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Addendum 5 to Quality Assurance Project Plan

Freshwater Fish Contaminant Monitoring Program: 2016

December 2016

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Addendum

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This addendum is an addition to an original Quality Assurance Project Plan. It is not a correction (errata) to the original plan.

Data for this project will be available on Ecology's Environmental Information Management (EIM) website at www.ecy.wa.gov/eim/index.htm. Search Study ID FFCMP16.

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Authors and Contact Information

Keith Seiders and Casey Deligeannis
Environmental Assessment Program
Washington State Department of Ecology
Olympia, Washington 98504-7710

For more information contact: Communications Consultant, phone 360-407-6764.

Addendum 5 to
Quality Assurance Project Plan

Freshwater Fish Contaminant Monitoring Program: 2016

December 2016

Approved by:

Signature:	Date: December 2016
Jessica Archer, Client and Author's Section Manager, EAP	
Signature:	Date: December 2016
Carol Smith, Client's Supervisor and Program Manager, EAP	
Signature:	Date: December 2016
Keith Seiders, Author / Project Manager, TSU, EAP	
Signature:	Date: December 2016
Debby Sargeant, Author's Supervisor, TSU, EAP	
Signature:	Date: December 2016
Dale Norton, Western Operations Section Manager, EAP	
Signature:	Date: December 2016
Tom Mackie, Supervisor, Eastern Operations Section, EAP	
Signature	Date: December 2016
Joel Bird, Director, Manchester Environmental Laboratory	
Signature:	Date: December 2016
Bill Kammin, Ecology Quality Assurance Officer	

Signatures are not available on the Internet version.
EAP: Environmental Assessment Program
TSU: Toxics Studies Unit

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3.0 Background

This document describes the 2016 sampling effort for the Washington State Department of Ecology (Ecology) Freshwater Fish Contaminant Monitoring Program (FFCMP) and is an addendum to the Quality Assurance Project Plan (Seiders, 2013). The 2016 sampling effort will focus on the Cowlitz River basin in Washington. The main goals are to characterize current contaminant levels in resident fish, establish a robust baseline for future monitoring efforts, and determine changes over time by comparing results with historical data. We were planning to sample the Walla Walla River basin in 2016 but have postponed that effort to 2017 because of second year of low flows and shifting priorities.

Previous studies and associated data were reviewed to guide development of project objectives and the sampling plan. Contaminants assessed in previous studies included CPs (chlorinated pesticides), PBDEs (polybrominated diphenyl ethers), PCBs (polychlorinated biphenyls), and PCDD/Fs (polychlorinated dibenzo-p-dioxins and –furans). These chemicals were often found at elevated levels from which a decrease could likely be detected over time, assuming that inputs decrease. Reductions in contaminant levels might also approach levels seen in similar species from "background" areas – those areas not directly impacted by human activities.

Collectively, data from the historical sampling efforts comprise a mix of sites, species, tissue types, collection seasons, and analytical methods. Monitoring efforts or data analyses to measure statistically significant temporal changes have not been pursued in the Cowlitz River basin. Typical challenges associated with such efforts include small sample sizes, high variability associated with fish tissue, and high costs associated with laboratory analyses for organic contaminants.

Information about previous work on contaminants in fish from the 2016 target locations is summarized below.

Cowlitz River

Two sites in the Cowlitz have been sampled in the past: the river near the town of Vader and the reservoir Mayfield Lake. The sampling was part of statewide screening-level studies for various contaminants. Table 1 shows the timeframe, species, and target analytes for studies conducted in the Cowlitz River.

Results from these studies showed that concentrations of several chemicals in fish tissue did not meet Washington water quality standards. These results led to 303(d) listings for PCBs, dioxin (2,3,7,8-TCDD), and mercury (Table 2). The 303(d) listings are also known as Category 5 listings in Ecology's periodic statewide Water Quality Assessment (http://www.ecy.wa.gov/programs/Wq/303d/index.html).

Table 1. Summary of fish contaminant studies for the Cowlitz River.

Study:		Ecology WSPMP [1]	Ecology PBDE [2]	Ecology WSTMP [3]
Sample Year:		**1995**	**2005**	**2005**
Species	**Location**	**Number and tissue type of samples analyzed**		
CTT	Cowlitz R, middle (near Vader)	1f		1f
LSS		2w		
MWF		2f		1f
NPM				1f
LMB	Mayfield Reservoir			1f*
LSS			1f	
NPM				1f*
YP				1f*
Target Analytes				
CP		x		x
Mercury				x
PBDE			x	x
PCB		x		x
PCDD/F				x

All samples are composites of fillets (f) or whole fish (w) from multiple fish.
References: 1- Davis et al., 1998; 2- Johnson et al., 2006; 3- Seiders et al., 2007.
Study Codes: PBDE: Statewide PBDE Screening Study. WSPMP: Washington State Pesticide Monitoring Program. WSPMP: Washington State Toxics Monitoring Program.
* Results from these samples were also used in the PBDE project.
Species Codes: CTT: Cutthroat trout; LMB: Largemouth bass; LSS: Largescale sucker; MWF: Mountain whitefish; NPM: Northern pikeminnow; YP: Yellow perch.

Table 2. Category 5 and Category 2 Listings for the Cowlitz Basin.

Waterbody Name	Assessment Unit ID	Water Quality Assessment Parameter Name	Current Category	Species Not Meeting Standard	Listing ID
Cowlitz River	17080005000220	PCBs	5	CTT, MWF, NPM	17164
		Mercury	5	NPM	52602
		2,3,7,8-TCDD (Dioxin)	5	CTT, NPM	51552
		2,3,7,8-TCDD TEQ	2	CTT, NPM	51605
Mayfield Lake	46122F5E3	PCBs	5	LMB, NPM	52669

Species Codes: CTT: Cutthroat trout; LMB: Largemouth bass; LSS: Largescale sucker; MWF: Mountain whitefish; NPM: Northern pikeminnow; YP: Yellow perch.

These 303(d) listings can affect how communities along the river manage their wastewater discharges, so the more comprehensive sampling effort in 2016 will help address questions about the extent of pollution in the river and its reservoirs. Table 3 summarizes results for chemicals in fish tissue from the Cowlitz River.

Table 3. Results for key parameters from past sampling efforts in the Cowlitz River.

Site	Species and Sample Year	t-PCB (ug/kg)	TCDD TEQ (ng/kg)	t-PBDE (ug/kg)	t-DDT (ug/kg)	Mercury (ug/kg)	Lipid (%)	Mean Total Length (mm)	Mean Weight (g)	Mean Age (yr)
Cowlitz River near Vader	CTT-1995	**84** J			**53** *		3.0	312	315	
	CTT-2005	**55**	**0.303**	5.0	29	87.0	4.7	360	493	3.0
	LSSw-1995	84 J			91		2.5	434	868	
	LSSw-1995	108 J			71		2.8	467	1036	
	MWF-1995	**47** J			13		6.0	350	403	
	MWF-1995	**60** J			10		5.8	382	611	
	MWF-2005	**46**		24	6.2	205	6.8	441	859	5.6
	NPM-2005	**92**	**0.410**	18	21	**859**	1.8	427	656	10.6
Mayfield Lake	LMB-2005	**5.5**	0.050 UJ	2.0	1.0 U	242	0.88	328	610	4.2
	LSS-2005			2.6 J			1.7	443	918	12.8
	NPM-2005	**8.9**	0.009	2.3	2.5	474	1.5	312	244	6.4
	YP-2005	5.0 U		0.38	1.0 U	84.0	0.52	237	164	4.0

Bold values indicate results that do not meet Washington's current water quality standards.

* 4,4'-DDE in this sample was 42 ug/kg which exceeded the water quality standard of 32 ug/kg.
J: Estimated value.
U: Not detected at or above the reported value.
UJ: Not detected at or above the estimated reporting limit.
Species Codes: CTT: Cutthroat trout; LMB: Largemouth bass; LSS: Largescale sucker; MWF: Mountain whitefish; NPM: Northern pikeminnow; YP: Yellow perch.

4.0 Project Description

The main goal of the 2016 monitoring effort is to develop a robust data set of contaminant levels in fish from the Cowlitz River to:

- Characterize temporal trends by comparisons to historical and future data.
- Compare results to current and proposed water quality standards (FTECs).
- Support fish consumption risk assessments by health jurisdictions.
- Inform water quality management efforts such as TMDLs and related planning.

Table 4 shows location information for the 2016 sites. Site selection was described in the original QAPP and is refined here for the 2016 effort. The key characteristics of sites selected for long term monitoring are:

- Concentrations of key contaminants are elevated in fish tissue.
- Likelihood of detecting change in contaminant levels over time.
- Presence of historical data that can be used for temporal comparisons.
  - Multiple samples taken during previous efforts.
  - Multiple sampling efforts at different times in the past.
  - Potential for pooling data to increase statistical sensitivity.
- Waters impaired: Category 5 or 2 from the most recent Water Quality Assessment.
- Ability to collect desired species: access, permits, species abundance.

Table 4. Site information for proposed sample locations, FFCMP 2016.

Waterbody	Site Description	WRIA	EIM Location ID
Cowlitz River	Longview/Kelso area to Castle Rock, RM 1-17	26 - Cowlitz	na
Cowlitz River	Olequa Cr, 8 mi N of Castle Rock, to I-5 bridge, RM 24-30	26 - Cowlitz	COWLITZ-F
Mayfield Lake (Cowlitz River)	From dam to east end narrows, Cowlitz R, RM 52.2-62	26 - Cowlitz	MAYFIELD-F
Riffe Lake (Cowlitz River)	From dam to east end of lake, RM 66-85	26 - Cowlitz	na
Scanewa Lake (Cowlitz-Cispus River confluence)	From Cowlitz Falls dam upstream to mouths of Cowlitz and Cispus Rivers (approx 1-2 miles)	26 - Cowlitz	na
Cowlitz River	Upstream confluence at east end of Riffe Lake to Cowlitz Falls, RM 85-88.5	26 - Cowlitz	na
Cowlitz River	Upstream of confluence with Cispus R to 4 mi NE of Packwood, RM 91-131	26 - Cowlitz	na

RM: River mile.

Figure 1 show the proposed sampling locations for 2016 in the Cowlitz River.

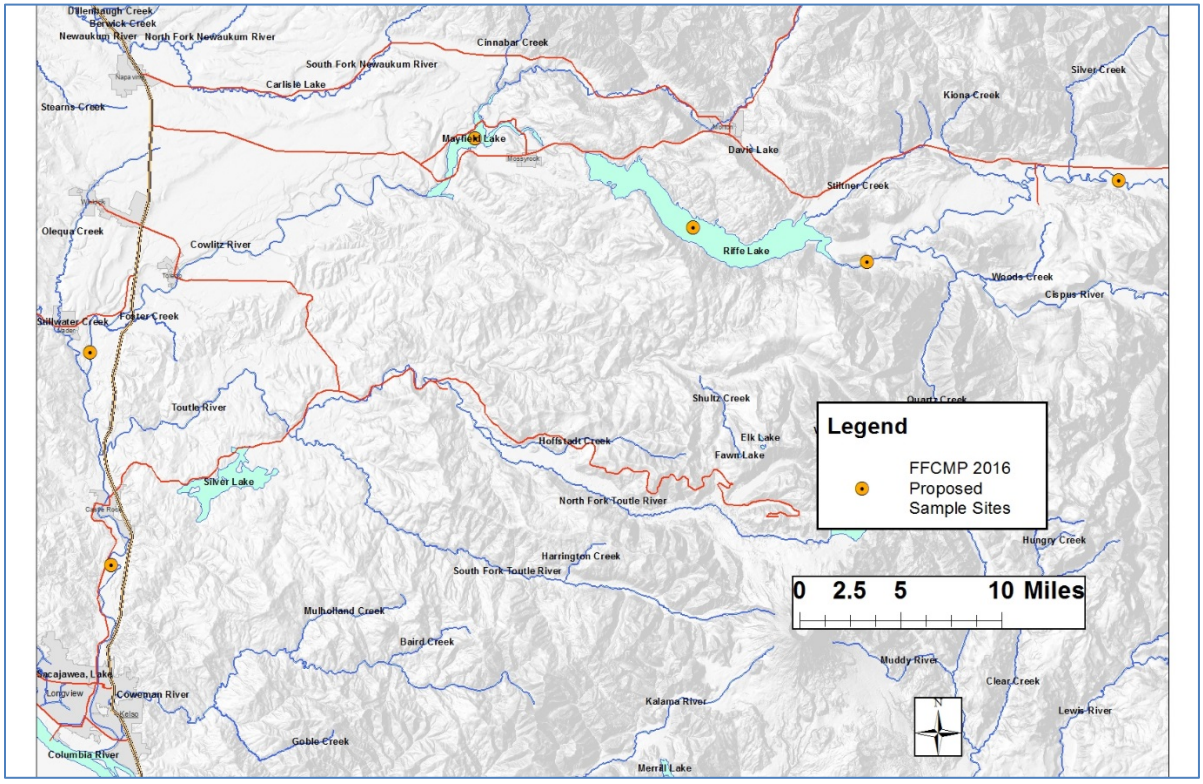

Figure 1. Proposed sampling locations in the Cowlitz River.

Target analytes include chlorinated pesticides, mercury, polybrominated diphenyl ethers (PBDEs), polychlorinated biphenyls (PCBs), and polychlorinated dibenzo-p-dioxins and -furans (PCDD/Fs).

This project will use data collected through past monitoring efforts conducted by Ecology as described above. These data and associated documentation (e.g., project plans, project reports, and laboratory data reports) will be reviewed to assess their usability in this project.

For the long-term monitoring strategy at selected sites in the target watersheds, multiple replicates of composite samples for each species at each site are anticipated to provide an adequately robust data set that will meet objectives. Review of field replicate data from previous FFCMP work showed that variance is inconsistent and can be high for organic contaminants, ranging up to 100% Relative Percent Difference (RPD) for PCBs, DDTs, and PCDD/Fs. A sample size of five to seven composite samples should reduce the variability associated with the mean and median tissue concentrations and improve the ability to determine change among sample results over time.

Table 5 shows the sites, target species, and number of analyses of composite samples by analyte group. Actual numbers of samples may be adjusted depending on success of fish collection efforts.

Table 5. Sample plan and estimated laboratory costs, FFCMP 2016.

Sites	Species Code	Number of Composite Samples for Each Analysis					
		Mercury	Cl Pest, PCB Aroclor, PBDE, lipid	3 PCB Aroclors, 3 DDTs, lipid	PCDD/F		CL Pest, HiRes **
Cowlitz R, lower	CTT	3	3	4	3		1
	LSSw		3	4			
	MWF	3	3	4	3		1
	NPM	3	3	4	3		
Cowlitz R, middle	CTT	3	3	4	3		1
	LSSw		3	4			
	MWF	3	3	4	3		1
	NPM	3	3	4	3		
Mayfield L (Cowlitz R)	CTT	3	3		3		1
	LSSw		3				
	LMB	3	3				
	NPM	3	3		3		1
Riffe L (Cowlitz R)	CTT	3	3		3		1
	LSSw		3				
	SMB	3	3				
	NPM	3	3		3		1
Scanewa L (Cowlitz R)	CTT	3	3		3		1
	LSSw		3				
	MWF	3	3		3		1
	NPM	3	3		3		
Cowlitz R, upper	CTT	3	3	4	3		1
	MWF	3	3	4	3		1
Total # field samples		51	66	40	45		12
Total # lab QC analyses		3	4	2	2		1
Total # analyses		54	70	42	47		13
Cost per analysis		$ 50	$ 620	$ 264	$ 531		$ 1,100
Subtotal costs		$ 2,700	$ 43,400	$ 11,088	$ 24,969		$ 14,300
Grand Total		**$ 82,157**					**$ 14,300**

** High resolution analysis performed only if selected pesticides are not detected in analyses using EPA Method 8081: Additional funding may be needed.
Species codes: CTT: Cutthroat trout; LMB: Largemouth bass; LSSw: Largescale sucker (as whole fish); MWF: Mountain whitefish; NPM: Northern pikeminnow; SMB: Smallmouth bass.

5.0 Organization and Schedule

Table 6 lists the people involved in this project. All are employees of the Washington State Department of Ecology. Table 6 is the proposed schedule for this project.

Table 6. Organization of project staff and responsibilities, FFCMP 2016.

EAP Staff	Title	Responsibilities
Jessica Archer SCS 360-407-6698	Client	Provides internal review of the QAPP, addendums, and reports. Approves the final QAPP and addendums.
Keith Seiders Toxics Studies Unit SCS 360-407-6689	Project Manager and Principal Investigator	Writes the QAPP, addendums, and reports. Reviews historical data and develops sample strategy for different sites on annual basis. Works with laboratories to obtain analytical services. Reviews, analyzes, and interprets data. Guides field assistants in various roles and tasks.
Patti Sandvik Toxics Studies Unit SCS 360-407-7198	Field and EIM Lead, Project Assistant	Leads efforts for sample collection, processing, and transportation of samples to the laboratory. Ensures that field and processing information is recorded. Enters field and laboratory data into EIM. Compiles and summarizes historical and current-year data. Assists report effort.
Debby Sargeant Toxics Studies Unit SCS 360-407-6139	Unit Supervisor for the Project Manager	Provides internal review of the QAPP, addendums, and reports. Approves the final QAPP and addendums. Manages budget and staffing needs.
Joel Bird Manchester Environmental Lab 360-871-8801	Laboratory Director	Approves the final QAPP. Oversees all operations at MEL regarding in-house analyses and processes for contracting analyses to commercial labs.
William R. Kammin 360-407-6964	Ecology Quality Assurance Officer	Reviews the draft QAPP and addendums. Approves the final QAPP and addendums.
Dale Norton WOS 360-407-6596	Supervisor, EAP – Western Operations	Helps coordinate SWRO and NWRO inter-program and inter-office efforts as needed, especially public communications.

EAP: Environmental Assessment Program
EIM: Environmental Information Management database
NWRO: Northwest Regional Office
SWRO: Southwest Regional Office
QAPP: Quality Assurance Project Plan
SCS: Statewide Coordination Section
WOS: Western Operations Section

Table 7. Schedule for completing field, laboratory, and report tasks, FFCMP 2016.

Field and laboratory work	Due date	Lead staff
Field work completed	October 2016	Patti Sandvik
Sample processing completed	December 2016	Patti Sandvik
Ecology Lab analyses completed	July 2017	MEL, Joel Bird
Contract Lab analyses completed	August 2017	MEL, Joel Bird
Environmental Information System (EIM) database		
EIM user study ID	FFCMP16	
Product	Due date	Lead staff
EIM data loaded	September 2017	Patti Sandvik
EIM data verification	October 2017	To be determined
EIM complete	November 2017	Patti Sandvik
Final report		
Author lead / Support staff	Keith Seiders / Patti Sandvik	
Schedule		
Draft due to supervisor	March 2018	
Draft due to client/peer reviewer	April 2018	
Draft due to external reviewer(s)	April 2018	
Final (all reviews done) due to publications coordinator	May 2018	
Final report due on web	June 2018	

6.0 Quality Objectives

Table 8 shows measurement quality objectives (MQOs).

Table 8. Measurement quality objective, FFCMP 2016.

Parameter	Analytical Method	Lab Duplicate (as RPD)	Lab Control Sample (% recovery)	Surrogates (% recovery)	Matrix Spike/Spike Duplicate (% recovery)
Mercury	EPA 245.6 (CVAA)	0%-20% (for results > 5x RL)	85%-115%	NA	75%-125%; RPD limit 20%
Chlorinated pesticides	EPA 8081 (GC/ECD); MEL SOP	0%-40%	50%-150%	20%-130% [a]	50%-150%; RPD limit 40%
Chlorinated pesticides (HiRes short list: if needed)	EPA 1699 or equivalent (HiRes GC/MS)	0%-40%	Per method for OPR, Internal Standards, and Labeled Compounds each sample & 1/batch [b]	NA	NA
PCB Aroclors	EPA 8082 (GC/ECD); MEL SOP	0%-40%	50%-150%	50%-150%	50%-150%; RPD limit 40%
PCB congeners (none planned for 2016)	EPA 1668A (HiRes GC/MS)	0%-40%	Per method for OPR, Internal Standards, and Labeled Compounds	NA	NA
PCDD/Fs	EPA 1613B (HiRes GC/MS)	0%-40%	Per method for OPR, Internal Standards, and Labeled Compounds	NA	NA
PBDEs	EPA 8270 (SIM); SOP 730104	0%-40%	50%-150%	50%-150%	50%-150%; RPD limit 40%
Lipids	MEL SOP 730009	0%-20%	NS	NA	NA

[a] Surrogate recovery limits were recently revised by MEL and are specific to surrogates used: some limits are 20%-120%, others are 30%-130%.

[b] Labeled compounds in each sample and Ongoing Precision and Recovery standards in each batch.

8.0 Sampling Procedures

Samples will be collected and processed as described in the project plan for the FFCMP (Seiders, 2013). Fish collection methods may include the use of gillnets, seines, electrofishing, and angling. Federal, tribal, and state scientific collection permits provide guidance for minimizing the disturbance of anadromous salmon and steelhead that may be present.

Table 9 shows sample containers, preservation, and holding times for fish tissue samples.

Table 9. Containers, preservation, and holding times for samples, FFCMP 2016.

Parameter	Sample Container	Minimum Amount Required *	Preservation	Holding Time
Mercury	2 oz. precleaned glass jar w/teflon lid	5g	freeze, -10° C	6 months to extraction, then 28 days to analysis
Chlorinated Pesticides	4 oz. precleaned glass jar w/teflon lid	30g, 60g preferred	freeze, -10° C	1 year to extraction, then 40 days to analysis
PCB Aroclors	4 oz. precleaned glass jar w/teflon lid	30g, 60g preferred	freeze, -10° C	1 year to extraction, then 40 days to analysis
PCB congeners (none planned for 2016)	4 oz. precleaned glass jar w/teflon lid	30g, 60g preferred	freeze, -10° C	1 year to extraction, then 40 days to analysis
PCDD/Fs	4 oz. precleaned glass jar w/teflon lid	30g, 60g preferred; ~220g if base digestion	freeze, -10° C	1 year to extraction, then 40 days to analysis
PBDEs	4 oz. precleaned glass jar w/teflon lid	30g, 60g preferred	freeze, -10° C	1 year to extraction, then 40 days to analysis
Lipids	4 oz. precleaned glass jar w/teflon lid	30 g	freeze, -10° C	1 year to extraction, then 40 days to analysis

8.3 Invasive species evaluation

Invasive or unwanted aquatic species may be encountered during fish collections for this project. Environmental ethics and Washington law prohibit the transportation of all aquatic plants, animals, and many noxious weeds. Sample collection efforts for this project will follow the Ecology Environmental Assessment Program's SOP to Minimize the Spread of Invasive Species (Parsons et al., 2012) and Washington Department of Fish and Wildlife's Invasive Species Management Protocols (Tweit et al., 2011).

For this year's target sites, the New Zealand mudsnail, an invasive species of extreme concern, is not known to be present. However, this mudsnail may be present in the first few river miles of the Cowlitz River and its confluence with the Columbia. While sampling is not planned for this area, the procedures described above will be followed if sampling occurs in this lower reach.

9.0 Measurement Methods

The analytical methods are consistent with the most recent FFCMP monitoring events. Laboratory analyses of most samples will be conducted by the Ecology Manchester Environmental Laboratory (MEL). Analyses for PCB congeners, PCDD/Fs, and chlorinated pesticides (if needed) will be done by an accredited laboratory through a contract managed by MEL. Both MEL and the contract laboratories are expected to meet the QC requirements of the analytical methods being used and any other requirements specified by MEL or the Project Officer.

Table 10 shows the parameters to be analyzed, analytical methods, desired reporting limits, and ranges of expected results (all results expressed as wet weight).

Table 10. Laboratory measurement methods for fish tissue samples, FFCMP 2016.

Parameter	Methods, Reporting Limits, and Sample Number			
	Number of Samples & Arrival Date [a]	Expected Range of Results [b]	Reporting Limits [c]	Analytical Method
Mercury	50, January 2017	10 - 1000 ug/kg	17 ug/kg	EPA 245.6 (CVAA)
Chlorinated pesticides	66-full suite plus 40 for 3 DDTs only, January 2017	0.1 - 1000 ug/kg for DDTs; 0.1 - 50 ug/kg for others	most 0.5 - 3.0 ug/kg	EPA 8081 (GC/ECD); MEL SOP
Chlorinated pesticides (HiRes short list IF NEEDED)	12, April, 2017	Varies by analyte: see Table 11	Varies by analyte: see Table 11	EPA 1699 or equivalent (HiRes GC/MS)
PCB Aroclors	66-full suite, plus 40 for 3 Aroclors only, January 2017	0.5 - 100 ug/kg, depending on Aroclor	1.1 - 5 ug/kg	EPA 8082 (GC/ECD); MEL SOP
PCB congeners (none planned for 2016)	None planned	0.005 - 10 ug/kg, depending on congener	0.003-0.01 ug/kg	EPA 1668A (HiRes GC/MS)
PCDD/Fs	45, January 2017	0.005 - 5.0 ng/kg, depending on congener and extraction method	EQL (Estimated Quantitation Limit) 0.017 - 0.5 ng/kg	EPA 1613B (HiRes GC/MS)
PBDEs	66 January 2017	0.1 - 100 ug/kg	0.10 - 2.6 ug/kg; PBDE 209 1.9 - 4.3 ug/kg	EPA 8270 (SIM); MEL SOP 730104
Lipids	106 (66+40), January 2017	0.1 - 20%	0.10%	MEL SOP 730009

[a] MEL will be informed of numbers and arrival dates when the sampling effort concludes.

[b] Values reflect historical data from the study area.

[c] Value reflects typical range.

Analytical methods need to be adequately sensitive to determine if water quality standards are being met. Ecology's recently proposed water quality standards for some chlorinated pesticides have values that are below the reporting and detection limits of commonly used methods. The use of Environmental Protection Agency (EPA) method 8081 often yields reporting limits that are higher than current or proposed water quality standards. Fish tissue is a challenging matrix and presents various interferences that often raise reporting limits for six chlorinated pesticides. These pesticides are aldrin, alpha-BHC, dieldrin, heptachlor, heptachlor epoxide, and toxaphene. These pesticides were identified in Table D-1 of the original QAPP as possibly needing extra effort by labs to achieve desired reporting limits (Seiders, 2013).

In order to obtain results that can be compared to water quality standards, a second round of analyses for pesticides may be conducted after reviewing results from the first round of analyses. An HRGC/HRMS method for chlorinated pesticides, such as method EPA 1699, or an equivalent or more sensitive method, will be used for this second round of analyses. A qualified laboratory will be selected through the Department of Enterprise Services bid solicitation process.

Table 11 shows the parameters to be analyzed with detection limits, quantitation limits, and the proposed and current water quality criteria; all are expressed as ug/kg wet weight. Pesticides other than the six mentioned above are also being analyzed to help inform MEL about issues related to interferences and interpretations of their analysis using EPA 8081.

Table 11. Characteristics of chlorinated pesticides to be analyzed using HR GC/MS for the FFCMP 2016 (ug/kg wet weight).

Analyte	CAS #	Required Detection Limit	Proposed FTEC	Current FTEC	Expected Range of Results
Aldrin	309-00-2	0.01	0.03	0.654	ND - 1.0
alpha-BHC (alpha-HCH)	319-84-6	0.02	0.07	1.69	ND - 1.0
Dieldrin	60-57-1	0.01	0.029	0.654	ND - 10
Heptachlor	76-44-8	0.02	0.111	2.35	ND - 10
Heptachlor Epoxide	1024-57-3	0.02	0.08	1.23	ND - 10
Toxaphene	8001-35-2	0.20	0.42	9.56	ND - 50
beta-BHC (beta-HCH)	319-85-7	0.02	0.2	5.98	ND - 1.0
Hexachlorobenzene	118-74-1	0.02	0.44	6.69	ND - 20

CAS: Chemical Abstract Service.
FTEC: Fish Tissue Equivalent Concentration.
ND: Non detect

10.0 Quality Control

Table 12 shows laboratory quality control procedures.

Table 12. Laboratory quality control sample types and frequencies, FFCMP 2016.

Parameter	Analytical Method	Lab Duplicates	Lab Control Standards	Surrogates	MS/MSD	Method Blanks
Mercury	EPA 245.6 (CVAA)	1/ batch [a]	1/batch	NA	1/batch	1/batch
Chlorinated pesticides	EPA 8081 (GC/ECD); MEL SOP	1/batch	1/batch	each sample	1/batch	1/batch
Chlorinated pesticides (HiRes short list)	HiRes GC/MS (EPA 1699 or equivalent)	1/batch	each sample & 1/batch [c]	NA	NA	1/batch
PCB Aroclors	EPA 8082 (GC/ECD); MEL SOP	1/batch	1/batch	each sample	1/batch	1/batch
PCB congeners [b] (none planned for 2016)	EPA 1668A (HiRes GC/MS)	1/batch	each sample & 1/batch [c]	NA	NA	1/batch
PCDD/Fs [b]	EPA 1613B (HiRes GC/MS)	1/batch	each sample & 1/batch [c]	NA	NA	1/batch
PBDEs	EPA 8270 (SIM); SOP 730104	1/batch	1/batch	each sample	1/batch	1/batch
Lipids	MEL SOP 730009	1/batch	1/batch	NA	NA	1/batch

[a] "Batch" is defined as up to 20 samples analyzed together.

[b] Includes one analysis of Certified Reference Material for the project (WMF-01 preferred; CARP-2 acceptable)

[c] Labeled compounds in each sample and Ongoing Precision and Recovery standards in each batch.

15.0 References

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