



Fish Tissue Sampling and Assessment Protocol

FISH TISSUE SAMPLING AND FISH ADVISORIES

INTRODUCTION

Routine monitoring for contaminants in fish tissue was initiated in 1979 as part of a nationwide network of stations encouraged by the U.S. Environmental Protection Agency (EPA). In the Commonwealth, whole fish samples were collected at 36 locations. In 1983, the Commonwealth decided the fish tissue sampling program should be designed to support public health protection. As a result, half of the 36 stations were sampled each year and both edible portion (fillet) and whole fish samples were collected. In 1988, the program began collecting fillet samples almost exclusively and initiated rotation of sampling throughout the Fixed Station Water Quality Network (WQN). Today, the sites chosen have expanded beyond the WQN stations to streams and lakes of concern and verification stations. The EPA outline for the nationwide program included a list of parameters for analysis in fish, including PCB, pesticides and selected heavy metals. This parameter list is still used in the Commonwealth's fish tissue sampling program (Attachment A).

Interagency Approach

The importance of the fish tissue sampling and advisory issuance program was fully recognized in May 1986 with the signing of an interagency agreement between the Department of Environmental Resources (now DEP), the Department of Health (DOH) and the Pennsylvania Fish Commission (now Pennsylvania Fish and Boat Commission, PFBC). This agreement was developed because "the agencies desire to pursue a systematic approach for the detection and evaluation of fish tissue contamination and to develop coordinated procedures for informing the public that may consume such fish of possible adverse health impacts." It listed the responsibilities of each agency and provided for the "timely joint issuance of a health advisory" when fish tissue contamination constituted a health risk. The first joint advisory was issued in June 1986 and included a number of waters throughout the Commonwealth.

An updated Memorandum of Understanding (MOU) was developed in 2002 with coordination provided by the Governor's Policy Office. This new agreement was finalized December 12, 2002. The MOU officially recognized the inclusion of the Department of Agriculture (DOA) in the fish consumption advisory program. In addition, the new agreement established a two-tiered system for advisory decisions and issuance. A Fish Consumption Advisory Policy Workgroup was established to oversee the program and make management decisions. This workgroup includes deputy secretaries from the three cabinet agencies and the

deputy executive director of PFBC. The Governor's Policy Office coordinates the activities of this group. The existing staff level workgroup was renamed the Fish Consumption Advisory Technical Workgroup and includes representatives of all four agencies. The technical workgroup coordinates routine program activities, such as sampling site identification and provides recommendations for advisory issuance or lifting to the policy workgroup.

Background and Planning

The annual fish tissue planning process begins in late spring when a DEP staff member from the Division of Water Quality Assessment and Standards (DWQAS) reviews the previous year's fish tissue data to determine possible sampling stations for the current year's fish tissue sampling. Stations are chosen based on: 1) the need for verification (second) samples at selected sites for possible new advisories or de-listings, 2) the demand of the Water Quality Network (WQN) rotation, and 3) the need to follow-up on existing advisories. In addition, DEP issues a request for suggested sampling station locations and target species to DEP Regional Biologists, PA Fish and Boat Commission Area Fisheries Managers (AFMs) and the Erie County Department of Health (ECDH). DEP reviews and prioritizes suggested sampling locations/species based on statewide needs and laboratory capabilities, and issues a preliminary list of sampling sites to DEP Regions, ECDH and AFMs, with a copy to the Bureau of Laboratories.

Samples are generally collected during periods of low flow between August and October. Generally, samples are collected in the fall when reproduction is complete and a full summer of exposure to potential toxins has occurred. For some fish species (i.e., walleye), their life cycles are not conducive to fall sampling and sampling is conducted in the spring.

A normal sample consists of 10 scaled, skin-on fillets from a composite of five individuals of the fish species being targeted. Channel catfish or bullhead samples consist of 10 skinless fillets. American eel samples consist of five 1-inch sections from each skinned and gutted eel. All fish in the composite should be the same species and approximate size, (the smallest should be at least 75% of the length of the largest).

The target species is normally a representative, recreationally important species for the waterbody being sampled, unless otherwise indicated. It should be a species commonly taken by anglers for consumption and individual fish should be of legal size. In trout streams, fish should be wild or stocked holdovers at least seven inches in length. A suggested ranking of warm water fish is bass, crappie, rock bass, redbreast sunfish, bluegill or pumpkinseed. If recreationally important, channel catfish can be collected from warm water locations. Samples of bottom feeders may be collected when advisories are in place for such species (i.e., carp).

METHODS

Sample Collection

Samples are collected by electrofishing until the required number of individuals of the target species is obtained or 3-5 individuals of a non-target species are caught. If conditions are not favorable for electrofishing (i.e., equipment failure, large/deep water), other methods of collection such as netting, trotlines or angling may be used to obtain the desired number of fish.

Once the fish are caught, each one is measured (total length) to the nearest tenth of an inch and weighed to the nearest ounce. In addition, any notes on general condition, tumors, lesions, collection problems, weather conditions, etc. are recorded. The fish are filleted in the field with a knife that is cleaned between samples and rinsed with purified hexane labeled as suitable for pesticide residue analysis. The sample is then wrapped in clean, restaurant grade aluminum foil with the dull side in contact with the fish. The foil-wrapped sample is placed in a food grade plastic bag, frozen as quickly as possible, and sent to the DEP lab for analysis.

Sample Preparation and Analysis

Upon arrival of the samples at the lab, an homogenous tissue sample is created using a commercial-grade food grinder that has been washed with soap and water and rinsed with hexane between samples to avoid cross-contamination. Each sample is ground three times, with the tissue mixed between grinding to ensure a homogenous sample. Four packets of tissue are prepared, wrapped in aluminum foil, numbered and refrozen. These four packets are used as follows: one for metals analysis, one for PCB analysis, one for pesticide analysis, and one as backup for re-analysis, if needed. The samples are then analyzed for PCBs, metals and pesticides, and the results are sent to a DWQAS staff member for review and evaluation.

Data Review

An initial review of the data is conducted to screen for anomalous results based on previous data for a species from a particular water body or data from a particular species (based on expected % lipids). If anomalous data are encountered, the Bureau of Laboratories is requested to either verify the result or reanalyze the sample using a new aliquot of the parent tissue. Once the results are final, the data is evaluated and compared to current advisory triggers. All recent tissue contaminant data is evaluated to determine the possible need for an advisory for a particular water body and fish species. The possibility of lifting or delisting a consumption advisory is also considered during this evaluation.

Advisory Triggers

PCBs and Chlordane

Currently, the Commonwealth's program includes a mixture of risk assessment-based methods and U.S. Food and Drug Administration (FDA) Action Levels that are used as the basis for issuing or lifting advisories. Risk assessment methods form the basis for meal-specific advisories due to PCBs, mercury, and chlordane. Advisories for other compounds use FDA Action levels to issue Do Not Eat advice. Trigger levels for PCBs and chlordane are shown in Table 1.

GROUP	MEAL ADVICE	PCB LEVELS (ppm)	CHLORDANE (ppm)
1	UNRESTRICTED	0 - 0.05	0 – 0.15
2	1 MEAL /WEEK (52 MEALS /YEAR)	0.06 - 0.2	0.16 – 0.65
3	1 MEAL/MONTH (12 MEALS/YEAR)	0.21 - 1.0	0.66 – 2.82
4	6 MEALS/YEAR	1.1 - 1.9	2.83 – 5.62
5	NO CONSUMPTION	>1.9	>5.62

Table 1. Trigger levels of PCBs and chlordane found in Fish Tissue and meal recommendations based on those levels.

PBC Meal-specific advisories based on this protocol were issued for Lake Erie and Presque Isle Bay for 1997, and it was applied statewide in 1998. The Commonwealth issued a general, statewide advisory recommending that anglers eat no more than one meal per week of recreationally caught sport fish in April 2001. As a result, only Groups 3, 4 and 5 from Table 1 are now applicable.

Mercury

Consumption advisories due to mercury in fish tissue are based on a health risk assessment developed by U.S. EPA. The EPA risk assessment was originally released in 1997. As a result of a request from Congress, EPA contracted with the National Research Council (NRC) to review the risk assessment and prepare recommendations on the appropriate reference dose for mercury exposure. In July 2000, the NRC reported that the Reference Dose (RfD) for mercury, developed by EPA, was a scientifically justifiable level for the protection of public health. As a result of this finding, EPA recommended that sensitive individuals should eat no more than one meal per week of sport-caught fish. As noted above, the Commonwealth has issued a statewide one meal per week advisory that mirrors this federal advice. Pennsylvania also issues more protective mercury advisories on a site-specific basis, using the EPA risk assessment and advisory triggers slightly modified from those in a September 1999 EPA fact sheet. The trigger levels and meal recommendations are outlined in Table 2. Because a statewide one meal per week advisory has been issued, site-specific mercury advice begins at two meals per month.

Meal-specific advisories for mercury were first issued at the same time as the general, statewide advisory, April 11, 2001

MEAL ADVICE	MERCURY (ppm)
UNRESTRICTED	0 – 0.12
ONE MEAL/WEEK	0.13 – 0.25
TWO MEALS/MONTH	0.26 – 0.50
1 MEAL/MONTH	0.51 – 1.0
6 MEALS/YEAR	1.1 – 1.90
DO NOT EAT	>1.9

Table 2. Trigger levels of Mercury found in Fish Tissue and meal recommendations based on those levels.

FDA Action Levels

FDA Action Levels are regulatory standards applicable to commercial fish and other foodstuffs. These Action Levels are developed based on general consumption patterns and may include consideration of economic issues such as potential loss of food supply. The FDA has acknowledged that Action Levels may not adequately protect sensitive individuals or those individuals who may consume larger quantities of recreationally caught sport fish. The work group has been unable to completely evaluate risk assessment-based methods for these contaminants due to resource constraints. In addition, evaluation of risk assessment-based methods for most of these contaminants has not been a priority because they are normally found in very low concentrations in Pennsylvania fish. The compounds for which FDA Action Levels constitute advisory triggers are listed in Table 3.

<u>Contaminant</u>	<u>FDA Action Level</u>
Aldrin and Dieldren (sum)	0.3 ppm
Chlordecone (Kepone)	0.3 ppm
DDT, DDE, and TDE (sum)	5.0 ppm
Heptachlor and Heptachlor Epoxide (sum)	0.3 ppm
Mirex	0.1 ppm

Table 3. FDA Action Level triggers for a recommendation of Do Not Eat.

Advisory Decisions

A DEP staff member (DWQAS) evaluates all readily available tissue contaminant data to prepare for a meeting of the Interagency Fish Consumption Advisory Technical Work Group, where advisory decisions will be made. This meeting is normally held in June or July each year. The data are compared to the applicable advisory triggers to determine the possible need for an advisory for a particular water body and a specific species. The possibility of lifting an advisory is also considered during this evaluation. Once the advisories are agreed upon at this level, the information is sent back to a DEP (DWQAS) staff member to determine the appropriate segment of the stream to list on the 303(d) listing of impaired waters.

The method for determining advisory segment length is subjective. The point or small reach where fish collection took place is located on a map, and major upstream and downstream landmarks (i.e., dams, roads, tributaries, other barriers) are located and evaluated as segment boundaries. Barriers, such as dams, are preferred because they block fish movement. Other boundaries are selected to be relatively easy for fishermen to recognize.

Once the segment is determined, the official advisory is sent to the PFBC by August 1 for inclusion in the fishing regulations booklet for the next calendar year, and the segment is included on the 303(d) list. Additionally, DEP and the PFBC publish the advisories on their websites. Finally, a joint press release is usually issued in November to remind the public of the advisories.

**Attachment A
PCBs**

Analyte (Test) Description	CAS Number
Arochlor 1221	11104282
Arochlor 1232	11141165
Arochlor 1242	53469219
Arochlor 1248	12672296
Arochlor 1254	11097691
Arochlor 1260	11096825

PESTICIDES

Analyte (Test) Description	CAS Number
4,4'-DDD	72548
4,4'-DDT	50293
4,4'-DDE	72559
O,P-DDD	53190
O,P-DDE	3424826
O,P-DDT	789026
Aldrin	309002
Dieldrin	60571
Endrin	72208
Alpha-Bhc	319846
Alpha-Chlordane	5103719
Gamma Chlordane	5103742
Oxychlordane	2668880488
Chlordene	3734483
Cis-Nonachlor	5103731
Trans-Nonachlor	39765805
Methoxychlor	72435
Heptachlor	76448
Heptachlor Epoxide	1024573
Lindane	58899

METALS

Test Description	Test Code	Unit Time
Cadmium in Fish, Wet	71940	3.7
Chromium in Fish, Wet	71939	3.7
Copper in Fish, Wet Weight	71937	3.7
Lead in Fish, Wet Weight	71936	3.7
Mercury in Fish, Wet Weight	71930	35
% Moisture		