

Mercury
and the
environment

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What's inside

This brochure provides information about mercury in the environment and explains what researchers have learned, as well as what they have yet to learn.

Mercury basics

What is mercury?

Mercury, a naturally-occurring element, has been on the earth since the beginning of time. It never degrades or breaks down and—like other basic chemical elements—it cannot be completely eliminated from the environment.

Where is mercury?

Mercury is present, in widely varying quantities and in various forms, everywhere in the environment. It exists in the air, water, soil and even the human body.

How are the different forms of mercury related?

Mercury goes through a complex cycle of changes in the environment. Researchers know that three main forms of mercury are found in the environment:

1. Elemental mercury (Hg^0): An inorganic form of mercury emitted into the atmosphere from natural and human-activity sources.
2. Mercuric mercury (Hg^{+2}): An inorganic form of mercury emitted into the atmosphere that is also the primary form of mercury deposited from the atmosphere to the earth's surface.
3. Methylmercury (CH_3HgR): An organic form of mercury that poses the greatest health risk because it accumulates through the food chain. More information about methylmercury health risks is detailed on page six of this publication.

One aspect that scientists don't yet fully understand is how mercury—in its various forms—cycles through the environment and is converted from one form to another. Studies continue on this aspect and in other areas.

Where has mercury been used?

As you may know, mercury is used in measuring instruments such as thermometers and thermostats. Mercury has also been used in fungicides, in electrical equipment and other products. Some dentists use an amalgam that contains 50 percent mercury for fillings. So you see, mercury has many useful properties. In addition, those who work with mercury are aware of its properties and treat it appropriately. And mercury disposal is carefully monitored and regulated at the state and federal levels.

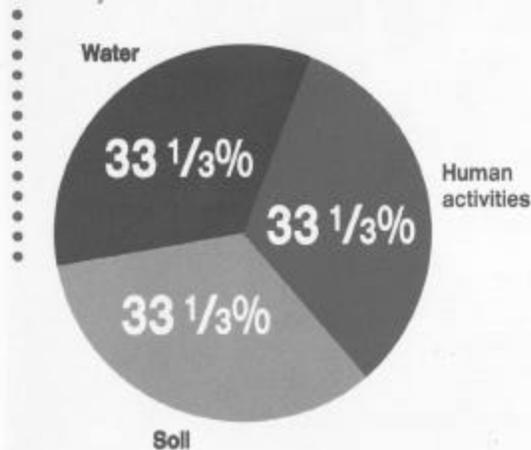


More about mercury sources

Where does mercury in the atmosphere come from?

As stated earlier, mercury has always been present in the air, water and soil, and—like other naturally occurring elements—it will remain in the environment. The latest research has found that about 6,600 tons of mercury are emitted into the earth's atmosphere each year from three main sources: water, soil and human activities. As the chart below shows, each source contributes approximately 2,200 tons of mercury each year. It's important to note that researchers don't yet know all the sources of mercury.

Estimated annual worldwide sources of mercury emissions



Source: Electric Power Research Institute (EPRI), EPRI Journal, April/May 1994; Nature, March 2, 1989; Nature, May 12, 1988.

The amount of mercury deposited from the atmosphere in Minnesota has decreased dramatically since about 1960.

What about mercury from human activities?

Anything that is burned—wood, candles, waste, coal, automotive fuel, etc.—produces various kinds of emissions, including trace amounts of mercury. Other processes, such as refining oil and gas and manufacturing lime, batteries and other products, also produce mercury emissions. Of the annual worldwide mercury emissions from human activities (2,200 tons), the United States accounts for approximately 242.5 tons, or about 11 percent.

The chart below details the main U.S. sources of mercury emissions from human activities, including incinerators, combustors, boilers and other sources.



Mercury emissions from U.S. electric power generation—mainly coal power plants—are less than one percent of the total mercury emissions into the global atmosphere.

Source: June 1996 Mercury Study Report to Congress (SAB Review Draft) by the Environmental Protection Agency (EPA).

What are the trends?

A 1996 report by the Electric Power Research Institute (EPRI) shows that the amount of mercury deposited from the atmosphere has decreased dramatically since about 1960. That report, titled "Mercury in the Environment—A Research Update," also notes that more research is needed to determine the reasons for that trend.

Another recent study shows that the rate at which mercury is entering Minnesota lakes has dropped significantly since the 1970s. This study is detailed on page four of this brochure.

Mercury in Minnesota

These two pages explain some results from a report by the Minnesota Pollution Control Agency (MPCA) and the Science Museum of Minnesota, published in the April 1997 issue of Environmental Science and Technology. Researchers studied sediment samples from the bottom of 12 Minnesota lakes—eight rural lakes and four urban lakes. The eight rural lakes are in two distinct geographic areas: four lakes in the Superior National Forest of northeastern Minnesota, and four in west-central Minnesota. The four urban lakes are located in residential neighborhoods in Minneapolis.

More coal use, less mercury entering Minnesota lakes

Coal is used to generate two-thirds of the electricity in Minnesota. Minnesota incinerators dispose of some of the state's waste and, in the process, generate electricity. Both processes release trace amounts of mercury into the environment. However, the MPCA/Science Museum of Minnesota study shows that despite a significant increase in coal use, there has been a significant decrease in the amount of mercury entering Minnesota lakes.

Where does mercury in Minnesota come from?

The exact amount of mercury deposited in Minnesota from in-state sources has not yet been accurately determined, but in-state mercury sources may contribute as little as five to ten percent of the total amount.

Although researchers don't yet fully understand how mercury moves in the environment, a study by the EPA's Environmental Research Laboratory in Duluth, MN, shows that a majority of the mercury deposited in Minnesota lakes from out-of-state sources is carried into Minnesota by winds from the south, southeast and southwest.

The amount of mercury deposited in Minnesota from in-state sources may contribute as little as five to ten percent of the total amount deposited from all sources.



What researchers found... Report results include:

● Sources

Mercury entering Minnesota's lakes comes from three broad sources: global sources from human activities, regional sources from human activities and naturally-occurring sources. Regional sources include incinerators, boilers and other sources located in North America.

● Trends

The present amount of mercury entering Minnesota lakes is about 25 percent lower than peak rates in the 1960s and 1970s.

● Summary

"The good news is that a variety of pollution control efforts over the past few decades have led to reduced mercury deposition in the upper Midwest," says Edward Swain, MPCA research scientist and the study's co-author.

● Looking ahead

This ongoing study has been expanded to include samples from 50 Minnesota lakes, including 20 in the Minneapolis/St. Paul metropolitan area. The findings will help researchers understand more about mercury sources and trends.

The present amount of mercury entering Minnesota lakes is about 25 percent lower than peak rates in the 1960s and 1970s.



Health issues

What the experts say

Both the EPA and EPRI note that high doses of methylmercury—like high doses of many other substances—pose a potential health risk. Since methylmercury accumulates in the food chain, the key potential health risk for humans is found in both freshwater fish and shellfish. Even so, researchers estimate that only about five percent of the mercury that enters Minnesota lakes is converted into methylmercury.

In general, fish in Minnesota lakes do not contain higher levels of methylmercury than fish in other areas of the United States.

What levels of methylmercury are a health risk?

As with other substances, setting health risk guidelines depends on how different regulators define certain terms. For instance, the World Health Organization (WHO) and the Minnesota Department of Health (MNDOH) have established widely different health risk levels for methylmercury in fish. The WHO level is much less restrictive than the MNDOH level.

In general, fish in Minnesota lakes do not contain higher levels of methylmercury than fish in other areas of the United States.

Also, the long-term health effects of eating fish with low levels of methylmercury (like the fish in Minnesota lakes) have not yet been documented.

What about fish consumption advisories?

Fish consumption advisories, which recommend fish consumption limits for people, have been developed for some lakes in Minnesota and throughout the United States. Again, these advisories depend on how terms are defined: *Wisconsin lists advisories for lakes when the level of mercury in fish exceeds 0.5 parts per million. The MNDOH fish consumption advisory, one of the nation's most restrictive, starts at only 0.16 parts per million. In other words, some lakes that carry a fish consumption advisory in Minnesota would not carry an advisory if they were located in Wisconsin or many other states.*

These varying advisory levels mean we need more studies supported by sound science to set universal "safe" levels of fish consumption.



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What we are doing about mercury

Working together with researchers, regulators and government agencies, Minnesota businesses, industries, utilities and others are acting to address concerns about mercury. This page summarizes some of those activities.

Handling with care

Through industrial pollution prevention programs and regulation, industry is using less mercury. For instance, no mercury has been added to latex paint made after 1991. Industry has also reduced or eliminated the use of mercury in paper mills and other processes, and in batteries and other products. Plus, mercury fungicides are no longer used on golf courses or for seed treatment in agriculture.

Recycling

Business, industry, government, consumers and others bring fluorescent lamps and other items that contain mercury to licensed recycling and disposal facilities. In addition, industry is using new methods to efficiently and safely handle and recycle waste.

Operating cleaner

It is likely that as little as five to ten percent of the mercury deposited in Minnesota is from in-state sources and mercury emissions from many in-state sources are declining. For example, incinerators and combustors are cleaner and operated more efficiently than ever, which reduces the amount of mercury emitted.

In addition, utilities have installed pollution control equipment on power plants to reduce particulates, sulfur dioxide and other emissions. This equipment also captures some mercury. Minnesota utilities participated in the Electric Utility Study authorized by the federal Clean Air Act of 1990. Several of

these utilities participated in a comprehensive assessment of power plant emissions. Study results show that existing control equipment removes some mercury from emissions.

Setting legislation, guidelines

Researchers can measure the trace amounts of mercury in coal and other fuels used to make electricity, but power plant emissions contain trace amounts of mercury that are difficult to measure. Even so, to develop more information on mercury emissions from power plants, several utilities and other groups in Minnesota helped develop mercury reporting legislation that passed during the 1997 state legislative session. This legislation requires utilities and others who generate electricity to annually report their mercury emissions to the Minnesota Pollution Control Agency.

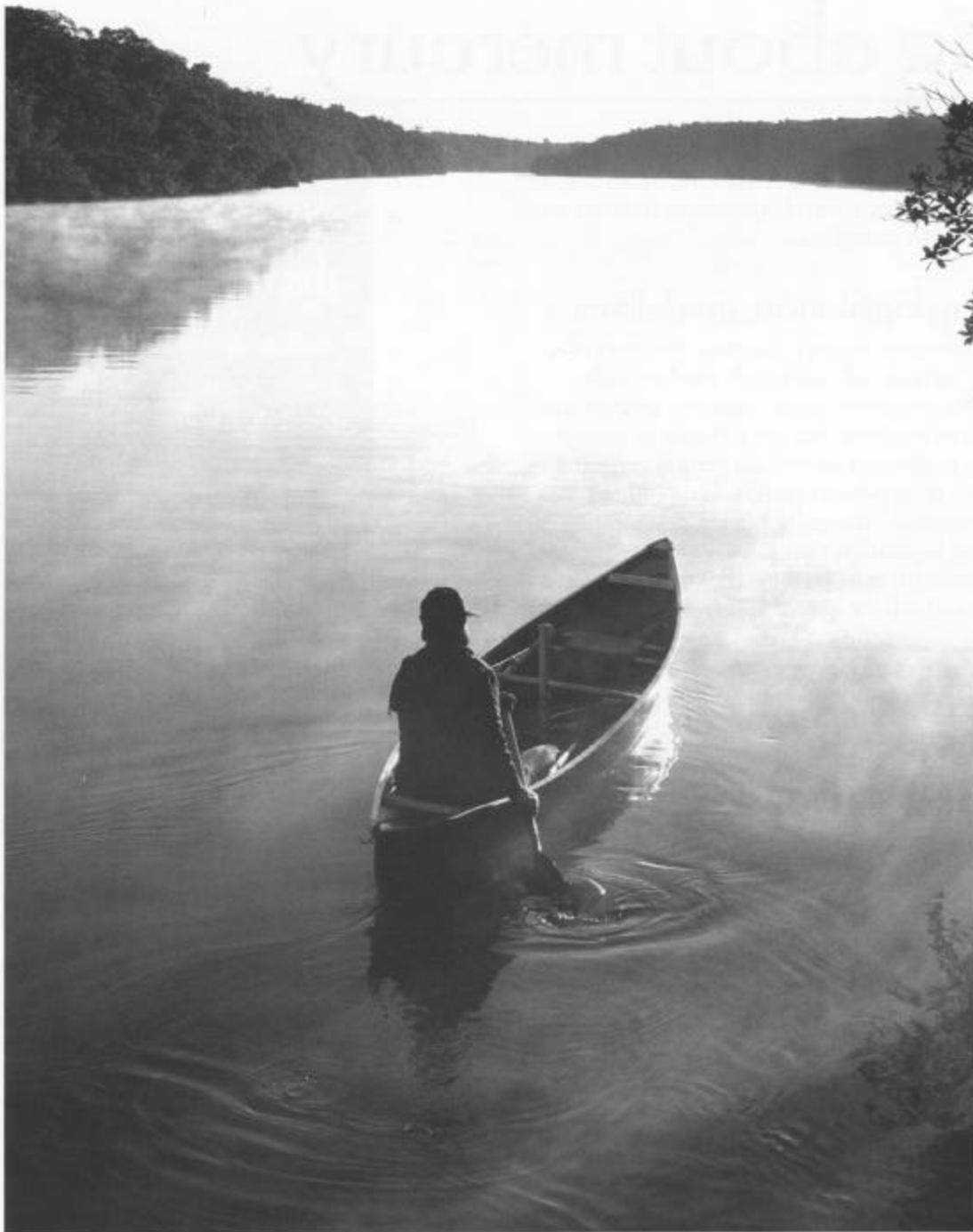


Studying health effects further

Utilities and others are actively participating in other thorough studies to learn more about mercury and how mercury in the environment may affect human health. As researchers learn more about mercury in the environment, they will also discover more about mercury-related health risks.

What does all this mean?

As you've read, there is much researchers don't yet fully understand about mercury, especially the specific health concerns about methylmercury in fish. It's important to remember that mercury from sources in our area is a small part of this global concern. As with other issues of this type, Minnesota is a leader in research, regulation and other efforts to more fully understand mercury in our environment. Working together, businesses, industries, utilities, government and others will find out more and take appropriate action.



About this brochure

This brochure was produced by the Partners for Affordable Energy. The group was founded by Minnesota electric cooperatives, investor-owned utilities and municipal utilities and has grown to include many other diverse organizations, including labor, business, agriculture and other groups. The Partners for Affordable Energy is working to maintain low electric rates, a healthy economy and a cleaner environment.

The Partners for Affordable Energy is concerned about mercury and the environment. Its members will continue researching and communicating information about these and other issues.

For more information about the Partners for Affordable Energy, call us at 612-831-0897, or write to us at P.O. Box 385846, Minneapolis, MN, 55438-5846. We'll send you a free informational packet.



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