Quality Assurance Project Plan

PCBs and Other Contaminants in Spokane River Fish, 2005

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December 2005

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Abstract

The Washington State Department of Ecology (Ecology) plans to assess contaminants in Spokane River fish during the summer and fall of 2005. Concentrations of polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs), and metals (arsenic, cadmium, lead, and zinc) will be analyzed in two or more species from six locations stretching from the Idaho border to Long Lake (Spokane River). A subset of samples will also be analyzed for polychlorinated dibenzo-*p*-dioxins and polychlorinated dibenzofurans (PCDD/Fs).

This survey is to be performed to compare current conditions to that of fish tissue studies sponsored by Ecology in 1999 and 2001. The 1999 results prompted the Washington State Department of Health (WDOH) to issue a consumption advisory which is still in place for parts of the Spokane River. The present survey will provide WDOH data to update their health assessment and review the fish consumption advisory for the Spokane River. Ecology will also apply the results to examine conditions and trends within the river system.

Background

Problem Description

Contamination of the Spokane River with polychlorinated biphenyls (PCBs), toxic metals, and other chemicals has been documented for over two decades (e.g., Hopkins et al., 1985; Ecology, 1995; Jack and Roose, 2002) and remains a cause for concern. There is currently an advisory issued by the Washington State Department of Health (WDOH) and the Spokane Regional Health District (SRHD) to avoid or limit consumption of fish in parts of the Spokane River due to elevated PCB levels (www.srhd.org/downloads/safety_environment/SpokaneRiverFishAdvisory.pdf). The advisory, issued in 2003, recommends against any consumption of fish between the Idaho border (river mile [RM] 96.1) and Upriver Dam (RM 80.2). For the reach between Upriver Dam and Ninemile Dam (RM 80.2-RM 58.1), WDOH advises against eating more than one meal per month of any species. The fish downstream of Ninemile Dam are deemed safe to eat.

Bottom sediments in much of the river are contaminated with high levels of arsenic, zinc, lead, and cadmium (Johnson and Norton, 2001). WDOH and SRHD have issued a warning to reduce exposure to shoreline sediments along parts of the river due to high arsenic and lead concentrations (www.srhd.org/downloads/safety_environment/ShorelineSoilsAdvisories.pdf), and in 2000 SRHD issued a fish advisory due to lead (Duff, 2001).

Total Maximum Daily Loads (TMDLs) are currently being developed for PCBs in the Spokane River (Serdar and Kinney, in preparation) and recommendations have previously been made for loadings of zinc, lead, and cadmium (Pelletier, 1998). Fish tissues analyzed in 2003-2004 as part of the Spokane PCB TMDL were found to have lower PCB concentrations than those used as the basis for the current consumption advisory (Johnson, 2000). However, the 2003-2004 sampling program is not directly comparable to the 1999 sampling and not designed to permit a

comprehensive WDOH review of the tissue advisory or evaluate trends; it does, though, suggest conditions may be changing.

Figures 1 and 2 summarize concentrations of PCBs in tissues of two Spokane River fish species sampled in 2003 and 2004. Where samples were collected from identical sites, PCBs in rainbow trout fillets were 7 – 15 times lower in 2003 compared to 1999 and PCBs in whole suckers were anywhere from equal to 35 times lower in 2003-2004 compared to 1999 samples. Appendix B lists all Spokane River fish tissue samples analyzed for PCBs by Ecology since 1993.

In addition to a re-evaluation of PCBs, several screening-level studies that have included Spokane River fish tissue suggest other chemicals may be a concern and warrant consideration in a health assessment. In particular, PBDEs and PCDD/Fs have been found at significant concentrations in tissue. Johnson and Olson (2001) reported total PBDEs ranging from 20 to 1,250 ng/g wet weight (ww) in three species of Spokane River fish, generally much higher than concentrations in fish from other parts of Washington (range 1 – 64 ng/g ww). There are no water quality or fish tissue standards for PBDEs. However, concerns about their increasing levels in the environment, bioaccumulative potential, and ability to cause neurologic development and reproductive effects in laboratory animals has prompted Washington State to develop a plan to reduce PBDE inputs to the environment (Peele, 2004).

Few data are available on PCDD/F concentrations in Spokane River fish, although recent screening data suggests concentrations merit further investigation. A single rainbow trout fillet sample analyzed from Ninemile in 2003 had a TCDD toxic equivalent (TEQ) of 0.36 pg/g ww. The only other recent analysis of PCDDs and PCDFs in tissue was a mountain whitefish fillet from upper Long Lake (Spokane River, RM 56.3 – RM 50.6) which had a TEQ of 0.09 pg/g ww. By way of comparison, the National Toxics Rule (NTR) tissue criterion for PCDDs/Fs is 0.07 pg/g ww TEQ. Although the NTR criterion is based on human health risks–one in a million excess lifetime cancer–it is used to assess water quality violations and is not a threshold for issuing consumption advisories.

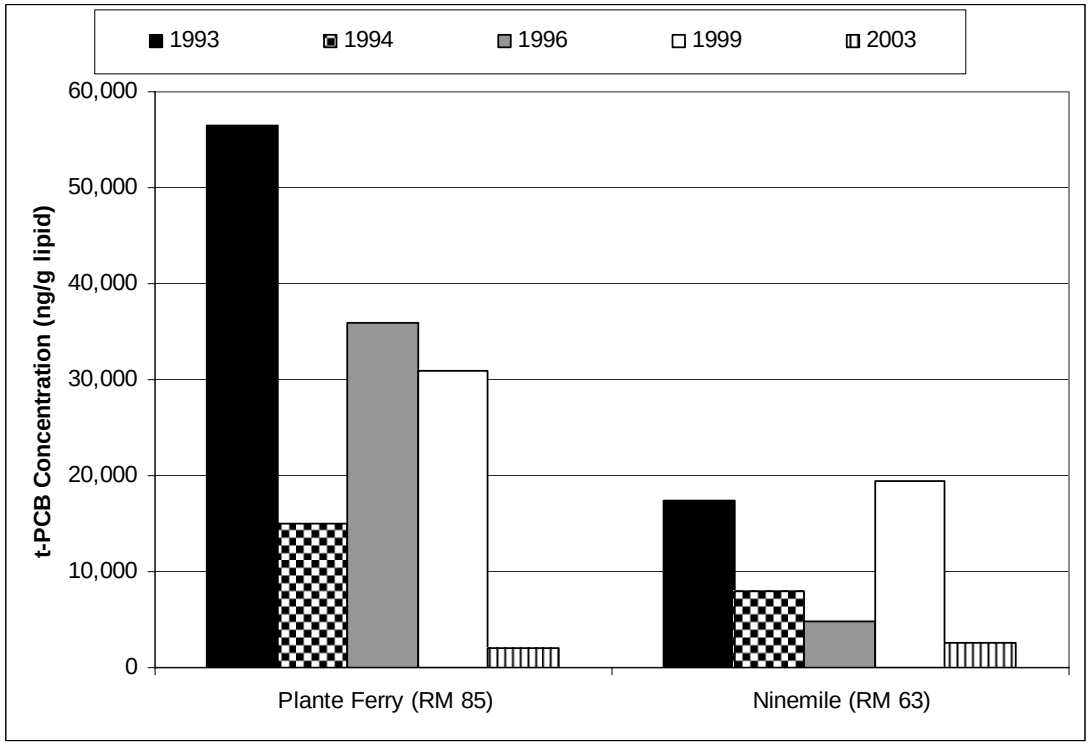

Figure 1. Lipid-Normalized Total PCB Concentrations in Spokane River Rainbow Trout Fillet, 1993-2003.

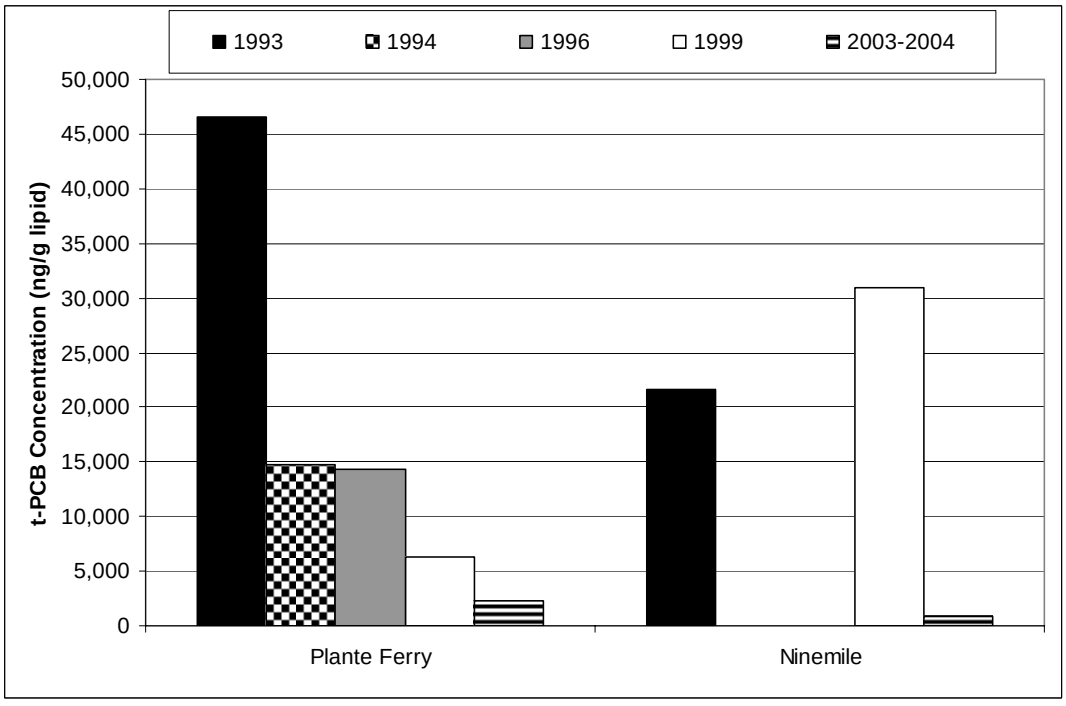

Figure 2. Lipid-Normalized Total PCB Concentrations in Spokane River Suckers Analyzed Whole, 1993-2004. All Data are for Largescale Suckers Except Bridgelip Suckers for the 2003-2004 Ninemile Specimens.

Project Description

This project is an assessment of PCBs and other chemicals in Spokane River fish. The primary objective is to provide high quality representative data to WDOH for use in a health assessment. Ecology will also apply the results to examine conditions and trends within the river system. Furthermore, some of the data will be used for Ecology's current study of PBDEs in Washington's lakes and rivers (Johnson and Seiders, 2005) and by the Washington State Toxics Monitoring Program (WSTMP) survey of PCDD/Fs in fish tissue.

Two or more fish species will be sampled at six locations along the Spokane River from August-November, 2005. All samples will be analyzed for PCB Aroclors, PBDEs, metals (arsenic, lead, cadmium, and zinc), and percent lipids. A small subset of samples will be analyzed for PCDD/Fs based on availability of funds provided by the WSTMP or other sources.

Organization and Schedule

Responsibilities

EAP Project Manager – Dave Serdar (360-407-6772)
Toxics Studies Unit Supervisor – Dale Norton (360-407-6765)
Manchester Environmental Laboratory (MEL) Director – Stuart Magoon (360-871-8801)
MEL Chemistry Unit Supervisor – Dean Momohara
(360-871-8808)
Ecology Quality Assurance Coordinator – Cliff Kirchmer (360-407-6455)
EIM Data Entry – Kristin Kinney (360-407-7168)

Schedule

Table 1. Primary Responsibilities and Deadlines

EIM Data Engineer	Kristin Kinney
EIM User Study ID	DSER0016
EIM Study Name	PCBs and Other Contaminants in Spokane River Fish, 2005
EIM Completion Due	May 2006
Final Report	
Report Author Lead	Dave Serdar
Schedule	
Report Supervisor Draft Due	March 2006
Report Client/Peer Draft Due	April 2006
Report External Draft Due	May 2006
Report Final Due (Original)	June 2006

Budget

Table 2. Estimated Laboratory Budget and Number of Samples for Study of Contaminants in Spokane River Fish.

Analysis	Price(a)	Samples	Duplicates	Matrix Spikes	Total Number of Samples	Cost
PCB Aroclors	$150	48	5	6	59	$8,850
PBDEs	$200	48	5	6	59	$11,800
Metals (As, Cd, Pb, Zn by ICP)	$96	48	5	6	59	$5,664
Percent Lipids	$31	48	5		53	$1,643
PCDD/Fs	$900	3	1	1	5	$4,500(b)
					Total =	$27,957(c)

(a) Based on 50% MEL discount for planned sampling. PCDD/F analysis will be done at a contract laboratory and includes 25% MEL surcharge.
(b) Cost covered by WSTMP.
(c) Does not include PCDD/F analysis.

Quality Objectives

Quality objectives for this project are to obtain data of sufficient quality so that: 1) Uncertainties in contaminant concentration values are minimized and 2) Results for new samples are comparable to existing data from other studies. The quality objectives will be achieved through careful attention to the field procedures, sample handling, and laboratory quality control (QC) described in this sampling plan.

Measurement Quality Objectives

MEL and any contract laboratory conducting PCDD/F analysis are expected to meet all QC requirements of the analytical methods being used for this project. Measurement quality objectives are shown in Table 3. Lowest concentrations of interest are the lowest achievable with the selected methods and within the budget constraints of this project.

Table 3. Measurement Quality Objectives for Analysis of Spokane River Fish Tissue.

Parameter	Lowest Concentration of Interest	Laboratory Control Samples (% recov.)	Laboratory Duplicates (RPD)	Matrix Spikes (% recov.)	Surrogates (% recov.)
PCBs Aroclors	5 ng/g ww	50-150	≤50	50-150	30-150
PBDEs	0.4 ng/g ww*	50-150	≤50	50-150	30-150
Arsenic	0.1 µg/g ww	80-120	≤25	80-120	na
Cadmium	0.1 µg/g ww	80-120	≤25	80-120	na
Lead	0.1 µg/g ww	80-120	≤25	80-120	na
Zinc	5 µg/g ww	80-120	≤25	80-120	na
Percent lipids	0.1%	na	≤20	na	na
PCDD/Fs	0.1-1 pg/g ww	50-150	≤50	na	na

*except PBDE-209 (4 ng/g ww).
na=not applicable.

Study Design

Study Area

The six fish collection sites along the Spokane River were selected to provide sampling coverage of nearly the entire river between the Idaho border and Long Lake Dam. Table 4 lists sampling locations and species of potential interest at each location.

Table 4. Sampling Locations and Species of Interest.

Location	Approximate River Mile	Species of Interest
Stateline	96.1-95.5	Rainbow trout Largescale sucker
Plante Ferry	86.0-85.0	Rainbow trout Largescale sucker
Monroe St.	78.5-74.5	Rainbow trout Mountain Whitefish Largescale sucker
Ninemile	64.5-63.5	Rainbow trout Mountain Whitefish Largescale sucker or Bridgelip sucker
Upper Long Lake (Spokane River)	56.3-50.6	Mountain whitefish Smallmouth bass Brown trout Largescale sucker
Lower Long Lake (Spokane River)	40.1-33.9	Mountain whitefish Smallmouth bass Largescale sucker

Stateline and Plante Ferry represent glide/riffle habitat with cobble or scoured substrates, ideal for rainbow trout and largescale suckers. The Monroe Street reach is characterized by water velocities high enough that fine sediments are not deposited, but the gradient and depths are such that riffles do not form. This reach has the most developed shoreline along the Spokane River and includes industrial sites as well as the convention area and Riverfront Park portions of downtown Spokane.

Most of the historic industrial and municipal PCB sources in the Spokane River are found in these upper reaches and are reflected in comparatively high PCB concentrations in fish tissue. There are no surface tributaries to the Spokane River between the Idaho border and the Monroe Street hydroelectric dam complex (upper Falls Dam and Monroe Street Dam). Due to impoundments and the lack of tributaries, this portion of the river is largely devoid of fine sediments.

Groundwater discharge from the Spokane aquifer increases surface flows in the vicinity of Plante Ferry. The influx of groundwater in this reach also lowers water temperatures in the summer and fall, drawing upstream rainbow trout to the cooler waters. As a result, rainbow trout are generally absent in the Stateline reach during this period.

The Ninemile reach is below the downtown Spokane area and is largely contained within Riverside State Park. This reach is characterized by a pool/riffle environment confined in a steep valley. Nearly all sampling for PCBs in this reach has been conducted below RM 61.7 because it is downstream of all known PCB sources, including the Spokane municipal sewage treatment plant (RM 67.4).

Latah Creek (formerly Hangman Creek) enters the Spokane River in the upper Ninemile reach and, while contributing little flow on average, contributes large loads of sediments during episodic high flows. These sediments are carried some 14 miles downstream to the forebay of Ninemile Dam where some of the sediments are diverted past the dam into Long Lake.

Long Lake (Spokane River) is a 24-mile long impoundment created by Long Lake Dam, although the uppermost two miles are more riverine than lacustrine. Most of the lake is relatively placid water and deep in the downstream sections (≈50 feet) with fine sediment substrate. The Little Spokane River enters Long Lake at RM 56.3.

In their survey of PCBs and metals in Long Lake fish, Jack and Roose (2002) divided the lake into thirds and sampled fish from the upper and lower reaches. By excluding the middle reach they probably avoided sampling overlapping populations, an approach that makes sense given the need to collect discrete samples that can be used to represent Long Lake.

Target Species

Rainbow trout (*Oncorhynchus mykiss*) and largescale suckers (*Catostomus macrocheilus*) are the only species targeted by anglers in the Stateline and Plante Ferry reaches of the Spokane River. As mentioned previously, mountain whitefish (*Prosopium williamsoni*) are absent in these reaches and rainbow trout are often absent in the Stateline reach during summer and fall. In the Monroe and Ninemile reaches, rainbow trout, mountain whitefish, and largescale suckers will be targeted for collection, although bridgelip suckers (*C. columbianus*) may be collected at Ninemile instead if largescale suckers are not present. In Long Lake, where the lacustrine environment supports a broader composition of species (but few rainbow trout), target species will include mountain whitefish, smallmouth bass (*Micropterus dolomieui*), brown trout (*Salmo trutta*), and largescale suckers.

Sampling Procedures

Fish specimens will be collected using electroshocking, hook and line, fyke net, or gill nets during August-November, 2005. Sampling was commenced prior to completion of this sampling plan in order to optimize the probability of fish capture during late summer. Stateline rainbow trout may be collected during March 2006 if earlier collection attempts are unsuccessful.

Specimens retained for sampling will be killed with a blow to the skull, weighed to the nearest gram, measured to the nearest millimeter, and assigned a sample number. Individual specimens will then be double wrapped in aluminum foil, placed in polyethylene bags, and transported on ice to Ecology headquarters where they will be stored frozen at -18° C.

When ready for processing, fish will be partially thawed and then the scales, otoliths, or other appropriate structures will be removed for age determination by WDFW. Composite samples of homogenate tissue will be prepared by methods described by EPA and Washington State Toxics Monitoring Program for screening level assessments of contaminants in fish tissue (EPA, 2000; Seiders, 2003). Briefly, sport fish will be scaled, fillets removed and weighed, then passed twice through a Kitchen-Aid food processor. Equal mass aliquots of tissue from five specimens will then be combined, mixed, and further homogenized with an additional pass through the food processor to form a composite sample. Bottom fish will be prepared in the same manner except they will be sectioned and homogenized whole (scales on) and homogenization will be done using a Hobart commercial meat grinder. Homogenates will be placed in two or more 4-oz glass jars with Teflon lid liners and certificates of analysis and stored frozen.

Three composite samples of each species collected at each location will be prepared for analysis. Composites will be grouped by the total length of individual specimens, resulting in small, medium, and large samples. It is not anticipated that composite samples will have vast differences in average fish length, since legal "keeper-sized" fish will be targeted for collection. These samples should not be considered replicates since the individuals in composites are not selected randomly from the available pool of specimens. This approach may also deviate from EPA's definition of replicates samples; the average length of fish in a composite sample should be no more than ±10% of the average of all composites (EPA, 2000). However, EPA does recommend grouping fish by size and this approach provides useful information about the relationship between fish size and contaminant concentrations.

All resection will be done with non-corrosive stainless steel implements. Persons preparing samples will wear non-talc polyethylene or nitrile gloves and work on aluminum foil or a polyethylene cutting board. Gloves and foil will be changed between samples. All equipment used for fish processing will be cleaned between composite samples using Liquinox® detergent and hot tap water, followed by rinses with 10% nitric acid, deionized water, pesticide grade acetone, and pesticide grade hexane. Implements will be air dried in a fume hood before use.

Measurement Procedures

Table 5 shows analytical methods to be used and required reporting limits. The complete list of analytes is in Appendix C. Samples for PCBs will be analyzed by MEL using GC/ECD. PBDEs will be analyzed using GC/MS. Metals will be analyzed by ICP/MS. PCDDs/PCDFs will be analyzed by a contract laboratory using high resolution GC/MS. Percent lipid will be analyzed gravimetrically at MEL.

Table 5. Methods for Analysis of Spokane River Fish Tissue.

Parameter	Reporting Limits	Expected Range of Results	Sample Preparation Method	Analysis Method
PCBs Aroclors	5 ng/g ww	<2.5-50 ng/g ww	EPA 3540/3620/3665	GC/ECD, EPA 8082, MEL SOP #730002
PBDEs	0.4 ng/g ww*	<0.5-10 ng/g ww	"	GC/MS, EPA 8270, MEL SOP #730096
Arsenic	0.1 µg/g ww	<0.1-1 µg/g ww	EPA 3051	ICP/MS, EPA 200.8
Cadmium	0.1 µg/g ww	<0.1-1 µg/g ww	"	"
Lead	0.1 µg/g ww	<0.1-1 µg/g ww	"	"
Zinc	5 µg/g ww	<0.1-100 µg/g ww	"	"
Percent lipids	0.1%	1-5%	na	Gravimetric, EPA 608.5
PCDD/Fs	0.1-1 pg/g ww	<0.1-2 pg/g ww	na	HRGC/MS, EPA 8290

*except PBDE-209 (4 ng/g ww).
na=not applicable.

Quality Control Procedures

Field

Field activities carried out in the manner described under Sampling Procedures will prevent contamination of samples. Nitrile gloves will be worn during sampling. A copy of the Quality Assurance (QA) Project Plan will be carried in the field for reference.

Laboratory

The QC procedures routinely followed by MEL for the chemical analyses requested will be satisfactory for purposes of this project. A similar routine is expected of the contract laboratory conducting PCDD/PCDF analysis, except the isotope dilution methodology of Method 8290 precludes the need for matrix spikes. At least one each of the following QC samples will be analyzed per preparation batch (maximum of 20 samples):

- Method blank
- Matrix spike
- Laboratory sample duplicate
- Surrogate spike (organics only)
- Laboratory control sample

Method blanks are used to identify contamination stemming from the laboratory environment. Matrix spikes are valuable in assessing bias due to matrix interferences. The project lead will identify the sample to be used for the matrix spikes.

Laboratory duplicates will provide an indication of analytical precision and sample homogeneity. Surrogate recoveries should provide an indication of overall accuracy at the concentrations used. Accuracy of the data will also be assessed through analysis of laboratory control samples with every batch. All samples will be analyzed within recommended holding times (one year for organics and two years for metals if frozen at -18°C).

Completeness will be assured through strict adherence to sampling procedures and program procedures for sample handling and tracking. Archives of all samples will be held in the Ecology headquarters building at -20°C.

Data Management Procedures

Field data will be entered into Excel spreadsheets and Ecology's Environmental Information Management (EIM) system. Laboratory data will be downloaded to EIM directly from MEL's data management system (i.e. LIMS). Data from any contract laboratories used will be delivered in Excel spreadsheets formatted for EIM compatibility.

Audits and Reports

The project lead will prepare a draft report of findings in March 2006 and a final report in May 2006. The project lead will transmit the laboratory results upon receipt (expected in February 2006) along with any pertinent information to WDOH for use in their health assessment. Ideally, the final Ecology report and the WDOH health assessment will coincide to minimize confusion sometimes created by multiple press releases.

In the event of delayed sampling of Stateline rainbow trout until spring 2006, Ecology's final report will remain scheduled for May 2006 completion with the delayed results subsequently reported as an addendum. It is anticipated that a delay in these results will not prevent a timely release of the WDOH health assessment.

At a minimum, Ecology's final report will include:

- Description of the study
- Summary of previous reports on Spokane River fish contamination
- Summary of the project objectives and work performed
- Map of the study area showing sampling sites
- Descriptions of field and laboratory methods used in the study
- A discussion of data quality and the significance of any problems encountered in the analyses
- Data collected in the field including location information for each sampling site.
- Details of the samples analyzed including biological data on specimens
- Tables of the chemistry data
- Discussion of the results with respect to temporal trends and geographical patterns
- Recommendations for follow-up work
- Appendices showing all relevant quality assurance and sample data

Data Verification and Validation

Data Verification

MEL will verify all of the results for environmental and QC sample analyses. Data verification reports will be sent to the project manager in the form of case narratives and will include an assessment of MEL's and the contract laboratory's performance in meeting the conditions and requirements set forth in this sampling plan. Case narratives will also include a comparison of QC results with method acceptance criteria such as precision data, surrogate and spike recoveries, laboratory control sample analysis, and procedural blanks. QC checks on instrument performance, such as initial and continuing calibrations, will also be noted. MEL will explain flags or qualifiers assigned to sample results.

Data Validation

The project manager will examine the complete data package in detail to determine whether the procedures in the methods, SOPs, and QA Project Plan were followed. The project manager will also determine if the MQOs in Table 3 have been met.

Precision obtained at the laboratory will be assessed by calculating RPDs for the laboratory duplicates. Bias will be calculated as deviations of mean percent recoveries of surrogate spike and laboratory control sample analyses. Consistently low or high recoveries may indicate the data are biased in that direction. Wide ranges in recovery values may indicate data are of questionable accuracy, but do not indicate bias in any particular direction. Matrix spike recoveries will indicate if bias is present due to matrix effects.

Completeness will be assessed through the following accounting:

- Number of samples collected compared to sampling plan
- Number of samples shipped and received at MEL and the contract laboratory in good condition
- Ability of MEL and the contract laboratory to produce usable results for each sample
- Acceptability of sample results by project lead

The project lead will periodically assess the field sampling procedures to ensure consistency with this sampling plan or make modifications if necessary. The project lead will review all field notes to ensure quality of the field data. Laboratory results will be reviewed by the project lead to check for reasonableness, and consistency with performance and completeness expectations. Any problems with the data will be discussed with chemists at MEL and the contract laboratory.

Data Quality (Usability) Assessment

The project manager will determine if the reviewed, verified, and validated data are of sufficient quantity and quality to meet the project objectives. A summary of QC sample results will include assessment of laboratory precision, contamination, accuracy, matrix interferences, and the success of QC samples meeting control limits.

There are no specific criteria for evaluating precision and sample homogeneity. However, the relative percent differences calculated from duplicate analysis of samples will provide estimates of laboratory variability. There are no criteria for data usability based on accuracy measurements, but taken as a whole, assessment of data accuracy will indicate if the data are biased and the direction of bias. Laboratory contamination representing >20% of the reported value will lead to rejection of the result.

References

Duff, R., 2001. *Evaluation of Polychlorinated Biphenyls (PCBs) in Spokane River Fish*. Health Consultation Prepared by Washington State Department of Health, Olympia, WA.

Ecology, 1995. *Department of Ecology 1993-1994 Investigation of PCBs in the Spokane River*. Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, Olympia, Washington. Pub. No. 95-310. www.ecy.wa.gov/biblio/95310.html.

EPA, 2000. *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories - Volume 1: Fish Sampling and Analysis, Third Edition*. U.S. Environmental Protection Agency, Office of Water, Washington, D.C. EPA 823-B-00-007.

Hopkins, B.S., D.K. Clark, M. Schlender, and M. Stinson, 1985. *Basic Water Monitoring Program Fish Tissue and Sediment Sampling for 1984*. Washington State Department of Ecology, Olympia, WA. Pub. No. 85-7. www.ecy.wa.gov/biblio/857.html.

Jack, R. and M. Roose, 2002. *Analysis of Fish Tissue from Long Lake (Spokane River) for PCBs and Selected Metals.* Washington State Department of Ecology, Olympia, WA. Pub. No. 02-03-049. www.ecy.wa.gov/biblio/0203049.html.

Johnson, A., 2000. *Results from Analyzing PCBs in 1999 Spokane River Fish and Crayfish Samples*. Memorandum from Art Johnson to John Roland. Washington State Department of Ecology, Olympia, WA. Pub. No. 00-03-040. www.ecy.wa.gov/biblio/0003040.html.

Johnson, A. and D. Norton, 2001. *Chemical Analysis and Toxicity Testing of Spokane River Sediments Collected in October 2000.* Washington State Department of Ecology, Olympia, WA. Pub. No. 01-03-019. www.ecy.wa.gov/biblio/0103019.html.

Johnson, A. and N. Olson, 2001. Analysis and Occurrence of Polybrominated Diphenyl Ethers in Washington State Freshwater Fish. *Archives of Environmental Contamination and Toxicology* 41: 339-344.

Johnson, A. and K. Seiders, 2005. *Quality Assurance Project Plan – PBT Monitoring: Measuring PBDE Levels in Washington Rivers and Lakes*. Washington State Department of Ecology, Olympia, WA. Pub. No. 05-03-113. www.ecy.wa.gov/biblio/0503113.html.

Peele, C., 2004. *Washington State Polybrominated Diphenyl Ether (PBDE) Chemical Action Plan: Interim Plan.* Washington State Department of Ecology, Olympia, WA. Pub. No. 04-03-056. www.ecy.wa.gov/biblio/0403056.html.

Pelletier, G.J., 1998. *Cadmium, Lead, and Zinc in the Spokane River: Recommendations for TMDL and Waste Load Allocations*. Washington State Department of Ecology, Olympia, WA. Pub. No. 98-329. www.ecy.wa.gov/biblio/98329.html.

Seiders, K., 2003. *Washington State Toxics Monitoring Program: Toxic Contaminants in Fish Tissue and Surface Water in Freshwater Environments, 2001*. Washington State Department of Ecology, Olympia, WA. Pub. No. 03-03-012. www.ecy.wa.gov/biblio/0303012.html.

Serdar, D. and K. Kinney, 2005 (Draft). *Total Maximum Daily Load for PCBs in the Spokane River, Washington*. Washington State Department of Ecology, Olympia.

Appendix A
Glossary of Acronyms, Symbols, and Units

Acronyms

Ecology – Washington State Department of Ecology
ECD – electron capture detector
EIM – Environmental Information Management
EPA – U.S. Environmental Protection Agency
GC – gas chromatography
ICP – inductively coupled argon plasma
LIMS – laboratory information management system
MEL – Manchester Environmental Laboratory
MS – mass spectrometry
NTR - National Toxics Rule
QA – quality assurance
QC – quality control
PBDE – polybrominated diphenylether
PCB – polychlorinated biphenyl
PCDD – polychlorinated dibenzo-*p*-dioxin
PCDF – polychlorinated dibenzofuran
RM – river mile
RPD – relative percent difference
SRHD – Spokane Regional Health District
TCDD – tetrachlorodibenzo-*p*-dioxin
TEQ – toxic equivalent
TMDL - Total Maximum Daily Load
WDFW – Washington Department of Fish and Wildlife
WDOH – Washington Department of Health
WSTMP - Washington State Toxics Monitoring Program
ww – wet weight

Symbols

As – arsenic
Cd – cadmium
Pb – lead
Zn – zinc

Units

ng/g – nanograms per gram (parts per billion)
pg/g – picograms per gram (parts per trillion)
µg/g – micrograms per gram (parts per million)

Appendix B
Historical Data on PCBs in Spokane River Fish

Table B-1. Historical Data on PCBs in Spokane River Fish (ng/g, ww).

Location	Species	Year	Tissue	Composite?	Samp ID	Analysis	T-PCB	Frx Lipid	Latitude	Longitude
Stateline	RBT	1999	Fillet	N	99485000	Aroclor	85	0.028	47.6985	-117.0446
Stateline	RBT	1999	Fillet	N	99485001	Aroclor	133	0.04	47.6985	-117.0446
Stateline	RBT	1999	Fillet	N	99485002	Aroclor	105	0.041	47.6985	-117.0446
Stateline	RBT	1999	Fillet	N	99485003	Aroclor	133	0.036	47.6985	-117.0446
Stateline	RBT	1999	Fillet	N	99485004	Aroclor	74	0.061	47.6985	-117.0446
Stateline	RBT	1999	Whole	Y	99485005	Aroclor	77	0.083	47.6985	-117.0446
Stateline	LSS	1999	Whole	Y	99485006	Aroclor	120	0.061	47.6985	-117.0446
Stateline	LSS	2004	Whole	Y	4324443	Congener	59	0.034	47.6981	-117.0435
Stateline	LSS	2004	Whole	Y	4324442	Congener	142	0.045	47.6981	-117.0435
Stateline	LSS	1999	Fillet	N	99485007	Aroclor	342	0.019	47.6985	-117.0446
Stateline	LSS	1999	Fillet	N	99485008	Aroclor	62	0.015	47.6985	-117.0446
Stateline	LSS	1999	Fillet	N	99485009	Aroclor	61	0.017	47.6985	-117.0446
Stateline	LSS	1999	Fillet	N	99485010	Aroclor	6	0.001	47.6985	-117.0446
Stateline	LSS	1999	Fillet	N	99485011	Aroclor	21	0.042	47.6985	-117.0446
Plante Ferry	RBT	1993	Fillet		93318255	Aroclor	1,084	0.019	47.6977	-117.2450
Plante Ferry	RBT	1993	Fillet		93318256	Aroclor	950	0.017	47.6977	-117.2450
Plante Ferry	RBT	1993	Fillet	Y	93378092	Aroclor	720	0.0269	47.6932	-117.2366
Plante Ferry	RBT	1994	Fillet		94318260	Aroclor	383	0.029	47.6977	-117.2450
Plante Ferry	RBT	1994	Fillet		94318260-dup	Aroclor	387	na	47.6977	-117.2450
Plante Ferry	RBT	1994	Fillet		94318261	Aroclor	740	0.025	47.6977	-117.2450
Plante Ferry	RBT	1995	Fillet		94328437 (dup. of 94318261)	Aroclor	471	0.028	47.6977	-117.2450
Plante Ferry	RBT	1994	Fillet		94318262	Aroclor	280	0.037	47.6977	-117.2450
Plante Ferry	RBT	1996	Fillet	Y	96428096	Aroclor	1,870	0.022	47.6977	-117.2450
Plante Ferry	RBT	1996	Fillet	Y	96428097	Aroclor	313	0.024	47.6977	-117.2450
Plante Ferry	RBT	1996	Fillet	Y	96428098	Aroclor	215	0.022	47.6977	-117.2450
Plante Ferry	RBT	1999	Fillet	N	99485013	Aroclor	1,353	0.034	47.6970	-117.2457
Plante Ferry	RBT	1999	Fillet	N	99485013-dup	Aroclor	1,248	0.03	47.6970	-117.2457
Plante Ferry	RBT	1999	Fillet	N	99485014	Aroclor	70	0.047	47.6970	-117.2457
Plante Ferry	RBT	1999	Fillet	N	99485015	Aroclor	1,610	0.02	47.6970	-117.2457

Location	Species	Year	Tissue	Composite?	Samp ID	Analysis	T-PCB	Frx Lipid	Latitude	Longitude
Plante Ferry	RBT	1999	Fillet	N	99485016	Aroclor	100	0.028	47.6970	-117.2457
Plante Ferry	RBT	1999	Fillet	N	99485017	Aroclor	1,320	0.045	47.6970	-117.2457
Plante Ferry	RBT	2003	Fillet	Y	4188309	Congener	28	0.017	47.6946	-117.2393
Plante Ferry	RBT	2003	Fillet	Y	4188308	Congener	41	0.017	47.6946	-117.2393
Plante Ferry	RBT	1999	Whole	Y	99485012	Aroclor	755	0.077	47.6970	-117.2457
Plante Ferry	LSS	1993	Whole	N	93318243	Aroclor	2,005	0.043	47.6977	-117.2450
Plante Ferry	LSS	1994	Whole		94318263	Aroclor	531	0.036	47.6977	-117.2450
Plante Ferry	LSS	1996	Whole	Y	96428099	Aroclor	530	0.037	47.6977	-117.2450
Plante Ferry	LSS	1999	Whole	Y	99485018	Aroclor	283	0.045	47.6970	-117.2457
Plante Ferry	LSS	2003	Whole	Y	4324440	Congener	140	0.046	47.6946	-117.2393
Plante Ferry	LSS	2003	Whole	Y	4324441	Congener	54	0.033	47.6946	-117.2393
Plante Ferry	LSS	1999	Fillet	N	99485019	Aroclor	207	0.019	47.6970	-117.2457
Plante Ferry	LSS	1999	Fillet	N	99485020	Aroclor	215	0.027	47.6970	-117.2457
Plante Ferry	LSS	1999	Fillet	N	99485021	Aroclor	67	0.024	47.6970	-117.2457
Plante Ferry	LSS	1999	Fillet	N	99485022	Aroclor	60	0.006	47.6970	-117.2457
Plante Ferry	LSS	1999	Fillet	N	99485023	Aroclor	191	0.016	47.6970	-117.2457
Monroe St.	RBT	1994	Fillet		94328425	Aroclor	164	0.012	47.6793	-117.3709
Monroe St.	RBT	1994	Fillet		94328426	Aroclor	111	0.011	47.6793	-117.3709
Monroe St.	RBT	1994	Fillet		94328427	Aroclor	161	0.012	47.6793	-117.3709
Monroe St.	RBT	1996	Fillet	Y	96428093	Aroclor	73	0.015	47.6793	-117.3709
Monroe St.	RBT	1996	Fillet	Y	96428094	Aroclor	78	0.011	47.6793	-117.3709
Monroe St.	RBT	1999	Fillet	N	99485024	Aroclor	136	0.012	47.6785	-117.3638
Monroe St.	RBT	1999	Fillet	N	99485025	Aroclor	325	0.029	47.6785	-117.3638
Monroe St.	RBT	1999	Fillet	N	99485026	Aroclor	398	0.022	47.6785	-117.3638
Monroe St.	RBT	1999	Fillet	N	99485027	Aroclor	143	0.011	47.6785	-117.3638
Monroe St.	RBT	1999	Fillet	N	99485028	Aroclor	126	0.018	47.6785	-117.3638
Monroe St.	RBT	1999	Whole	Y	99485029	Aroclor	362	0.043	47.6785	-117.3638
Monroe St.	MWF	1994	Fillet		94328428	Aroclor	530	0.056	47.6793	-117.3709
Monroe St.	MWF	1994	Fillet		94328429	Aroclor	449	0.055	47.6793	-117.3709
Monroe St.	MWF	1994	Fillet		94328430	Aroclor	725	0.046	47.6793	-117.3709
Monroe St.	MWF	1996	Fillet	Y	96428091	Aroclor	398	0.042	47.6793	-117.3709
Monroe St.	MWF	1996	Fillet	Y	96428092	Aroclor	364	0.039	47.6793	-117.3709
Monroe St.	MWF	1999	Fillet	N	99485030	Aroclor	478	0.083	47.6785	-117.3638
Monroe St.	MWF	1999	Fillet	N	99485031	Aroclor	338	0.082	47.6785	-117.3638
Monroe St.	MWF	1999	Fillet	N	99485032	Aroclor	335	0.058	47.6785	-117.3638
Monroe St.	MWF	1999	Fillet	N	99485033	Aroclor	380	0.074	47.6785	-117.3638

Location	Species	Year	Tissue	Composite?	Samp ID	Analysis	T-PCB	Frx Lipid	Latitude	Longitude
Monroe St.	MWF	1999	Fillet	N	99485034	Aroclor	162	0.091	47.6785	-117.3638
Monroe St.	MWF	1999	Whole	Y	99485035	Aroclor	397	0.167	47.6785	-117.3638
Monroe St.	LSS	1994	Whole		94328431	Aroclor	201	0.012	47.6793	-117.3709
Monroe St.	LSS	1996	Whole	Y	96428095	Aroclor	116	0.008	47.6793	-117.3709
Monroe St.	LSS	1999	Whole	Y	99485041	Aroclor	449	0.025	47.6785	-117.3638
Monroe St.	LSS	2000	Whole	Y	99485041-dup	Aroclor	440	na	47.6785	-117.3638
Monroe St.	LSS	1999	Fillet	N	99485036	Aroclor	144	0.012	47.6785	-117.3638
Monroe St.	LSS	1999	Fillet	N	99485037	Aroclor	429	0.008	47.6785	-117.3638
Monroe St.	LSS	1999	Fillet	N	99485038	Aroclor	92	0.007	47.6785	-117.3638
Monroe St.	LSS	1999	Fillet	N	99485039	Aroclor	193	0.017	47.6785	-117.3638
Monroe St.	LSS	1999	Fillet	N	99485040	Aroclor	88	0.006	47.6785	-117.3638
Ninemile	RBT	1993	Fillet		93318252	Aroclor	505	0.029	47.7445	-117.5246
Ninemile	RBT	1993	Fillet		93318253	Aroclor	474	0.027	47.7445	-117.5246
Ninemile	RBT	1994	Fillet		94318254	Aroclor	320	0.054	47.7445	-117.5246
Ninemile	RBT	1994	Fillet		94318255	Aroclor	205	0.03	47.7445	-117.5246
Ninemile	RBT	1994	Fillet		94318256	Aroclor	589	0.052	47.7445	-117.5246
Ninemile	RBT	1996	Fillet	Y	96428084	Aroclor	63	0.015	47.7445	-117.5246
Ninemile	RBT	1996	Fillet	Y	96428085	Aroclor	128	0.017	47.7445	-117.5246
Ninemile	RBT	1996	Fillet	Y	96428086	Aroclor	38	0.015	47.7445	-117.5246
Ninemile	RBT	1999	Fillet	N	99485043	Aroclor	363	0.006	47.7407	-117.5196
Ninemile	RBT	1999	Fillet	N	99485044	Aroclor	75	0.003	47.7407	-117.5196
Ninemile	RBT	1999	Fillet	N	99485045	Aroclor	65	0.006	47.7407	-117.5196
Ninemile	RBT	1999	Fillet	N	99485046	Aroclor	86	0.006	47.7407	-117.5196
Ninemile	RBT	1999	Fillet	N	99485047	Aroclor	139	0.009	47.7407	-117.5196
Ninemile	RBT	1999	Fillet	N	99485048	Aroclor	185	0.032	47.7407	-117.5196
Ninemile	RBT	1999	Fillet	N	99485049	Aroclor	85	0.023	47.7407	-117.5196
Ninemile	RBT	2003	Fillet	N	3084299	Congener	17	0.002	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084293	Congener	27	0.018	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084284	Congener	34	0.019	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084304	Congener	10	0.003	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084290	Congener	75	0.033	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084288	Congener	17	0.019	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084281	Congener	10	0.015	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084305	Congener	12	0.005	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084291	Congener	52	0.025	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084303	Congener	29	0.009	47.7324	-117.5096

Location	Species	Year	Tissue	Composite?	Samp ID	Analysis	T-PCB	Frx Lipid	Latitude	Longitude
Ninemile	RBT	2003	Fillet	N	3084301	Congener	43	0.015	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084296	Congener	11	0.004	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084285	Congener	51	0.011	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084298	Congener	16	0.009	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084292	Congener	45	0.02	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084295	Congener	15	0.006	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084306	Congener	35	0.016	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084294	Congener	10	0.01	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084283	Congener	13	0.013	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084289	Congener	42	0.007	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084302	Congener	20	0.008	47.7324	-117.5096
Ninemile	RBT	2004	Fillet	N	3084308 dup. of 03084282)	Congener	59	0.028	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084282	Congener	53	0.026	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084287	Congener	12	0.004	47.7324	-117.5096
Ninemile	RBT	2003	Fillet	N	3084286	Congener	12	0.01	47.7324	-117.5096
Ninemile	RBT	1999	Whole	Y	99485042	Aroclor	221	0.021	47.7407	-117.5196
Ninemile	MWF	1993	Fillet		93318254	Aroclor	522	0.027	47.7445	-117.5246
Ninemile	MWF	1994	Fillet		94318257	Aroclor	120	0.069	47.7445	-117.5246
Ninemile	MWF	1994	Fillet		94318258	Aroclor	111	0.084	47.7445	-117.5246
Ninemile	MWF	1994	Fillet		94318259	Aroclor	185	0.066	47.7445	-117.5246
Ninemile	MWF	1996	Fillet	Y	96428087	Aroclor	560	0.045	47.7445	-117.5246
Ninemile	MWF	1996	Fillet	Y	96428088	Aroclor	430	0.055	47.7445	-117.5246
Ninemile	MWF	1996	Fillet	Y	96428089	Aroclor	343	0.051	47.7445	-117.5246
Ninemile	MWF	1999	Fillet	N	99485050	Aroclor	291	0.039	47.7407	-117.5196
Ninemile	MWF	1999	Fillet	N	99485051	Aroclor	483	0.072	47.7407	-117.5196
Ninemile	MWF	1999	Fillet	N	99485052	Aroclor	172	0.037	47.7407	-117.5196
Ninemile	MWF	1999	Fillet	N	99485053	Aroclor	1,490	0.062	47.7407	-117.5196
Ninemile	MWF	2000	Fillet	N	99485053-dup	Aroclor	2,170	na	47.7407	-117.5196
Ninemile	MWF	1999	Fillet	N	99485054	Aroclor	386	0.038	47.7407	-117.5196
Ninemile	MWF	1999	Whole	Y	99485055	Aroclor	930	0.149	47.7407	-117.5196
Ninemile	LSS	1993	Whole		93318242	Aroclor	1,210	0.056	47.7445	-117.5246
Ninemile	LSS	1996	Whole	Y	96428090	Aroclor	345	0.021	47.7445	-117.5246
Ninemile	LSS	1999	Whole	Y	99485061	Aroclor	680	0.022	47.7407	-117.5196
Ninemile	LSS	1999	Fillet	N	99485056	Aroclor	100	0.008	47.7407	-117.5196
Ninemile	LSS	1999	Fillet	N	99485057	Aroclor	154	0.013	47.7407	-117.5196
Ninemile	LSS	1999	Fillet	N	99485058	Aroclor	247	0.03	47.7407	-117.5196

Location	Species	Year	Tissue	Composite?	Samp ID	Analysis	T-PCB	Frx Lipid	Latitude	Longitude
Ninemile	LSS	1999	Fillet	N	99485059	Aroclor	113	0.026	47.7407	-117.5196
Ninemile	LSS	2000	Fillet	N	99485059-dup	Aroclor	70	na	47.7407	-117.5196
Ninemile	LSS	1999	Fillet	N	99485060	Aroclor	142	0.026	47.7407	-117.5196
Ninemile	BLS	2004	Whole	Y	4324450	Congener	28	0.048	47.7430	-117.5216
Ninemile	BLS	2004	Whole	Y	4324447	Congener	32	0.027	47.7430	-117.5216
Ninemile	BLS	2005	Whole	Y	4324448 (dup. of 04324447)	Congener	30	0.025	47.7430	-117.5216
Long Lake	MWF	1993	Fillet		93318250	Aroclor	780	0.035	47.8404	-117.7289
Long Lake	MWF	1994	Fillet		94318249	Aroclor	150	0.036	47.8404	-117.7289
Long Lake	MWF	1994	Fillet		94318250	Aroclor	118	0.034	47.8404	-117.7289
Long Lake	MWF	1994	Fillet		94318251	Aroclor	71	0.019	47.8404	-117.7289
Long Lake	MWF	2001	Fillet	Y	2158308	Aroclor	89	0.0188	47.7966	-117.5858
Long Lake	MWF	2001	Fillet	Y	2158309	Aroclor	60	0.0153	47.7966	-117.5858
Long Lake	MWF	2001	Fillet	Y	2158310	Aroclor	70	0.0183	47.7966	-117.5858
Long Lake	LMBS	1993	Fillet		93318249	Aroclor	97	0.006	47.8404	-117.7289
Long Lake	LMBS	1994	Fillet		94318240	Aroclor	94	0.01	47.8404	-117.7289
Long Lake	LMBS	1994	Fillet		94318247	Aroclor	104	0.011	47.8404	-117.7289
Long Lake	LMBS	2001	Fillet	Y	2158303	Aroclor	47	0.0041	47.8094	-117.7962
Long Lake	LMBS	2001	Fillet	Y	2158304	Aroclor	64	0.0062	47.8094	-117.7962
Long Lake	LMBS	2001	Fillet	Y	2158305	Aroclor	57	0.0032	47.8094	-117.7962
Long Lake	LMBS	2001	Fillet	Y	2158306	Aroclor	39	0.0061	47.7966	-117.5858
Long Lake	LMBS	2001	Fillet	Y	2158307	Aroclor	72	0.0076	47.7966	-117.5858
Long Lake	LMBS	2001	Fillet	Y	2158311	Aroclor	39	0.0033	47.7966	-117.5858
Long Lake	SMBS	2001	Fillet	Y	2138294	Aroclor	33	0.0017	47.8094	-117.7962
Long Lake	SMBS	2001	Fillet	Y	2138295	Aroclor	11 (U)	0.0009	47.8094	-117.7962
Long Lake	SMBS	2001	Fillet	Y	2138296	Aroclor	31	0.0023	47.8094	-117.7962
Long Lake	YPER	1993	Fillet		93318251	Aroclor	9	0.002	47.8404	-117.7289
Long Lake	YPER	1993	Fillet		93318251	Aroclor	10	0.002	47.8404	-117.7289
Long Lake	YPER	1994	Fillet		94318244	Aroclor	9	0.002	47.8404	-117.7289
Long Lake	YPER	1994	Fillet		94318245	Aroclor	16	0.002	47.8404	-117.7289
Long Lake	YPER	1994	Fillet		94318246	Aroclor	6	0.002	47.8404	-117.7289
Long Lake	YPER	2001	Fillet	Y	2138297	Aroclor	10 (U)	0.0013	47.8094	-117.7962
Long Lake	YPER	2001	Fillet	Y	2148298	Aroclor	11 (U)	0.0017	47.8094	-117.7962
Long Lake	YPER	2001	Fillet	Y	2148299	Aroclor	10 (U)	0.0018	47.8094	-117.7962
Long Lake	PKMN	1994	Fillet		94318233	Aroclor	300	0.015	47.8404	-117.7289
Long Lake	PKMN	1994	Fillet		94318234	Aroclor	206	0.016	47.8404	-117.7289
Long Lake	PKMN	1994	Fillet		94318235	Aroclor	200	0.012	47.8404	-117.7289

Location	Species	Year	Tissue	Composite?	Samp ID	Analysis	T-PCB	Frx Lipid	Latitude	Longitude
Long Lake	WHCR	1994	Fillet		94318243	Aroclor	97	0.025	47.8404	-117.7289
Long Lake	WHCR	1994	Fillet		94328436 (dup. of 94318243)	Aroclor	98	0.025	47.8404	-117.7289
Long Lake	BRT	1994	Fillet		94318241	Aroclor	193	0.04	47.8404	-117.7289
Long Lake	LSS	1994	Whole		94318248	Aroclor	820	0.034	47.8404	-117.7289
Long Lake	LSS	2001	Whole	N	2138281	Aroclor	393	0.0254	47.8094	-117.7962
Long Lake	LSS	2001	Whole	N	2138282	Aroclor	321	0.041	47.8094	-117.7962
Long Lake	LSS	2001	Whole	N	2138283	Aroclor	336	0.0402	47.7966	-117.5858
Long Lake	LSS	2001	Whole	N	2138284	Aroclor	294	0.0552	47.7966	-117.5858
Long Lake	LSS	2001	Whole	N	2138285	Aroclor	164	0.0146	47.7966	-117.5858
Long Lake	LSS	2004	Whole	Y	4324446	Congener	253	0.091	47.8277	-117.7452
Long Lake	LSS	2004	Whole	Y	4324444	Congener	195	0.077	47.8277	-117.7452
Long Lake	LSS	2001	Fillet	Y	2138288	Aroclor	112	0.0192	47.8094	-117.7962
Long Lake	LSS	2001	Fillet	Y	2138289	Aroclor	63	0.0148	47.8094	-117.7962
Long Lake	LSS	2001	Fillet	Y	2138290	Aroclor	100	0.0186	47.8094	-117.7962
Long Lake	LSS	2001	Fillet	Y	2138280	Aroclor	112	0.0183	47.7966	-117.5858
Long Lake	LSS	2001	Fillet	Y	2138286	Aroclor	86	0.0155	47.7966	-117.5858
Long Lake	LSS	2001	Fillet	Y	2138287	Aroclor	132	0.0189	47.7966	-117.5858
Long Lake	LSS	2001	Fillet	Y	2138291	Aroclor	32	0.0046	47.7966	-117.5858
Long Lake	LSS	2001	Fillet	Y	2138292	Aroclor	40	0.0043	47.7966	-117.5858
Long Lake	LSS	2001	Fillet	Y	2138293	Aroclor	54	0.0069	47.7966	-117.5858
Long Lake	LSS	2001	Fillet	Y	2148300	Aroclor	11 (U)	0.0026	47.7966	-117.5858
Long Lake	LSS	2001	Fillet	Y	2148301	Aroclor	11 (U)	0.0035	47.7966	-117.5858
Long Lake	LSS	2001	Fillet	Y	2148302	Aroclor	11 (U)	0.0033	47.7966	-117.5858

BLS=bridgelip sucker
BRT=brown trout
LMBS=largemouth bass
LSS=largescale sucker
MWF=mountain whitefish
PKMN=northern pike minnow
RBT=rainbow trout
SMBS=smallmouth bass
WHCR=white crappie
YPER=yellow perch
na=not analyzed
U=undetected at concentration shown

Appendix C
Target Organic Analytes and Reporting Limits

Table C-1. Target Organic Analytes and Reporting Limits

Analyte	Reporting Limit (ng/g ww)		Analyte	Reporting Limit (pg/g ww)
PCBs			**PCDDs/PCDFs**	
Aroclor-1016	5		2,3,7,8-TCDD	0.7
Aroclor-1221	5		1,2,3,7,8-PeCDD	0.5
Aroclor-1232	5		1,2,3,4,7,8-HxCDD	0.6
Aroclor-1242	5		1,2,3,6,7,8-HxCDD	0.6
Aroclor-1248	5		1,2,3,7,8,9-HxCDD	0.6
Aroclor-1254	5		1,2,3,4,6,7,8-HpCDD	0.9
Aroclor-1260	5		OCDD	0.8
			2,3,7,8-TCDF	0.3
PBDEs			1,2,3,7,8-PeCDF	0.9
PBDE-47	0.4		2,3,4,7,8-PeCDF	0.3
PBDE-66	0.4		1,2,3,4,7,8-HxCDF	0.6
PBDE-71	0.4		1,2,3,6,7,8-HxCDF	0.6
PBDE-99	0.4		2,3,4,6,7,8-HxCDF	0.6
PBDE-100	0.4		1,2,3,7,8,9-HxCDF	0.6
PBDE-138	0.4		1,2,3,4,6,7,8-HpCDF	0.3
PBDE-153	0.4		1,2,3,4,7,8,9-HpCDF	0.7
PBDE-154	0.4		OCDF	0.9
PBDE-183	0.4			
PBDE-184	0.4			
PBDE-191	0.4			
PBDE-209	4			