

**State Of Ohio  
Cooperative Fish Tissue Monitoring Program  
Fish Tissue Environmental Assessment Program**

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# Table of Contents

## Acronyms

### 1.0 History

### 2.0 Current Assessment Procedures

2.1 Lake Erie and the Ohio River Assessments

2.2 River and Stream Assessments

2.3 Inland Lake and Reservoir Assessments

### 3.0 Special Wildlife Exposure Assessments

3.1 Fish Tissue Wildlife Exposure Assessments

3.2 Sediment Wildlife Exposure Assessments

3.3 Sample Collection, Preparation and Transport

3.4 Fillet Preparation

3.5 Sample Analyses

### 4.0 Environmental Assessments

**Table 1: Ohio EPA Division of Environmental Services  
Fish Tissue (FT) and Sediment (S) Reporting Limits (RLs)**

## References

## Acronyms

PCB	Polychlorinated Biphenyl
GC/MS	Gas Chromatography/Mass Spectrometry
ODNR	Ohio Department of Natural Resources
SOP	Standard Operating Procedure
ORSANCO	Ohio River Valley Water Sanitation Commission
TOC	Total Organic Carbon
RL	Reporting Limit

## 1.0 History

The State of Ohio did not have a formal fish tissue monitoring program between 1975 and 1991. Monitoring projects varied in objectives, sample type, sample size and parameters analyzed. Limited numbers of whole body and fillet samples were analyzed. The majority of samples were analyzed for organochlorine pesticides and Polychlorinated Biphenyls (PCBs). A limited number of samples were analyzed by Gas Chromatography/Mass Spectrometry (GC/MS) for organic priority pollutants. Other chemicals were selected based upon analytical method development or environmental monitoring objectives. Sampling site selection was limited because of the narrow-focused objectives of the various monitoring projects. A detailed description of the various historical monitoring projects can be found in Ohio EPA's 1992, 1994 and 1996 305(b) biennial reports to Congress.

## 2.0 Current Assessment Procedures

### 2.1 Lake Erie and the Ohio River Assessments

The Ohio Department of Natural Resources (ODNR) is responsible for collecting Lake Erie and Ohio River fish samples for Ohio's Fish Tissue Monitoring Program. Ohio EPA's standard operating procedures (SOPs) for sample collection, identification, preparation, preservation and transport are followed (Ohio EPA 2004).

For Lake Erie, station locations are identified by Lake Erie grid number (Smith *et al.* 1961). The latitude and longitude of the Lake Erie grid number's center where the fish are caught are used to identify the Lake Erie fish collection station location. A station where the grid center's latitude and longitude are located on land along the Lake Erie shore is moved within the grid so that the station latitude and longitude are located over the Lake.

Geographic collecting areas described by numbered, north-south boundaries can not be used to identify fish tissue sample collection locations. Historically, ODNR identified project collection geographic areas by describing numbered, north-south boundaries. Two historically defined boundary area examples are: Area 1 - Maumee

Bay; Area 3 - Toussaint River to Catawba Point (ODNR 1989). Area boundaries were changed over the years for different projects (ODNR 1989; ODNR 1990; ODNR 1991; and ODNR 1992). There was no consistency for boundary locations and area descriptions.

ODNR follows the same fish sampling and sample preparation procedures that are used by Ohio EPA in large Ohio rivers when collecting Ohio River samples (Ohio EPA 2004). The ODNR/Ohio EPA collection and analyses of Ohio River fish samples are done independent of the Ohio River Valley Water Sanitation Commission's (ORSANCO's) Ohio River Fish Tissue Monitoring Program.

## *2.2 River and Stream Assessments*

Ohio EPA is responsible for collecting Ohio river and stream fish samples for Ohio's Fish Tissue Monitoring Program. The number of fish tissue sampling stations in a river or stream is dependent upon river/stream size. In large rivers like the Scioto River or Muskingum River, sampling stations are located every 9 or 10 miles. In smaller rivers/streams like the Olentangy River or Darby Creek, sampling stations are located every 5 to 7 miles. In small streams like Scippo Creek, located in Circleville, 3 sampling locations, one at an upstream control location or upstream from an entity/location of concern, a near downstream location and a far downstream location are needed. The final number of stations may be adjusted based upon data requirements. Environmental assessments usually require four stations, the fourth location being a second far downstream location. When the area of concern is located close to a river confluence, the confluence is bracketed with sampling locations upstream and downstream from the confluence. Heavily fished streams like the Mad River and the Stillwater River have fish tissue sampling stations every 5 miles. A stream location that is visually impacted, or that is known to be receiving chemicals of concern, may be bracketed by additional station locations to evaluate fish tissue chemical uptake.

Fish sampling zone distance varies. If all of the priority fish species, numbers and sizes are collected in a small area, the crew processes the samples and then proceeds to the next station. Within a reach, crews generally move from spot to spot sampling the proper habitat for the larger species. In larger rivers, the sampling zone distance is approximately 300 to 500 meters. At wading sites, crews generally sample approximately 100 to 200 meters. A fish tissue sampling location is defined as the midpoint latitude and longitude of the sampling zone. Longer distances may be sampled if there is very good habitat, but the priority fish can not be found within the standard distances. Usually, sampling in standard distance zones requires 45 minutes to one hour of sampling to either collect the required specimens, or to make the decision to move to the next sampling location. Samples are collected by moving from downstream locations to upstream locations in wading sized streams. Rivers and streams sampled with boat electro-fishing equipment are sampled from upstream to downstream going with the current.

### *2.3 Inland Lake and Reservoir Assessments*

ODNR is responsible for collecting inland lake and reservoir fish samples for Ohio's Fish Tissue Monitoring Program. The number of fish sample locations in inland lakes and reservoirs varies. A small lake/reservoir will have one fish sampling location, most lakes/reservoirs will have two sampling locations and large lakes/reservoirs will have three or more sampling locations. At least three priority species specific samples are collected at each sampling location in a screening evaluation. Specific species collected and analyzed at a lake/reservoir may be selected based upon ODNR creel data and/or stocking and management activities. This procedure is considered a screening to determine if there are any fish tissue contaminant problems. If a problem is identified, follow-up sample collections and analyses are scheduled. The number of fish samples collected at each sampling location is twice that of a screening evaluation. Usually, follow-up data are required prior to issuing lake/reservoir fish impact assessments or consumption advisory advice.

## **3.0 Special Wildlife Exposure Assessments**

### *3.1 Fish Tissue Wildlife Exposure Assessments*

Both whole body composite and fillet composite samples are collected at each station. A minimum of 150 grams of sample material are required. Ideally, more than 150 grams of sample should be collected and submitted for analyses.

Multiple-species whole body composite samples of small fish (minnows, etc.) can be used to evaluate wildlife exposure. This is the only occasion when a multiple-species sample is collected and analyzed for an exposure assessment. All of the species in the multi-species sample must be identified.

### *3.2 Sediment Wildlife Exposure Assessments*

A wildlife fish tissue environmental assessment must also include the analysis of at least one sediment sample per fish tissue sampling location. Sediment samples are collected, identified, processed and transported on ice to the laboratory for analyses according to Ohio EPA described methods and standard operating procedures (SOPs) (Ohio EPA 2001). A composite surficial sediment sample of from 0 to 3 inches, and no deeper than 6 inches, must be collected according to Ohio EPA's sediment collecting procedures (Ohio EPA 2001). The sediment samples should be analyzed for the Fish Tissue Monitoring Program parameters, or an identified fish tissue chemical(s) of concern, and include sediment analytical results for Total Organic Carbon (TOC) and sediment particle composition (see Table 1 for analyte reporting limits - RIs).

### *3.3 Sample Collection, Preparation and Transport*

Whole body and fillet fish samples are collected, identified, processed and transported on ice to a storage area where they are kept frozen at minus twenty-one degrees Celsius until they are transported to the laboratory for analyses according to Ohio EPA described methods and standard operating procedures (SOPs) (Ohio EPA 2004; Ohio EPA 2001; Ohio EPA, DES).

Fish tissue samples for environmental assessment include whole body composite and fillet composite samples. Fillet composite samples of most sport caught fish are analyzed as scaled, skin-on samples. Catfish and bullhead composite fillets are analyzed with skin-off. Carp composite, scaled fillet samples may be analyzed with skin-on or skin-off depending upon sampling objectives. Fat is not trimmed from the fillet samples. The percent lipid is reported for all fish tissue samples.

Whole body and fillet composite samples usually consist of whole bodies or both fillets of from two to five fish of the same species (Ohio EPA 2004). The minimum sample wet weight prepared for analyses is 150 grams. The minimum number of fish for a composite sample is two fish. More than a five fish composite may be used to meet the minimum 150 gram sample weight requirement if the fish being collected from the site are small and are an important or priority species for monitoring. Under certain conditions, a large, single fish whole body or fillet composite sample can be analyzed if no other fish for that species are available. A three to five fish composite sample is usually collected for analyses. Fish are measured (in millimeters), weighed (in kilograms) and rinsed; fish for fillet composite samples are scaled or skinned and filleted in the field. Fat is not trimmed from the fillets. For all samples, the smallest fish in the sample must be within ten percent of the total length of the largest fish in the sample.

### *3.4 Fillet Preparation*

A skin-on "Standard Fillet" is prepared using the following procedure.

The fish is rinsed with water taken from the stream from which the fish are collected to remove any sediment and/or organic matter present on the fish. All scales are then removed. A shallow cut is made through the skin on either side of the dorsal fin from the base of the head to the tail. A second cut is made along the entire length of the gill cover cutting through skin and flesh to the bone. A third cut is made along the belly (includes the belly flap) from the base of the pectoral fin to the tail and along the side of the anus and the fin directly behind. The skin-on fillet is removed and major bones are removed. Both fillets are prepared as described and Ohio EPA SOPs are followed for the remainder of the sample preparation, transport, storage and analyses. Skin-off fillets are prepared using the same procedure as skin-on fillets, except that the skin is removed from the fillet.

### *3.5 Sample Analyses*

The Ohio EPA, Division of Environmental Services (DES) usually analyzes Ohio EPA's fish tissue and sediment samples. The samples are transported to the Laboratory for analyses according to Ohio EPA's standard operating procedures (SOPs) (Ohio EPA 2004; Ohio EPA, DES). Sample collection, storage and transport to the DES Laboratory must be documented with Chain of Custody per Ohio EPA requirements. The list of analytes and their reporting limits (RLs) are listed in Table 1. Additional parameters may be analyzed on an as-needed basis.

### **4.0 Environmental Assessments**

Sample data are reviewed for chemical(s) of concern presence and reported concentrations. The extent and magnitude of the contaminated area are delineated and possible contaminant sources are identified. Options for remediation activities and/or chemical release control and/or prevention are reviewed.

**Table 1: Ohio EPA Division of Environmental Services (2003) Fish Tissue (FT) and Sediment (S) Reporting Limits (RLs) \***

Chemical	Reporting Limits		Chemical	Reporting Limits	
	Fish Tissue **	Sediment		Fish Tissue **	Sediment
Aldrin	10	2	PCB-1232	50	10
Total Arsenic	40	800	PCB-1242	50	10
Total Cadmium	4	2	PCB-1248	50	10
Alpha-Chlordane	10	2	PCB-1254	50	10
Gamma-Chlordane	10	2	PCB-1260	50	10
Oxychlordane	10	2	Total Selenium	40	800
cis-Nonachlor	10	2	Toxaphene	20	10
trans-Nonachlor	10	2	SAS 305		
4,4'-DDD	10	2	o-isopropyl-1,1-diphenylethane	40	20
4,4'-DDE	10	2	m-isopropyl -1,1-diphenylethane	40	20
4,4'-DDT	10	2	p-isopropyl- 1,1-diphenylethane	40	20
Dieldrin	10	2	p-isopropyl-1,2-diphenylethane	40	20
Endosulfan	10	2	SAS 310		
Endrin	10	2	o-sec Butyl diphenylmethane	40	40
Heptachlor	10	2	m-sec Butyl diphenylmethane	40	40
Heptachlor Epoxide	10	2	p-sec Butyl diphenylmethane	40	40
Hexachlorobenzene	10	2	o-sec Butyl 1,1-diphenylethane	40	40
Total Lead	40	800	m-sec Butyl 1,1-diphenylethane	40	40
Methoxychlor	10	2	p-sec Butyl 1,1-diphenylethane	40	40
Mirex	10	2	o-sec Butyl 1,2-diphenylethane	40	40
Total mercury	24	80	m-sec Butyl 1,2-diphenylethane	40	40
PCB-1016	50	10	p-sec Butyl 1,2-diphenylethane	40	40
PCB-1221	50	10			

\* Fish tissue RLs and Total Metals are reported in ug/kg wet weight. Sediment RLs and Total Metals are reported in ug/kg dry weight. Metals are analyzed as Total Metals.

\*\* Analytical results include percent lipid for each fish tissue sample.

FT = Fish Tissue; S = Sediment

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