

South River Science Team UPDATE

Keeping you up to date on South River Science Team activities

Summer 2002

At A Glance:

A Quick Look at South River History and Activities

Since the discovery of mercury contamination in the Shenandoah River system in the mid-1970s, the Virginia Department of Environmental Quality (VDEQ) and other state agencies have carried out a monitoring program to gather the data necessary to protect the health of the public and the river ecosystems. Soon after the initial discovery of mercury in fish tissue, the Virginia Department of Health (VDH) administered a fish harvest ban on the South Fork

Shenandoah River and on the South River downstream of Waynesboro. The data collected through the monitoring program has provided for a more thorough understanding of the mercury distribution in the rivers, resulting in fish consumption advisories replacing the overall fish harvest ban. Advancements in the understanding of mercury behavior in the environment, coupled with continued river monitoring, will provide the tools necessary to make informed decisions on managing river resources in the future.

Mercury is very stable in the environment and is expected to remain in the river system for many years. The VDEQ administers a monitoring program that routinely evaluates the status of mercury levels in water, sediments, and fish. Data collected in the past three decades indicate that the mercury levels in water are generally below detection. However, the mercury concentrations in fish and sediments have remained fairly stable over time. The evaluation of the monitoring data by mercury experts led to the conclusion that it would do more harm to the

river system to try to remove the mercury than to leave it in place. These reports went through public review prior to approval by the State Water Control Board.

In the fall of 2000, the South River Science Team was formed to serve as a focal point for technical and scientific issues concerning mercury in the South River and downstream waterways. The team is a cooperative effort between the VDEQ, Department of Health, and the Department of Game and Inland Fisheries and representatives from academia, citizen groups, and DuPont. In addition to providing technical direction for the mercury monitoring conducted in the South River, the team's focus includes filling data gaps to better understand mercury behavior, reviewing new technologies, addressing outstanding risk-based questions, and ensuring that there is effective communication provided to the users of the river.

This newsletter will be published twice a year to serve as a communication tool for the South River Science Team activities and accomplishments.

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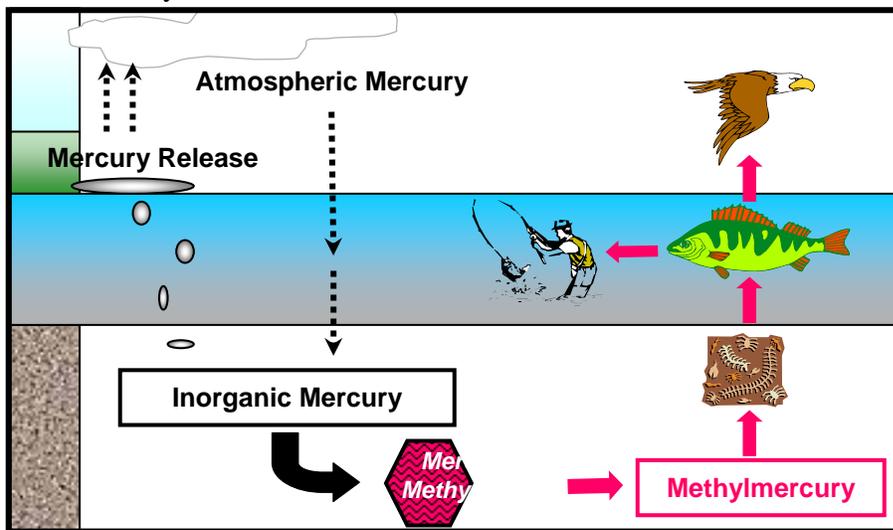
Tech Corner: The Basics of Mercury and the Environment

Mercury is familiar to most people from its use in thermometers, electrical switches, dental fillings, and fungicides. Because it is the only metal that is liquid at room temperature, most of us have had the fascinating experience of playing with a mercury droplet spilled from a broken thermometer. However, in spite of its common use, mercury is a toxic substance, and prolonged exposure to mercury can result in serious adverse effects on human health. The manner in which humans are exposed to mercury depends on the form in which the mercury is encountered. In addition to the familiar silvery metallic form (from which mercury vapors are the main route of risk), mercury is also present in less obvious forms. Of most concern is methylmercury, a compound that can be formed from the mercury that is present in the environment. Methylmercury is of particular concern to human health because it may impact the nervous system. It accumulates in the tissues of organisms at the bottom of the aquatic food chain, and, as a result, most of the mercury present in fish tissue is in the form of methylmercury.

Mercury enters the environment through both human and natural sources. Human sources of mercury include the mining of mercury ores, burning of fossil fuels, gold mining, manufacture of chlorine gas, and manufacture of organomercurials for use as antibacterial or antifungal agents. Natural sources include natural ores and volcanic gasses. Because fossil fuels contain traces of mercury, the burning of these compounds (particularly coal) is one of the most significant sources of mercury to the environment. The emissions from the burning of fossil fuels introduce mercury into the atmosphere from which it is redeposited onto the Earth's surface through rain or dry deposition. On a local level, mercury can enter the environment as a result of spills or inappropriate disposal of mercury containing wastes.

The process that transforms mercury to methylmercury is called mercury methylation. The

details of the methylation process are not completely understood, and, thus, it is currently an area of intense research. Some of the experts in the field of mercury research are collaborating with the South River Science Team to share their ideas about how to continue to address mercury contamination in the South River (see "Did You Know? Expert Panel Formed to Collaborate with Science Team" on page 3). It is known that mercury methylation is carried out by naturally occurring microorganisms. Once mercury is methylated, it is absorbed or consumed by small organisms in the sediments.



These organisms serve as food for larger fish, which, in turn, are consumed by still larger fish or other predators. Because living organisms are efficient at collecting and retaining methylmercury (e.g., fish may have methylmercury concentrations many times higher than the water in which they live), over time organisms accumulate the methylmercury contained in their food. In this way, very small amounts of mercury in the environment can result in significant amounts of methylmercury accumulation in fish.

Depending on an environment's capacity for mercury methylation, the small amounts of mercury deposited from the atmosphere can result in fish with comparable amounts of methylmercury as environments where large amounts of mercury have been introduced as a result of a concentrated spill. The Florida Everglades is an example of a region where atmospheric deposition has resulted in elevated methylmercury levels in fish. Because even low levels of mercury can result in unacceptably high levels of mercury within the food chain, cleaning up mercury contamination is extremely difficult. For example, South River and South Fork

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At A Glance: History and Activities
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Highlights of the South River Science Team during the past year include the following:

- Ongoing dialog between the diverse stakeholders involved with South River and South Fork Shenandoah River mercury monitoring through meetings or conference calls at least once every two months
- Compilation of all reports and all data related to mercury in the South River and downstream waters, including extensive statistical review and discussions, particularly for fish tissue data
- Press releases to update the public on fish tissue results, including a public meeting in Harrisonburg in March 2001 to share new data and explain changes to the advisory based on new risk analyses (see “From the Team...VDH Modifies Fish Advisories” below)
- A productive meeting between key Science Team members and the primary author of several historic reports on South River mercury
- Fish tissue trend assessment and development of recommendations for further work and data gathering
- Initiation of research to address data gaps and important issues not considered in previous studies, including a fish food organism study that will be completed by Virginia Tech and a “mud mapping” project to identify sediment depositional areas

- Ongoing communications and meetings with the team’s Expert Panel, a group of internationally recognized leaders in mercury research (see “Did You Know? Expert Panel Formed to Collaborate with Science Team” below)

Did You Know? Expert Panel Formed to Collaborate with Science Team

Because the science of mercury has evolved over the past 20 years, the South River Science Team formed an Expert Panel of nationally and internationally recognized experts in the field of mercury. These professionals have specialized mercury expertise and a knowledge of other mercury sites. The names of the panelists are listed below, along with their affiliation and area of expertise.

- Mike Newman, Virginia Institute of Marine Science: Environmental chemistry
- Rob Mason, University of Maryland: Speciation of mercury
- Gary Bigham, Exponent: Ecology
- Ralph Turner, Private Consultant: Environmental chemistry

The panel keeps the team up to date on the most recent information and innovations pertaining to mercury in the environment, suggests to the team issues to explore, and provides feedback on proposed team activities.

From the Team... VDH Modifies Fish Advisories

Last Spring, the Virginia Department of Health (VDH) revised its fish consumption advisories for mercury contamination in the South River, Shenandoah River, South Fork Shenandoah River, and North Fork Shenandoah River based on recommendations by the National Academy of Sciences (NAS). The consumption advisory revisions were not a result of any changes in the mercury levels in the rivers. The VDH had historically used the Food and Drug Administration’s (FDA) guidelines for issuing fish consumption advisories for mercury. After the NAS released its review of methylmercury toxicity and recommended a reference dose of 0.0001 milligrams per kilograms per day, the VDH revised its guidelines. The reference dose is an estimate of the amount of a contaminant that one can be exposed to over a lifetime and not result in adverse health effects.

The first part of the advisory restricts all fish consumption, except for trout, from the South River from Waynesboro to where the North and South Rivers converge at Port Republic. The second part of the advisory is for fish caught in the South Fork Shenandoah River from Port Republic to the confluence with the North Fork Shenandoah River and continuing north along the main stem of the Shenandoah River to the Warren Power Dam just north of Front Royal. This advisory also covers part of the North Fork Shenandoah River in Front Royal from the mouth of the river upstream to the Riverton Dam. The advisory recommends that women who are pregnant or may become pregnant, nursing mothers, and young children should not eat fish from these waters. Other people are advised to eat no more than two meals per month of fish caught from these areas.

Tech Corner: Mercury
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Shenandoah River data obtained in the 1970s and 1980s were studied, and the Virginia state environmental agencies concluded that it would do more harm to the river systems to try to remove the mercury than to leave it in place (see “At A Glance...A Quick Look at South River History, the Science Team, and Activities” on page 3).

In the United States, eating methylmercury-contaminated fish represents the primary route of human exposure to mercury. For this reason, fish are routinely monitored for their mercury content. In the case of the South River and South Fork Shenandoah River, fish are monitored twice a year at 15 sampling locations. Long-term monitoring programs and fish consumption advisories are important tools used to protect the public from the health risks posed by mercury contamination. The Virginia Department of Health recently modified the fish consumption advisories for the South River and the South Fork Shenandoah River (see “From the Team...VDH Modifies Fish Advisories” on page 3).

For answers to frequently asked questions concerning mercury in the environment, visit <<http://www.epa.gov/mercury/information.htm#questions>>.

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