
OSHA PEL: 500 PPM  
ACGIH TLV: 50 PPM, A2

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Proprietary: NO

Ingredient: BENZENE (SARA 313) (CERCLA) LD50(ORAL,RAT):3320 MG/KG  
Ingredient Sequence Number: 02  
Percent: 48.54  
NIOSH (RTECS) Number: CY1400000  
CAS Number: 71-43-2  
OSHA PEL: SEE 1910.1028  
ACGIH TLV: 10 PPM; A2

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Proprietary: NO

Ingredient: ACENAPHTHENE (CERCLA)  
Ingredient Sequence Number: 03

Percent: 0.182  
NIOSH (RTECS) Number: AB1000000  
CAS Number: 83-32-9  
OSHA PEL: N/K (FP N)  
ACGIH TLV: N/K (FP N)

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Proprietary: NO  
Ingredient: ACENAPHTHYLENE (CERCLA)  
Ingredient Sequence Number: 04  
Percent: 0.182  
NIOSH (RTECS) Number: AB1254000  
CAS Number: 208-96-8  
OSHA PEL: N/K (FP N)  
ACGIH TLV: N/K (FP N)

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Proprietary: NO  
Ingredient: ANTHRACENE (SARA 313) (CERCLA)  
Ingredient Sequence Number: 05  
Percent: 0.182  
NIOSH (RTECS) Number: CA9350000  
CAS Number: 120-12-7  
OSHA PEL: N/K (FP N)  
ACGIH TLV: N/K (FP N)

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Proprietary: NO  
Ingredient: BENZ(A)ANTHRACENE (CERCLA)  
Ingredient Sequence Number: 06  
Percent: 0.182  
NIOSH (RTECS) Number: CV9275000  
CAS Number: 56-55-3  
OSHA PEL: N/K (FP N)  
ACGIH TLV: A2

-----  
Proprietary: NO  
Ingredient: BENZ(E)ACEPHENANTHRYLENE; (BENZO[B]FLUORANTHENE) (CERCLA)  
Ingredient Sequence Number: 07  
Percent: 0.182  
NIOSH (RTECS) Number: CU1400000  
CAS Number: 205-99-2  
OSHA PEL: N/K (FP N)  
ACGIH TLV: A2

-----  
Proprietary: NO  
Ingredient: BENZO(K)FLUORANTHENE (CERCLA)  
Ingredient Sequence Number: 08  
Percent: 0.182  
NIOSH (RTECS) Number: DF6350000  
CAS Number: 207-08-9  
OSHA PEL: N/K (FP N)  
ACGIH TLV: N/K (FP N)

-----  
Proprietary: NO  
Ingredient: BENZO(GHI)PERYLENE (CERCLA)  
Ingredient Sequence Number: 09  
Percent: 0.182

NIOSH (RTECS) Number: DI6200500  
CAS Number: 191-24-2  
OSHA PEL: N/K (FP N)  
ACGIH TLV: N/K (FP N)

-----  
Proprietary: NO  
Ingredient: BENZO(A)PYRENE (CERCLA)  
Ingredient Sequence Number: 10  
Percent: 0.182  
NIOSH (RTECS) Number: DJ3675000  
CAS Number: 50-32-8  
OSHA PEL: 0.2 MG/M3  
ACGIH TLV: A2

-----  
Proprietary: NO  
Ingredient: CHRYSENE (CERCLA)  
Ingredient Sequence Number: 11  
Percent: 0.182  
NIOSH (RTECS) Number: GC0700000  
CAS Number: 218-01-9  
OSHA PEL: 0.2 MG/M3  
ACGIH TLV: A2

-----  
Proprietary: NO  
Ingredient: DIBENZ(A,H)ANTHRACENE (CERCLA)  
Ingredient Sequence Number: 12  
Percent: 0.182  
NIOSH (RTECS) Number: AN2625000  
CAS Number: 53-70-3  
OSHA PEL: N/K (FP N)  
ACGIH TLV: N/K (FP N)

-----  
Proprietary: NO  
Ingredient: FLUORANTHENE (CERCLA) LD50(ORAL,RAT):2000 MG/KG  
Ingredient Sequence Number: 13  
Percent: 0.182  
NIOSH (RTECS) Number: LL4025000  
CAS Number: 206-44-0  
OSHA PEL: N/K (FP N)  
ACGIH TLV: N/K (FP N)

-----  
Proprietary: NO  
Ingredient: FLUORENE (CERCLA)  
Ingredient Sequence Number: 14  
Percent: 0.182  
NIOSH (RTECS) Number: LL5670000  
CAS Number: 86-73-7  
OSHA PEL: N/K (FP N)  
ACGIH TLV: N/K (FP N)

-----  
Proprietary: NO  
Ingredient: INDENO(1,2,3-CD)PYRENE (CERCLA)  
Ingredient Sequence Number: 15  
Percent: 0.182  
NIOSH (RTECS) Number: NK9300000

CAS Number: 193-39-5  
OSHA PEL: N/K (FP N)  
ACGIH TLV: N/K (FP N)

-----  
Proprietary: NO  
Ingredient: NAPHTHALENE (SARA 313) (CERCLA) LD50(ORAL,RAT):1780 MG/KG  
Ingredient Sequence Number: 16  
Percent: 0.182  
NIOSH (RTECS) Number: QJ0525000  
CAS Number: 91-20-3  
OSHA PEL: 10 PPM  
ACGIH TLV: 10 PPM/15 STEL

-----  
Proprietary: NO  
Ingredient: PHENANTHRENE (CERCLA) LD50(ORAL,RAT):700 MG/KG  
Ingredient Sequence Number: 17  
Percent: 0.182  
NIOSH (RTECS) Number: SF7175000  
CAS Number: 85-01-8  
OSHA PEL: N/K (FP N)  
ACGIH TLV: N/K (FP N)

-----  
Proprietary: NO  
Ingredient: PYRENE (SARA 302) (CERCLA)  
Ingredient Sequence Number: 18  
Percent: 0.182  
NIOSH (RTECS) Number: UR2450000  
CAS Number: 129-00-0  
OSHA PEL: N/K (FP N)  
ACGIH TLV: N/K (FP N)

-----  
Proprietary: NO  
Ingredient: SUPDAT:BENZ(A)ANTHRACENE; BENZO(A)PYRENE; DIBENZ(A,H)  
ANTHRACENE:IARC MONOGRAPHS, SUPP, VOL 7, PG 56, 1987:GROUP (ING 20)  
Ingredient Sequence Number: 19  
NIOSH (RTECS) Number: 9999999ZZ  
OSHA PEL: NOT APPLICABLE  
ACGIH TLV: NOT APPLICABLE

-----  
Proprietary: NO  
Ingredient: ING 19:2A. ANIMAL:LUNG, SKIN, KIDNEYS. NTP 7TH ANNUAL RPT ON  
CARCINOGENS; 1994:ANTIC TO BE CARCINOGEN. (ING 21)  
Ingredient Sequence Number: 20  
NIOSH (RTECS) Number: 9999999ZZ  
OSHA PEL: NOT APPLICABLE  
ACGIH TLV: NOT APPLICABLE

-----  
Proprietary: NO  
Ingredient: ING 20:BENZ(E)ACEPHENATHRYLENE; BENZO(K)FLUOROANTHENE;  
INDENO(1,2,3-CD)PYRENE:IARC MONOGRAPHS, SUPP, VOL 7, PG (ING 22)  
Ingredient Sequence Number: 21  
NIOSH (RTECS) Number: 9999999ZZ  
OSHA PEL: NOT APPLICABLE  
ACGIH TLV: NOT APPLICABLE

Proprietary: NO  
Ingredient: ING 21:56, 1987:GROUP 2B. NTP 7TH ANNUAL RPT ON CARCINOGENS.  
1994:ANTIC TO BE CARCINOGEN. ANIMAL:LUNG, SKIN, (ING 23)  
Ingredient Sequence Number: 22  
NIOSH (RTECS) Number: 9999999ZZ  
OSHA PEL: NOT APPLICABLE  
ACGIH TLV: NOT APPLICABLE

-----  
Proprietary: NO  
Ingredient: ING 22:KIDNEYS. METHYLENE CHLORIDE:IARC MONOGRAPHS, SUPP, VOL  
7, PG 194, 1987:GROUP 2B. NTP 7TH ANNUAL RPT (ING 24)  
Ingredient Sequence Number: 23  
NIOSH (RTECS) Number: 9999999ZZ  
OSHA PEL: NOT APPLICABLE  
ACGIH TLV: NOT APPLICABLE

-----  
Proprietary: NO  
LUNG.  
Ingredient Sequence Number: 24  
NIOSH (RTECS) Number: 9999999ZZ  
OSHA PEL: NOT APPLICABLE  
ACGIH TLV: NOT APPLICABLE

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Physical/Chemical Characteristics

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Appearance And Odor: LIQUID

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Fire and Explosion Hazard Data

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Flash Point: NOT APPLICABLE  
Extinguishing Media: CARBON DIOXIDE, DRY CHEMICAL POWDER, OR WATER SPRAY.  
Special Fire Fighting Proc: WEAR NIOSH/MSHA APPROVED PRESSURE DEMAND SCBA  
& FULL PROTECTIVE EQUIPMENT (FP N).  
Unusual Fire And Expl Hazrds: THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE  
HCL AND PHOSGENE (FP N).

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Reactivity Data

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Stability: YES  
Cond To Avoid (Stability): NONE SPECIFIED BY MANUFACTURER.  
Materials To Avoid: STRONG OXIDIZERS.  
Hazardous Decomp Products: NOT APPLICABLE. HCL, PHOSGENE (FP N).  
Hazardous Poly Occur: NO  
Conditions To Avoid (Poly): NOT RELEVANT

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Health Hazard Data

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LD50-LC50 Mixture: SEE INGREDIENTS.  
Route Of Entry - Inhalation: YES  
Route Of Entry - Skin: YES  
Route Of Entry - Ingestion: YES  
Health Haz Acute And Chronic: TOXIC; IRRITANT. ALL CHEMICALS SHOULD BE CONSIDERED HAZARDOUS-DIRECT PHYSICAL CONTACT SHOULD BE AVOIDED. CHLOROCARBON MATERIALS HAVE PRODUCED SENSITIZATION OF THE MYOCARDIUM TO EPINEPHRINE IN LAB ANIMALS & COULD HAVE A SIMILAR EFT IN HUMANS. ADRENOMIMETICS (E.G., EPINEPHRINE) MAY BE CONTRAINDICATED (EFTS OF OVEREXP)  
Carcinogenicity - NTP: YES  
Carcinogenicity - IARC: YES  
Carcinogenicity - OSHA: YES  
Explanation Carcinogenicity: BENZENE:IARC MONOGRAPHS, SUPP, VOL 7, PG 120, 1987:GROUP 1. NTP 7TH ANNUAL RPT ON CARCINS. 1994:KNOWN TO BE (SUPDAT)  
Signs/Symptoms Of Overexp: HLTH HAZS:EXCEPT FOR LIFE SUSTAINING USES IN HUMANS ACUTELY OR CHRONICALLY EXPOSED TO CHLORCARBONS (FP N).  
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.  
Emergency/First Aid Proc: INGESTION:CALL MD IMMEDIATELY (FP N). EYE: FLUSH WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES. SKIN:FLUSH WITH COPIOUS AMOUNTS OF WATER. INHALATION:REMOVE TO FRESH AIR-GIVE OXYGEN, IF NECESSARY. CONTACT PHYSICIAN.

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Precautions for Safe Handling and Use

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Steps If Matl Released/Spill: DUE TO THE SMALL QUANTITY INVOLVED, SPILLS OR LEAKS SHOULD NOT POSE A SIGNIFICANT PROBLEM. A LEAKING BOTTLE MAY BE PLACED IN A PLASTIC BAG AND NORMAL DISPOSAL PROCEDURES FOLLOWED. LIQUID SAMPLES MAY BE ABSORBED ON VERMICULITE OR SAND.  
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.  
Waste Disposal Method: OBSERVE ALL FEDERAL, STATE AND LOCAL LAWS CONCERNING DISPOSAL.  
Precautions-Handling/Storing: KEEP TIGHTLY AT AND STORE IN A COOL, DRY PLACE. THIS MATERIAL SHOULD ONLY BE USED BY THOSE PERSONS TRAINED IN THE SAFE HANDLING OF HAZARDOUS CHEMS.  
Other Precautions: NO SMOKING IN AREA OF USE. DO NOT USE IN THE GENERAL VICINITY OF ARC WELDING, OPEN FLAMES OR HOT SURFACES. HEAT AND/OR UV RADIATION MAY CAUSE THE FORMATION OF HCL AND/OR PHOSGENE (FP N).

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Control Measures

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Respiratory Protection: USE NIOSH/MSHA APPROVED RESPIRATOR APPROPRIATE FOR EXPOSURE OF CONCERN (FP N). USE APPROPRIATE OSHA/NIOSH/MSHA APPROVED SAFETY EQUIPMENT.  
Ventilation: NONE SPECIFIED BY MANUFACTURER.  
Protective Gloves: IMPERVIOUS GLOVES (FP N).  
Eye Protection: ANSI APPROVED CHEM WORKERS GOGGS(SUPDAT)

Other Protective Equipment: ANSI APPRVD EMER EYEWASH & DELUGE SHOWER (FP N). WEAR CHEM RESIST CLTHG SUCH AS LAB COAT &/OR RUB APRON TO PVNT (SUPDAT)

Work Hygienic Practices: NONE SPECIFIED BY MANUFACTURER.

Suppl. Safety & Health Data: MFR TRADE/PART #:MIXTURE AT 2000 UG/ML IN METHYLENE CHLORIDE/BENZENE (1:1). EYE PROT:AND FULL LENGTH FACE SHIELD (FP

N). OTHER PROT EQUIP:CONTACT WITH EYES, SKIN AND CLOTHING. EXPLAN OF MYELOID LEUKEMIA, HODGKINS DISEASE, LYMPHOMA. (ING 19)

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Transportation Data

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Disposal Data

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Label Data

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Label Required: YES

Technical Review Date: 23APR96

Label Status: G

Common Name: US-106NS, POLYNUCLEAR AROMATIC HYDROCARBONS (SUPDAT)

Chronic Hazard: YES

Signal Word: WARNING!

Acute Health Hazard-Moderate: X

Contact Hazard-Slight: X

Fire Hazard-None: X

Reactivity Hazard-None: X

Special Hazard Precautions: ACUTE:INHALATION OF VAPORS MAY CONTRIBUTE TO CANCER HAZARD. CONTAINS BENZENE, METHYLENE CHLORIDE, BENZ(E)

ACEPHENOTHRYLENE, BENZ(A)ANTHRACENE, BENZO(K)FLUORANTHENE,

BENZO(A)PYRENE,

DIBENZ(A,H)ANTHRACENE, INDENO(1,2,3-CD)PYRENE WHICH ARE LISTED AS HUMAN BLOOD & ANIMAL LUNG, SKIN AND KIDNEY CARCINOGENS (FP N).

Protect Eye: Y

Protect Skin: Y

Protect Respiratory: Y

Label Name: ULTRA SCIENTIFIC

Label Street: 250 SMITH ST

Label City: NORTH KINGSTOWN

Label State: RI

Label Zip Code: 02852

Label Country: US

Label Emergency Number: 401-294-9400

MSDS Number: E6500 \* \* \* \* \* Effective Date: 09/14/00 \* \* \* \* \* Supersedes: 07/15/99

<b>MSDS</b>	<b>Material Safety Data Sheet</b>	24 Hour Emergency Telephone: 908-859-2151 CHEMTREC: 1-800-424-9300
		National Response in Canada CANUTEC: 613-996-6666
From: Mallinckrodt Baker, Inc. 222 Red School Lane Phillipsburg, NJ 08865		Outside U.S. And Canada Chemtrec: 703-527-3887
<b>MBI</b>		<b>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.</b>
All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.		

## DIOCTYLPHTHALATE

### 1. PRODUCT IDENTIFICATION

**Synonyms:** Di-(2-ethylhexyl)phthalate; DEHP; bis(2-ethylhexyl)phthalate; DOP; 1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl)ester; Di-sec-octyl phthalate  
**CAS No.:** 117-81-7  
**Molecular Weight:** 390.56  
**Chemical Formula:** C<sub>24</sub>H<sub>38</sub>O<sub>4</sub>

### 2. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient	CAS No	Percent
Hazardous		
-----	-----	-----
-----		
Di-sec-octyl Phthalate	117-81-7	100%
Yes		

### 3. HAZARDS IDENTIFICATION

#### Emergency Overview

-----  
**WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS THE CENTRAL NERVOUS SYSTEM, LIVER, REPRODUCTIVE**

**SYSTEM, AND GASTROINTESTINAL TRACT. POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure. MAY CAUSE ADVERSE REPRODUCTIVE EFFECTS.**

**Potential Health Effects**  
-----

**Inhalation:**

The low vapor pressure of this material essentially eliminates inhalation hazards unless the material is heated or misted. Inhalation of mists can cause nausea and is irritating to the respiratory tract.

**Ingestion:**

Ingestion causes nausea, abdominal cramps, diarrhea. CNS depression - lethargy, drowsiness, staggering and sleepiness - can result from absorbing large amounts.

**Skin Contact:**

Slight skin irritation may occur from prolonged skin contact. Low levels may be absorbed through the skin.

**Eye Contact:**

Causes irritation, redness, and pain.

**Chronic Exposure:**

Material is a suspected carcinogen and a suspected teratogen.

**Aggravation of Pre-existing Conditions:**

No information found.

---

**4. FIRST AID MEASURES**

**Inhalation:**

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

**Ingestion:**

Do NOT induce vomiting. Give large amounts of water. Never give anything by mouth to an unconscious person. Get medical attention.

**Skin Contact:**

Immediately flush skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

**Eye Contact:**

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

## 5. FIRE FIGHTING MEASURES

### **Fire:**

Flash point: 215C (419F) OC

Autoignition temperature: 390C (734F)

Flammable limits in air % by volume:

l<sub>el</sub>: 0.3

Slight fire hazard.

### **Explosion:**

Above the flash point, explosive vapor-air mixtures may be formed.

### **Fire Extinguishing Media:**

Water spray, dry chemical, alcohol foam, 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. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

---

## 7. HANDLING AND STORAGE

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Wear special protective equipment (Sec. 8) for maintenance break-in or where exposures may exceed established exposure levels. Wash hands, face, forearms and neck when exiting restricted areas. Shower, dispose of outer clothing, change to clean garments at the end of the day. Avoid cross-contamination of street clothes. Wash hands before eating and do not eat, drink, or smoke in workplace. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

---

## 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

### **Airborne Exposure Limits:**

- OSHA Permissible Exposure Limit (PEL):  
5 mg/m<sup>3</sup> (TWA).
- ACGIH Threshold Limit Value (TLV):  
5 mg/m<sup>3</sup> (TWA); A3 - animal carcinogen.

### **Ventilation System:**

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. 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):**

If the exposure limit is exceeded and engineering controls are not feasible, a full facepiece particulate respirator (with NIOSH type P100 or R100 filters) may be worn for up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. Please note that N series filters are not recommended for this material. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres. Where respirators are required, you must have a written program covering the basic requirements in the OSHA respirator standard. These include training, fit testing, medical approval, cleaning, maintenance, cartridge change schedules, etc. See 29CFR1910.134 for details.

### **Skin Protection:**

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

### **Eye Protection:**

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

## 9. PHYSICAL AND CHEMICAL PROPERTIES

### **Appearance:**

Clear oily liquid.

### **Odor:**

Slightly amine to odorless.

**Solubility:**

Insoluble in water.

**Specific Gravity:**

0.9861 @ 20C/20C

**pH:**

No information found.

**% Volatiles by volume @ 21C (70F):**

No information found.

**Boiling Point:**

230C (446F)

**Melting Point:**

-50C (-58F)

**Vapor Density (Air=1):**

16

**Vapor Pressure (mm Hg):**

1.32 @ 200C (392F)

**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:**

Nitrates, strong oxidizers, acids and alkalis.

**Conditions to Avoid:**

Heat, flames, ignition sources and incompatibles.

---

## 11. TOXICOLOGICAL INFORMATION

Oral rat LD50: 30 g/kg; Skin rabbit LD50: 25 g/kg. Irritation Data (rabbit, std Draize, 500mg/24H): Skin, mild; Eye, mild. Investigated as a tumorigen, mutagen, reproductive effector.

-----\Cancer Lists\-----  
-----  
-----NTP Carcinogen-----

Ingredient Category	Known	Anticipated	IARC
Di-sec-octyl Phthalate (117-81-7)	No	Yes	3

## 12. ECOLOGICAL INFORMATION

### Environmental Fate:

When released into water, this material may biodegrade to a moderate extent. This material may bioaccumulate to some extent. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition.

### Environmental Toxicity:

The LC50/96-hour values for fish are over 100 mg/l.

## 13. DISPOSAL CONSIDERATIONS

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste 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			
Di-sec-octyl Phthalate (117-81-7)	Yes	Yes	Yes

Yes

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

Ingredient	Korea	---Canada---	DSL	NDSL
Phil.				
Di-sec-octyl Phthalate (117-81-7)	Yes	Yes	Yes	No

Yes

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

313----- Ingredient	-SARA 302- RQ	TPQ	-----SARA List	Chemical
----- Di-sec-octyl Phthalate (117-81-7)	----- No	----- No	----- Yes	----- No

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

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
----- Di-sec-octyl Phthalate (117-81-7)	----- 100	----- U028	----- No

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

**WARNING:**

THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

**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.

---

**16. OTHER INFORMATION**

**NFPA Ratings:** Health: 1 Flammability: 1 Reactivity: 0

**Label Hazard Warning:**

WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS THE CENTRAL NERVOUS SYSTEM, LIVER, REPRODUCTIVE SYSTEM, AND GASTROINTESTINAL TRACT. POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure. MAY CAUSE ADVERSE REPRODUCTIVE EFFECTS.

**Label Precautions:**

Do not get in eyes, on skin, or on clothing.

Do not breathe mist.

Keep container closed.

Use only with adequate ventilation.

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 contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.

**Product Use:**

Laboratory Reagent.

**Revision Information:**

MSDS Section(s) changed since last revision of document include: 8, 11.

**Disclaimer:**

\*\*\*\*\*

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\*\*\*\*\*

**Prepared by:** Environmental Health & Safety

Phone Number: (314) 654-1600 (U.S.A.)

## YSI 3161 Conductivity Calibrator 1,000 micromho/cm

### Material Safety Data Sheet

January 29, 2003

YSI Incorporated

1725 Brannum Lane

YELLOW SPRINGS, OH 45387

USA

Information and Emergency Phone: (937) 767-7241

Page 1 of 2

### SECTION 1 - MATERIAL IDENTIFICATION

PRODUCT NAME: YSI 3161 Conductivity Calibrator 1,000 micromho/cm FORMULA: n/ap

Chemical Type: Dilute water solution of the listed ingredients.

CAS No. n/ap

### SECTION 2 - HAZARDOUS / IMPORTANT INGREDIENTS

Chemical / Synonym CAS No. PERCENT PEL/TLV CARCINOGEN  
(OSHA,NTP,IARC)

Potassium Chloride 7447-40-7 <1.0 none no

Water (balance)

### SECTION 3 - CHEMICAL AND PHYSICAL PROPERTIES

Appearance: clear bluish tinted liquid Boiling Point: 212°F (100°C)

Odor: slt. acrid Melting Point: 32 °F (0°C)

pH: neutral Specific Gravity: 1.00

Water Solubility: infinite Vapor Pressure: = water

Evaporation Rate: = water Vapor Density: = water vapor

### SECTION 4 - FIRE AND EXPLOSION HAZARDS

Flash Point: none Explosive Limits: none

Extinguishing Media: n/ap

Material is basically water, and is not combustible nor does it emit flammable vapors.

### SECTION 5 - REACTIVITY INFORMATION

Stable: X Unstable: Precautions: none

Hazardous Polymerization: Occurs: Does Not Occur: X

Incompatibility: Extensive contact may cause reaction with aluminum, steel, zinc, magnesium.

Hazardous Decomposition Products: none from water solution

YSI 3161 Page 2 of 2 January 29, 2003

### SECTION 6 - HEALTH HAZARDS / PROTECTIVE MEASURES / FIRST AID

Inhalation:

Use a NIOSH approved respirator for liquid mists and/or splashes. Get supplier recommendations.

Provide adequate ventilation. Avoid conditions that cause misting or splashing. Remove to fresh air. Give artificial respiration and get medical attention as needed.

Skin:

May cause irritation with repeated exposure.

Wear water-resistant gloves as needed.

Wash exposed areas with soap and water for 15 minutes. Remove contaminated clothing, and wash before re-using.

Eyes:

Can cause irritation and potential eye damage with repeated exposure.

Wear splash-proof water resistant goggles. Have convenient eye-wash stations.

Flush with water for 15 minutes.

#### Ingestion

Can cause irritation of mouth, throat, and an upset stomach.

Wear a mouth cover or face shield when there is splashing.

Do not swallow. Rinse mouth. If swallowed, do not induce vomiting. Get prompt medical attention.

(No chronic effects reported)

**IN ALL CASES: GET MEDICAL ATTENTION IF EFFECTS PERSIST.**

Most likely routes of entry: skin, eyes, ingestion.

#### **SECTION 7 - PRECAUTIONS FOR SAFE HANDLING AND USE**

Spills and Leaks: Flush to sewer or ground with lots of water.

Storage and Handling: Keep containers closed, and do not heat over about 125°F. Discard any material that may be contaminated or which otherwise may have changed composition. Use personal protection as described in Section 6.

Waste Disposal: In accordance with applicable regulations for liquid wastes. Is not a RCRA hazardous waste as of this date.

Empty Containers: Rinse. Dispose as appropriate for glass and plastic containers.

#### **SECTION 8 - REGULATORY INFORMATION**

DOT: Not regulated.

SARA Title III, S.313, Form R: Nothing reportable.

The information contained herein is based on data available at this time and is believed to be accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. Since information contained herein may be applied under conditions beyond our control, and with which we may be unfamiliar, no responsibility is assumed for the results of its use. The person receiving this information shall make his own determination of the suitability of the material for his particular use.

A96002C

## YSI 3821 Buffer Solution, pH = 4.00

A96023 Rev B Page 1 of 3

### MATERIAL SAFETY DATA SHEET

NCL of Wisconsin, Inc.

P.O. Box 8

Biramwood, WI 54414

Emergency Telephone No: 715-449-2673

---

Date of this revision: August 1, 2001

#### PRODUCT IDENTIFICATION:

Product name: YSI 3821 Buffer Solution, pH = 4.00

Synonyms: None. Molecular weight: NA

Chemical Name: NA Chemical Family: NA

Product CAS#: NA Formula: NA

#### INGREDIENTS:

1. Potassium Acid Phthalate CAS# 877-24-1

Percent: <2 SARA: Not listed.

TLV: Not established. PEL: Not established.

Hazard: May cause eye and respiratory tract irritation.

2. Red Food Coloring CAS# Not listed.

Percent: <0.02 SARA: Not listed.

TLV: Not established. PEL: Not established.

Hazard: None known.

3. Deionized water CAS# 7732-18-5

Percent: >98 SARA: Not listed.

TLV: Not applicable. PEL: Not applicable.

Hazard: None.

#### PRECAUTIONARY MEASURES

\*\*\*\*\*

Avoid contact with eyes, skin, and clothing. Wash thoroughly after handling. Minimal contact, as with all chemicals, is a good policy to follow.

#### EMERGENCY/FIRST AID

\*\*\*\*\*

In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes. If swallowed, give two glasses of water or milk to dilute. Call a physician.

DOT Hazard Class: Not Regulated.

\*\*\*\*\*

#### Physical Data SECTION ONE

\*\*\*\*\*

Appearance: Clear pink solution.

Odor: Odorless.

Solubility: Infinitely soluble in water.

Boiling Point: 100 C (212 F)

Melting Point: 0 C (32 F)

Specific Gravity: 1.0

Vapor Density (Air=1): Essentially the same as water.

A96023 Rev B Page 2 of 3

Vapor Pressure (mm Hg): Essentially the same as water.

Evaporation Rate: Essentially the same as water.

\*\*\*\*\*

#### Fire and Explosion SECTION TWO

##### Information

\*\*\*\*\*

Fire: Not considered to be a fire hazard.

Explosion: Not considered to be an explosion hazard.

Fire Extinguishing Media: Use any suitable means for extinguishing surrounding fire.

\*\*\*\*\*

Reactivity Data SECTION THREE

\*\*\*\*\*

Stability: Stable under ordinary conditions of use and storage.  
Hazardous Decomposition Products: May emit toxic fumes of carbon monoxide, carbon dioxide, and potassium oxide if involved in a fire.  
Hazardous Polymerization: This substance does not polymerize.  
Incompatibilities: Strong solutions of nitric acid.

\*\*\*\*\*

Leak/Spill/Disposal SECTION FOUR

Information

\*\*\*\*\*

Flush to sewer with large amounts of water.  
Ensure compliance with Federal, State, and local regulations.  
Reportable Quantity: 5000 lbs.

\*\*\*\*\*

Health Hazard Information SECTION FIVE

\*\*\*\*\*

A. Exposure/Health Effects

Inhalation: May cause irritation to mucous membranes due to slight acidity.  
Ingestion: Large doses may cause nausea, vomiting and abnormal sensations in hands and feet. Because of slight acidity, may cause irritation to mucous membranes.  
Skin Contact: May cause irritation, redness, and pain.  
Eye Contact: May cause irritation and damage.  
Chronic Exposure: No information found.  
Cancer information: No information found for any ingredient.  
Aggravation of Pre-existing conditions: No information found.

B. FIRST AID

Inhalation: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

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Ingestion: If swallowed give two glasses of water to dilute.

Get medical attention immediately.

Skin Exposure: Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing. Get medical attention if irritation develops or persists.

Eye Exposure: Wash eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

\*\*\*\*\*

Occupational Control SECTION SIX

Measures

\*\*\*\*\*

Ventillation System: In general, dilution ventillation is a satisfactory health hazard control for this material. However, if conditions of use create discomfort to a worker, a local exhaust should be considered.

Personal Respirators (NIOSH Approved): For conditions of use where exposure to mist exists, a dust/mist respirator may be worn. For emergencies, a self-contained breathing apparatus may be necessary.

Skin Protection: Rubber gloves and lab coat, apron or overalls.

Eye Protection: Use chemical safety goggles and/or a full face shield where splashing is possible. Contact lenses should not be worn when working with this material.

Maintain eye-wash fountain and quick-drench facilities in work area.

\*\*\*\*\*

Storage and Special SECTION SEVEN

Information

\*\*\*\*\*

Keep in a tightly closed container. Protect container from physical damage.

\*\*\*\*\*

The information contained herein is provided in good faith and is believed to be correct as of the date hereof. However, NCL of Wisconsin, Inc. makes no representation as to the comprehensiveness or accuracy of the information. It is expected that individuals receiving the information will exercise their independent judgement in determining its appropriateness for a particular purpose. Accordingly, NCL of Wisconsin, Inc. will not be responsible for damages of any kind resulting from the use of or reliance upon such information. NO REPRESENTATIONS, OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR TO THE PRODUCT TO WHICH THE INFORMATION REFERS.

\*\*\*\*\*

END OF MATERIAL SAFETY DATA SHEET

## YSI 3822 Buffer Solution, pH = 7.00

A96024Rev B Page 1 of 3

### MATERIAL SAFETY DATA SHEET

NCL of Wisconsin, Inc.

P.O. Box 8

Biramwood, WI 54414

Emergency Telephone No: 715-449-2673

---

Date of this revision: August 1, 2001

#### PRODUCT IDENTIFICATION:

Product name: YSI 3822 Buffer Solution, pH = 7.00

Synonyms: None. Molecular weight: NA

Chemical Name: NA Chemical Family: NA

Product CAS#: NA Formula: NA

#### INGREDIENTS:

1. Potassium Phosphate Monobasic CAS# 7778-77-0

Percent: <1 SARA: Not listed.

TLV: Not established. PEL: Not established.

Hazard: Moderately toxic-May cause Irritation.

2. Sodium hydroxide CAS# 1310-73-2

Percent: <1 SARA: Not listed.

TLV: 2 mg/M3 PEL: 2 mg/M3

Hazard: Moderately toxic-May cause Irritation.

3. Yellow Food Coloring CAS# Not listed.

Percent: <0.02 SARA: Not listed.

TLV: Not established. PEL: Not established.

Hazard: None known.

4. Deionized water CAS# 7732-18-5

Percent: >98 SARA: Not listed.

TLV: Not applicable. PEL: Not applicable.

Hazard: None.

#### PRECAUTIONARY MEASURES

\*\*\*\*\*

Avoid contact with eyes, skin, and clothing. Wash thoroughly after handling. Minimal contact, as with all chemicals, is a good policy to follow.

#### EMERGENCY/FIRST AID

\*\*\*\*\*

In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes. If swallowed, give two glasses of water or milk to dilute. Call a physician.

DOT Hazard Class: Not Regulated.

\*\*\*\*\*

#### Physical Data SECTION ONE

\*\*\*\*\*

Appearance: Clear yellow solution

Odor: Odorless.

Solubility: Infinitely soluble in water.

Boiling Point: 100 C (212 F)

Melting Point: 0 C (32 F)

Specific Gravity: 1.0

Vapor Density (Air=1): Essentially the same as water.

Vapor Pressure (mm Hg): Essentially the same as water.

Evaporation Rate: Essentially the same as water.

A96024Rev B Page 2 of 3

\*\*\*\*\*

#### Fire and Explosion SECTION TWO

Information

\*\*\*\*\*

Fire: Not considered to be a fire hazard.  
Explosion: Not considered to be an explosion hazard.  
Fire Extinguishing Media: Use any suitable means for extinguishing surrounding fire.

\*\*\*\*\*

Reactivity Data SECTION THREE

\*\*\*\*\*

Stability: Stable under ordinary conditions of use and storage.  
Hazardous Decomposition Products: None known.  
Hazardous Polymerization: This substance does not polymerize.  
Incompatibilities: None known.

\*\*\*\*\*

Leak/Spill/Disposal SECTION FOUR  
Information

\*\*\*\*\*

Flush to sewer with large amounts of water.  
Ensure compliance with Federal, State, and local regulations.  
Reportable Quantity: 5000 lbs.

\*\*\*\*\*

Health Hazard Information SECTION FIVE

\*\*\*\*\*

A. Exposure/Health Effects

Inhalation: No information found.  
Ingestion: Large doses may cause diarrhea.  
Skin Contact: Prolonged contact may cause skin irritation.  
Eye Contact: May cause irritation.  
Chronic Exposure: Potassium phosphate, one of the ingredients, may sequester calcium and cause calcium phosphate deposits in the kidneys.  
Cancer information: No information found for any ingredient.  
Aggravation of Pre-existing conditions: No information found.

B. FIRST AID

Inhalation: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.  
Ingestion: If swallowed give two glasses of water to dilute. Get medical attention immediately.  
Skin Exposure: Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing. Get medical attention if irritation develops or persists.  
Eye Exposure: Wash eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

\*\*\*\*\*

Occupational Control SECTION SIX

Measures

\*\*\*\*\*

Ventillation System: In general, dilution ventillation is a satisfactory health hazard control for this material. However, if conditions of use create discomfort to a worker, a local exhaust should be considered.  
Personal Respirators (NIOSH Approved): For conditions of use where exposure to mist exists, a dust/mist respirator may be worn. For emergencies, a self-contained breathing apparatus may be necessary.  
Skin Protection: Rubber gloves and lab coat, apron or overalls.  
Eye Protection: Use chemical safety goggles and/or a full face shield where splashing is possible. Contact lenses should not be worn when working with this material.  
Maintain eye-wash fountain and quick-drench facilities in work area.

\*\*\*\*\*

Storage and Special SECTION SEVEN  
Information

\*\*\*\*\*

Keep in a tightly closed container. Protect container from physical damage.

\*\*\*\*\*

The information contained herein is provided in good faith and is believed to be correct as of the date hereof. However, NCL of Wisconsin, Inc. makes no representation as to the comprehensiveness or accuracy of the information. It is expected that individuals receiving the information will exercise their independent judgement in determining its appropriateness for a particular purpose. Accordingly, NCL of Wisconsin, Inc. will not be responsible for damages of any kind resulting from the use of or reliance upon such information. NO REPRESENTATIONS, OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR TO THE PRODUCT TO WHICH THE INFORMATION REFERS.

\*\*\*\*\*

END OF MATERIAL SAFETY DATA SHEET

## YSI 3682 Zobell Solution

*Material Safety Data Sheet*

*August 1, 2001*

YSI Incorporated

1725 Brannum Lane

Yellow Springs, OH 45387

USA

*Information and Emergency Phone: (937) 767-7241*

*Page 1 of 2*

### **SECTION 1 - MATERIAL IDENTIFICATION**

PRODUCT NAME: **YSI 3682 Zobell Solution** FORMULA: n/ap

Chemical Type: Inorganic chloride / cyanide

CAS No. n/app

### **SECTION 2 - HAZARDOUS / IMPORTANT INGREDIENTS**

Chemical CAS No. PERCENT PEL/TLV CARCINOGEN

(OSHA, NTP, IARC)

Potassium chloride 7447-40-7 72 - 78% none no

Potassium ferrocyanide, trihydrate 14459-95-1 10 - 15% none no

Potassium ferricyanide 13746-66-2 10 - 15% none no

### **SECTION 3 - CHEMICAL AND PHYSICAL PROPERTIES**

Appearance: white powder Boiling Point: n/av

Odor: none Melting Point: n/av

pH: neutral Specific Gravity: n/av

Water Solubility: infinite Vapor Pressure: n/ap

Evaporation Rate: n/av Vapor Density: n/ap

### **SECTION 4 - FIRE AND EXPLOSION HAZARDS**

Flash Point: none Explosive Limits: none

Extinguishing Media: n/ap

Special Firefighting Procedures and Hazards: Material is not combustible. May emit toxic fumes when heated, such as

NO<sub>x</sub>, HCN, HCl. Wear protection as described in Section 6.

### **SECTION 5 - REACTIVITY INFORMATION**

Stable: X Unstable: Precautions: none known

Hazardous Polymerization: Occurs: Does Not Occur: X

Incompatibility: strong acids and oxidizing agents.

Hazardous Decomposition Products: When heated, possibly NO<sub>x</sub>, HCN, HCl.

*YSI 3682 Page 2 of 2 August 1, 2001*

### **SECTION 6 - HEALTH HAZARDS / PROTECTIVE MEASURES / FIRST AID**

Inhalation:

Possible irritation from dusts. (see CHRONIC below)

Use a NIOSH approved respirator for dusts. Get supplier recommendations. Provide adequate ventilation.

Minimize dusty conditions.

Remove to fresh air and provide artificial respiration if needed.

Skin:

Possible irritation from dusts. (see CHRONIC below)

Wear dust-proof gloves and other body protection as needed. Minimize dusty conditions.

Wash exposed areas with soap and water for 15 minutes. Remove contaminated clothing, and wash before re-using.

Eyes:

Possible irritation from dust.

Wear dust barrier goggles. Eliminate dusty conditions.

Flush with water for 15 minutes.

Ingestion

No effects expected from normal use and minor amounts ingested. Large amounts, over 1 tablespoon, can cause digestive system upset s. (see CHRONIC below)

Reduce dusting. Avoid mouth breathing. Use facemask. Provide adequate ventilation.

Avoid swallowing. Spit out. Drink large amounts of water. Induce vomiting if person is conscious.

Otherwise, and if effects persist, get medical attention.

CHRONIC EFFECTS: None reported for this material. "Cyanides" in general are often reported as toxic to humans. Therefore, it is recommended that exposure via skin, inhalation, and ingestion be limited. IN ALL CASES: GET MEDICAL ATTENTION IF EFFECTS PERSIST.

Most likely routes of entry: skin, eyes, ingestion.

**SECTION 7 - PRECAUTIONS FOR SAFE HANDLING AND USE**

Spills and Leaks: Take up powder in any container and hold for disposal. Flush residual to sewer or ground. Provide personal protection as described in Section 6.

Storage and Handling: Keep containers closed. Discard any material that may be contaminated. Minimize dusting.

Waste Disposal: Is not listed as RCRA hazardous waste at this date. Cyanides are restricted in water disposed to streams and to sewers. Therefore, landfill disposal is indicated; check with local disposal companies.

Empty Containers: Rinse well. Dispose as appropriate for glass and plastic containers.

**SECTION 8 - REGULATORY INFORMATION**

DOT: Not regulated.

SARA Title III, S.313, Form R: Nothing reportable.

The information contained herein is based on data available at this time and is believed to be accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. Since information contained herein may be applied under conditions beyond our control, and with which we may be unfamiliar, no responsibility is assumed for the results of its use. The person receiving this information shall make his own determination of the suitability of the material for his particular use.

A96008B

**GRABBER WARMERS**

Product Name: GRABBER WARMERS

Part #: G28, G28B, RH8, WP12, WP30, WP40, SW1, HWSKI, TWSKI, PENTW,

PENPW, PENHW

**SECTION I SUPPLIER INFORMATION**

Common Name: AIR ACTIVATED WARMERS

Chemical Name/Formula: N/A

Product CAS#: N/A

Supplier: MYCOAL WARMERS

P .0. Box: 388 MINAGAWA -JOUNAI-CHO TOCHIGI-CITY

Address:

City, St, Zip: TOCHIGI-PREF. JAPAN Phone: (0282)31-1013

\*\*\*\*\* EMERGENCY PHONE #: 305-484-5300

\*\*\*\*\*

Date Issued: 4/23/96 Date Entered:

Date Revised: 2/13/98

**SECTION II INGREDIENT INFORMATION**

INGREDIENT %MIN %MAX CAS PEL-OSHA TLV-ACGIH 313

NO HAZ MATERIAL

\*\*\*\*\*  
\*\*\*\*\* INGREDIENT HAZARD STATEMENT  
\*\*\*\*\*

NO HAZARDOUS MATERIALS

**SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS**

Boiling Point: N/A  
Specific Gravity (H2O = 1): N/A  
Melting Point: N/A  
Vapor Pressure (mm Hg): N/A  
Vapor Density (Air=1): N/A  
Evaporation Rate (Butyl Acetate=1): N/A  
Solubility/Water: N/A  
pH Level: N/A  
Percent Volatile: UNKNOWN

\*\*\*\*\*  
\*\*\*\*\* APPEARANCE AND ODOR  
\*\*\*\*\*

ODORLESS

\*\*\*\*\*  
\*\*\*\*\* ADDITIONAL INFORMATION  
\*\*\*\*\*

NONE

**SECTION IV FIRE AND EXPLOSION HAZARD DATA**

Flash Point (Method): N/A  
LEL: N/A  
UEL: N/A

Auto-Ignition: N/A

\*\*\*\*\*  
\*\*\*\*\* NFPA HAZARD CLASSIFICATION  
\*\*\*\*\*

Flammable: 0 Health: 0  
Reactivity: 0 Special: -

\*\*\*\*\*  
\*\*\*\*\* HMIS HAZARD CLASSIFICATION  
\*\*\*\*\*

Flammable: 0 Health: 0  
Reactivity: 0 Special: -

\*\*\*\*\*  
\*\*\*\*\* EXTINGUISHING MEDIA  
\*\*\*\*\*

N/A

\*\*\*\*\*  
\*\*\*\*\* SPECIAL FIRE FIGHTING PROCEDURES  
\*\*\*\*\*

NONE

\*\*\*\*\*  
\*\*\*\*\* UNUSUAL FIRE AND EXPLOSION HAZARDS  
\*\*\*\*\*

NONE

**SECTION V REACTIVITY DATA**

Stability? PRODUCT IS STABLE  
Avoid: N/A

\*\*\*\*\*  
\*\*\*\*\* INCOMPATIBILITY (Materials to Avoid)  
\*\*\*\*\*

NONE

\*\*\*\*\*  
\*\*\*\*\* HAZARDOUS DECOMPOSITION OR BY-PRODUCTS  
\*\*\*\*\*

NONE

Hazardous Polymerization? N/A  
Avoid: N/A

**SECTION VI HEALTH HAZARD DATA**

\*\*\*\*\*  
\*\*\*\*\* ROUTES OF ENTRY  
\*\*\*\*\*

Inhalation? NONE  
Skin? NONE  
Ingestion? NONE  
Eyes? NONE

\*\*\*\*\* ADDITIONAL INFORMATION  
\*\*\*\*\*

NONE

\*\*\*\*\* CARCINOGENICITY  
\*\*\*\*\*

NTP? N/A IARC? N/A OSHA? N/A

\*\*\*\*\* ADDITIONAL INFORMATION (CARCINOGENICITY)  
\*\*\*\*\*

NO ADDITIONAL INFORMATION

\*\*\*\*\* ACUTE AND CHRONIC HEALTH HAZARDS  
\*\*\*\*\*

ACUTE -PROLONGED OR IMPROPER USE IN SAME AREA OF BODY COULD CAUSE  
MINOR

BLISTERING OR BURNS

\*\*\*\*\* SIGNS AND SYMPTOMS OF EXPOSURE  
\*\*\*\*\*

MINOR BLISTERING OR BURNS

\*\*\*\*\* MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE  
\*\*\*\*\*

PROLONGED OR IMPROPER USE IN SAME AREA MAY CAUSE MINOR BLISTERING  
OR BURNS

\*\*\*\*\* EMERGENCY AND FIRST AID PROCEDURES  
\*\*\*\*\*

NONE

**SECTION VII PRECAUTIONS FOR SAFE HANDLING AND USE**

DOT Classification: N/A

\*\*\*\*\* STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED  
\*\*\*\*\*

NO SPECIAL PRECAUTIONS NECESSARY

\*\*\*\*\* WASTE DISPOSAL METHOD  
\*\*\*\*\*

NO SPECIAL METHOD OF DISPOSAL

\*\*\*\*\* PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE/REGULATORY  
DATA \*\*\*\*\*

NONE

\*\*\*\*\* OTHER PRECAUTIONS  
\*\*\*\*\*

NONE

**SECTION VIII CONTROL MEASURES**

\*\*\*\*\* RESPIRATORY PROTECTION  
\*\*\*\*\*

N/A

\*\*\*\*\* VENTILATION  
\*\*\*\*\*

Local Exhaust: N/A

Special Exhaust: N/A

Mechanical Exhaust: N/A

Other: N/A

\*\*\*\*\* OTHER PROTECTION  
\*\*\*\*\*

Gloves: N/A

Eye Protection: N/A

**SECTION VIII CONTROL MEASURES is continued on the next page.**

MATERIAL SAFETY DATA SHEET

**SECTION VIII CONTROL MEASURES is continued from the previous page.**

\*\*\*\*\* CLOTHING

\*\*\*\*\*

N/A

\*\*\*\*\* WORK/HYGIENE PRACTICES

\*\*\*\*\*

N/A

## HEXANE

MSDS Number: H2381 --- Effective Date: 11/02/01

---

### 1. Product Identification

**Synonyms:** Hexanes, Normal Hexane; Hexyl Hydride; Hexane 95%

**CAS No.:** 110-54-3 (n-hexane)

**Molecular Weight:** 86.18

**Chemical Formula:** CH<sub>3</sub>(CH<sub>2</sub>)<sub>4</sub>CH<sub>3</sub> n-hexane

9262, 9304, 9308, N168

---

### 2. Composition/Information on Ingredients

Ingredient	CAS No	Percent
Hazardous	-----	-----
-----	-----	-----
Hexane	110-54-3	85 - 100%
Yes		
Methylcyclopentane	96-37-7	1 - 2%
Yes		
Trace amount of Benzene (10 ppm)	071-43-2	*
No		

---

### 3. Hazards Identification

#### Emergency Overview

-----  
**DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL OR FATAL IF SWALLOWED. HARMFUL IF INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS THE CENTRAL AND PERIPHERAL NERVOUS SYSTEMS.**

**J.T. Baker SAF-T-DATA<sup>(tm)</sup>** Ratings (Provided here for your convenience)

-----  
Health Rating: 2 - Moderate

Flammability Rating: 3 - Severe (Flammable)

Reactivity Rating: 0 - None

Contact Rating: 2 - Moderate

Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER

Storage Color Code: Red (Flammable)

---

#### Potential Health Effects

-----  
The health hazards addressed are for the major component: n-hexane.

#### Inhalation:

Inhalation of vapors irritates the respiratory tract. Overexposure may

cause lightheadedness, nausea, headache, and blurred vision. Greater exposure may cause muscle weakness, numbness of the extremities, unconsciousness and death.

**Ingestion:**

May produce abdominal pain, nausea. Aspiration into lungs can produce severe lung damage and is a medical emergency. Other symptoms expected to parallel inhalation.

**Skin Contact:**

May cause redness, irritation, with dryness, cracking.

**Eye Contact:**

Vapors may cause irritation. Splashes may cause redness and pain.

**Chronic Exposure:**

Repeated or prolonged skin contact may defat the skin and produce irritation and dermatitis. Chronic inhalation may cause peripheral nerve disorders and central nervous system effects.

**Aggravation of Pre-existing Conditions:**

Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance. May affect the developing fetus.

---

4. First Aid Measures

**Inhalation:**

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

**Ingestion:**

Aspiration hazard. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.

**Skin Contact:**

Remove any contaminated clothing. Wipe off excess from skin. Wash skin with soap and water for at least 15 minutes. Get medical attention if irritation develops or persists.

**Eye Contact:**

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

**Note to Physician:**

BEI=2,5-hexadione in urine, sample at end of shift at workweeks end, 5 mg/g creatine. Also, measure n-hexane in expired air. Analgesics may be necessary for pain management, there is no specific antidote. Monitor arterial blood gases in cases of severe aspiration.

---

5. Fire Fighting Measures

**Fire:**

Flash point: -23C (-9F) CC  
Autoignition temperature: 224C (435F)  
Flammable limits in air % by volume:  
lel: 1.2; uel: 7.7

Extremely Flammable Liquid and Vapor! Vapor may cause flash fire. Dangerous fire hazard when exposed to heat or flame.

**Explosion:**

Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Contact with oxidizing materials may cause extremely violent combustion. Explodes when mixed @ 28C with dinitrogen tetroxide.

Sensitive to static discharge.

**Fire Extinguishing Media:**

Dry chemical, foam or carbon dioxide. Water may be ineffective.

**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. Water spray may be used to keep fire exposed containers cool. Vapors can flow along surfaces to distant ignition source and flash back. Vapor explosion hazard exists indoors, outdoors, or in sewers.

---

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker SOLUSORB® solvent adsorbent is recommended for spills of this product.

---

7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from direct sunlight and any area where the fire hazard may be acute. Store in tightly closed containers (preferably under nitrogen atmosphere). Outside or detached storage is preferred. Inside storage should be in a standard flammable liquids storage room or cabinet. Separate from oxidizing materials. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

---

8. Exposure Controls/Personal Protection

**Airborne Exposure Limits:**

N-Hexane [110-54-3]:

-OSHA Permissible Exposure Limit (PEL): 500 ppm (TWA)

-ACGIH Threshold Limit Value (TLV): 50 ppm (TWA), Skin

other isomers of hexane

-ACGIH Threshold Limit Value (TLV): 500 ppm (TWA), 1000ppm (STEL)

**Ventilation System:**

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. 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):**

If the exposure limit is exceeded and engineering controls are not feasible, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134).

**Skin Protection:**

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

**Eye Protection:**

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

9. Physical and Chemical Properties

**Appearance:**

Clear, colorless liquid.

**Odor:**

Light odor.

**Solubility:**

Insoluble in water.

**Specific Gravity:**

0.66

**pH:**

No information found.

**% Volatiles by volume @ 21C (70F):**

100

**Boiling Point:**

ca. 68C (ca. 154F)

**Melting Point:**

ca. -95C (ca. -139F)

**Vapor Density (Air=1):**

3.0

**Vapor Pressure (mm Hg):**

130 @ 20C (68F)

**Evaporation Rate (BuAc=1):**

9

---

10. Stability and Reactivity

**Stability:**

Stable under ordinary conditions of use and storage. Heat will contribute to instability.

**Hazardous Decomposition Products:**

May produce acrid smoke and irritating fumes when heated to decomposition.

**Hazardous Polymerization:**

Will not occur.

**Incompatibilities:**

Strong oxidizers.

**Conditions to Avoid:**

Heat, flames, ignition sources and incompatibles.

---

11. Toxicological Information

N-Hexane: Oral rat LD50: 28710 mg/kg. Irritation eye rabbit: 10 mg mild.  
Investigated as a tumorigen, mutagen and reproductive effector.

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

Ingredient Category	---NTP Carcinogen---		IARC
	Known	Anticipated	
Hexane (110-54-3)	No	No	None
Methylcyclopentane (96-37-7)	No	No	None
Trace amount of Benzene (10 ppm) (071-43-2)	Yes	No	1

---

## 12. Ecological Information

### **Environmental Fate:**

When released into the soil, this material may biodegrade to a moderate extent. When released into the soil, this material is not expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into water, this material may biodegrade to a moderate extent. When released to water, this material is expected to quickly evaporate. When released into the water, this material is expected to have a half-life between 1 and 10 days. This material has an estimated bioconcentration factor (BCF) of less than 100. This material has a log octanol-water partition coefficient of greater than 3.0. This material is not expected to significantly bioaccumulate. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life between 1 and 10 days.

### **Environmental Toxicity:**

No information found.

---

## 13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste 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

### **Domestic (Land, D.O.T.)**

-----

**Proper Shipping Name:** HEXANES  
**Hazard Class:** 3  
**UN/NA:** UN1208  
**Packing Group:** II  
**Information reported for product/size:** 52L

### **International (Water, I.M.O.)**

-----

**Proper Shipping Name:** HEXANES

---

**Hazard Class:** 3  
**UN/NA:** UN1208  
**Packing Group:** II  
**Information reported for product/size:** 52L

15. Regulatory Information

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

Ingredient	TSCA	EC	Japan
Australia			
Hexane (110-54-3)	Yes	Yes	Yes
Methylcyclopentane (96-37-7)	Yes	Yes	No
Trace amount of Benzene (10 ppm) (071-43-2)	Yes	Yes	Yes

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

Ingredient	Korea	DSL	NDSL
Phil.			
Hexane (110-54-3)	Yes	Yes	No
Methylcyclopentane (96-37-7)	Yes	Yes	No
Trace amount of Benzene (10 ppm) (071-43-2)	Yes	Yes	No

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

Ingredient	-SARA 302-	-SARA						
313	RQ	TPQ	Catg.	List	Chemical			
Catg.	List	Chemical						
Hexane (110-54-3)	No	No	Methylcyclopentane (96-37-7)	No	No	Trace amount of Benzene (10 ppm) (071-43-2)	No	No
Methylcyclopentane (96-37-7)	No	No	Trace amount of Benzene (10 ppm) (071-43-2)	No	No			
Trace amount of Benzene (10 ppm) (071-43-2)	No	No						

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

Ingredient	CERCLA	-RCRA-	-TSCA-
	5000	261.33	8(d)
Hexane (110-54-3)	No	No	No
Methylcyclopentane (96-37-7)	No	No	No
Trace amount of Benzene (10 ppm) (071-43-2)	10	U019	No

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

**WARNING:**

THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

**Australian Hazchem Code:** 3[Y]E

**Poison Schedule:** No information found.

**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.

---

16. Other Information

**NFPA Ratings:** Health: 1 Flammability: 3 Reactivity: 0

**Label Hazard Warning:**

DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL OR FATAL IF SWALLOWED. HARMFUL IF INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS THE CENTRAL AND PERIPHERAL NERVOUS SYSTEMS.

**Label Precautions:**

Keep away from heat, sparks and flame.  
Keep container closed.  
Use only with adequate ventilation.  
Wash thoroughly after handling.  
Avoid breathing vapor or mist.  
Avoid contact with eyes, skin and clothing.

**Label First Aid:**

Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. In all cases call a physician.

**Product Use:**

Laboratory Reagent.

**Revision Information:**

MSDS Section(s) changed since last revision of document include: 8

## **ATTACHMENT C**

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**HEALTH AND SAFETY  
CERTIFICATIONS FOR  
FIELD PERSONNEL**



(Primary copy/print)

**Compliance Solutions**  
"Today's Training... Tomorrow's Solution"

10515 E 42nd Ave, Suite 116, Denver Colorado 80239 800-711-2706

Student Affiliation:  
Integral Consulting, Inc.  
99775330

**Certificate of Completion**

This is to certify that

**Jane Sund**

has successfully completed the classroom requirements for  
**8 Hour HAZWOPER Refresher**  
**29 CFR 1910.120(e)**

Presented

Friday, April 22, 2005

**Compliance Solutions Occupational Trainers, Inc.**

Certificate Number: 68485



Neval Gupta  
Vice President



Jeffrey Kline  
President/CEO



This recognizes that  
**SUSAN FITZGERALD**  
has completed the requirements for  
**STANDARD FIRST AID**  
conducted by  
**RED CROSS OF KING-KITSAP**  
Date completed **10/07/2005**  
The American Red Cross recognizes this certificate  
as valid for **3** year(s) from completion date.



This recognizes that  
**SUSAN FITZGERALD**  
has completed the requirements for  
**ADULT CPR**  
conducted by  
**RED CROSS OF KING-KITSAP**  
Date completed **10/07/2005**  
The American Red Cross recognizes this certificate  
as valid for **1** year(s) from completion date.



Figure 9-1

## **APPENDIX C**

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STANDARD OPERATING  
PROCEDURE FOR YSI  
650/6600 MULTI PROBE

## STANDARD OPERATING PROCEDURE SOP-SW01

### YSI 650/6600 MULTI PROBE

---

#### Introduction

The purpose of this standard operating procedure (SOP) is to describe the procedures for the measurement of general water quality parameters using a Multi Probe YSI 6600 attached to an YSI 650 Multiparameter Display System (MDS) handheld unit. This multiparameter system will be used to simultaneously measure dissolved oxygen, conductivity, temperature, depth, pH, and oxidation-reduction potential while in the field.

This SOP should be used in conjunction with the operating manual supplied by the manufacturer, *YSI 6-Series Environmental Monitoring Systems Operations Manual* (YSI Environmental, Yellow Springs, Ohio). A goal of this SOP is to ensure that the highest quality, most representative data be collected, and that these data are comparable to data collected by different programs that follow these same guidelines.

#### Summary of Method

The YSI 6600 Multi Probe, or sonde, is used for measuring conventional water parameters in the field. A sonde is a torpedo-shaped water quality monitoring device that is placed in the water to gather water quality data. The 6600 sonde has multiple probes. Each probe has sensors that read water quality data. The 6600 sonde is attached to a YSI 650 MDS (650 MDS), handheld, microcomputer-based instrument that allows the user to display sonde readings, configure sondes, store and recall data, upload data from sondes, and transfer data to computers for analysis and plotting.

Concurrent with the collection of surface water samples at each sampling station, the 6600 sonde will be used for measuring parameters such as temperature, pH, dissolved oxygen (DO), conductivity, oxidation-reduction potential, turbidity, and depth. These measurements are then recorded in the same order as described in the water sample log sheet.

The table below shows when data recording will be set at different time intervals, depending on the sampling station requirements. If the station is stationary and sampling will take longer than one hour, set the YSI unit to record a data point at every 15 minutes.

If an initial high-resolution vertical profile of the water column is required, set the YSI unit to record a data point every second.

Type of Sampling Station	High-Resolution Water Column Profile	Data Point Recording Period
Stationary—short period	Yes	Every 30 seconds
Stationary—long period	No	Every 5 minutes

Once sampling is complete, the data will be uploaded to the computer using EcoWatch for Windows.

Once measurements are made *in situ*, the probe is rinsed with deionized water and replaced into the transport/calibration cup with 1/8 of the volume filled with deionized water.

The unit will be calibrated before each daily sampling begins and again at the end of the sampling day.

At each sample location, the probe will be attached to a rope and deployed to the side of the boat either by hand or with the help of a davit. Measurements will be recorded continuously. At the end of every monitoring event, data will then be transferred to a computer.

## Equipment and Supplies

The YSI 6600 sonde is a rugged, handheld unit with the sensors enclosed in a heavy-duty probe sensor guard. A 10- to 20-m cable is directly connected to the probe module body, making the entire unit waterproof. The following equipment is needed in the field to operate the unit:

- Instrument with barometer option
- 10- to 20-m cable
- DO/temp/depth/conductivity/pH/turbidity/ORP probes
- Extra C batteries
- Large carrying case
- Transport/calibration cup
- Probe sensor guard.

## Sampling Procedures

### Instrument/Cable Connection

Line up the pins and guides on the cable with the holes and indentations on the cable connector at the bottom of the YSI 650 instrument. The other end of the cable is a military-style 8-pin connector (MS-8). Attach the cable to the instruments as follows:

1. To attach a field cable to the sonde connector, remove the waterproof cap from the sonde connector and set it aside for later reassembly during deployment or storage.
2. Connect the field cable to the sonde connector. Refer to Figure 38 in Section 2.3.4 of the *YSI 6-Series Environmental Monitoring Systems Operations Manual* (YSI Environmental, Yellow Springs, Ohio).
3. A built-in “key” will ensure proper pin alignment. Rotate the cable gently until the “key” engages and then tighten the connectors together by rotating clockwise.
4. Attach the strain relief connector to the sonde bail.
5. Rotate the strain relief connector nut to close the connector's opening.

### Equipment Pre-Testing

The following steps describe how each probe is checked every day prior to sampling.

#### pH Measurements

To test the pH probe, two buffers of pH 4 and pH 7 are used. Different buffers may be used if the general pH range of the water to be sampled is higher. Prior to taking pH measurements, the pH probe is rinsed with deionized water and excess water gently shaken off before insertion into a buffer solution. Once measurement is made, the probe is again rinsed with deionized water and replaced into the container with deionized water. The pH probe is ready for field measurements.

#### Conductivity Measurements

To test the conductivity probe, a standard conductivity solution is used that is in the general range of conductivities expected from the water to be sampled (for the lower Duwamish River use 1,400  $\mu$ S/cm specific conductivity standard solution). Temperature compensation is corrected using the appropriate scale for the temperature and conductivity of the calibration solution. The conductivity meter is adjusted until the conductivity reading agrees with the value of the standard solution. The probe is removed from the standard solution and rinsed with deionized water. The conductivity probe is ready for field measurements.

## **Dissolved Oxygen (DO) Measurements**

The oxygen electrode is measured as % saturation inside a probe-specific measuring cup containing 1/8 in. of water. The probe is ready for measurements after saturation reading.

## **Temperature Measurements**

Temperature is measured using a temperature probe attached to the Multi Probe system.

## **Turbidity Measurements**

Turbidity is measured using a nephelometer probe attached to the Multi Probe. To test the probe, two standard solutions (0 NTU and 100 NTU) are used. Prior to taking turbidity measurements, the probe is rinsed with deionized water and excess water gently shaken off before insertion into a 0 NTU turbidity solution. Once measurement is made, the probe is inserted into the 100 NTU standard solution (no rinsing required between solutions). After the last measurement, the probe is then rinsed with deionized water and replaced into the container with deionized water. The turbidity probe is ready for field measurements.

Calibration of the nephelometer is only required once a week. Therefore, after initial calibration on the first day, the probe will be checked for accuracy before and after each sampling event.

**NOTE:** Standard solutions are probe-specific and generic standard solutions are not adequate for calibration of this YSI probe.

## **Multi Probe Procedures**

The unit is removed from its case and attached to the 10- to 20-meter cable by inserting the cable connector into the instrument as described above. Care should be taken when handling the probe at the other end of the cable.

## **Daily Check Procedures**

1. Press the **On/off** key OR select **Run** from the main menu to display the run screen.
2. Make sure the probe transport/calibration cup is installed.
3. Add the appropriate standard solution, as described above, to the transport/calibration cup and gently hold the probe module in the solution. Be sure to completely immerse all the sensors.
4. Watch the readings on the display until they are stable.
5. Press the **Escape** key to display the main menu screen.

6. Use the arrow keys to highlight the **Sensor** selection.
7. Press the **Enter** key to display the sensors-enabled screen. A black dot to the left of a sensor indicates that sensor is enabled. Sensors with an empty circle are disabled.
8. Use the arrow keys to highlight the sensor to be changed; then press the **Enter** key to enable or disable it.
9. Repeat step 6 for each sensor to be changed.
10. Press the **Escape** key to return to the main menu screen.
11. Use the arrow keys to highlight the **Report** selection.
12. Press the **Enter** key to display the report setup screen.

**NOTE:** A black dot to the left of a parameter indicates that parameter is selected for display. Parameters with an empty circle will not be displayed. It may be necessary to scroll down past the bottom of the screen to see all the parameters.
13. Use the arrow keys to highlight the parameter to be changed; then press the **Enter** key. If a parameter cannot be found, even after scrolling down past the bottom of the screen, the sensor used for that parameter is disabled.
14. If temperature, specific conductivity, conductivity, resistance, or total dissolved solids are selected, the **Units** screen will appear.
15. Use the arrow keys to select the units desired; then press the **Enter** key to return to the report setup screen.
16. If dissolved oxygen %, dissolved oxygen mg/L, pH, pH mv, or ORP mv are selected, the selection dot will simply toggle on or off.
17. Repeat steps 14 and 15 for each parameter needed to be changed.

**NOTE:** All parameters may be enabled at the same time.
18. Press the **Escape** key to return to the **Main** menu screen.
19. Watch the readings on the display until they are stable.
20. Read the value for each parameter being measured and check against values of standard solution. Record all measurements in field log book.
21. Once all measurements are read, remove probe from last solution and rinse with deionized water.
22. Gently remove the probe guard and replace it with the transport/calibration cup.
23. Turn off instrument. Blot it dry with a paper towel, unscrew cable from unit, and place it back on its case.

**NOTE:** If the YSI 650 unit displays high drift when measuring standard solutions, it may be required to re-calibrate the probe. See the *YSI 6-Series Environmental Monitoring Systems Operations Manual* for instructions on calibration procedures (YSI Environmental, Yellow Springs, Ohio).

## Real-Time Data

Measurements of general water quality parameters will be taken using the YSI 6600 sonde unit concurrently with surface water sampling. The unit will be programmed to collect readings by setting the recording time period as explained above. In addition, field personnel will transcribe readings onto the YSI Water Quality Parameters Sample Log sheet every 30 minutes for long sampling periods.

Before measuring samples, the probe module must be prepared by removing the transport/calibration cup. Follow these procedures:

1. Press the **On/off** key OR select **Run** from the main menu to display the run screen.
2. Make sure the probe sensor guard is installed.
3. Place the probe module in the sample (e.g., river water). Be sure to completely immerse all the sensors.
4. Rapidly move the probe module through the sample to provide fresh sample to the DO sensor.
5. Watch the readings on the display until they are stable.
6. Read and record values top to bottom and from first column to second column every 30 minutes for long sampling periods.
7. Once sampling is complete, remove probe from water and rinse with deionized water.
8. Gently remove the probe guard and replace it with the transport/calibration cup.

Turn off instrument. Blot it dry with a paper towel, unscrew cable from unit, and place it back on its case.

## Upload Data to Computer Using Ecowatch

Once sampling is complete for the day, the data will be uploaded to a computer using EcoWatch software. A detailed description is located in the *YSI 6-Series Environmental Monitoring Systems Operations Manual*, Section 2.8. Use the following procedures to upload the data:

1. Using supplied transfer cable, connect YSI 650 MDS to computer. A serial port to USB port adaptor may be required.
2. Turn on 650 MDS unit and run EcoWatch software on the computer.
3. Select **Sonde** icon on the EcoWatch program. If a “#” prompt appears instead of the Main sonde menu, type “menu” at the prompt to generate the display as shown.
4. Press 3—**File** to view data handling options.

5. Select 1—**Directory** to view all files in the sonde memory.
6. Select 2—**Upload** to view file list in memory and upload the data to the computer.

## Instrument Calibration and Frequency

Calibration is required within 24 hours before use and within 24 hours after measurement activities in the field are performed. A calibration worksheet is attached and a summary of acceptance criteria for each parameter provided below.

### Acceptance Criteria

Acceptance criteria for each parameter are given in the calibration worksheet as ranges:

- Conductivity  $5.0 \pm 0.5 \mu\text{S/cm}$
- pH 7 buffer  $0 \pm 50 \text{ mV}$
- pH 4 buffer  $+ 177\text{mV}$  from pH 7 buffer
- pH 10 buffer  $- 177\text{mV}$  from pH 7 buffer
- DO charge  $50 \pm 25$
- DO gain 1.0 (0.7 to 1.5)
- ORP  $0 \pm 100 \text{ mV}$
- Pressure offset  $0 \pm 6$  (vented)
- Turbidity  $\pm 2 \text{ NTU}$  or 5% relative percent difference

**Note:** Span between pH 4 and pH 7 and between pH 7 and pH 10, the millivolt numbers should be between 165 mV and 180 mV.

If, after post-calibration checks, it is determined that the acceptable amount of drift has been exceeded for a Multi Probe instrument, data collected by the probe for that sampling event should, in most cases, not be submitted for inclusion into the database, unless appropriately flagged and tracked as such. Field personnel will resolve the problem with the instrument, either by conducting routine maintenance or by sending the instrument to the manufacturer for repair.

### Inspection/Acceptance Requirements for Supplies and Consumables

The purchase of supplies, equipment, and services must be controlled to ensure that specifications are met for the high quality and reliability required for each field sampling event. All chemicals are dated upon receipt. All supplies are stored appropriately and are discarded upon expiration date.

## **APPENDIX D**

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### STANDARD OPERATING PROCEDURE FOR NISKIN BOTTLE SAMPLING

## STANDARD OPERATING PROCEDURE SOP-SW02

### NISKIN BOTTLE SAMPLING

---

#### Scope and Application

The purpose of this standard operating procedure (SOP) is to describe the procedures for the collection of surface water samples using a Niskin bottle. The Niskin bottle is used to collect discrete water samples from below the surface of a water body. The bottle is attached to a cable and lowered by means of a winch to the desired depth of sampling.

A goal of this SOP is to ensure that the highest quality, most representative data be collected, and that these data are comparable to data collected by different programs that follow these same guidelines.

The Niskin bottle is a plastic cylinder with stoppers at each end, connected by an elastic cord. The stoppers are held open by plastic cords attached to a release mechanism. Clamps on the side of the cylinder are used to attach the bottle to a hydrographic line (a 3/16-in. steel cable with a 60-lb weight at the end) so that it can be lowered to a discrete depth in the water. When a small weight encircling the hydrographic line, called a “messenger,” is released down the line, it strikes the release mechanism resulting in the two stoppers being pulled into the ends of the cylinder, thereby trapping water from that depth.

#### Equipment and Supplies

The following equipment and supplies are needed to retrieve a water sample using the Niskin bottle approach:

- 5-L Niskin bottle
- PVC end stoppers (two each)
- PVC handles
- Stainless-steel cable clamps with external springs
- Teflon™-coated Deldrin stopcocks
- Teflon™ air vent screw
- Teflon™ drain valve

- Viton o-rings
- Nylon monofilament lanyards
- End closure stopper with spherical section sealing surface held firmly against o-ring seal by external stainless springs
- 1,000-mg messenger
- Nylon rope (or similar rope/line) having a diameter fitting inside the center of the messenger
- Buoys: needed to locate water sample locations.
- Personnel protective equipment
- Decontamination supplies
- Liquinox™
- Tape measure
- Field notebook
- Digital camera
- Ice
- GPS.

## Sampling Procedures

1. Locate sampling locations using GPS and record location. Assess the need to set buoy in place prior to the day of bottle deployment, if possible.
2. Using non-contaminating markers or tape, place 1-ft marks on rope/twine attached to the 5-L Niskin bottles for accurate depth placement for the collection of whole water samples. Attach rope/twine per manufacturer's specifications to attachment point in 5-L Niskin bottle. Be sure to thread messenger device onto rope/twine prior to attaching rope/twine to 5-L Niskin bottle.
3. Keep stoppers closed on both ends of clean (deconned) 5-L Niskin bottle until it is ready for deployment. Clean (deconned) 5-L Niskin bottles should also be kept in a sealed plastic bag until ready for use.
4. Travel to the pre-determined water sample buoy location, anchor the boat at a down current location and **turn off the engine**. Make sure that the bow of the boat is adjacent to the proposed water sample location and that the boat engine is at the farthest possible location relative to the pre-determined water sample location, preferably downstream and downwind. Check the GPS location and verify that the location has not moved. Different tidal cycles, or wind events, will change the position of the buoy, creating an apparent shift in the GPS location. If

- in doubt, tug on the line to verify that the weight is securely in place, and that there is minimal slack in the buoy line. Adjust as necessary.
5. After arriving at the deployment site and shutting off the boat engine, make sure to shut off generator or any other vapor-emitting device. No fuel leaks, oily rags, or other potential contaminant sources may be aboard the boat.
  6. Obtain total depth of water column using a lead-line or weighted graded device (e.g., graded nylon string with weight).
  7. Deploy the 5-L Niskin bottle to the desired depth at the sampling location, ensuring the release mechanism safety catch is on.
  8. Record the surface water quality parameters of the river water at the depth that the 5-L Niskin bottle will be deployed, using a Multi Probe submersible sonde.
  9. Open 5-L Niskin bottles by tuning open both end stoppers and placing attached nylon monofilament lanyards between side pegs. The nylon monofilament line will automatically rest against the side of the peg that is away from the end stopper from which it is attached. **Be sure that the drain valve is in a closed position.**
  10. While holding rope/twine attached to 5-L Niskin bottle, gently place 5-L Niskin bottle into river and slowly lower to the appropriate depth for sample collection. When at the desired sample depth (using graded rope/twine), allow water to flush through the Niskin 5-L bottle for a minimum of 10 seconds. This will allow the interior of the 5-L Niskin bottle to rinse and allow material from the water surface, which may have been lowered at depth by the 5-L Niskin bottle, to leave the vicinity of the 5L Niskin bottle. **Be sure to keep the 1,000-mg messenger in hand at a position above the water surface while each 5-L Niskin bottle is lowered.**
  11. Record GPS coordinates and time of deployment of the 5-L Niskin bottles into the river.
  12. When at the desired sampling depth, drop the 1,000-mg messenger into the water toward the 5-L Niskin bottle. Ensure the rope/ line is taught enabling the messenger to 'free fall', so it will strike the release mechanism with enough force to trigger the spring release stoppers.
  13. Gently pull the 5-L Niskin bottle(s) up from the water column using the rope/twine. Once retrieved, ensure that the stoppers are completely sealed, and that the cylinder is completely filled with water, then immediately place water sample from 5-L Niskin bottle used for total analysis directly into a clean (deconned) container. Securely attach lid on the container and place it directly on ice, or sample directly from the container ensuring the water is continuously stirred or agitated. Be sure to wear proper gloves and PPE throughout the process.

14. Making sure that the boat motor is at the farthest possible location from water sample location, start the boat and slowly and carefully bring the boat anchor(s) back to the boat. Make all attempts possible not to increase the water column turbidity. **Gently rinse sediment off of anchor before bringing it aboard.**
15. Slowly maneuver the boat at a down current position from the pre-determined water sample to transport water samples back to shore.

## References

Arnold, D. 2005. Procedure for 5L Niskin bottle use. Prepared for Lower Passaic River Restoration Project. Malcolm Pirnie, Inc., White Plains, NY.

## APPENDIX E

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### WATER QUALITY FORMS

- Chain of Custody Form
- Field Change Request and  
Correction Action Record  
Forms
- Water Quality Form



	<b>FIELD CHANGE REQUEST</b>	Project Number:
Project Number: Project Name:		Field Change No. Page _____ to
<p><b>CHANGE REQUEST</b>          Applicable Reference:          Description of Change:</p> <p>Reason for Change:</p> <p>Impact on Present and Completed Work:</p> <div style="display: flex; justify-content: space-between; margin-top: 20px;"> <div style="width: 60%;"> <p style="text-align: center;">(Field Scientist)</p> <p style="text-align: center;">(Field Task Leader)</p> </div> <div style="width: 35%; text-align: right;"> <p>Requested by:            Date: ____/____/</p> <p>Acknowledged by:            Date: ____/____/</p> </div> </div>		
<p style="text-align: center;"><b>FIELD OPERATIONS MANAGER RECOMMENDATION</b></p> <p>Recommended Disposition:</p> <div style="display: flex; justify-content: flex-end; margin-top: 20px;"> <p>Recommendation by:            Date: ____/____/</p> </div> <p style="text-align: center;">(Sampling and Analysis Coordinator)</p>		
<p style="text-align: center;"><b>PROJECT MANAGER APPROVAL</b></p> <p>Final Deposition:</p> <div style="display: flex; justify-content: flex-end; margin-top: 20px;"> <p>Approved/Disapproved by:            Date: ____/____/</p> </div> <p style="text-align: center;">(CERCLA Coordinator)</p>		

**CORRECTIVE ACTION RECORD**

Page \_\_\_ of

Audit Report No. : \_\_\_\_\_ Date:

Report Originator:

Person Responsible for Response:

DESCRIPTION OF PROBLEM:

Date and Time Problem Recognized: \_\_\_\_\_ By:

Date of Actual Occurrence: \_\_\_\_\_ By:

Analyte: \_\_\_\_\_ Analytical Method:

Cause of Problem:

CORRECTIVE ACTION PLANNED:

Person Responsible for Corrective Action:

Date of Corrective Action:

Corrective Action Plan Approval: \_\_\_\_\_ Date:

DESCRIPTION OF FOLLOW-UP ACTIVITIES:

Person Responsible for Follow-up Activities:

Date of Follow-up Activity:

Final Corrective Action Approval: \_\_\_\_\_ Date:

