Contaminants and Health Risks

**Contaminants** Fish and other aquatic organisms are indicators of the environmental health of our waterways. Certain chemicals tend to accumulate in fish. The chemicals currently of greatest concern in West Virginia are dioxin, polychlorinated biphenyls (PCBs) and mercury. The West Virginia Bureau for Public Health (BPH) also encourages anglers and consumers to review the United States Environmental Protection Agency's (EPA) and Food and Drug Administration's (FDA) recent national revised advisory notification issued in 2004 at, [http://www.epa.gov/waterscience/fishadvice/advice.html](http://www.epa.gov/waterscience/fishadvice/advice.html) which warns pregnant women, women of childbearing age, nursing mothers, and children about the health concerns of consuming fish that may be contaminated with mercury.

According to the EPA, the current major source of dioxins is from incineration. Dioxins are produced in small quantities during the combustion of fossil fuels, wood, and municipal and industrial waste. Bleaching processes used in pulp and paper production also produce dioxins, and they occur as contaminants during the production of some chlorinated organic chemicals. Dioxins have been detected in soil, surface water, sediment, plants, and animal tissue in all regions of earth and are highly persistent in the environment. Dioxins in surface waters and sediments are accumulated by aquatic organisms and bioaccumulated through the aquatic food chain.

Past industrial activities in the lower Kanawha Valley, especially near the city of Nitro, West Virginia, have resulted in several dioxin-contaminated sites. Dioxin likely originated with the production of industrial solvents and the herbicide 2,4,5-T at facilities in and around Nitro. Disposal practices earlier in the 20th century-- including burial of drums, dumping of dioxin-contaminated liquid wastes, and incineration of dioxin-contaminated material-- spread dioxin throughout the Nitro area. Areas downstream of Nitro likely became contaminated through the release and transport of dioxin into the Kanawha River and its tributaries. The Kanawha River and two of its tributaries, the Pocatalico River and Armour Creek, have been the focus of a total maximum daily load (TMDL) study and preliminary federal Superfund investigations to determine the location and extent of the dioxin sources. In March 2004, EPA entered into an administrative order to conduct an Engineering Evaluation/Cost Analysis to study dioxin-contaminated sediment in the Kanawha River. The purpose of this is to evaluate response alternatives that would protect public health, welfare, and the environment and to provide sufficient information for EPA to determine the necessity, feasibility, and effectiveness of particular non-time critical removal actions. Although the manufacture of PCBs has been banned since 1979, these compounds were used extensively for heat transfer agents, lubricants, plasticizers, and
waterproofing. Due to indiscriminate disposal and atmospheric transport, PCB residues are found worldwide and continue to persist in the environment.

Mercury is a naturally occurring metal found in the environment. Inorganic mercury may enter the air through burning of fossil fuels, mining, and waste or industrial emissions. In freshwater bodies, small organisms convert inorganic mercury to the organic form, methylmercury, which enters the aquatic food chain by binding with particles and sediment eaten by the fish. Large fish will accumulate mercury when they eat smaller mercury-contaminated fish. Fish eliminate mercury at a very slow rate; therefore, mercury tends to accumulate in their tissues and organs. Mercury has been detected in most fish species sampled from freshwater bodies in West Virginia and other states. However, the range is quite broad and varies by water body and by species of fish. Sources of mercury emissions in West Virginia have been identified and are reported in "Atmospheric Mercury Emissions in West Virginia" (Updegrave, 2004).

Selenium is a naturally occurring mineral that is widely distributed in most rocks and soils. It is a component of pigments in plastics and paints. Selenium is also used in the preparation of pharmaceuticals, pesticides and rubber. Selenium can be released into the environment during the combustion of fossil fuels and when metals are smelted. It is present in the leachate from coal fly ash disposal areas. In West Virginia selenium has been found downstream of large-scale earth disturbance activities.

**Health Risks** Health risks are categorized as acute (immediate) or chronic (long-term). There are no known acute health risks at low levels of contaminants in fish tissue. However, there are chronic concerns. The fish-related carcinogenic risks are greatest for anglers who frequently consume large quantities of fish from contaminated waters. One useful way of placing these advisories into a broader perspective is to consider how the health risks associated with eating contaminated fish compares to other everyday risks. Cancer will affect about one in every three people in West Virginia, primarily due to tobacco use, poor diet and heredity factors. The risk of contracting cancer as a result of PCBs, dioxins and other contaminants in fish is much lower. As a policy, the Bureau for Public Health (BPH), Division of Natural Resources (DNR) and Department of Environmental Protection (DEP) seek to reduce risks associated with chemical exposure to no more than 1 in 10,000. Because the current risks associated with specific species located within the advisory areas exceed this goal, BPH, DNR and DEP are recommending that the public reduce or eliminate consumption of contaminated fish.

Your risk of cancer from eating contaminated fish cannot be predicted with certainty. Exposure to contaminants in the fish you eat may not increase your cancer risk at all. Children, women of childbearing age and people who frequently eat fish are
particularly susceptible to contaminants that build up in the body over time. If you follow this advisory over your lifetime, you will minimize your exposure and reduce whatever cancer risk is associated with those contaminants.

Long lasting contaminants such as PCBs and dioxin build up in your body over time. It may take months or years of frequently eating contaminated fish to build up amounts that are a health concern. Health problems which may result from the contaminants found in fish range from small barely detectable health changes to cancer. Adults are less likely to have health problems at the low levels that affect children.

People who consume moderate amounts of fish in a varied diet typically are not at risk of exposure to high levels of mercury. However, mercury may cause damage to the nervous system of an unborn child. Pregnant women who have high amounts of mercury in their body pass some directly to the fetus. Because the effect mercury has on the nervous system is so well documented and because the developing fetus is highly sensitive, the BPH recommends that, pregnant, women of child bearing age, nursing mothers, and children follow both the West Virginia Sport Fish advisory recommendations and the USEPA/FDA recommendations on restaurant and grocery-acquired fish.

Selenium in an essential nutrient and is frequently a component of multiple-vitamin supplements. Excessive exposure to selenium may disrupt endocrine function and growth hormones and cause dermatologic effects, such as hair and nail loss.

Understanding fish consumption guidelines will help you make informed choices. It is important to consider both meal frequency and portions sizes when consuming sport-caught fish. If a fish is listed in the “one meal per month” category, refer to the “Meal Size” table to determine the appropriate meal size for you or your child. If the guidelines are followed, eating such fish no more often than one meal per month should cause no significant health risks. The fish consumption advice, if followed for a 30 - year period has a health impairment risk factor of 1 in 10,000. Since most people would not eat that much fish from public waters, it is easy to see that these guidelines are very conservative.

Implementing and Determining Solutions

Informing the public- The advisories are intended to provide the public with information to make an informed decision regarding fish consumption. The information will be distributed to the media and through local and state health departments, DNR's fishing regulations and DEP regional offices. Phone numbers and
Reducing pollution in our waterways- West Virginia's water quality management goal is to reduce these advisories by eliminating the sources of pollution. DEP is aggressively working toward this goal through the state hazardous waste management and environmental remediation programs and through the federal Superfund program, the non-point source pollution program, control of combined sewer overflows, the sediment and storm water control program, and other activities. A study performed by the USEPA in 2000 (Dioxin TMDL Development for Kanawha River, Pocatalico River, and Armour Creek, West Virginia, September 14, 2000) indicated that a 99 percent reduction in existing load from ground water sources and a 92 percent reduction in load from soils during wet weather events would be necessary for the Kanawha River to be in compliance with the state’s dioxin water quality standard. As mentioned previously, the EPA is continuing to assess the extent and magnitude of dioxin contamination in the Nitro area.

Additional fish contamination monitoring- Fish contamination is a measure of environmental health as well as a potential source of human illness. BPH, DNR, and DEP are striving to improve the understanding of fish contamination throughout West Virginia. In 2001, DEP secured a grant from the USEPA to conduct a two year statewide evaluation of fish for PCB and mercury contaminants. The DEP, DNR, BPH and the West Virginia University/US Geological Cooperative Fish and Wildlife Research Unit conducted this research. The study was finalized in 2004 and supplied the basis for the 2005 Fish Consumption Advisories. Unfortunately, funding for continuing tissue collection and analysis remains an issue, especially if the program is to include dioxin monitoring. Dioxin sampling is prohibitively expensive, and unless substantial financial resources are located, no further testing for dioxin is scheduled or anticipated.

Information about BPH, DNR and DEP Collaboration

Information about fish contamination in West Virginia has been collected since the late 1970s. Beginning in the 1980s, the Division of Natural Resources and the Bureau for Public Health were issuing advisories and posting notices in the area of affected waters. Starting in 1992, the DNR, BPH, and DEP maintained an informal technical work group composed of staff from each agency to assess, manage, and consistently communicate to the public issues related to fish contamination. Through Governor Underwood's September 2000 Executive Order, however, the agencies started a more formalized collaborative process through an interagency agreement to guide activities associated with fish consumption advisories.
Advisory Information/Preparation Advice

West Virginia has implemented risk-based principles to determine whether fish consumption advisories are needed. These advisories are intended to inform and educate the public so they can make decisions about eating fish caught in West Virginia waters. The advisories inform the public about elevated levels of chemicals in fish while still allowing people an opportunity to enjoy recreational fishing and appropriate consumption. The risk-based approach estimates the probability of adverse health effects. The principles consider information on:

- The concentration of contaminants in the edible portion of the fish;
- The type of adverse health effects associated with the detected contaminants;
- The relationship between the dose (a ratio between the contaminant concentration, human body weight and time) and the human health response; and
- the expected exposure of the contaminants to the human population through fish consumption.

The information we gather by monitoring contamination in fish results in a statement on the health risk posed to the angler and particularly high-risk groups such as women of childbearing age and children. Advisories include advice on proper fish preparation to reduce and minimize risk. The intent is that fish consumers should be given information needed to evaluate risk.

Evaluating health risks of eating contaminated fish should be balanced with the knowledge that fish are nutritious and good to eat. When properly prepared, fish provide numerous health benefits. The American Heart Association recommends eating two to three fish meals each week. The benefits of eating fish include:

- Fish offer high-quality protein with fewer calories than a similar-sized portion of meat. For example, both catfish and ground beef are about 18 percent protein. But for an eight ounce meal, the catfish has about 232 calories while the ground beef has about 640 calories.
- Fish are low in sodium and are a good source of potassium, vitamins and other minerals.
- Fish are generally low in cholesterol and saturated fats, which have been associated with heart disease.
- While the health benefits of fish are still being studied, much of the current research is focused on various kinds of beneficial fats in fish, particularly the kind called omega-3 fatty acids found in some fish and fish oils. Some studies have indicated that these fatty acids have favorable effects on health conditions such as hardening of the arteries and high cholesterol.
Preparation Advice - You can further reduce your exposure to contaminants by following these recommendations:

- Eat smaller fish. As a general rule, larger, older fish may be more contaminated than smaller, younger fish.
- Vary the kind of fish you eat. Trout and sunfish, such as bluegills, eat insects and other aquatic life that are less likely to contain high levels of contaminants. Top predators like bass and walleyes may have higher levels of contaminants. If you eat these species, eat the smaller fish to minimize your exposure.
- Clean and cook fish properly. How you clean and cook fish can reduce the level of contaminants by as much as half in some fish. Some contaminants concentrate in the fatty tissues and internal organs of fish. Filleting, removing the skin and internal organs, and trimming the fat along the back, side, and belly of the fish reduces the contaminants you eat. While cooking does not destroy contaminants, heat from cooking melts some of the fat and allows some of the contaminated fat to drain away. Broil, grill, or bake the trimmed, skinned fish on a rack so that the fat drips away. Deep-fat frying removes some of the contaminants, but you should discard the oil after you cook the fish. Pan frying does not remove much of the contaminants.