

FISH TISSUE CONSUMPTION ASSESSMENT METHOD

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INTRODUCTION

To protect the Recreation and Fish Consumption (Fishing) use, DEP implements fish data collection protocols and fish tissue assessment methods. Priority is given to surface waters that are targeted by anglers or subsistence populations. In surface waters that do not contain fishable populations of organisms, it may not be possible to assess fish consumption. To use this method for assessment determinations data collection must follow applicable protocols established in the Monitoring Book (Shull and Lookenbill 2018).

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), DOH, and Pennsylvania Fish Commission (now 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 Pennsylvania. A new agreement, signed in 2002, added the Pennsylvania Department of Agriculture (PDA) to the fish consumption advisory program and 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 Executive Director of the PFBC. The existing staff-level workgroup was renamed the Fish Consumption Advisory Technical Workgroup (FCATW) 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. Additionally, the FCATW reviews and adopts specific meal advise to be protective of subsistence anglers and sensitive individuals. In April of 2001, **Pennsylvania issued a general, statewide recommendation that anglers eat no more than one meal per week of recreationally caught sport fish.** As a result, only Groups 3-6 from Table 1 constitute an advisory and are considered impaired for the Recreation and Fish Consumption (Fishing) use.

DATA REVIEW

The annual data review process begins in late spring when the DEP Bureau of Labs (BOL) has finished analyzing the samples collected from the previous year. An initial review of the data is conducted to screen for anomalous results based on previous data

and expected results for a species, sample size (average length and weight), lipid percentage or particular waterbody. If anomalous data are encountered, the BOL is requested to either verify the result or reanalyze the sample using a backup 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 waterbody and fish species. Sample results that exceed the recommended consumption frequency of one meal per week, but do not exceed the “Do Not Eat” threshold, are subject to a second verification sample before an advisory can be issued or lifted. A “Do Not Eat” advisory is issued if a single representative sample result exceeds the appropriate “Do Not Eat” trigger. The possibility of lifting or reducing a “Do Not Eat” consumption advisory also requires a verification sample. All issued advisories are considered impaired for the Fishing use.

ADVISORY TRIGGERS

PCBs and Chlordane

Currently, Pennsylvania’s program includes a mixture of risk assessment methods and United States Food and Drug Administration (USFDA) 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 Polychlorinated biphenyls (PCBs) and chlordane. Advisories for other compounds use USFDA Action Levels to issue “Do Not Eat” advice. Trigger levels for PCBs and chlordane are shown in Table 1. PCB meal-specific advisories based on this method were issued for Lake Erie and Presque Isle Bay for 1997, and statewide in 1998.

Mercury

Consumption advisories due to mercury in fish tissue are based on a health risk assessment developed by USEPA. The USEPA risk assessment was originally released in 1997. As a result of a request from Congress, USEPA contracted with the National Research Council (NRC) to review the risk assessment and prepare recommendations on the appropriate RfD that would be used to calculate risk assessments for mercury exposure. In July 2000, the NRC reported that the RfD for mercury, developed by USEPA, was a scientifically justifiable level for calculations of risk assessments for the protection of public health. As a result of this finding, USEPA recommended that sensitive individuals should eat no more than one meal per week of sport-caught fish. The USFDA and USEPA currently post these federal recommendations online (USEPA 2018a). As noted above, Pennsylvania has recommended a statewide one meal per week consumption frequency that mirrors this federal advice. Pennsylvania also issues more protective mercury advisories on a site-specific basis, using the USEPA risk assessment and advisory triggers slightly modified from those in a September 1999 USEPA fact sheet. The trigger levels and meal

recommendations are outlined in Table 1. Because a statewide one meal per week recommendation 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 recommendation in April 2001.

PFOS

Per- and polyfluoroalkyl substances (PFAS) are environmentally persistent chemical substances that have been used extensively in the manufacturing of fire-fighting foams and non-stick materials based on resistance to heat, grease, oils, and water. PFAS were originally developed for manufacturing during World War II, based on these unique properties. By the early 2000s technological advancements led to PFAS detection limits in the range of parts per billion (ppb). The ability to detect these substances led to a phase-out of PFAS chemicals based human health concerns once they were detectable in some drinking water sources and fish tissue sources. Many PFAS compounds bio-accumulate, with long-chain substances – such as perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) – tending to bio-accumulate more than short-chain PFAS. Additionally, toxicity varies across PFAS with many being considered less toxic than PFOS (USEPA, 2018b).

Pennsylvania, through the FCATW, works collaboratively with the Great Lakes Consortium for Fish Consumption (Consortium). The Consortium was created in the 1980s to align protocols and communicate fish consumption advisories across shared waters of the United States and Canada. In 2019, the Consortium published “Best Practice for Perfluorooctane Sulfonate (PFOS) Guidelines” (PFOS-Best Practice, Consortium 2019) that summarizes the history, toxicity, and current advisories used by Consortium members for various PFAS substances. The PFOS-Best Practice recommends meal frequencies for PFOS based on a drinking water RfD of 2×10^{-5} milligrams per kilogram per day (mg/kg/day, USEPA 2016). Recommended trigger values for meal frequencies were modified for Pennsylvania by converting $\mu\text{g}/\text{kg}$ to parts per million (ppm) for standardized reporting and by removing the “two meals per week” frequency (10-20 $\mu\text{g}/\text{kg}$ or 0.01-0.02 ppm). The decision to remove the original recommendation of “two meals per week” was based on the general statewide recommendation being more restrictive at one meal per week. The FCATW voted to adopt the PFOS-Best Practice meal frequency advisory on March 23, 2021. For PFOS contamination, two meal frequencies that are more restrictive than the general statewide recommendation were adopted based on PFOS concentrations in fish tissue: one meal per month for PFOS concentrations 0.05-0.2 ppm and do not eat for PFOS concentrations greater than 0.2 ppm (Table 1).

Table 1. Trigger levels for contaminant concentrations found in fish tissue and subsequent meal recommendations. Bold values represent meal frequencies that are more restrictive than general statewide advice. Concentration values are in ppm.

Group	Meal Advice	PCBs	Chlordane	Mercury	PFOS
1	UNRESTRICTED	0-0.05	0-0.15	0-0.12	
2	1 MEAL/WEEK (52 MEALS/YEAR)	0.06-0.2	0.16-0.65	0.13-0.25	0.02-0.05
3	2 MEALS/MONTH (24 MEALS/YEAR)			0.26-0.50	
4	1 MEAL/MONTH (12 MEALS/YEAR)	0.21-1.0	0.66-2.82	0.51-1.0	0.05-0.2
5	6 MEALS/YEAR	1.1-1.9	2.83-5.62	1.1-1.9	
6	DO NOT EAT	>1.9	>5.62	>1.9	>0.2

USFDA Action Levels

USFDA 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. USFDA has acknowledged that Action Levels may not adequately protect sensitive individuals or those individuals who may consume larger quantities of recreationally caught sport fish. Due to resource constraints, the FCATW has been unable to completely evaluate risk assessment methods for these contaminants. In addition, evaluation of risk assessment 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 USFDA Action Levels constitute advisory triggers are listed in Table 2.

Table 2. USFDA Action Level triggers for a recommendation of Do Not Eat.

Contaminant	FDA Action Level
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

ADVISORY DECISIONS

For the evaluation of advisories that are more restrictive than the statewide advisories (i.e., one meal per week), DEP evaluates all readily available tissue contaminant data to prepare for a meeting of the FCATW where final advisory decisions will be made. This meeting is held annually in early summer. These data are compared to the applicable advisory triggers to determine the possible need for an advisory for a particular waterbody and a specific species. The possibility of lifting or modifying an advisory is also considered during this evaluation. Once the advisories are agreed upon at the workgroup level, the FCATW considers the most appropriate spatial delineation of the advisory. The method for determining the advisory delineation area is based on the movement potential of fishes throughout a waterbody. 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 recreational anglers to recognize. Once the spatial delineation is determined, the official advisories are sent to the PFBC by August 1 for inclusion in the fishing regulations booklet for the next calendar year, and the advisory delineation is included on the 303(d) list of impaired waters. DEP and the PFBC publish the advisories on their websites and may issue a joint press release as needed.

LITERATURE CITED

Great Lakes Consortium for Fish Consumption Advisories (Consortium). 2019. Best Practice for Perfluorooctane Sulfonate (PFOS) Guidelines. Accessed Online, April 2021.
<https://www.health.state.mn.us/communities/environment/fish/docs/consortium/bestpracticepfos.pdf>

- Shull, D. R., and M. J. Lookenbill (editors). 2018. Water Quality Monitoring Protocols for Streams and Rivers. Pennsylvania Department of Environmental Protection, Harrisburg, Pennsylvania.
- USEPA. (2016). Drinking water health advisory for perfluorooctane sulfonate (PFOS). Office of Water (4304T), Health and Ecological Criteria Division EPA. Accessed Online, April 2021. https://www.epa.gov/sites/production/files/2016-05/documents/pfos_health_advisory_final_508.pdf.
- USEPA. (2018a). Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Volume 2. EPA 823-B-00-008. Accessed Online, April 2021. <https://www.epa.gov/sites/production/files/2018-11/documents/guidance-assess-chemical-contaminant-vol2-third-edition.pdf>
- USEPA. (2018b). Human Health Toxicity Values for Perfluorobutane Sulfonic Acid (CASRN 375-73-5) and Related Compound Potassium Perfluorobutane Sulfonate. EPA-823-R-18-307. Accessed Online, April 2021. https://www.epa.gov/sites/production/files/2018-11/documents/pfbs_public_comment_draft_toxicity_assessment_nov2018-508.pdf