Lower Duwamish Waterway Group

Port of Seattle / City of Seattle / King County / The Boeing Company

QUALITY ASSURANCE PROJECT PLAN: COLLECTION AND ANALYSIS OF JUVENILE CHINOOK SALMON *FINAL*

For submittal to

The U.S. Environmental Protection Agency
Region 10
Seattle, WA

The Washington State Department of Ecology
Northwest Regional Office
Bellevue, WA

October 14, 2003

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TITLE AND APPROVAL PAGE
LDW JUVENILE CHINOOK
QUALITY ASSURANCE PROJECT PLAN

Windward Project Manager _____ _____
Name Date

Windward QA/QC Manager _____ _____
Name Date

EPA Project Manager _____ _____
Name Date

EPA QA Manager _____ _____
Name Date

Ecology Project Manager _____ _____
Name Date

Distribution List

This list identifies all individuals to receive a copy of the approved QA Project Plan, either in hard copy or electronic format, as well as any subsequent revisions.

LDWG

EPA Project Manager: Allison Hiltner

Ecology Project Manager: Rick Huey

Project Manager: Kathy Godtfredsen, Windward Environmental

Laboratory Manager: Greg Salata, Columbia Analytical Services

QA/QC Manager: Tad Deshler, Windward Environmental

QA/QC Coordinator and Field Coordinator: Joanna Florer, Windward Environmental

Field supervisor: Bill Taylor, Taylor and Associates

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Acronyms

%RSD	percent relative standard deviation
ASTM	American Society for Testing and Materials
COC	chain of custody
DMM	Data Management Manual (Windward and Appendix A 2001)
DQO	data quality objective
DQI	data quality indicator
EPA	US Environmental Protection Agency
ERA	Ecological risk assessment
FC	field coordinator
GPS	global positioning system
LDW	Lower Duwamish Waterway
LDWG	Lower Duwamish Waterway Group
MDL	method detection limit
NMFS	National Marine Fisheries Service
NRC	Natural Resource Consultants
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PM	project manager
PSEP	Puget Sound Estuary Program
QA/QC	quality assurance/quality control
QAPP	quality assurance project plan
RI	Remedial Investigation
RM	river mile
RPD	relative percent difference
SDG	sample delivery group

1.0 Introduction

This quality assurance project plan (QAPP) describes the methods and quality control for collecting, archiving, and chemically analyzing juvenile chinook salmon tissue samples collected from the Lower Duwamish Waterway (LDW) study area.[1] EPA guidance for QAPPs was followed in the preparation of this project plan (EPA 2002a). This plan is organized into the following sections:

- Section 2 – Project management
- Section 3 – Data generation and acquisition
- Section 4 – Assessment and oversight
- Section 5 – Data validation and usability
- Section 6 – References
- This project is designed to collect wild and hatchery juvenile chinook salmon from two locations in the LDW and one upstream. One composite sample from the hatchery will also be collected. Whole fish and stomach contents tissues will be chemically analyzed. These data will be used in the Phase 2 ecological risk assessment (ERA) of the Phase 2 Remedial Investigation (RI) to estimate exposure to juvenile chinook salmon and piscivorous receptors of concern.

2.0 Project Management

This section describes the overall management of the project including key personnel, project description, problem definition and background, quality objectives and criteria, special training requirements and certification, and documents and record keeping.

2.1 PROJECT ORGANIZATION

The overall project organization and the individuals responsible for the various tasks required for the tissue sample collection and analysis are shown in Figure 2-1. Responsibilities of these individuals are described in the following sections.

[1] A final QAPP for collecting and processing juvenile chinook salmon tissue samples was approved by EPA and Ecology on May 9, 2003, prior to the sample collection. In addition to the information contained in the May 9, 2003 QAPP, this QAPP contains a full discussion of analytes, analytical methods, and quality assurance/quality control (QA/QC) considerations. Any modification that occurred during field sampling and processing approaches, as outlined in the May 9, 2003 QAPP, will be documented in progress and data reports. Changes to relevant sections were not made in this QAPP to reflect those modifications.

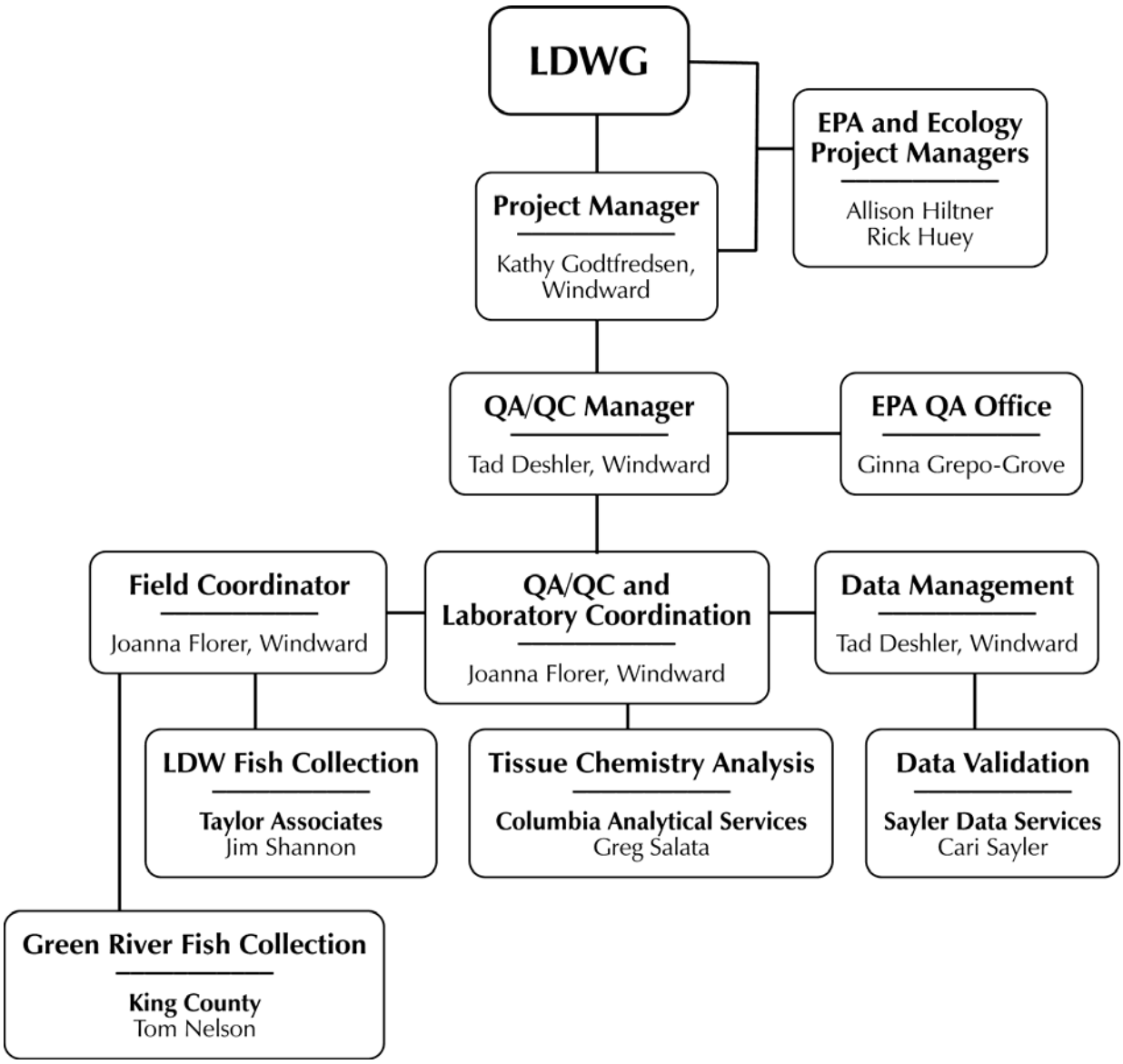

Figure 2-1. Project organization and team responsibilities

2.1.1 Project management

The Lower Duwamish Waterway Group (LDWG), Allison Hiltner (the US Environmental Protection Agency [EPA] Project Manager [PM]), and Rick Huey (the Washington Department of Ecology PM) will be involved in all aspects of this project, including discussion, review, and approval of the QAPP, and interpretation of the results of the investigation.

Kathy Godtfredsen will serve as the Windward PM. The PM is responsible for overall project coordination, planning and coordination, production of work plans, production of all project deliverables, and performance of the administrative tasks

needed to ensure timely and successful completion of the project. The PM is also responsible for coordinating with LDWG and EPA's and Ecology's PMs, on schedule, deliverables, and other administrative details. The PM can be reached as follows:

Kathy Godtfredsen
Windward Environmental LLC
200 W. Mercer St., Suite 401
Seattle, WA 98119
Telephone: 206.577.1283
Facsimile: 206.217.0089
E-mail: kathyg@windwardenv.com

2.1.2 Field coordination

Joanna Florer will serve as the Windward Field Coordinator (FC). The FC is responsible for day-to-day technical oversight, and collecting and submitting environmental samples to the designated laboratories for chemical and physical analyses. All field activities will be performed under the direction of the FC.

Tom Nelson of King County will collect wild and hatchery fish from river mile (RM) 13[2] of the Green River with assistance provided by Windward. Taylor Associates will collect wild and hatchery fish from two areas in the LDW with assistance provided by Windward. Windward will collect fish from the hatchery. Details of the study design are presented in Sections 2.2 and 2.3.

The FC will be responsible for all decisions concerning sample collection and for QA/QC oversight, ensuring that appropriate protocols for sample collection, preservation, and holding times are observed. Deviations from this QAPP will be reported to the PM for consultation. Significant deviations from the QAPP will be further reported to representatives of the LDWG, EPA, and Ecology. The FC and Tom Nelson can be reached as follows:

Joanna Florer
Windward Environmental LLC
200 W. Mercer St., Suite 401
Seattle, WA 98119
Telephone: 206.577.1294
Facsimile: 206.217.0089
Email: joannaf@windwardenv.com

[2] River miles in this document are relative to the upstream end of the West Waterway (just downstream of the West Seattle Bridge).

Tom Nelson
King County
Department of Natural Resources
201 S. Jackson St. Suite 600
Seattle, WA 98104
Telephone: 206.296.8012
Facsimile: 206.296.0192
Email: tom.nelson@metrokc.gov

2.1.3 Quality assurance/quality control

Tad Deshler of Windward will oversee quality assurance/quality control (QA/QC) for the project. As the QA/QC manager, he will provide oversight for both the field sampling and laboratory programs, and supervise data validation and project QA coordination. Joanna Florer will serve as Windward's QA/QC coordinator. The QA/QC coordinator will ensure that samples are collected and documented appropriately and coordinate with the analytical laboratories to ensure that QAPP requirements are followed. Independent third-party data review and validation will be provided by Cari Sayler of Sayler Data Solutions.

2.1.4 Laboratory project management

Laboratory QA coordination will be performed by Windward's QA/QC coordinator. Analytical Resources, Inc. (ARI) will homogenize and archive the tissue and stomach content samples. Columbia Analytical Services (CAS) will perform the chemical analyses on the tissue samples. The laboratory PM at CAS can be reached as follows:

Greg Salata
Columbia Analytical Services, Inc.
1317 So. 13th Avenue
Kelso, WA 98626
Telephone: 360-577-7222
Facsimile: 360-636-1068
E-mail: gsalata@kelso.caslab.com

The analytical laboratory will accomplish the following:

- adhere to the methods outlined in this QAPP, including those methods referenced for each analytical procedure
- adhere to documentation, custody, and sample logbook procedures
- implement QA/QC procedures required by EPA guidelines (EPA 1997, 2000)
- meet all reporting requirements
- deliver electronic data files as specified in this QAPP

- meet turnaround times for deliverables as described in the QAPP
- allow EPA and the QA/QC contractor to perform laboratory and data audits.

2.1.5 Data Management

Tad Deshler will oversee data management to ensure that analytical data are incorporated into the LDWG database with appropriate qualifiers following acceptance of the data validation. QA/QC of the database entries will ensure accuracy for use in Phase 2.

2.2 PROJECT DESCRIPTION

The primary objective of the study is to collect representative juvenile chinook salmon whole body and stomach content tissue samples for chemical analysis. Collection of these data will expand the set of LDW juvenile chinook salmon tissue residue data that have undergone QA/QC review (EPA 2003) for use in the LDW Phase 2 Remedial Investigation (RI). At this time, only data collected near Kellogg Island by Windward and the Port of Seattle in 2002 meet Phase 2 data requirements. The data now proposed for collection will be used to support the following RI activities: 1) determination of risk to juvenile chinook salmon using a critical tissue residue and dietary approach and 2) determination of risk to piscivorous ROCs including sculpin, eagle, heron, and otter, based on an estimated chemical dose from dietary items including juvenile chinook salmon.

Juvenile chinook salmon will be sampled from two locations in the LDW to estimate chemical exposure during their outmigration through the LDW. These fish will be analyzed as whole body (guts included) composite samples for PCBs, organochlorine pesticides, TBT and lipids based on the results of the Phase 1 ERA and the use of the critical residue approach to assess risk from these chemicals in Phase 2. Collection locations will include one site at the downstream end of the LDW chosen to collect fish near the downstream extent of their LDW migration and another site midway through the LDW near areas with higher sediment concentrations of analytes of interest (i.e., PCBs). Sampling will be conducted during two events, one just before the first hatchery release to characterize tissue residues in wild fish, and another after the last hatchery release (late June/early July) to characterize both hatchery and wild fish. Juvenile chinook will also be sampled upstream of the LDW at RM 13 of the Green River to characterize tissue residues of both wild and hatchery fish before they enter the LDW. One composite sample of hatchery fish will also be collected at the hatchery. Composite samples of stomach contents from hatchery fish will also be collected at the two LDW sites as well as the upstream location. Stomach contents will be analyzed for PAHs (including alkylated PAH homologues), and metals (except mercury). These analytes were selected based on the results of the Phase 1 ERA and the use of a dietary approach to assess risk from these chemicals in Phase 2.

2.3 PROBLEM DEFINITION/BACKGROUND

The Puget Sound chinook salmon, listed as a threatened species under the Endangered Species Act, was a receptor of concern (ROC) in the Phase I ERA conducted for the LDW Phase I Remedial Investigation (RI) and will continue to be an ROC in the Phase 2 ERA. The additional data collected under this QAPP will be used in the Phase 2 ERA.

The exposure scenarios and study design to address these scenarios were determined at a March 4, 2003 meeting with the agencies where both temporal and spatial exposure issues were discussed. The timing and locations of samples were selected to represent a reasonable range of exposure of juvenile chinook in the LDW, taking into account uncertainty in juvenile chinook behavior and the limited sampling that is possible. Juvenile chinook will be collected upstream to assess chemical residues in fish entering the LDW.

To meet these needs, tissues will be collected from two locations: 1) a location at the downstream terminus of the LDW, and 2) a location with relatively higher concentrations of sediment-associated PCBs. Wild fish will be collected before the first hatchery release, and both hatchery and wild fish will be collected after the last release of hatchery-raised juvenile chinook into the Green-Duwamish River. Because some portion of hatchery fish have not had their adipose fins clipped, collection of fish after a hatchery release can result in erroneously identifying hatchery fish as wild. Collection of fish prior to the first release of hatchery fish into the Green-Duwamish River will provide assurance that fish with adipose fins are wild spawned. Collection of fish after the hatchery release will be used to characterize the tissue residues of both hatchery and wild fish following the peak of outmigration. In addition, fish will be checked for coded wire tags to verify status. Unclipped fish without coded wire tags will be assumed to be wild in this sampling event.

Both hatchery and wild fish will be collected upstream of the LDW at RM 13 and hatchery fish will also be collected at the hatchery to examine whether exposure has occurred due to maternal transfer of chemicals (e.g., PCBs) or other sources outside the LDW.

2.4 QUALITY OBJECTIVES AND CRITERIA FOR CHEMICAL MEASUREMENT DATA

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, acceptable, and defensible quality.

Table 2-1 lists specific data quality indicators (DQIs) for each analysis. Interferences in individual samples may result in an increase in the reported detection limits. To achieve the required low detection limits, some modifications to the methods may be necessary. Any modifications required will be documented.

Table 2-1. Data quality indicators for tissue analysis

Parameter	Units	Target Detection Limit	Precision	Accuracy	Completeness	Method	Reference	Sample Holding Time	Container	Preservative
PCBs as Aroclors[a]	µg/kg ww	5.0	±50%	40-160%	90%	GC/ECD	EPA 8082A	1 year to extract, 40 days to analyze	aluminum foil (whole fish) glass jar (homogenate),	freeze/-20°C
DDTs and other organochlorine pesticides[a,b]	µg/kg ww	3.0	±50%	30-150%	90%	GC/ECD	EPA 8081A	1 year to extract, 40 days to analyze	aluminum foil (whole fish) glass jar (homogenate),	freeze/-20°C
PAHs (and alkylated PAH homologues)[c,d,e]	µg/kg ww	1.0[d]	±50%	40-130%	90%	GC/MS	EPA 8270-SIM	1 year to extract, 40 days to analyze	glass jar	freeze/-20°C
Arsenic[c]	mg/kg ww	0.50	±20%	75-125%	90%	ICP-MS	EPA 6020	6 months	glass jar	freeze/-20°C
Cadmium[c]	mg/kg ww	0.80	±20%	75-125%	90%	ICP-MS	EPA 6020	6 months	glass jar	freeze/-20°C
Chromium[c]	mg/kg ww	0.050	±20%	75-125%	90%	ICP-AES	EPA 6010	6 months	glass jar	freeze/-20°C
Copper[c]	mg/kg ww	0.017	±20%	75-125%	90%	ICP-MS	EPA 6020	6 months	glass jar	freeze/-20°C
Lead[c]	mg/kg ww	0.020	±20%	75-125%	90%	ICP-MS	EPA 6020	6 months	glass jar	freeze/-20°C
Silver[c]	mg/kg ww	0.012	±20%	75-125%	90%	ICP-MS	EPA 6020	6 months	glass jar	freeze/-20°C
Zinc[c]	mg/kg ww	4.0	±20%	75-125%	90%	ICP-MS	EPA 6020	6 months	glass jar	freeze/-20°C
TBT[a]	µg/kg ww	2.0	±50%	50-150%	90%	GC/FPD	Stallard et al. 1988	1 year to extract, 40 days to analyze	glass jar	freeze/-20°C

Parameter	Units	Target Detection Limit	Precision	Accuracy	Completeness	Method	Reference	Sample Holding Time	Container	Preservative
Lipids[a]	% ww	na	±30%	na	90%	gravimetric	Bligh and Dyer (1959)	1 year	aluminum foil (whole fish) glass jar (homogenate),	freeze/-20°C
Moisture[a,c]	%	0.1	±20%	na	90%	oven-dried	EPA 160.3	6 months	aluminum foil (whole fish) glass jar (homogenate),	freeze/-20°C

[a] Analyte for whole-body composite sample analysis

[b] Target pesticides include: 4,4'-DDT, 4,4'-DDE, 4,4'-DDD, 2,4'-DDT, 2,4'-DDE, 2,4'-DDD, dieldrin, aldrin, cis- and trans- nonachlor, oxychlordane, cis-and trans-chlordane, mirex, and toxaphene

[c] Analyte for stomach content composite sample analysis

[d] Target PAHs include: anthracene, pyrene, dibenzofuran, dibenzothiophene, benzo(g,h,i)perylene, benzo(e)pyrene, indeno(1,2,3-cd)pyrene, perylene, benzo(b)fluoranthene, fluoranthene, benzo(k)fluoranthene, acenaphthylene, chrysene, benzo(a)pyrene, dibenz(a,h)anthracene, benz(a)anthracene, acenaphthene, phenanthrene, fluorene, 1-methylnaphthalene, naphthalene, 2-methylnaphthalene, and biphenyl. Target alkylated PAH homologs include: C1-chrysenes, C2-chrysenes, C3-chrysenes, C4-chrysenes, C1-dibenzothiophenes, C2-dibenzothiophenes, C3-dibenzothiophenes, C1-fluoranthenes/pyrenes, C1-fluorenes, C2-fluorenes, C3-fluorenes, C1-phenanthrenes/anthracenes, C2-phenanthrenes/anthracenes, C3-phenanthrenes/anthracenes, C4-phenanthrenes/anthracenes, C2-naphthalenes, C3-naphthalenes, C4-naphthalenes

[e] The target detection limit for alkylated PAH homologues may be increased to 5 µg/kg ww, if necessary

GC – gas chromatography

MS –mass spectrometry

ICP – Inductively coupled plasma emission spectrometry

FPD – flame photometric detection

SIM – select ion monitoring

ww – wet weight basis

na – not applicable

The parameters used to assess data quality are precision, accuracy, representativeness, comparability, and completeness. These parameters are discussed in the following sections.

2.4.1 Precision

Precision is the measure of the reproducibility among individual measurements of the same property, usually under similar conditions, such as multiple measurements of the same sample. Precision is assessed by performing multiple analyses on a sample and is expressed as a relative percent difference (RPD) when duplicate analyses are performed and as a percent relative standard deviation (% RSD) when more than two analyses are performed on the same sample (e.g., triplicates). Precision is assessed by duplicate analyses for all parameters except when reference materials are not available or spiking of the matrix is inappropriate; in these cases, precision is assessed by triplicate analyses. Precision measurements can be affected by the nearness of a chemical concentration to the method detection limit, where the percent error (expressed as either % RSD or RPD) increases. The DQI for precision varies depending on the analyte (Table 2-1).The equations used to express precision are as follows:

$$RPD = \frac{|\text{measured conc} - \text{measured duplicate conc}|}{(\text{measured conc} + \text{measured duplicate conc}) \div 2} \times 100$$

$$\%RSD = (SD/D_{ave}) \times 100$$

where

$$SD = \sqrt{\left(\frac{\sum (D_n - D_{ave})^2}{(n-1)} \right)}$$

D	=	sample conc
D_{ave}	=	average sample conc
n	=	number of samples
SD	=	standard deviation

2.4.2 Accuracy

Accuracy is an expression of the degree to which a measured or computed value represents the true value. Accuracy may be expressed as a percentage of the true or reference value for reference material, or as a percent recovery in those analyses where reference materials are not available and spiked samples are analyzed. The DQI for accuracy varies, depending on the analyte (Table 2-1). The equations used to express accuracy are as follows:

For reference materials:

$$\text{Percent of true value} = \frac{\text{measured value}}{\text{true value}} \times 100$$

For spiked samples:

$$\text{Percent recovery} = \frac{\text{spike sample result} - \text{unspiked sample result}}{\text{amount of spike added}} \times 100$$

2.4.3 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent an environmental condition. The sampling approach, described in Section 2.3, was selected to address specific Phase 2 ERA questions.

2.4.4 Comparability

Comparability expresses the confidence with which one data set can be evaluated in relation to another data set. For this investigation, comparability of data will be established through the use of program-defined general methods and reporting formats and the use of common, traceable calibration and reference materials from the National Institute of Standards and Technology or other established sources.

2.4.5 Completeness

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

$$\text{Completeness} = \frac{\text{number of valid measurements}}{\text{total number of data points planned}} \times 100$$

The DQI for completeness for all components of this project is 90%. Data that have been qualified as estimated because the QC criteria were not met will be considered valid for the purpose of assessing completeness. Data that have been qualified as rejected will not be considered valid for the purpose of assessing completeness.

2.5 SPECIAL TRAINING REQUIREMENTS/CERTIFICATION

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. The regulations in 29 CFR 1910.120 require training to provide employees with the knowledge and skills enabling them to perform their jobs safely and with minimum risk to their personal health. All field sampling personnel will have completed the 40-hr HAZWOPER training course and 8-hour refresher courses, as necessary. Additional project-specific health and safety briefings will occur, as described in Section A.11 of the Health and Safety Plan (Appendix A). The 40-hour course meets the OSHA regulation 29 CFR 1910.120(e)(3).

2.6 DOCUMENTATION AND RECORDS

2.6.1 Field operations records

A complete record of all field activities will be recorded in a field logbook maintained by the FC. The field logbook will provide a description of all sampling activities, discussions among field crew associated with field sampling activities, sampling personnel, weather conditions, and a record of all modifications to the procedures and plans identified in this QAPP. The field logbook will consist of bound, numbered pages. All entries will be made in indelible ink. The field logbook is intended to provide sufficient data and observations to enable participants to reconstruct events that occurred during the sampling period.

After sample collection, the following information will be recorded on the field log sheet.

- date and time of collection or logging and name of person logging sample
- names of crew members
- project name
- weather conditions
- area/station location with GPS coordinates
- approximate number of fish caught in net
- number of seining attempts
- comments

If fish are collected for stomach content composites, the following additional information will be recorded on the field log sheet.

- sample identification number
- fish length/size range
- weight of individual fish to the nearest 0.1 g
- weight of stomach content composite to the nearest 0.002 g
- sample type
- total number of fish used per composite

2.6.2 Laboratory records

Laboratories will be responsible for internal checks on sample handling and analytical data reporting and will correct errors identified during the QA review. Close contact will be maintained with the laboratories to resolve any QC problems in a timely manner. The laboratory data package will include the following:

- Project narrative: This summary, in the form of a cover letter, will present any problems encountered during any aspect of analysis. The summary will include, but not be limited to, discussion of quality control, sample shipment, sample storage, and analytical difficulties. Any problems encountered, actual or perceived, and their resolutions, will be documented in as much detail as necessary.
- Records: Legible copies of the chain-of-custody (COC) forms will be provided as part of the data package. This documentation will include the time of receipt and the condition of each sample received by the laboratory. Additional internal tracking of sample custody by the laboratory will also be documented.
- Sample results: The data package will summarize the results for each sample analyzed. The summary will include the following information, when applicable:
  - field sample identification code and the corresponding laboratory identification code
  - sample matrix
  - date of sample extraction/digestion
  - date and time of analysis
  - weight and/or volume used for analysis
  - final dilution volumes or concentration factor for the sample
  - percent moisture in the samples
  - identification of the instruments used for analysis
  - method reporting and quantitation limits
  - all data qualifiers and their definitions
  - a computer diskette containing all of the data
- ***QA/QC summaries***: This summary will contain the results of all QA/QC procedures. Each QA/QC sample analysis will be documented with the same information required for the sample results (see above). The laboratory will make no recovery or blank corrections. The required summaries are listed below; additional information may be requested.
  - Calibration data summary: This summary will contain the concentrations of the initial calibration and daily calibration standards and the date and time of analysis. The response factor, percent relative standard deviation (%RSD), percent difference, and retention time for each analyte will be listed, as appropriate. Results for standards to indicate instrument sensitivity will be reported.

- Internal standard area summary: This summary will report the internal standard areas as appropriate.
- Method blank analysis: This summary will report the method blank analysis associated with each sample and the concentration of all compounds of interest identified in these blanks.
- Surrogate spike recovery: This summary will report all surrogate spike recovery data for organic analyses. The name and concentration of all compounds added, percent recoveries, and QC limits will be listed.
- Matrix spike recovery: This summary will report the matrix spike recovery data for analyses, as appropriate. The name and concentration of all compounds added, percent recoveries, and QC limits will be listed. The relative percent difference for all matrix spike and matrix spike duplicate analyses will be reported.
- Matrix duplicate: This summary will report the RPD for all matrix duplicate analyses. The quality control limits for each compound or analyte will be listed.
- Standard reference material analysis: This summary will report the results of the SRM analyses and list the precision for each analyte.
- Laboratory control analysis: This summary will report the results of the analyses of laboratory control samples The quality control limits for each compound or analyte will be listed.
- Relative retention time: This summary will report the relative retention times for the primary and conformational columns of each analyte detected in the samples, as appropriate. Summaries of retention times and established retention windows for three to five major Aroclor peaks used in quantitation (Form 6B) will be submitted as well as retention time shifts of decachlorobiphenyl (DCB) for both columns used in the analysis.

- **Original data:** Legible copies of the original data generated by the laboratory will be provided, including the following:
  - sample refrigerator temperature logs
  - sample extraction/digestion, preparation, and cleanup logs
  - instrument specifications and analysis logs for all instruments used on days of calibration and analysis
  - reconstructed ion chromatograms for all samples, standards, blanks, calibrations, spikes, replicates, and reference materials
  - enhanced spectra of detected compounds with associated best-match spectra for each sample

- printouts and quantitation reports for each instrument used, including reports for all samples, standards, blanks, calibrations, spikes, replicates, and reference materials
- original data quantification reports for each sample
- original data for blanks and samples not reported

All contract laboratories for this project will submit data both in hard copy and in electronic format. Guidelines for electronic data deliverables for chemistry data are as follows:

- Each row of data should contain only one analyte for a given sample. Therefore, one complete sample will require multiple rows.
- Each row should contain the following information at a minimum: Windward sample identifier, sample matrix, laboratory sample identifier (if used), date of sampling, date of laboratory analysis, laboratory method, analyte name, measured result, laboratory qualifiers, units, and measurement basis.
- If using a spreadsheet file to produce the electronic deliverable, the value representing the measured concentration or detection limit should be formatted to show the correct number of significant figures and should not contain any trailing digits that are hidden in the formatting.
- If using a database program to produce the electronic deliverable, the value representing the measured concentration or detection limit should be stored in a character field, or a field in addition to the numeric result field should be provided to define the correct number of significant figures.
- If a result for an analyte is below the detection limit, the laboratory qualifier should be U, and the value in the result column should be the sample-specific detection limit.
- Laboratory samples for QA/QC should be included and clearly identified in the file with unique laboratory sample identifiers. Additional columns may be used to distinguish the sample type (e.g., matrix spike, matrix spike duplicate).
- If replicate analyses are conducted on a submitted field sample, the laboratory sample identifier must distinguish among the replicates.
- Wherever possible, all analytes and replicates for a given sample should be grouped together.

An example of the acceptable electronic deliverable for analytical chemistry is provided in Table 2-2.

Table 2-2. Example of acceptable organization of electronic deliverable for analytical chemistry

Field Name	Required or Optional
Event Name	Required
COC ID	Required
Lab Sample ID	Required
Matrix	Required
Sample Collection Date/Time	Required
Requested Analysis	Required
Analyte	Required
CAS Number	Required
Date/Time Analyzed	Required
Detection Limit	Required
Reporting Limit	Required
Reporting Limit Type	Required
Sample Result	Required
Units	Required
ResultSigFig	Required
Lab Qualifier	Optional
Analysis Batch	Optional
True Value/Spiked amount	Optional
Percent Recovery	Optional
Upper Limit	Optional
Lower Limit	Optional
Analyst	Required
Dilution	Required
Extraction Batch	Required
Extraction Date/Time	Required
Extraction Method	Required
Percent Moisture	Optional
Lab Notes	Optional
Laboratory	Required

2.6.3 Data reduction

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

2.6.4 Data report

A data report will be prepared documenting all activities associated with the collection, handling, and analysis of samples. At a minimum, the following will be included in the data report:

- summary of all field activities, including descriptions of any deviations from the approved QAPP
- written report of the survey describing survey methodology, equipment, and analysis
- description and map of the sampling locations
- enumeration of the species collected in seining attempts
- photocopies of field notebooks
- summary of the QA/QC review of the analytical data
- laboratory records as described in Section 2.6.2

Data will be validated within 20 working days of receiving data packages from the respective laboratories. A draft data report will be submitted within 60 working days from Phase 2 Work Plan approval. A final data report will be submitted within 30 working days from receipt of EPA and Ecology comments.

3.0 Data Generation and Acquisition

This section describes the methods that will be used to collect the fish and process and store the collected tissues. Elements include experimental design, fish collection methods, decontamination procedures, sample handling and custody requirements, analytical methods, quality control, instrument/equipment testing, inspection and maintenance, instrument calibration, supply inspection/acceptance, and data management.

3.1 EXPERIMENTAL DESIGN

To meet the study objectives as presented in Section 2.3, composite whole body and stomach content tissue samples will be collected at two locations in the LDW on two dates (Table 3-1). Figure 3-1 presents the primary and alternative locations of samples to be collected. The two primary locations in the LDW are Slip 4 (MWa), representing potentially higher exposure to sediment-associated PCBs, and the downstream terminus of the LDW near Kellogg Island (LWa), representing exposure experienced after passage of juvenile chinook salmon through the entire LDW. The Slip 4 location was selected because sediment concentrations of PCBs in this area are generally higher relative to other areas in the LDW and because juvenile chinook salmon collected from this location (NMFS 2002) had higher whole body PCB concentrations relative to those collected near Kellogg Island. The LDW terminus location was selected because, in theory, concentrations of chemicals in juvenile chinook salmon at the terminal end of their outmigration would reflect an integration of their exposure throughout the LDW site. Alternative locations will be sampled if samples cannot be collected at the primary locations. Prioritization will be as follows. At the downstream terminus of the LDW, attempts will be made to sample stations in the following order: LWa, LWb, LWc, LWd (Figure 3-1). At the stations in the middle of the LDW (i.e., around Slip 4), attempts will be made to sample stations in the following order: MWa, MWb, MWc, MWd (Figure 3-1). Fishing will continue at each subsequent station until enough individuals are caught or until three or fewer juvenile chinook salmon suitable[3] for tissue analysis are captured in four consecutive attempts. Subsequent stations will be sampled only if required to collect sufficient tissue for analysis. If fish are caught at multiple locations representing the lower or mid waterway, fish will be composited in lower or mid waterway composite samples, but if possible, fish from the same location will be composited together.

[3] In the early May sampling, juvenile chinook of less than 100 mm with intact adipose fins will be targeted. In the June sampling, subyearling hatchery fish will be identified as adipose-clipped juvenile chinook and wild fish will be identified as non-adipose-clipped juvenile chinook. Other closely related fish that may be present at this time include juvenile chum salmon, juvenile coho salmon, yearling hatchery chinook salmon, juvenile steelhead, and juvenile cutthroat trout. Species and origin (hatchery vs. wild) will be verified for juvenile chinook samples by a Taylor and Associates fisheries biologist for LDW samples and by Tom Nelson in the Green River samples.

Table 3-1. Number of composite samples collected at each area[a]

	MAY				JUNE/JULY		
	MW	LW	HATCHERY	RM 13	MW	LW	RM 13
Wild fish	3	3		3	3	3	3[b]
Hatchery fish			1		3	3	3
Hatchery fish stomach contents					1	1	1

[a] Each wild fish composite consists of 9 individual whole-body fish in the May samples and 8 individual whole-body fish in the June/July samples; hatchery fish composites will be comprised of a sufficient number of individual whole body fish to make a composite sample weighing at least 50 g.

[b] An effort will be made to collect these samples; however, wild juvenile chinook outmigrant data collected by King County in 2001 show that insufficient fish may be available for collection of these samples.

MW represents a mid waterway station; LW represents a lower waterway station (see Figure 3-1)

In addition, King County, with assistance from Windward, will collect samples upstream of the LDW at RM 13 under a separate endangered species take permit, as the permit allows (Table 3-1, Figure 3-1). Though there is a remote possibility that outmigrant juvenile chinook from the LDW may move back upstream to this location, best professional judgment suggests that such movement is highly unlikely. Data from Warner and Fritz (1995) show that the upstream extent of saltwater influence in the LDW is approximately RM 6.5[4] until extreme low flow events in August when saltwater was detected at approximately RM 10[4] during high tide. In three years of monitoring at the RM 13 sampling site, flow reversal has never been observed (Nelson 2003). Because juvenile chinook salmon would have to move 7 miles upstream, it is highly unlikely that juvenile chinook salmon that previously occupied the LDW would be captured at the RM 13 sampling site. Hatchery and wild fish will be collected by beach seine at this location. Actual sampling areas will be recorded and included in the data report (see Section 5.0).

The sampling dates shown in Table 3-1 are tentative dates dependent on hatchery release dates. The first round of sampling will occur two to three days prior to the first release of hatchery fish into the Green River. If samples are difficult to obtain after one day of sampling, the Windward PM will contact the EPA and Ecology PMs to discuss a course of action. The second round of sampling in the LDW will be conducted after the last hatchery release, is targeted for the last week of June or the first week of July.

[4] RMs reported for these sampling locations are different than those derived from river kilometers reported in Warner and Fritz (1995). In this QAPP, RMs are defined relative to the upstream end of West Waterway.

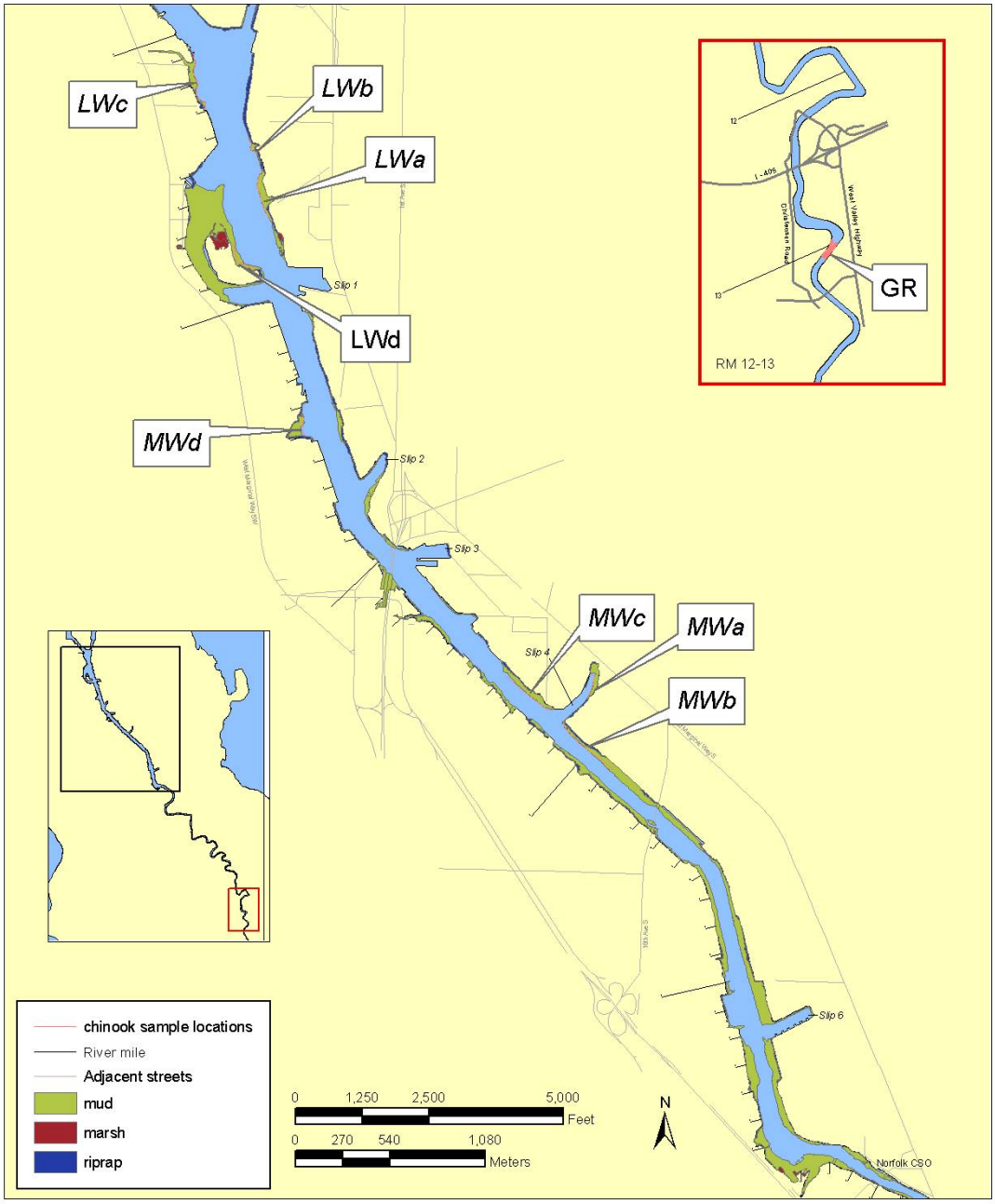

Figure 3-1. Proposed LDW juvenile chinook sampling areas

The exact sampling date will be determined by consulting with Tom Nelson of King County who will be conducting beach seining in the LDW. When Mr. Nelson indicates that the number of wild juvenile chinook in the LDW is diminishing, the Windward PM will contact the EPA and Ecology PMs to set the sampling date. If insufficient fish tissue and stomach contents are collected after attempts at all sites over a period of two days in June/July, the Windward PM will contact the EPA and Ecology PMs to determine a course of action. A maximum of four days effort will be conducted for the June/July sampling event. The hatchery sample will be collected at the Soos Creek Hatchery in May. In both the May and June/July sampling events, the upstream samples will be collected a few days before the LDW samples. May sampling will be coordinated with the Soos Creek Hatchery Manager, Mike Wilson. The FC will contact Mr. Wilson the first week of May to determine the likely release date and Mr. Wilson will call the FC approximately one week before release to confirm the planned release date. Contact information for Mike Wilson is as follows:

Mike Wilson
Hatchery Manager, Soos Ck. Hatchery
Washington Department of Fish and Wildlife
13030 Auburn Black Diamond Rd.
Auburn, WA 98092
Telephone: 253.931.3950

During the first sampling event, only wild fish will be captured. During the second event, both wild and hatchery fish will be captured. Wild fish will be distinguished from hatchery fish by the presence of an intact adipose fin or a coded wire tag, although it is acknowledged that a small percentage of the hatchery fish may not be fin-clipped due to inefficiencies of the machines.

Table 3-1 presents numbers of composite samples to be collected at each location. Hatchery and wild fish will be composited separately. Each composite sample of wild fish will comprise 8 or 9 individual fish due to permitting constraints. Each composite sample of hatchery fish will comprise approximately 12 fish. The number of hatchery fish per composite was chosen to provide sufficient sample volume for chemical analysis. In the June/July samples, each hatchery fish will be approximately 5-7 g, resulting in a total weight for each composite sample of approximately 60 g. Collection of wild fish is limited in the take permit to 100 fish, thus 9 fish per composite for the May samples and 8 fish per composite for the June/July samples was selected to maximize the amount of tissue, number of composites, number of locations, and number of sampling events.[5] Assuming 3-5 g per wild fish in the May samples, composite samples of wild fish are likely to weigh approximately 27-45 g. Assuming 5-7 g in the June/July samples, composite samples of wild fish are likely to weigh approximately 40-56 g. Because the number of hatchery fish available is not

[5] The wild fish collected at RM 13 will be collected under the King County take permit, and thus are not included in the 100 fish restriction on the Port of Seattle take permit.

limited, sufficient numbers of hatchery fish will be composited to obtain the target analytical mass. If possible within the limitations of analytical tissue requirements, composites of wild and hatchery fish will include the same number of fish. At each LDW location, three composite samples each of wild and hatchery fish will be collected to provide some measure of the variation between events and among locations. One composite sample of 12 hatchery fish weighing at least 50 g will be collected from the Soos Creek Hatchery. Whole fish will be composited with guts included.

In addition, sufficient fish will be collected to form a single composite sample of hatchery fish stomach contents from each of the two LDW locations and the upstream site if possible (Table 3-1, Figure 3-1). At each site, stomach contents from at least 20 hatchery fish will be collected to obtain a single composite sample weighing at least 15 g.[6]

3.2 SAMPLING METHODS REQUIREMENTS

All field activities will be performed under the direction of the FC. Sampling will be accomplished by a joint operation of Windward and Taylor. Sampling in the LDW will be conducted by boat, which will be staffed, at a minimum, with the captain, two field technicians, and the FC.

3.2.1 Sample identification

Unique alphanumeric sample numbers will be assigned to each individual and each composite sample. The first three characters are "LDW" to identify the Lower Duwamish Waterway project area. The next two characters identify the specific sampling area; "LWa", "LWb", "LWc", or "LWd" for the Lower Waterway locations a-d, "MWa", "MWb", "MWc" or "MWd" for mid waterway locations a-d, and "GR" for those collected at RM 13 of the Green River. Following these identifiers, "H" or "W" designates hatchery or wild fish. The next identifier will be either "SC" or "WF" for stomach contents or whole fish. The next identifier will be either "I" or "comp" for individual or composite. The final identifier is a sample number. For example, the sample identifier LDW-LWa-W-WF-I-01 would represent an individual wild fish collected from the lower waterway location a. Each individual fish will have a unique alphanumeric sample number and will also be part of a composite sample. The compositing scheme will accompany the fish to the analytical lab and will specify which individual fish to include in each composite (see Section 3.2.2.2) and the resulting composite identifier (e.g., LDW-LWa-W-WF-comp-01).

[6] The target mass of 15 g is based on contract laboratory tissue recommendations for the analysis of PAH compounds, alkylated PAH homologues, TBT and metals (except mercury).

3.2.2 Field operations and sample collection equipment

The following sections provide information on vessel positioning and sampling methods for sediment collection.

3.2.2.1 Navigation and positioning

A handheld global positioning system (GPS) receiver unit will be used to obtain coordinates in the sampling areas. Coordinates will be taken at the starting location of each beach seine deployment. The GPS unit will receive radio broadcasts of GPS signals from satellites to produce positioning accuracy to within 1-2 m. Washington State Plane coordinates North (NAD 83) will be used for the horizontal datum.

Locations of seining activities will also be identified by reference to landmarks. The crew will note place names or approximate distances to nearby landmarks and photo-document the seining locations. The FC will ensure that specimens are collected within the areas specified in Figure 3-1.

3.2.2.2 Fish collection methods

Fish will be captured in the field using a standard beach seine measuring 37 m long and 3 m deep, with 6-mm mesh in the wings and 5-mm mesh in the center bag. The seine is equipped with floats to minimize snagging of the lead line on submerged pilings, riprap, and other debris, and 30-m ropes to haul the net to shore. To avoid contamination, the beach seine will be cleaned of all debris before being deployed. The net will be deployed 30 m from shore and parallel to the beach using an outboard-powered boat and three or four workers. One or two workers will stand on shore holding the 30-m rope attached to one end of the net until the reversing boat pulls the rope taut. Once the rope is taut, another worker will feed the net from the bow of the boat into the water as the skipper slowly motors in reverse to lay out all the net parallel to shore. The rope on the opposite end of the net will then be motored to shore, and the person who had been in the bow of the boat deploying the net will jump ashore with the rope end to assist with retrieving the net. Teams of one or two workers will then stand at each end of the net, approximately 40 m apart, to pull the net toward shore at a steady rate. When the net is approximately 10 m from shore, the two teams will move together until they are about 10 m apart for the final hauling of the net up onto the shore.

The net will be deployed at low tide, as close to slack water as possible. Prior to each deployment, the area, time of day, and weather conditions will be recorded.

Individual juvenile chinook salmon captured in the beach seine will be removed from the net by hand and placed in 5-gal buckets filled with ice. Fish of similar size will be preferentially selected. All fish will be inspected carefully to ensure that their skin and fins have not been damaged by the sampling equipment, damaged specimens will not be accepted. Fish that are not selected will be returned to the LDW using techniques to minimize harm to these fish. Holes will be drilled in the bottom of each

bucket to allow the melting ice to drain. Ice will be made from distilled water. Use of ice to stun small fish is recommended by EPA (2000).

Upstream wild fish will be collected at RM 13 of the Green River by Tom Nelson via beach seine with assistance from Windward Environmental. The methods employed will be the same as those described above, except that a 18 m (60 ft) long net will be used and the net will be swept downstream, perpendicular to the shore before hauling it in.

Once the sampling is completed at an area, whole fish will be rinsed with distilled water to remove any debris, measured to the nearest mm and weighed to the nearest 0.1 g, individually wrapped in aluminum foil, enclosed in individual Ziploc® bags with an identification label, also enclosed in a Ziploc® bag. All packaged individual specimens from a particular area will be kept together in one large Ziploc® bag with the date and area recorded on the outside of the bag with indelible ink. The iced fish will be transported in coolers to Windward.

At Windward, the FC will review the length and weight information and determine which fish will be assigned to each of the composite samples. Composite samples within each of the sampling groups will be formed to composite similarly sized fish (e.g., smaller fish will be grouped with other smaller fish). The individual and composite sample identifiers will be entered on the specimen collection log sheet. Immediately after the specimens have been processed, they will be stored in coolers supplied with ice or frozen blue ice. The coolers will be delivered to ARI within 24 hrs of processing.

Stomachs of hatchery fish not collected for whole body analysis will be surgically removed at the time of sampling on shore near the collection site. Fish will be killed by severing the spinal column just behind the head. Individual fish will be measured and weighed. Fish will be cut from the anal vent to the head and the entire GI tract removed. Fish will be checked for the presence of a coded wire tag. If a tag is detected it will be excised for later determination of the origin of the fish. Hatchery fish sacrificed for gut contents will be disposed of in a plastic bag and landfilled. Each stomach will be cut open and the gut contents scraped out. Fullness of the gut and distinguishable prey contents will be noted. In the field, gut contents will be weighed to the nearest 0.002 g and composited together with those from all fish from a given location. A composite will be complete when the accumulated gut contents weigh at least 15 g and gut contents from at least 20 fish have been accumulated. Composite samples will be collected in tared scintillion vials, enclosed in individual Ziploc® bags with an identification label, and transferred to a large Ziploc® bag with the date and area recorded on the outside of the bag with indelible ink. The iced samples will be transported within 24 hrs to ARI for homogenization.

3.2.3 Decontamination procedures

Potential sources of contamination in the field include sampling equipment, sediment, boat engine exhaust, and dust. Sample handling will be minimized and sources of contamination will be carefully avoided. To minimize potential contamination by sediment, fish will be rinsed with distilled water and shaken before they are wrapped in aluminum foil and placed in Ziploc® bags. The beach seine will be cleaned of all debris before being deployed. To avoid potential contamination from ice, whole fish will be wrapped in aluminum foil and placed in watertight plastic bags, and the crushed ice will be placed in separate plastic bags.

To minimize sample contamination, the following practices will be followed:

- caught fish will only be placed on clean surfaces, such as aluminum foil (dull side touching the fish)
- ice chests will be cleaned prior to any sampling activities
- samples will be placed in sealable, waterproof plastic bags to avoid contamination from melting ice
- sampling equipment will be free from contaminants such as oils, grease, and fuels
- all utensils or equipment used directly in handling fish (e.g., such as measuring boards) will be cleaned in the laboratory prior to each field sampling effort and placed in aluminum foil

The field collection team will clean this equipment between sampling sites by rinsing with ambient water rewrapping in aluminum foil.

3.3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Sample custody is a critical aspect of environmental investigations. Sample possession and handling must be traceable from the time of sample collection, through laboratory and data analysis, to the time sample results are ready to be introduced as evidence. This section describes the minimum program requirements for sample handling and custody procedures.

3.3.1 Sample custody procedures

Samples are considered to be in custody if they are: 1) in the custodian's possession or view; 2) in a secured place (under lock) with restricted access; or 3) in a container that is secured with an official seal(s) such that the sample cannot be reached without breaking the seal(s). The principal documents used to identify samples and to document possession are field logbooks and chain of custody (COC) forms. . Custody procedures will be used for all samples throughout the collection, transport, and analytical process, and for all data and data documentation whether in hard copy or electronic format. Custody procedures will be initiated during sample collection. A

COC form will accompany samples to the laboratory. Each person who has custody of the samples will sign the COC form and ensure that the samples are not left unattended unless properly secured. Minimum documentation of sample handling and custody will include:

- sample location, project name, and unique sample number
- sample collection date and time
- any special notations on sample characteristics or problems
- initials of the person collecting the sample
- date sample was sent to the laboratory
- shipping company name and waybill number

The laboratory PMs at each laboratory will ensure that COC forms are properly signed upon receipt of the samples and will note questions or observations concerning sample integrity on the COC forms. The laboratories will contact the QA/QC Coordinator immediately if discrepancies are discovered between the COC forms and the sample shipment upon receipt. The temperature inside the cooler(s) will be checked upon receipt of the samples. The laboratory PM will specifically note any coolers that do not contain ice packs or that are not sufficiently cold (4 ± 2 °C) upon receipt. The laboratory PM shall immediately inform the Windward PM of any unsuitable samples. The Windward PM will discuss with EPA the suitability of the sample. Any specimen deemed unsuitable for further processing and analysis should be discarded and identified on the sample processing record.

Each sample will be assigned a unique laboratory number, and samples will be grouped in appropriate sample delivery groups.

All samples will be handled so as to prevent contamination or loss of any sample. Samples will be assigned a specific storage area within the laboratory and will be kept there until analyzed.

The laboratory PM will ensure that a sample-tracking record follows each sample through all stages of laboratory processing. The sample-tracking record must contain, at a minimum, the name/initials of responsible individuals performing the analyses, dates of sample extraction/preparation and analysis, and the type of analysis being performed.

3.3.2 Shipping requirements and receipt

The FC will be responsible for all sample tracking and custody procedures for samples in the field. She will be responsible for final sample inventory and will maintain sample custody documentation. She will also complete COC forms prior to removing samples from the sampling area. At the end of each day, and prior to transfer, COC entries will be made for all samples. Finally, information on the labels will be checked against sample log entries and sample tracking forms and samples

will be recounted. COC forms will accompany all samples. The COC forms will be signed at each point of transfer. Copies of all COC forms will be retained and included as appendices to QA/QC reports.

Sample coolers containing samples for homogenization will be hand delivered by Windward personnel to ARI in Seattle, WA. Prior to delivery, sample containers will be securely packed inside a cooler with frozen blue ice packs or crushed ice. For chemical analysis, sample coolers containing homogenized samples will be delivered frozen (-4°C) within 24 hrs to lab. Prior to shipping or hand delivery, sample containers will be wrapped in bubble wrap and securely packed inside a cooler with frozen blue ice packs or crushed ice. The original signed COC forms will be placed in a sealable plastic bag, sealed, and taped to the inside lid of the cooler. Fiber tape will be wrapped completely around the cooler. On each side of the cooler a *This Side Up* arrow label will be attached; a *Handle with Care* label will be attached to the top of the cooler, and the cooler will be sealed with a custody seal in two locations.

The laboratory PM will ensure that COC forms are properly signed upon receipt of the samples, and will note questions or observations concerning sample integrity on the COC records. The laboratory PM will contact the FC immediately if discrepancies between the COC forms and the sample shipment are discovered upon receipt. The laboratory QA Officer will specifically note any coolers that are not sufficiently cold upon receipt. The laboratory will not dispose of the environmental samples for this project until notified by the PM or FC.

3.4 ANALYTICAL METHODS

Tissue homogenization of the composite samples will be done at the ARI laboratory. For whole body samples, 8 to 9 wild fish or at least 50 g of whole hatchery fish will be homogenized to form one composite sample. For stomach contents samples, stomach contents from at least 20 fish will be homogenized to form one composite weighing at least 15 g. Tissue processing will occur within 24 hours of receipt at the laboratory. Laboratory SOPs for tissue homogenization are presented in Appendix B. Individual whole body fish will be homogenized together to form a composite sample according to the compositing plan described in Section 3.2.2.2. Individual stomach contents will be homogenized together to form a single composite for each collection site. In order to achieve the targeted detection limits (Table 2-1), the tissue and stomach contents samples analyzed for organic analytes will be soxhlet extracted and the extracts will be submitted for gel permeation chromatography as well as florisil and/or silica gel columns to remove lipids and other potential sources of analytical interference. The methods of chemical analysis are identified in Table 2-1. All methods selected represent standard methods used for the analysis of these analytes in tissue. The laboratory will analyze the whole body tissue samples for percent moisture, percent lipids, TBT, PCBs as Aroclors, and DDTs and other organochlorine pesticides. The stomach content samples will be analyzed for metals (except mercury), and PAHs and alkylated PAH homologues. The laboratory quality control samples will consist

of method blanks, laboratory control samples, matrix spikes, and matrix spike duplicates. Analytical data will be validated. The laboratory project manager will determine the remedy to be utilized if the project method detection limit (MDL) cannot be attained in consultation with Windward QA/QC manager and the EPA.

The laboratory will provide the chemical analysis results within 20 working days following the delivery of the samples.

3.5 QUALITY ASSURANCE/QUALITY CONTROL

Before analyzing the samples, the laboratory must provide written protocols for the analytical methods to be used, calculate MDLs for each analyte in each matrix of interest, and establish an initial calibration curve for all analytes. The laboratory must demonstrate their continued proficiency by participation in interlaboratory comparison studies and through repeated analysis of certified reference materials, calibration checks, laboratory reagent blanks, and spiked samples.

3.5.1 Determination of method detection limits

The MDL is defined as the lowest concentration of an analyte or compound that a method can detect in either a sample or a blank with 99% confidence. The laboratories determine MDLs using standard procedures outlined in 40CFR§136. In summary, seven replicate samples will be fortified at 1 to 5 times (but not to exceed 10 times) the expected MDL concentration. The MDL is then determined by calculating the standard deviation of the replicates and multiplying by a factor of 3.14.

3.5.2 Sample delivery group

Project and/or method specific quality control measures such as matrix spikes and matrix duplicates will be analyzed per sample delivery group (SDG) or sample batch. An SDG is defined as no more than 20 samples or a group of samples received at the laboratory within a two-week period. Although an SDG may span two weeks, all holding times must be met for each analytical method.

3.5.3 Laboratory quality control criteria

The analyst will review results of QC analyses from each sample group immediately after a sample group has been analyzed. The QC sample results will then be evaluated to determine whether control limits have been exceeded. If control limits are exceeded in the sample group, the QA/QC Coordinator will be contacted immediately, and corrective action, such as method modifications followed by reprocessing of the affected samples, will be initiated before processing a subsequent group of samples.

All primary chemical standards and standard solutions used in this project will be traceable to the National Institute of Standards and Technology, Environmental Resource Associates, National Research Council of Canada, or other documented, reliable, commercial sources. Standards will be validated to determine their accuracy

by comparison with an independent standard. Any impurities found in the standard will be documented. The following sections summarize the procedures that will be used to assess data quality throughout sample analysis. Table 3-2 summarizes the QC procedures to be performed by the laboratory, which follow EPA guidelines (EPA 2000). The associated control limits for precision and accuracy are summarized in Table 2-1.

Analytical Replicates

Analytical replicates provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Analytical replicates are subsamples of the original sample that are prepared and analyzed as a separate sample, assuming sufficient sample matrix is available. A minimum of one replicate will be analyzed for each sample group or for every 20 samples, whichever is more frequent. The only exception will be for the stomach contents sample, due to limited tissue available for this matrix no analytical replicate will be run. A triplicate analysis will be performed for analyses where no other QC is available, such as percent lipid and percent moisture, and will follow the same guidelines as a replicate.

Matrix Spikes and Matrix Spike Duplicates

The analysis of matrix spike samples provides information on the extraction efficiency of the method on the sample matrix. By performing duplicate matrix spike analyses, information on the precision of the method is also provided for organic analyses. A minimum of one matrix spike will be analyzed for each sample group or for every 20 samples, whichever is more frequent, when possible. The full suite of target compounds will be used in the MS/MSD spike with the exception of toxaphene.

Surrogate Spikes

All project samples analyzed for organic compounds will be spiked with appropriate surrogate compounds as defined in the analytical methods. Surrogate recoveries will be reported by the laboratories; however, no sample results will be corrected for recovery using these values. In addition the laboratory shall add DCB surrogate to all samples and standards analyzed.

Method Blanks

Method blanks are analyzed to assess possible laboratory contamination at all stages of sample preparation and analysis. A minimum of one method blank will be analyzed for each extraction/digestion batch or for every 20 samples, whichever is more frequent.

Standard Reference Material

Standard reference materials (SRMs) are samples of similar matrix and of known analyte concentration, processed through the entire analytical procedure and used as

an indicator of method accuracy. A minimum of one SRM will be analyzed for each sample group or for every 20 samples, whichever is more frequent. Tissue SRMs are available for all analytes. A mussel tissue SRM is available for PCBs and PAHs. A dogfish fillet SRM is available for metals. The SRM for PCBs reports the PCB concentrations on a congener rather than an Aroclor basis, and therefore, will not be analyzed for this project.

Table 3-2. Laboratory QC sample analysis summary

Analysis Type	Initial Calibration	Continuing Calibration	Matrix Duplicate or Replicates	Matrix Spikes[B]	Matrix Spike Duplicates[B]	Method Blanks	Surrogate Spikes
PCBs/pesticides[a]	Prior to analysis	Every 10-12 analyses or 12 hrs	1 per batch or SDG	1 per batch or SDG	1 per batch or SDG	1 per batch or SDG	Each sample
PAHs and alkylated PAH homologues	Prior to analysis	Every 10-12 analyses or 12 hrs	1 per batch or SDG	1 per batch or SDG	1 per batch or SDG	1 per batch or SDG	Each sample
Metals (except mercury)	Prior to analysis	Every 10 samples or 2 hrs	1 per batch or SDG	1 per batch or SDG	na	1 per batch or SDG	na
TBT	Prior to analysis	Every 10 samples or 2 hrs	1 per batch or SDG	1 per batch or SDG	1 per batch or SDG	1 per batch or SDG	Each sample
Lipids	Daily	na	1 per batch or SDG	na	na	na	na
Percent moisture	na	na	1 per batch or SDG	na	na	na	na

[a] -If an Aroclor is detected in a sample, the detected Aroclor must be analyzed within 72 hrs of detection and within a valid 12 hr sequence.

[b] –Matrix spikes will include all targeted metals, PAHs, pesticides (except toxaphene), and PCB Aroclors 1016 and 1260.

na – not applicable

SDG – sample delivery group (will not exceed 20 samples)

3.6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION AND MAINTENANCE

The FC will be responsible for overseeing the testing, inspection, and maintenance of all field equipment. The scale is the only field equipment that will require calibration.

The laboratory project manager will be responsible for laboratory equipment testing, inspection, and maintenance requirements are met. The calibration methods used in calibrating the analytical instrumentation are described in the following section.

3.7 INSTRUMENT CALIBRATION AND FREQUENCY

Multipoint initial calibration will be performed on each instrument at the start of the project, after each major interruption to the analytical instrument, and when any continuing calibration does not meet the specified criteria. The number of points used in the initial calibration is defined in each analytical method. Continuing calibrations will be performed daily to ensure proper instrument performance.

The only field equipment requiring calibration is the analytical scale. An Ohaus Scout II SC4010 analytical scale with readability to 0.1 g will be used for weighing fish. An Ohaus CT10 with readability to 0.002 g will be used for weighing stomach contents. The scales will be calibrated using each scale's internal calibration before weighing samples at each sampling event. Scales will be tared before each sample is weighed.

Calibration of analytical equipment used for chemical analysis includes instrument blanks or continuing calibration blanks, which provide information on the stability of the baseline established. Continuing calibration blanks will be analyzed immediately after the continuing calibration verification at a frequency of one blank for every 10 samples analyzed for inorganic analyses and one blank for every 12 hours for organic analyses. If the continuing calibration does not meet the specified criteria, the analysis must stop. Analysis may resume after corrective actions have been taken to meet the method specifications. All project samples analyzed by an instrument found to be out of compliance must be reanalyzed.

3.8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

The FC will be responsible for ensuring that all supplies necessary to conduct sampling and to package and record samples are available and in good working order for the duration of each sampling event. The FC will generate a checklist of all supplies needed to conduct sampling and use the checklist to confirm that all necessary supplies are available at the beginning of each sampling event. The FC will monitor supplies and equipment throughout sampling and replenish supplies as necessary.

3.9 NON-DIRECT MEASUREMENTS

No non-direct measurements will be used for this project.

3.10 DATA MANAGEMENT

Analytical laboratories are expected to submit data in both electronic and hard copy format as discussed in Section 2.6.2. The laboratory PM should contact the QA/QC Coordinator prior to data delivery to discuss specific format requirements. All electronic data submitted to the agencies will be in a format compatible with SEDQUAL.

A library of routines will be used to translate typical electronic output from laboratory analytical systems and to generate data analysis reports. The use of automated routines ensures that all data are consistently converted into the desired data structures and that operator time is kept to a minimum. In addition, routines and methods for quality checks will be used to ensure such translations are correctly applied.

Written documentation will be used to clarify how field and laboratory duplicates and QA/QC samples were recorded in the data tables and to provide explanations of other issues that may arise. The data management task will include keeping accurate records of field and laboratory QA/QC samples so that project team members who use the data will have appropriate documentation.

In addition to placing all data and identifiers in an electronic database, hard copies of all original analytical data or study records will be placed in a library filing system. Each analytical data set or document will be given a unique code based on the original source of the data or information, and filed based on that code. A master list of all filed documents, sorted in order by filing code, will be maintained for easy retrieval from the library. Data management files will be stored on a secure computer or on a removable hard drive that can be secured.

After the data have been validated, all original data and documentation generated by the laboratories will be kept in a secure location for seven years. COC procedures will be followed for all laboratory data and data documentation, whether in hard copy or electronic format. All laboratory data and data documentation, including electronic data files, will be submitted to the QA/QC Coordinator for validation.

4.0 Assessment/Oversight

This section presents plans for assessment and response actions as well as reports to management.

4.1 ASSESSMENTS AND RESPONSE ACTIONS

This section describes how the project's activities will be assessed during the project to ensure that the QAPP is being implemented as approved.

4.1.1 Assessments

Laboratory and field performance assessments consist of on-site reviews of quality assurance systems and equipment for sampling, calibration, and measurement. EPA personnel may conduct a laboratory audit prior to sample analysis. Any pertinent laboratory audit reports will be made available to the QA/QC Coordinator upon request. All laboratories are required to have written procedures addressing internal QA/QC, method SOPs, and MDLs and reporting limits; these procedures will be submitted for review by the QA/QC Coordinator and the EPA QA officer to ensure compliance with the QAPP. All laboratories and QA/QC Coordinators are required to ensure that all personnel engaged in sampling and analysis tasks have appropriate training.

4.1.2 Response actions for field sampling

The FC or a designee will be responsible for correcting equipment malfunctions throughout the field sampling effort and resolving situations in the field that may result in nonconformance or noncompliance with the QAPP. There may be contingencies during field activities that require modification of the general procedures outlined in Section 3.2. Modification of procedures will be at the discretion of the FC after consultation with the PM, Taylor Associates, and Tom Nelson. EPA and LDWG will be notified if significant deviations from the QAPP are required. All corrective measures will be documented in the field logbook, and sample alteration forms will be completed (see Attachment 1).

4.1.3 Corrective action for laboratory analyses

All laboratories are required to comply with the standard operating procedures previously submitted to the QA/QC Coordinator. The laboratory PMs will be responsible for ensuring that appropriate corrective actions are initiated as required for conformance with this QAPP. All laboratory personnel will be responsible for reporting problems that may compromise the quality of the data.

The QA/QC Coordinator will be notified immediately if any QC sample exceeds the project-specified control limits (Table 2-1). The analyst will identify and correct the anomaly before continuing with the sample analysis. The laboratory PM will document the corrective action taken in a memorandum submitted to the QA/QC Coordinator within 5 days of the initial notification. A narrative describing the anomaly, the steps taken to identify and correct it and the treatment of the relevant sample batch (i.e., recalculation, reanalysis, re-extraction) will be submitted with the data package in the form of a corrective action form (see Attachment 2).

4.2 REPORTS TO MANAGEMENT

Progress reports will be prepared by the Windward FC following each sampling event and by the QA/QC manager after the sampling is completed and samples have been

submitted for analysis, when information is received from the laboratory, and when analysis is complete. The status of the samples and analysis will be indicated with emphasis on any deviations from the Project QAPP. These reports shall be delivered electronically to LDWG and the EPA, Ecology, and Windward PMs.

A data report will be written after validated data are available for each sampling event, as described in Section 2.6.4. These reports will be delivered electronically to LDWG and the EPA, Ecology, and Windward PMs.

5.0 Data Validation and Usability

The following sections present plans for data review, validation and verification requirements and methods, and reconciliation with data quality objectives.

5.1 Data Review, Validation, and Verification Requirements

Data are not considered final until validated. All data, including laboratory and field QC sample results, will be summarized in a QA summary report. The QA summary reports will focus on data that did not meet the DQOs. The QA summary reports will be included as an appendix to the data report. The summary reports will also describe any deviations from this QAPP and actions taken to address those deviations.

5.2 Validation and Verification Methods

Data validation, initiated in the laboratory, is a process in which data are reviewed and evaluated by supervisory personnel or QA specialists within the laboratory. The laboratory analyst is responsible for ensuring that the analytical data are correct and complete, that appropriate procedures have been followed, and that quality control results are within the acceptable limits. The QA/QC Coordinator is responsible for ensuring that all analyses performed by the laboratories are correct, properly documented, and complete, and that they satisfy the project DQOs and DQIs specified in this QAPP.

Independent third-party data review and full validation of the analytical chemistry data will be conducted by Cari Sayler of Sayler Data Solutions. Twenty percent of the validated data will be peer reviewed by the EPA QA Office for oversight.

Quality assurance review of the tissue chemistry data will be performed in accordance with the QA/QC requirements (described in Section 3.6), the technical specifications of the methods and the National Functional Guidance for Organic and Inorganic Data Review (EPA 1999, 2002b).

All discrepancies and requests for additional, corrected data will be discussed with the laboratories prior to issuing the formal data validation report. All contacts with the laboratories will be documented in a communication report. Review procedures used and findings made during data validation will be documented on worksheets. A

validation report will be prepared for each matrix; that report will summarize quality control results, qualifiers, and possible data limitations. Only validated data with appropriate qualifiers will be released for general use.

5.3 RECONCILIATION WITH DATA QUALITY OBJECTIVES

Data Quality Assessment will be conducted by the Windward QA/QC manager in consultation with the EPA QA office. The results of the third-party independent review and validation will be reviewed, and cases where the project DQOs or DQIs were not met will be identified. The usability of the data will be determined in terms of the magnitude of the DQO exceedance.

6.0 References

EPA. 1997. Recommended guidelines for sampling marine sediment, water column, and tissue in Puget Sound. US Environmental Protection Agency, Region 10, Seattle, WA.

EPA. 1999. Contract laboratory program national functional guidelines for organic data review. EPA540/R-99/008. Office of Emergency and Remedial Response, US Environmental Protection Agency, Washington, DC.

EPA. 2000. Guidance for assessing chemical contaminant data for use in fish advisories, vol 1 - fish sampling and analysis. Third ed. EPA 823-B-00-007. Office of Water, US Environmental Protection Agency, Washington, DC.

EPA. 2002a. Guidance for quality assurance project plans. EPA QA/G-5, Quality staff, Office of Environmental Information, US EPA, Washington, DC.

EPA. 2002b. Contract laboratory program national functional guidelines for inorganic data review. EPA540/R-01/008. Office of Emergency and Remedial Response, US Environmental Protection Agency, Washington, DC .

EPA. 2003. Quality assurance review memorandum. February 10, 2003. US Environmental Protection Agency, Region 10, Seattle, WA.

Nelson T. 2003. Personal communication (telephone conversation with Matt Luxon, Windward Environmental, regarding sampling station at RM 13 of the Green River). Fisheries Biologist, King County Department of Natural Resources and Parks, Seattle, WA.

NMFS. 2002. Unpublished data on PCB concentrations in juvenile chinook salmon captured in the Lower Duwamish Waterway during 1993 and 2000. Environmental Conservation Division, National Marine Fisheries Service, Seattle, WA.

Stallard MO, Cola SY, Dooley CA. 1988. Optimization of butyltin measurements for seawater, tissue and marine sediment samples. Appl Organometal Chem 3:105-114

Warner EJ, Fritz RL. 1995. The distribution and growth of Green River Chinook salmon and chum salmon outmigrants in the Duwamish Estuary as a function of water quality and substrate. Muckleshoot Indian Tribe, Auburn, WA.

Windward and Appendix A Technologies. 2001. Data management manual. Prepared for Port of Seattle. Windward and Appendix A Technologies, Seattle, WA.

Attachment 1. Sample Alteration Form

Project name and number: _____

Material to be sampled: _____

Measurement parameter: _____

_____

_____

Standard procedure for field collection & laboratory analysis (cite reference):

_____

_____

Reason for change in field procedure or analysis variation: _____

_____

_____

Variation from field or analytical procedure: _____

_____

_____

Special equipment, materials or personnel required: _____

_____

_____

_____

Initiator's name: _____ Date: _____

Project officer: _____ Date: _____

QA officer: _____ Date: _____

Attachment 2. Corrective Action Form

Project name and number: _____

Sample dates involved: _____

Measurement parameter: _____

_____

_____

Acceptable data range: _____

_____

_____

Problem areas requiring corrective action: _____

_____

_____

Measures required to correct problem: _____

_____

_____

Means of detecting problems and verifying correction: _____

_____

_____

Initiator's name: _____ Date: _____

Project officer: _____ Date: _____

QA Officer: _____ Date: _____

Appendix A. Health and Safety Plan

By their signature, the undersigned certify that this Health and Safety Plan (HSP) is approved and that it will be used to govern health and safety aspects of fieldwork described in the Quality Assurance Project Plan to which it is attached.

Name Project Manager	Date
Name Corporate Health and Safety Manager	Date
Name Field Coordinator/Health and Safety Officer	Date

Acronyms

CPR	cardiopulmonary resuscitation
EPA	US Environmental Protection Agency
FC	field coordinator
HSM	Project Health and Safety Manager
HSO	Field Health and Safety Officer
HSP	health and safety plan
OSHA	Occupational Safety and Health Administration
PAH	polycyclic aromatic hydrocarbon
PCBs	polychlorinated biphenyls
PFD	personal flotation device
PSEP	Puget Sound Estuary Program
PPE	personal protective equipment
TBT	tributyltin

A.1.0 Introduction

This site-specific health and safety plan (HSP) describes safe working practices for conducting field activities at potentially hazardous sites and for handling potentially hazardous materials/waste products. This HSP covers elements as specified in 29 CFR 1910§120. The goal of the HSP is to establish procedures for safe working practices for all field personnel.

This HSP addresses all activities associated with collection and handling of juvenile chinook salmon in the Lower Duwamish Waterway (LDW). During site work, this HSP will be implemented by the Field Coordinator (FC), who is also the designated site Health and Safety Officer (HSO), in cooperation with the Corporate Health and Safety Manager (HSM) and the Project Manager (PM).

All personnel involved in fieldwork on this project are required to comply with this HSP. The contents of this HSP reflect anticipation of the types of activities to be performed, knowledge of the physical characteristics of the site, and consideration of preliminary chemical data from previous investigations at the site. The HSP may be revised based on new information and/or changed conditions during site activities. Revisions will be documented in the project records.

A.2.0 Site Description and Project Scope

A.2.1 SITE DESCRIPTION

The sampling area is in the LDW (see Figure 3-1 in the attached QAPP). The area is affected by tidal fluctuations. The QAPP to which this HSP is attached provides complete details of the sampling program. The following section summarizes the types of work that will be performed during field activities.

A.2.2 SCOPE AND DURATION OF WORK

Specific tasks to be performed are as follows:

- Collection of juvenile chinook salmon from the LDW using a beach seine deployed from a boat
- Sample handling, processing, and shipping

Sampling will commence during the week of May 12, 2003 and will be completed by July 2003, as described in the QAPP.

A.3.0 Health and Safety Personnel

Key health and safety personnel and their responsibilities are described below. These individuals are responsible for the implementation of this HSP.

Project Manager: The PM has overall responsibility for the successful outcome of the project. The PM will ensure that adequate resources and budget are provided for the health and safety staff to carry out their responsibilities during fieldwork. The PM, in consultation with the HSM, makes final decisions concerning implementation of the HSP.

Field Coordinator/Health and Safety Officer: Because of the limited scope and duration of fieldwork, the FCand HSO will be the same person. The FC/HSO will direct field sampling activities, coordinate the technical components of the field program with health and safety components, and ensure that work is performed according to the QAPP.

The FC/HSO will implement this HSP at the work location and will be responsible for all health and safety activities and the delegation of duties to a health and safety technician in the field, if appropriate. The FC/HSO also has stop-work authority, to be used if there is an imminent safety hazard or potentially dangerous situation. The FC/HSO or his designee shall be present during sampling and operations.

Corporate Health and Safety Manager: The HSM has overall responsibility for preparation, approval, and revisions of this HSP. The HSM will not necessarily be present during fieldwork, but will be readily available, if required, for consultation regarding health and safety issues during fieldwork.

Field Crew: All field crew members must be familiar with and comply with the information in this HSP. They also have the responsibility to report any potentially unsafe or hazardous conditions to the FC/HSO immediately.

A.4.0 Hazard Evaluation and Control Measures

This section covers potential physical and chemical hazards that may be associated with the proposed project activities, and presents control measures for addressing these hazards. The activity hazard analysis, Section A.4.3, lists the potential hazards associated with each site activity and the recommended site control to be used to minimize each potential hazard.

Confined space entry will not be necessary for this project. Therefore, hazards associated with this activity are not discussed in this HSP.

A.4.1 PHYSICAL HAZARDS

For this project, it is anticipated that physical hazards will present a greater risk of injury than chemical hazards. Physical hazards are identified and discussed below.

A.4.1.1 Slips, trips, and falls

As with all fieldwork sites, caution should be exercised to prevent slips on slick surfaces. In particular, sampling from a boat or other floating platform requires careful attention to minimize the risk of falling down or of falling overboard. The same care should be used in rainy conditions or on the shoreline where slick rocks are found. Slips can be minimized by wearing boots with good tread, made of material that does not become overly slippery when wet.

Trips are always a hazard on the uneven deck of a boat, in a cluttered work area, or in the intertidal zone where uneven substrate is common. Personnel will keep work areas as free as possible from items that interfere with walking.

Falls may be avoided by working as far from exposed edges as possible, by erecting railings, and by using fall protection when working on elevated platforms. For this project, no work is anticipated that would present a fall hazard.

A.4.1.2 Sampling equipment deployment

A beach seine will be used to collect juvenile chinook samples. The seine is deployed 30 m from shore using an outboard-powered boat. One worker will stand on shore holding the 30-m rope attached to one end of the net until the reversing boat pulls the rope taut. Once the rope is taut, another worker will feed the net from the bow of the boat into the water as the skipper slowly motors in reverse to lay out all the net. The rope on the opposite end of the net will then be motored to shore, and the person who had been in the bow of the boat deploying the net will jump ashore with the rope end to assist with retrieving the net. Teams of one or two workers will then stand at each end of the net to pull the net toward shore at a steady rate. Before sampling activities begin, there will be a training session for all field personnel for the equipment that will be onboard the sampling vessel and used onshore.

A.4.1.3 Falling overboard

Some of the sampling activities will be done from a boat. As with any work from a floating platform, there is a chance of falling overboard. Personal flotation devices (PFDs) will be worn while working from the boat.

A.4.1.4 Manual lifting

Equipment and samples must be lifted and carried. Back strain can result if lifting is done improperly. During any manual handling tasks, personnel should lift with the load supported by their legs and not their backs. For heavy loads, an adequate

number of people will be used, or if possible, a mechanical lifting/handling device will be used.

A.4.1.5 Heat stress, hypothermia, or frostbite

Sampling operations and conditions that might result in the occurrence of heat stress, hypothermia, or frostbite are not anticipated. The sampling will occur during the time of year when extreme weather conditions are not expected to occur.

A.4.1.6 Weather

In general, field team members will be equipped for the normal range of weather conditions. The FC/HSO will be aware of current weather conditions, and of the potential for those conditions to pose a hazard to the field crew. Some conditions that might force work stoppage are electrical storms, high winds, or high waves resulting from winds.

A.4.2 CHEMICAL HAZARDS

Previous investigations have shown that some chemical substances are present at higher-than-background concentrations in the sampling area. For the purposes of discussing potential exposure to substances in sediments, the chemicals of concern are metals, tributyltin (TBT), petroleum hydrocarbons, polycyclic aromatic hydrocarbons, and polychlorinated biphenyls (PCBs).

A.4.2.1 Exposure routes

Potential routes of chemical exposure include inhalation, dermal contact, and ingestion. Exposure will be minimized by using safe work practices and by wearing the appropriate personal protective equipment (PPE). Further discussion of PPE requirements is presented in Section A.6.

Inhalation —Inhalation is not expected to be an important route of exposure.

Dermal exposure — Dermal exposure to hazardous substances associated with sediments, surface water, or equipment decontamination will be controlled by the use of PPE and by adherence to detailed sampling and decontamination procedures.

Ingestion — Ingestion is not considered a major route of exposure for this project. Accidental ingestion of surface water is possible. However, careful handling of equipment and containers aboard the boat should prevent the occurrence of water splashing or spilling during sample collection and handling activities.

A.4.2.2 Description of chemical hazards

Metals and tributyltin — Exposure to metals may occur via ingestion or skin contact. As mentioned above, neither is likely as an exposure route. Metal fumes or metal-contaminated dust will not be encountered during field and sample handling

activities. Large amounts of sediment would need to be ingested for any detrimental effects to occur. Momentary skin contact allows little, if any, opportunity for passage of any of the metals into the body. Field procedures require immediate washing of sediments from exposed skin.

Petroleum hydrocarbons and PAHs — Exposure to petroleum hydrocarbons and PAHs may occur via ingestion or skin contact. The most important human health exposure pathway for this group of chemicals, inhalation, is not expected to occur at this site. Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure, but these effects have not been seen in people. Some PAHs may reasonably be expected to be carcinogens. Large amounts of sediment would need to be ingested for any detrimental effects to occur. Momentary skin contact allows little, if any, opportunity for passage of any of the compounds into the body. Field procedures require immediate washing of sediments from exposed skin.

Polychlorinated biphenyls — Prolonged skin contact with PCBs may cause acne-like symptoms known as chloracne. Irritation to eyes, nose, and throat may also occur. Acute and chronic exposure can damage the liver, and cause symptoms of edema, jaundice, anorexia, nausea, abdominal pains, and fatigue. PCBs are a suspected human carcinogen. Skin absorption may substantially contribute to the uptake of PCBs. Large amounts of sediment would need to be ingested for any detrimental effects to occur. Momentary skin contact allows little, if any, opportunity for passage of any of the compounds into the body. Field procedures require immediate washing of sediments from exposed skin.

A.4.3 ACTIVITY HAZARD ANALYSIS

The activity hazard analysis summarizes the field activities to be performed during the project, outlines the hazards associated with each activity, and presents controls that can reduce or eliminate the risk of the hazard occurring.

Table A-1 presents the activity hazard analysis for the following activities:

- Beach seine deployment from boat
- Sample handling, processing, and shipping
- Equipment decontamination

Table A-1. Activity hazard analysis

ACTIVITY	HAZARD	CONTROL
sampling from a boat	Falling overboard	Use care in boarding/departing from vessel. Deploy and recover the beach seine over the bow. Wear PFD.
	Skin contact with contaminated sediments or liquids	Wear modified Level D PPE.
Sample handling, packaging, and shipping	Skin contact with contaminated sediments or liquids	Wear modified Level D PPE.
	Back strain	Use appropriate lifting technique when handling filled sample coolers, or seek help.
Equipment decontamination	Inhalation of or eye contact with airborne mists or vapors	Wear safety glasses. Perform decontamination activities outdoors or in a well-ventilated area. Stay upwind when spray-rinsing equipment.
	Skin contact with contaminated materials	Wear modified Level D PPE.
	Ingestion of contaminated materials	Decontaminate clothing and skin prior to eating, drinking, smoking, or other hand-to-mouth activities. Follow the decontamination procedure for personal decontamination.

A.5.0 Work Zones and Shipboard Access Control

During sampling and sample handling activities, work zones will be established to identify where sample collection and processing are actively occurring. The intent of the zone is to limit the migration of sample material out of the zone and to restrict access to active work areas by defining work zone boundaries.

A.5.1 WORK ZONE

The work zone onshore will encompass the area where sample collection and handling activities are performed. On the beach, the FC/HSO will delineate the work zone as a particular area. Only persons with appropriate training, PPE, and authorization from the FC/HSO will be allowed to enter the work zone while work is in progress.

A.5.2 DECONTAMINATION STATION

A decontamination station will be set up, and personnel will clean soiled boots or PPE prior to leaving the work zone. The station will have the buckets, brushes, soapy water, rinse water, or wipes necessary to clean boots, PPE, or other equipment leaving the work zones. Plastic bags will be provided for expendable and disposable materials. If the location does not allow the establishment of a decontamination

station, the FC/HSO will provide alternatives to prevent the spread of contamination.

A.5.3 ACCESS CONTROL

Security and control of access to the boat will be the responsibility of the FC/HSO and boat captain. Boat access will be granted only to necessary project personnel and authorized visitors. Any security or access control problems will be reported to the client or appropriate authorities.

A.6.0 Safe Work Practices

Following common sense rules will minimize the risk of exposure or accidents at a work site. These general safety rules will be followed on site:

- Do not climb over or under obstacles of questionable stability
- Do not eat, drink, smoke, or perform other hand-to-mouth transfers in the work zone
- Work only in well-lighted spaces
- Never enter a confined space without the proper training, permits, and equipment
- Make eye contact with equipment operators when moving within the range of their equipment
- Be aware of the movements of shipboard equipment when not in the operator's range of vision
- Get immediate first aid for all cuts, scratches, abrasions, or other minor injuries
- Use the established sampling and decontamination procedures
- Always use the buddy system
- Be alert to your own and other workers' physical condition
- Report all accidents, no matter how minor, to the FC/HSO
- Do not do anything dangerous or unwise even if ordered by a supervisor

A.7.0 Personal Protective Equipment and Safety Equipment

Appropriate PPE will be worn as protection against potential hazards. In addition, a PFD will be required when working aboard the boat. Prior to donning PPE, the field

crew will inspect their PPE for any defects that might render the equipment ineffective.

Fieldwork will be conducted in Level D or modified Level D PPE, as discussed below in Sections A.7.1 and A.7.2. Situations requiring PPE beyond modified Level D are not anticipated. Should the FC/HSO determine that PPE beyond modified Level D is necessary, the HSM will be notified and an alternative selected.

A.7.1 LEVEL D PERSONAL PROTECTIVE EQUIPMENT

Workers performing general activities in which skin contact with contaminated materials is unlikely will wear Level D PPE. Level D PPE includes the following:

- Cotton overalls or lab coats
- Chemical-resistant steel-toed boots
- Chemical-resistant gloves
- Safety glasses

A.7.2 MODIFIED LEVEL D PERSONAL PROTECTIVE EQUIPMENT

Workers performing activities where skin contact with contaminated materials is possible and in which inhalation risks are not expected will be required to wear an impermeable outer suit. The type of outerwear will be chosen according to the types of chemical contaminants that might be encountered. Modified Level D PPE includes the following:

- Impermeable outer garb such as rain gear
- Chemical-resistant steel-toed boots
- Chemical-resistant outer gloves

A.7.3 SAFETY EQUIPMENT

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

- A copy of this HSP
- First aid kit adequate for the number of personnel
- Emergency eyewash

The FC/HSO will ensure that the safety equipment is aboard. Equipment will be checked daily to ensure its readiness for use.

A.8.0 Monitoring Procedures for Site Activities

A monitoring program that addresses the potential site hazards will be maintained. For this project, air, dust, and noise monitoring will not be necessary. No volatile organic compounds have been identified among the expected contaminants, the sampled media will be wet and will not pose a dust hazard, and none of the equipment emits high-amplitude (>85 dBA) sound. For this project, the monitoring program will consist of all workers monitoring themselves and their co-workers for signs that might indicate physical stress or illness.

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

- Headaches
- Dizziness
- Nausea
- Symptoms of heat stress
- Blurred vision
- Cramps
- Irritation of eyes, skin, or respiratory system
- Changes in complexion or skin color
- Changes in apparent motor coordination
- Increased frequency of minor mistakes
- Excessive salivation or changes in papillary response
- Changes in speech ability or speech pattern
- Shivering
- Blue lips or fingernails

If any of these conditions develop, work shall be halted immediately and the affected person(s) evaluated. If further assistance is needed, personnel at the local hospital will be notified, and an ambulance will be summoned if the condition is thought to be serious. If the condition is the direct result of sample collection or handling activities, procedures will be modified to address the problem.

A.9.0 Decontamination

Decontamination is necessary to prevent the migration of contaminants from the work zone(s) into the surrounding environment and to minimize the risk of exposure of personnel to contaminated materials that might adhere to PPE. The following sections discuss personnel and equipment decontamination. The following supplies will be available to perform decontamination activities:

- Wash buckets
- Rinse buckets
- Long-handled scrub brushes
- Clean water sprayers
- Paper towels
- Plastic garbage bags
- Alconox® or similar decontamination solution

A.9.1 MINIMIZATION OF CONTAMINATION

The first step in addressing contamination is to prevent or minimize exposure to existing contaminated materials and the spread of those materials. During field activities, the FC/HSO will enforce the following measures:

Personnel:

- Do not walk through areas of obvious or known contamination
- Do not handle, touch, or smell contaminated materials directly
- Make sure PPE has no cuts or tears prior to use
- Fasten all closures on outer clothing, covering with tape if necessary
- Protect and cover any skin injuries
- Stay upwind of airborne dusts and vapors
- Do not eat, drink, chew tobacco, or smoke in the work zones

Sampling equipment and boat:

- Use care to avoid getting sampled media on the outside of sample containers
- If necessary, bag sample containers before filling with sampled media
- Place clean equipment on a plastic sheet or aluminum foil to avoid direct contact with contaminated media

- Keep contaminated equipment and tools separate from clean equipment and tools
- Clean boots before entering the boat

A.9.2 PERSONNEL DECONTAMINATION

The FC/HSO will ensure that all site personnel are familiar with personnel decontamination procedures. Personnel will perform decontamination procedures, as appropriate, before eating lunch, taking a break, or before leaving the work location. Following is a description of these procedures.

Decontamination procedure:

1. If outer suit is heavily soiled, rinse it off
2. Wash and rinse outer gloves and boots with in water
3. Remove outer gloves; inspect and discard if damaged
4. Wash hands if taking a break
5. Don necessary PPE before returning to work

Dispose of soiled, expendable PPE before leaving for the day

A.9.3 SAMPLING EQUIPMENT DECONTAMINATION

Before use at each sampling location, the beach seine will be rinsed in river water to dislodge and remove any sediment and cleared of all debris before being deployed.

A.10.0 Disposal of Contaminated Materials

Contaminated materials that may be generated during field activities include PPE, decontamination fluids, and excess sample material. These contaminated materials will be disposed of as an integral part of the project.

A.10.1 PERSONAL PROTECTIVE EQUIPMENT

Gross surface contamination will be removed from PPE. All disposable sampling materials and PPE, such as disposable coveralls, gloves, and paper towels used in sample processing, will be placed in heavyweight garbage bags. Filled garbage bags will be placed in a normal refuse container for disposal as solid waste.

A.10.2 EXCESS SAMPLE MATERIALS

At each sampling location, all excess salmon and other species will be returned to the water. Rejected samples, if any, will also be returned to the water.

A.11.0 Training Requirements

Individuals performing work at locations where potentially hazardous materials and conditions may be encountered must meet specific training requirements. It is not anticipated that hazardous concentrations of contaminants will be encountered in sampled material, so training will consist of site-specific instruction for all personnel and oversight of inexperienced personnel by an experienced person for one working day. The following sections describe the training requirements for this fieldwork.

A.11.1 PROJECT-SPECIFIC TRAINING

In addition to HAZWOPER training, as described in Section 2.5 of the QAPP, field personnel will undergo training specifically for this project. All personnel must read this HSP and be familiar with its contents before beginning work. They shall acknowledge reading the HSP by signing the field team HSP review form contained in Attachment 1. The form will be kept in the project files.

The boat captain and FC/HSO or a designee will provide project-specific training prior to the first day of fieldwork and whenever new workers arrive. Field personnel will not be allowed to begin work until project-specific training is completed and documented by the FC/HSO. Training will address the HSP and all health and safety issues and procedures pertinent to field operations. Training will include, but not be limited to, the following topics:

- Activities with the potential for chemical exposure
- Activities that pose physical hazards, and actions to control the hazard
- Ship access control and procedure
- Use and limitations of PPE
- Decontamination procedures
- Emergency procedures
- Use and hazards of sampling equipment
- Location of emergency equipment on the vessel
- Vessel safety practices
- Vessel evacuation and emergency procedures

A.11.2 DAILY SAFETY BRIEFINGS

The FC/HSO or a designee and the boat captain will present safety briefings before the start of each day's activities. These safety briefings will outline the activities expected for the day, update work practices and hazards, address any specific

concerns associated with the work location, and review emergency procedures and routes. The FC/HSO or designee will document safety briefings in the logbook.

A.11.3 FIRST AID AND CPR

At least one member of the field team must have first-aid and cardiopulmonary resuscitation (CPR) training. Documentation of which individuals possess first-aid and CPR training will be kept in the project health and safety files.

A.12.0 Medical Surveillance

A medical surveillance program conforming to the provisions of 29 CFR 1910§120(f) is not necessary for field team members because they do not meet any of the four criteria outlined in the regulations for implementation of a medical surveillance program:

- Employees who are or may be exposed to hazardous substances or health hazards at or above permissible exposure levels for 30 days or more per year (1910.120(f)(2)(I)
- Employees who must wear a respirator for 30 days or more per year (1910.120(f)(2)(ii))
- Employees who are injured or become ill due to possible overexposures involving hazardous substances or health hazards from an emergency response or hazardous waste operation (1910.120(f)(2)(iii))
- Employees who are members of HAZMAT teams (1910.120(f)(2)(iv)).

As described in Section A.8, employees will monitor themselves and each other of any deleterious changes in their physical or mental condition during the performance of all field activities.

A.13.0 Reporting and Record Keeping

Each member of the field crew will sign the HSP review form (see Attachment 1). If necessary, accident/incident report forms and OSHA Form 200s will be completed by the FC/HSO.

The FC/HSO or a designee will maintain a health and safety field logbook that records health- and safety-related details of the project. Alternatively, entries may be made in the field logbook, in which case a separate health and safety logbook will not be required. The logbook must be bound and the pages must be numbered consecutively. Entries will be made with indelible blue ink. At a minimum, each day's entries must include the following information:

- Project name or location
- Names of all personnel onboard
- Weather conditions
- Type of fieldwork being performed

The person maintaining the entries will initial and date the bottom of each completed page. Blank space at the bottom of an incompletely filled page will be lined out. Each day's entries will begin on the first blank page after the previous workday's entries.

A.14.0 Emergency Response Plan

As a result of the hazards onboard and the conditions under which operations will be conducted, the potential exists for an emergency situation to occur. Emergencies may include personal injury, exposure to hazardous substances, fire, explosion, or release of toxic or non-toxic substances (spills). OSHA regulations require that an emergency response plan be available for use onboard to guide actions in emergency situations.

Onshore organizations will be relied upon to provide response in emergency situations. The local fire department and ambulance service can provide timely response. Field personnel will be responsible for identifying an emergency situation, providing first aid if applicable, notifying the appropriate personnel or agency, and evacuating any hazardous area. Shipboard personnel will attempt to control only very minor hazards that could present an emergency situation, such as a small fire, and will otherwise rely on outside emergency response resources.

The following sections identify the onboard individual(s) who should be notified in case of emergency, provide a list of emergency telephone numbers, offer guidance for particular types of emergencies, and provide directions and a map for getting from any sampling location to a hospital.

A.14.1 Pre-emergency Preparation

Before the start of field activities, the FC/HSO will ensure that preparation has been made in anticipation of emergencies. Preparatory actions include the following:

- Meeting with the FC/HSO and equipment handlers concerning the emergency procedures in the event that a person is injured.
- A training session given by the FC/HSO informing all field personnel of emergency procedures, locations of emergency equipment and their use, and proper evacuation procedures.

- A training session given by senior staff operating field equipment, to apprise field personnel of operating procedures and specific risks associated with that equipment.
- Ensuring that field personnel are aware of the existence of the emergency response plan in the HSP and ensuring that a copy of the HSP accompanies the field team.

A.14.2 PROJECT EMERGENCY COORDINATOR

The FC/HSO will serve as the Project Emergency Coordinator in the event of an emergency. He will designate his replacement for times when he is not onboard or is not serving as the Project Emergency Coordinator. The designation will be noted in the logbook. The Project Emergency Coordinator will be notified immediately when an emergency is recognized. The Project Emergency Coordinator will be responsible for evaluating the emergency situation, notifying the appropriate emergency response units, coordinating access with those units, and directing interim actions onboard before the arrival of emergency response units. The Project Emergency Coordinator will notify the HSM and the PM as soon as possible after initiating an emergency response action. The PM will have responsibility for notifying the client.

A.14.3 EMERGENCY RESPONSE CONTACTS

All onboard personnel must know whom to notify in the event of an emergency situation, even though the FC/HSO has primary responsibility for notification. Table A-2 lists the names and phone numbers for emergency response services and individuals.

Table A-2. Emergency response contacts

CONTACT	TELEPHONE NUMBER
Emergency Numbers	
Ambulance	911
Police	911
Fire	911
Harborview Medical Center	(206) 323-3074
Emergency Responders	
US Coast Guard	
Emergency General information	(206) 286-5400 (206) 442-5295 UHF Channel 16
National Response Center	(800) 424-8802
EPA	(908) 321-6660
Washington State Department of Ecology – Northwest Region Spill Response (24-hour emergency line)	(206) 649-7000
Emergency Contacts	
Project Manager	
Kathy Godtfredsen	(206) 577-1292
Corporate Health and Safety Manager	
Tad Deshler	(206) 577-1285
Field Coordinator/ Field Health and Safety Officer	Site cellular telephone:
Joanna Florer	(206) 954-1780

A.14.4 RECOGNITION OF EMERGENCY SITUATIONS

Emergency situations will generally be recognizable by observation. An injury or illness will be considered an emergency if it requires treatment by a medical professional and cannot be treated with simple first-aid techniques.

A.14.5 DECONTAMINATION

In the case of evacuation, decontamination procedures will be performed only if doing so does not further jeopardize the welfare of site workers. If an injured individual is also heavily contaminated and must be transported by emergency vehicle, the emergency response team will be told of the type of contamination. To the extent possible, contaminated PPE will be removed, but only if doing so does not exacerbate the injury. Plastic sheeting will be used to reduce the potential for spreading contamination to the inside of the emergency vehicle.

A.14.6 FIRE

Field personnel will attempt to control only small fires, should they occur. If an explosion appears likely, personnel will follow evacuation procedures specified during the training session. If a fire cannot be controlled with a fire extinguisher on board that is part of the required safety equipment, personnel will either withdraw from the vicinity of the fire or evacuate the boat as specified in the training session.

A.14.7 PERSONAL INJURY

In the event of serious personal injury, including unconsciousness, possibility of broken bones, severe bleeding or blood loss, burns, shock, or trauma, the first responder will immediately do the following:

- Administer first aid, if qualified
- If not qualified, seek out an individual who is qualified to administer first aid, if time and conditions permit
- Notify the Project Emergency Coordinator of the incident, the name of the individual, the location, and the nature of the injury

The Project Emergency Coordinator will immediately do the following:

- Notify the boat captain and the appropriate emergency response organization.
- Assist the injured individual.
- Follow the emergency procedures for retrieving or disposing equipment reviewed in the training session and leave the site en route to the predetermined land-based emergency pick-up.
- Designate someone to accompany the injured individual to the hospital.
- If a life-threatening emergency occurs, i.e., injury where death is imminent without immediate treatment, the FC/HSO or boat captain will call 911 and arrange to meet the Medic One unit at the nearest accessible dock. Otherwise, for emergency injuries which are not life-threatening (i.e., broken bones, minor lacerations, etc.) the Project Emergency Coordinator will follow the procedures outlined above and proceed to the Harbor Island Marina or to an alternative location of his choice if that would be more expedient.
- Notify the HSM and the PM.

If the Project Emergency Coordinator determines that emergency response is not necessary, he or she may direct someone to decontaminate and transport the individual by vehicle to the nearest hospital. Directions and a map showing the route to the hospital are in Section A.14.10.

If a worker leaves the boat to seek medical attention, another worker should accompany them to the hospital. When in doubt about the severity of an injury or exposure, always seek medical attention as a conservative approach, and notify the Project Emergency Coordinator.

The Project Emergency Coordinator will have responsibility for completing all accident/incident field reports, OSHA Form 200s, and other required follow-up forms.

A.14.8 OVERT PERSONAL EXPOSURE OR INJURY

If an overt exposure to toxic materials occurs, the first responder to the victim will initiate actions to address the situation. The following actions should be taken, depending on the type of exposure.

A.14.8.1 Skin contact

- Wash/rinse the affected area thoroughly with copious amounts of soap and water
- If eye contact has occurred, eyes should be rinsed for at least 15 minutes using the eyewash that is part of the emergency equipment onboard
- After initial response actions have been taken, seek appropriate medical attention

A.14.8.2 Inhalation

- Move victim to fresh air
- Seek appropriate medical attention

A.14.8.3 Ingestion

- Seek appropriate medical attention

A.14.8.4 Puncture wound or laceration

- Seek appropriate medical attention

A.14.9 SPILLS AND SPILL CONTAINMENT

No bulk chemicals or other materials subject to spillage are expected to be used during this project. Accordingly, no spill containment procedure is required for this project.

A.14.10 EMERGENCY ROUTE TO THE HOSPITAL

The name, address, and telephone number of the hospital that will be used to provide medical care is as follows:

Harborview Medical Center
325 - 9th Ave.
Seattle, WA
(206) 323-3074

Directions from the vicinity of LDW to Harborview Medical Center are as follows:

- Dock the vessel at the 1st Ave S boat launch
- Drive east on S River Street
- Turn left on Occidental Ave S
- Turn left on E Marginal Way S
- Turn right on S Michigan Street
- Look for entrance ramps to I-5 Northbound
- Head north on I-5
- Take the James Street exit
- Head east on James Street to 9th Avenue
- Turn right on 9th Avenue
- Emergency entrance will be two blocks south on the right

A.15.0 References

PSEP. 1997. Recommended guidelines for sampling marine sediment, water column, and tissue in Puget Sound. Final report. Prepared for the US Environmental Protection Agency, Seattle, WA. Puget Sound Water Quality Action Team, Olympia, WA.

Attachment A1. Field Team Health and Safety Plan Review

I have read a copy of the Health and Safety Plan, which covers field activities that will be conducted to investigate potentially contaminated areas in the LDW. I understand the health and safety requirements of the project, which are detailed in this Health and Safety Plan.

Signature	Date
Signature	Date
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Appendix B. Standard Operating Procedure for Tissue Preparation

This standard operating procedures (SOP) manual details the laboratory processing of tissue data for the LDW RI. Fish tissue samples will be prepared in accordance with US Environmental Protection Agency (EPA) guidance (EPA 2000). Tissue homogenization will be done at the analytical laboratory. Tissue processing will occur within 24 hours of receipt of the specimens at the laboratory.

B.1.0 General Guidelines

All tissue sample processing will occur in the laboratory under clean room conditions. Laboratory processing to prepare whole fish composite samples involves:

- Inspecting individual fish for foreign material on the surface and rinsing if necessary
- Preparing whole fish homogenates

Whole fish will be delivered on ice to the laboratory. Samples will be processed by the laboratory within 24 hours of receipt. Precautions will be taken to ensure that any liquid formed in thawing remains with the sample. Thawed or partially thawed whole fish will be homogenized as composites. Fish may be composited prior to homogenization. Homogenates may be frozen; however, frozen individual homogenates must be rehomogenized before compositing for analysis. Recommended container materials, storage temperatures, and holding times are given in Table B-1 (Stober 1991).

Table B-1. Recommendations for container, preservation, and maximum holding times for fish tissue from receipt at sample processing laboratory to analysis

ANALYTE	MATRIX	SAMPLE CONTAINER	STORAGE	MAXIMUM HOLDING TIME[a]
Other metals	Tissue (whole specimens, homogenates)	Plastic, borosilicate glass, quartz, PTFE	Freeze at <-20°C	6 months[c]
Organics	Tissue (whole specimens, homogenates)	Borosilicate glass, quartz, PTFE, aluminum foil	Freeze at <-20°C	1 year[d]
Lipids	Tissue (whole specimens, homogenates)	Plastic, borosilicate glass, quartz, PTFE	Freeze at <-20°C	1 year to extract 40 days to analyze

PTFE = Polytetrafluoroethylene (Teflon).

[a] Maximum holding times recommended by US EPA (1995b).

[b] The California Department of Fish and Game (1990) and the USGS National Water Quality Assessment Program (Crawford and Luoma1993) recommend a maximum holding time of 6 months for all metals, including mercury.

[c] This maximum holding time is also recommended by the California Department of Fish and Game (1990), the 301(h) monitoring program (US EPA 1986), and the USGS National Water Quality Assessment Program (Crawford and Luoma 1993). The Puget Sound Estuary Program (1997) recommends a maximum holding time of 2 years.

[d] This maximum holding time is also recommended by the Puget Sound Estuary Program (1997). The California Department of Fish and Game (1990) and the USGS National Water Quality Assessment Program (Crawford and Luoma 1993) recommend a more conservative maximum holding time of 6 months. EPA (1995a) recommends a maximum holding time of 1 year at -10°C for dioxins and dibenzofurans.

B.2.0 Sample Processing Procedures

B.2.1 SAMPLE INSPECTION

Individual fish received will be carefully unwrapped and vigilantly inspected to ensure that they have not been compromised in any way (i.e., not properly preserved during shipment). Any specimen deemed unsuitable for further processing and analysis should be discarded and identified on the sample processing record. The laboratory manager shall immediately inform the Windward project manager of the unsuitable sample.

B.2.2 PREPARATION OF INDIVIDUAL HOMOGENATES

To ensure even distribution of contaminants throughout tissue samples, whole fish will be ground and homogenized prior to analyses. Whole fish may be ground in a hand crank meat grinder (fish or fillet < 300 g) or a food processor (fish or fillet > 300 g). To avoid contamination by metals, grinders and homogenizers used to grind and blend tissue should have tantalum or titanium blades and/or probes. Grinding and homogenization of biological tissue, especially skin from whole fish or fillet

samples, is easier when the tissue is partially frozen (Stober 1991). Chilling the grinder/homogenizer briefly with a few chips of dry ice will reduce the tendency of the tissue to stick to the grinder. The ground sample will be divided into quarters, opposite quarters mixed together by hand, and the two halves mixed back together. The grinding, quartering, and hand mixing will be repeated two more times. If chunks of tissue are present at this point, the grinding/ homogenizing will be repeated. No chunks of tissue should remain because these may not be extracted or digested efficiently. If the sample is to be analyzed for metals only, the ground tissue may be mixed by hand in a polyethylene bag (Stober 1991). Homogenization of each individual fish will be noted on the sample processing record. At this time, individual whole fish homogenates may be either composited or frozen and stored at -20°C in cleaned containers that are noncontaminating for the analyses to be performed (Table B-1).

B.2.3 PREPARATION OF COMPOSITE HOMOGENATES

Composite homogenates will be prepared from either fish whole bodies or equal weights of individual homogenates. If individual whole fish or fillet homogenates have been frozen, they will be thawed partially and rehomogenized prior to compositing. Any associated liquid will be maintained as a part of the sample. The weight of each individual fish or homogenate that is used in the composite homogenate will be recorded, to the nearest gram, on the sample processing record. Each composite homogenate will be blended by dividing it into quarters, mixing opposite quarters together by hand, and mixing the two halves together. The quartering and mixing will be repeated at least two more times. If the sample is to be analyzed only for metals, the composite homogenate may be mixed by hand in a polyethylene bag (Stober 1991). At this time, the composite homogenate may be processed for analysis or frozen and stored at -20°C (Table B-1).

The remainder of each individual homogenate not used in the composite homogenate will be archived at –20°C. The designation "Archive" and the expiration date will be indicated on the sample label. The location of the archived individual homogenates will be indicated on the sample processing record.

B.3.0 References

California Department of Fish and Game. 1990. Laboratory Quality Assurance Program Plan. Environmental Services Division, Sacramento, CA.

Crawford JK, Luoma SN. 1993. Guidelines for studies of contaminants in biological tissues for the National Water-Quality Assessment Program. USGS Open-File Report 92-494. US Geological Survey, Lemoyne, PA.

EPA. 1986. Bioaccumulation Monitoring Guidance: 4. Analytical methods for US EPA priority pollutants and 301(h) pesticides in tissues from marine and estuarine organisms. EPA-503/6-90-002. US Environmental Protection Agency, Office of Marine and Estuarine Protection, Washington, DC.

EPA. 1995a. Method 1613b. Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution RGC/HRMS. Final Draft. US Environmental Protection Agency, Office of Water, Office of Science and Technology, Washington, DC.

EPA. 1995b. QA/QC Guidance for sampling and analysis of sediments, water, and tissues for dredged material evaluations—chemical evaluations. EPA 823-B-95-001. US Environmental Protection Agency, Office of Water, Washington, DC, and Department of the Army, US Army Corps of Engineers, Washington, DC.

EPA. 2000. Guidance for assessing chemical contaminant data for use in fish advisories, Volume 1 - Fish sampling and analysis. Third edition. EPA 823-B-00-007. US Environmental Protection Agency, Office of Water, Washington, DC.

PSEP. 1997. Recommended guidelines for sampling marine sediment, water column, and tissue in Puget Sound. Final Report. Prepared for the US Environmental Protection Agency, Seattle, Washington, and the Puget Sound Water Quality Action Team, Olympia, WA.

Stober QJ. 1991. Guidelines for fish sampling and tissue preparation for bioaccumulative contaminants. Environmental Services Division, Region 4, US Environmental Protection Agency, Athens, GA.

Texas Water Commission. 1990. Texas Tissue Sampling Guidelines. Texas Water Commission, Austin, TX.