Mercury hot spots of North America

Mercury (Hg) is a highly toxic liquid metal, which most people recognize as the shiny liquid in fever thermometers. It occurs naturally in the environment, but it's also generated through such human activities as the production of electricity from coal-fired power plants, waste incineration, fuel combustion and some industrial processes.

In its most dangerous form, methylmercury, the health effects of its exposure to women of childbearing age and children can be devastating. For instance, in pregnant women methylmercury can accumulate in the fetal brain to cause brain damage. In adults, long-term exposure to the compound can damage the brain and central nervous system, causing loss of motor control, memory, hearing and vision.

Because mercury is a naturally occurring and persistent substance, it can never be completely eliminated from the environment. Canada, Mexico and the United States are therefore working together to prevent and reduce mercury pollution due to human activities. On behalf of the three governments, the Commission for Environmental Cooperation (CEC) initiated a North American Regional Action Plan (NARAP) to achieve the "virtual elimination" of new sources of mercury.

Policy changes have already helped cut the generation of mercury pollution, which has doubled in the atmosphere since the beginning of the industrial age. The elimination of certain mercury-based chemicals used in pulp and paper production in the 1970s led to a big drop in pollution. And in the 1980s, the elimination of most mercury in batteries and paints produced further significant reductions.

Today, mercury "hot spots" still dot the North American landscape. This mercury hot spot map indicates 244 locations where the amount of mercury contamination exceeds the background, or naturally occurring, level in the environment.

It's the first time such a map has been presented for North America based on national data.

The grasshopper effect
Mercury can be deposited locally to aquatic or terrestrial ecosystems, or be carried long distances in the atmosphere from one country to another. With the right amount of solar energy, toxic substances such as old pesticides and mercury may vaporize and condense until they reach an area like the Polar regions where there is insufficient energy to re-vaporize these substances. Some scientists have concluded that this is the reason for high levels of pesticides and mercury in areas like the Arctic, far from where they were used.

A cycle of contamination
When mercury is deposited into water, microorganisms help convert it to methylmercury. Small organisms, fish and plants ingest this mercury as they feed. Concentrations increase as it is transferred up the food chain to fish, birds, animals, marine mammals and humans.

After the gold rush
Before modern mining techniques were introduced, the California gold rush that began in 1848 left a legacy of mercury pollution that continues today. As recently as 2001, health officials warned about eating fish from certain lakes and miners still find pockets of liquid mercury along rivers and streams.

Air
Once in the atmosphere, this toxic heavy metal can move thousands of kilometers from its source. The latest report from the United Nations Environment Programme indicates that half the mercury falling on North America comes from outside the continent. Increased energy use in the Asian region pumps over 1,000 tonnes of mercury into the atmosphere each year, compared to 210 tonnes in North America.

Learn more
The CEC's mercury action plan to eliminate new sources of mercury pollution in North America is available at <http://www.cec.org/programs_projects/pollutants_health/smoc/>.

For more information, please consult the following sites:
- Great Lakes Binational Toxics Strategy, <http://www.epa.gov/grtlakes/bns>.
- Environment Canada, <http://www.ec.gc.ca/mercury>.
- Arctic Monitoring and Assessment Program, <http://www.amap.no>.
- EPA Mercury Action Plan, <http://www.epa.gov/pbt/hgaction.htm>.
- North American Mercury Deposition Network, <http://nadp.sws.uiuc.edu/mdn>.
- National Ecology Institute, <http://www.ine.gob.mx>.
- UNEP Global Mercury Assessment, <http://irptc.unep.ch/mercury>.

A colonial legacy
It is estimated that Spain sent as much as 45,000 tonnes of mercury to Mexico during the colonial period (1540–1850) for use in the extraction of gold and silver. Today, millions of kilograms still lie beneath the soil in dozens of colonial mining sites, polluting groundwater and farmers' fields.

Artic sunrise
When mercury reaches the Arctic, it undergoes a transformation that causes it to deposit onto the snow at the start of the Arctic sunrise—the first appearance of the sun after the long, dark winter. Scientists believe that a significant mass of mercury enters the biotic and abiotic environment, and the rest re-enters the atmosphere. Contamination of Arctic regions and traditional foods that Aboriginal people consume is a major concern.

Contaminated water and fish
Eating contaminated fish is the main source of human exposure to methylmercury. The mercury released into the atmosphere generally ends up in water bodies where fishing can occur. For instance, it is estimated that 40 percent of the mercury deposited from the atmosphere into the Great Lakes basin may be from external sources.

Health alert
More than 90 percent of fish consumption advisories are because of mercury contamination. Health officials have warned consumers in 41 US states and most Canadian provinces to limit their intake of certain fish, or avoid eating them altogether. Ten US states advise pregnant women to limit the consumption of canned tuna. Exposure data from women in the US indicate that as many as eight percent of women of childbearing age may be exposed to mercury at levels that exceed US EPA recommendations. This means that approximately 300,000 babies are born each year in the United States with mercury exposures above recommended levels.

Coal-fired power stations
The number one source of atmospheric mercury pollution in North America is coal-fired energy production, with some 91 tonnes emitted directly to the atmosphere annually. Smokestack mercury is deposited near and far, sometimes traveling thousands of kilometers from the source.

Waste incineration
Municipal and medical incinerators are the second-largest source of atmospheric mercury pollution in North America. In addition to contaminating the local environment, the air spreads mercury to rivers, lakes and land across the continent, and beyond.

Commission for Environmental Cooperation of North America

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Mercury hot spot.
In Canada and Mexico, sites with high mercury concentration were selected as hot spots when the mercury concentration was greater than 1ppb. In the United States, hot spots are indicated where mercury concentration was above US environmental standards for mercury.