Washington State Mercury Chemical Action Plan

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Washington State Mercury Chemical Action Plan

by
Cheri Peele

The Mercury Chemical Action Plan Committee contributed to the development of this document.

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Washington State
Department of Ecology

Washington State
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Dear Citizen:

Thank you for your interest in learning more about the hazards that mercury poses to our citizens and our environment – and thank you for your interest in doing something about it!

In 1998 the Department of Ecology embarked on an effort to address a certain class of substances that are toxic and long-lasting, and which tend to accumulate in the tissues of humans and animals. One of those substances is mercury. Over the past century, a wealth of information has been amassed about the hazards of eating, breathing, or even touching mercury. Biologists know it. Toxicologists know it. Medical doctors know it. Based upon this knowledge, our environmental and public health departments have committed to work together to inform people about the risks and take decisive steps to protect our citizens from mercury contamination.

Yes, mercury is a natural-occurring element in the environment. But most mercury-related health problems are due to human activities that have concentrated mercury in ways that Mother Nature never would. These concentrations may enter and build up in the food chain faster and with greater intensity, threatening the balance of an intricate and complex web of life. There are many things in life that are outside of human control, but we *can* prevent mercury contamination.

The Washington State Departments of Ecology and Health, with the assent of our state legislature, have jointly produced this *Mercury Chemical Action Plan*. The purpose was to identify sources of human-caused mercury in our state, outline the existing regulatory structure around mercury, describe existing mercury-reduction efforts and identify additional strategies, and recommend actions the Department of Ecology could take to make further progress.

As you'll see, mercury enters our lives via many paths – through industrial emissions and through consumer goods, such as thermometers, fluorescent lights, and a variety of other products. It will take a broad-based effort and considerable collaboration to make a difference.

We know that some believe this action plan is too bold, while others believe we are not being bold enough. We believe Washington State has both the authority and the obligation to address the environmental and human health hazards posed by mercury. And we owe it to ourselves and to future generations to take deliberate steps to reduce and remove sources of human-caused mercury releases from our environment so we can preserve and enhance the unique quality of life of our state. We offer this action strategy for your consideration and ask for your support.

We want to personally thank the citizens who participated on the Mercury Action Plan Advisory Committee. Without their time, interest, and effort, the development of this plan, which provides Washington with a practical strategy to reduce mercury in the environment and reduce health risks to its citizens, would not have been possible.

Tom Fitzsimmons, Director
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Purpose of this Document

This document identifies sources of human-caused (anthropogenic) mercury in Washington State, outlines the existing regulatory structure around mercury, describes existing mercury-reduction efforts, identifies possible strategies for further mercury reduction, and makes recommendations for action to be taken by the state Department of Ecology and the state Department of Health.

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Acronyms and Abbreviations

AMSA	Association of Metropolitan Sewerage Agencies
Btu	British thermal unit
CFR	Code of Federal Regulations
DOH	Washington State Department of Health
EAP	Environmental Assessment Program, Washington State Department of Ecology
H2E	Hospitals for a Healthy Environment
Hg	mercury
HVAC	heating, ventilation, and cooling
HWTR	Hazardous Waste & Toxics Reduction Program, Washington State Department of Ecology
MIRT	Medical Industry Waste Prevention Round Table
MSW	municipal solid waste
NEWMOA	Northeast Waste Management Officials' Association
NPDES	National Pollutant Discharge Elimination System
PBT	persistent, bioaccumulative toxin
POTW	publicly-owned treatment works (sewage treatment facility)
ppb	parts per billion
ppm	parts per million
RCRA	Resource Conservation and Recovery Act
RCW	Revised Code of Washington
SIC	standard industrial classification
TCP	Toxics Cleanup Program, Washington State Department of Ecology
TMDL	total maximum daily load
TRI	Toxics Release Inventory
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WAC	Washington Administrative Code
WWTF	Wastewater treatment facility
WWTP	Wastewater treatment plant

Executive Summary

Washington State has begun an effort to substantially reduce human sources of exposure to several toxic chemicals called *persistent, bioaccumulative toxins* – or PBTs. PBTs pose particular threats to humans because they build up through the food chain. Once lodged in organs or tissues, PBTs can remain indefinitely, even affecting developing fetuses. Many PBTs can be especially harmful to infants and children because they affect development.

Under guidance provided by the Legislature in 2002, the departments of Ecology and Health have developed a plan that targets mercury as the first priority pollutant in the state's PBT initiative. The agencies were assisted by an advisory committee of 22 representatives of business, health, environmental, and local government organizations.

The *Mercury Chemical Action Plan* describes elements of a statewide campaign to virtually eliminate the use and release of human-caused mercury in Washington State and take steps to further minimize human exposure to mercury.

Reducing Mercury Exposure and Pollution

Currently, about 3,800 to 5,000 pounds of mercury are released into Washington's environment each year from human sources within the state. By simply focusing on better waste disposal, mercury pollution can be greatly reduced. Additional pollution-prevention strategies can assist hundreds of businesses, industries, and government agencies.

Nearly one ton of mercury pollution can be prevented from entering Washington's environment each year by improving waste separation and disposal methods in dentistry, households, medical facilities, and others areas where mercury is used. Actions that will be pursued include:

- ***Installing amalgam separators in dental offices***. Many dentists have already invested in amalgam separators. Half of the 3,600 dentists in the state practice in King County, where a local ordinance requires amalgam separators by July 2003. The Department of Ecology and Washington Dental Association will work with dentists elsewhere to make these investments over the next two years.
- ***Safely disposing of mercury waste in households and small businesses***. More than half of the state's households report using fluorescent light bulbs or tubes. Batteries also are a staple of modern life, and many people still use mercury thermometers. These products are thrown into the trash, where they release mercury when broken in transport or at landfills. State grants are available to local governments and non-profit organizations to strengthen and better publicize local hazardous-waste services and facilities. Mercury-thermometer exchanges are being pursued with a variety of partners, including retail pharmacies.
- ***Replacing medical equipment containing mercury and improving waste separation in hospitals***. The Washington State Hospital Association will work with Ecology to reduce hospitals' reliance on equipment containing mercury by promoting and helping them acquire safer alternatives.

Up to another half-ton of mercury pollution can be prevented in the following ways:

- ***Reducing coal-power emissions***. A 35 percent, or 150-pound, reduction in mercury emissions from the TransAlta coal plant in Lewis County is expected due to new scrubbers installed in the summer of 2002. USEPA currently is developing rules to address the problem of mercury from coal-powered utility plants.

- ***Providing technical and engineering assistance to manufacturers and oil refiners.*** Environmental engineers from Ecology are providing technical assistance to many commercial facilities that together account for about 500 pounds of mercury each year. Instrument, cement and lime, pulp and paper, chemical manufacturers, aluminum and secondary steel smelters, and oil refineries are included in continuing technical-assistance efforts.

- ***Providing technical assistance to wastewater treatment plants and waste recycling and disposal facilities.*** Waste treatment, recycling, and disposal facilities will get help reducing mercury from waste water, sewage sludge, municipal garbage incinerators, and landfills.

In the coming years, other mercury sources will need to be addressed as part of national mercury-reduction efforts.

- ***Preventing mercury pollution from existing mine operations.*** When operating at full capacity, a lode gold mine in Ferry County releases more than 700 pounds of mercury waste a year. Ecology will work with the mining industry and national efforts led by the USEPA to reduce pollution at hard-rock mines.

- ***Achieving cleaner fuels with less mercury.*** Jet fuel, diesel fuel, and heating oil contain mercury at low levels. Ecology will work with the petroleum industry and USEPA in national efforts to further reduce the amount of mercury emitted from petroleum combustion.

Mercury's Properties and Uses

Mercury is an element that is a heavy liquid metal in its pure form. It reacts with other substances to form organic and inorganic compounds, as well as amalgams with other metals. Mercury occurs naturally in certain hard-rock and metallic ores, and it can enter the environment from both natural emissions and human activities. All forms of mercury can be toxic to humans and other animals, depending on the route and amount of exposure.

Mercury is extremely malleable, expanding and contracting according to temperature. Its unique properties are suited to numerous technological and manufacturing products and processes. In dentistry, for instance, mercury is used in fillings because of its strength and ability to accommodate temperature ranges of the foods and liquids we consume. The same holds true for other products subjected to heat fluctuations, including thermometers, switches, thermostats, and fluorescent light bulbs or tubes. Mercury also is used to produce chemicals, pharmaceuticals, and cosmetics.

Mercury in the Environment

Mercury pollution in Washington State comes from mining, petroleum combustion, coal-powered plants, various manufacturing sources, refineries, municipal sewage plants, and other sources, as well as land-filling and incinerating a variety of consumer products. Mercury discharged to land, air, or water can eventually find its way to lakes, rivers, and the ocean, where it settles into sediments. Here, bacteria convert the inorganic mercury into methylmercury, a carbon-containing (organic) compound of mercury, and thus it enters the food chain.

As larger species consume smaller species, they accumulate higher levels of mercury. Mercury concentrations are particularly high in large, predatory fish, such as bass, swordfish, and shark. As people eat mercury-tainted fish, the mercury is transferred to humans and builds up in the body. Fish is generally very good food. While other foods are known to contain trace amounts of mercury, consumption of certain fish that have higher levels of mercury can pose potential health risks for some people.

Human Health Effects of Mercury Exposure

Health problems caused by mercury are most severe for the developing fetus and young children. Pregnant women who eat fish contaminated with large amounts of methylmercury run the risk that their babies will have health problems in their central nervous systems and possibly in their heart or blood vessels. In adults, methylmercury can lead to problems in their central-nervous and cardiovascular systems.

Mercury Pollution in Washington

Mercury in Washington comes from of a mixture of in-state and out-of-state, as well as human-caused and natural sources. Actual and potential natural sources include volcanoes, geothermal systems, and the degassing and erosion associated with mineral deposits and mercury-enriched soils.

Mercury pollution is a very real problem in Washington State.

- Mercury-containing products that are washed down drains, sinks, and toilets end up in sewage treatment plants throughout Washington.
- Fish-consumption advisories have been issued for five locations: Eagle Harbor on Bainbridge Island, Sinclair Inlet near Bremerton, Lake Whatcom near Bellingham, Lake Roosevelt on the Columbia River, and in the lower Duwamish River in Seattle. These advisories, issued by health departments, warn against eating fish and shellfish contaminated with mercury. Additionally, there is a statewide fish-consumption advisory for certain species of fish (swordfish, shark, tilefish, king mackerel, tuna steak) having high levels of mercury and all canned tuna that are sold in Washington fish markets and food stores.
- At least 15 toxic cleanup sites are known to be contaminated by mercury.
- At least 30 lakes, rivers, and bays fail environmental standards because of mercury in water, fish, or bottom sediments.

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Introduction and Background to the Mercury Chemical Action Plan

Goal of the Mercury Chemical Action Plan

The *Mercury Chemical Action Plan* is designed to meet two equal goals:

1. Virtually eliminate the use and release of human-caused mercury in Washington.
2. Minimize human exposure to mercury.

"Virtual elimination" is defined for this document as a reduction of mercury releases to the air, water, and land from human-made sources using life-cycle management practices (e.g., pollution-prevention and release controls) so as to approach the levels and fluxes of mercury that would be expected from naturally-occurring processes. This virtual-elimination goal is identical to that expressed in the USEPA Working Draft: PBT National Action Plan for Mercury, the Canada-US Binational Toxics Strategy for the Great Lakes, and in the tri-lateral North American Regional Action Plan developed by Canada, the U.S., and Mexico.

A purpose of the *Mercury Chemical Action Plan* is to prevent new mercury from entering the environment and to reduce the contribution of existing sources. Since eating fish is the greatest source of mercury exposure for most people (as opposed to breathing mercury or absorbing it though the skin), preventing the entry of mercury into the environment is the best way to reduce mercury exposure that causes health effects.

The long-term strategy for reducing exposure to mercury is to lower concentrations of methylmercury in fish by limiting mercury releases into the atmosphere from burning mercury-containing fuel and waste and from other industrial processes. Reducing the consumer use of mercury-containing products and trading in these products also helps to prevent spills that contribute to environmental contamination. Mercury that is released into the atmosphere today may end up on our dinner table tomorrow.

Preventing mercury exposure has great benefit for public health and well-being. Children are especially sensitive to the damaging effect of mercury on the development of their nervous and circulatory systems. Damage to children's ability to learn and control their behavior has great social and economic costs. In addition, heart disease is a major killer of adults, and there is evidence that early exposure to mercury damages blood vessels in the heart and those leading to the brain.

There also are reports of similar physical defects in wildlife, indicating that reducing mercury would benefit our ecosystems as well.

Mercury is an element that is a heavy liquid metal in its pure form and that reacts with other substances to form organic and inorganic compounds as well as amalgams with other metals. Mercury occurs naturally in certain ores called cinnabar. Mercury is released from ores by natural processes such as volcanic action, and through human mining and smelting. Mercury can enter the environment both from natural emissions and from human activities. All forms of mercury are toxic to humans and other animals, depending on the route and amount of exposure.

Exposure to Mercury

Human beings can be exposed through three routes:

1. Eating certain fish that are long-lived or are predators that have accumulated mercury in their tissues through the food web.
2. Inhaling mercury vapor from liquid-mercury spills (a problem in enclosed spaces only) and, to a limited amount, from amalgams.
3. Skin absorption through contact with liquid mercury or creams and unguents containing mercury in any form.

Mercury exposure can occur from all three routes of exposure in certain ritual or religious practices.

How Mercury Enters the Environment

The most common source of exposure to mercury for most people is eating of fish that contain methylmercury, a carbon-containing (organic) compound of mercury. While other foods are known to contain trace amounts of mercury, consuming fish with high mercury levels is by far the largest exposure source from mercury for most fish-eating people. Fish is generally very good food. Understanding how mercury gets into the environment is essential to understanding how mercury gets into fish and, ultimately, into people.

Elemental mercury can evaporate and enter the air even at ambient temperatures, but especially when heated. Compounds of mercury (that are found in coal, for instance) can undergo chemical reaction during combustion and release elemental mercury to the air. Elemental mercury also can be released slowly from ores and from the amalgams it forms with other metals. Most elemental mercury released into the air is circulated worldwide at high atmospheric levels. It may react with other chemicals, especially chlorine compounds, in the atmosphere and be deposited through rain or snow precipitation anywhere worldwide. While it is in the atmosphere, mercury cannot be breathed and does not present a route of exposure to humans or other living things. Once it reacts and precipitates to soil or sediment, its compounds can enter the food web.

Inorganic mercury compounds (i.e., mercurous or mercuric chloride) result from chemical reactions between mercury and other elements or compounds. Exposure to such compounds is rare for people who do not work in laboratories or industries where such compounds are used. Mercury compounds are very caustic and present a health problem mostly when people swallow mercury compounds accidentally or deliberately. The corrosive nature of the mercury compounds can damage the stomach and digestive tract. Inorganic mercury compounds also can be converted to organic mercury compounds in the digestive tract, which can then be absorbed into the general circulation and be transported by blood and other body fluids to the brain and kidney, where they cause damage.

Mercury gets into fish through a complex process that involves many steps (see Figure 1). First, mercury in the form of mercuric chloride from combustion of mercury-containing materials enters bodies of water by being deposited directly on water, or on land that drains into the water. The combustion process causes chemical reactions between other substances and mercury, forming fine particles in air that can be caught up in water droplets that later fall to earth as rain or snow. Run-off from land puts the inorganic mercury into streams and lakes throughout their watershed. Once in sediments of streams and lakes, bacteria can take up the deposited mercury, and change it chemically to the organic form (methylmercury), which does not readily leave the bacteria.

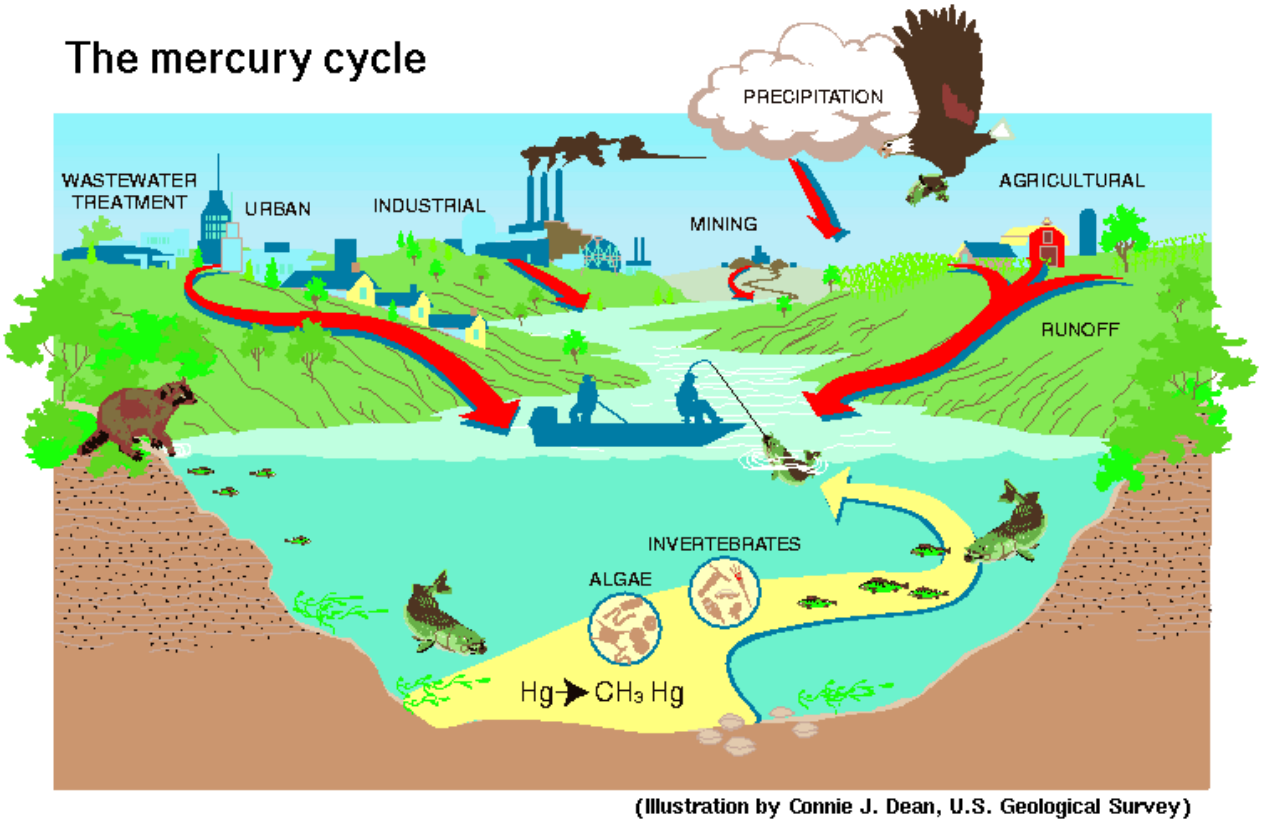

Figure 1. The Mercury Cycle

Animals that eat the bacteria accumulate the mercury compounds within the bacteria. Because most living things are not very efficient at extracting energy from food, they must eat many times their own weight to sustain their life. Mercury in food is excreted very slowly and is left largely bound up in cells. Because of these qualities, it increases in amount over time within individual living things if they are continually exposed to mercury. Invertebrate organisms eat bacteria and other mercury-containing microorganisms in large amounts. Large fish eat many times their weight in small fish and invertebrates. At each step of this food chain, the amount of mercury left behind in tissues increases. Predatory fish that are long-lived can accumulate hundreds of thousands to millions of times the concentration of mercury that entered the water as precipitation or run-off. Human beings can be exposed to mercury when they eat fish that have high mercury concentrations. The amount of mercury that human beings get depends on the amount of fish they eat, and the concentrations in the fish species they choose to eat.

How to Keep Mercury from Getting Into Fish

Limiting mercury releases into the atmosphere from burning coal and waste and from other industrial processes will reduce fall-out of mercury to water bodies and watersheds, and ultimately will reduce mercury concentrations in fish. Likewise, reducing the consumer products containing mercury and trading in those products also helps prevent spills that contribute to environmental contamination. Eating fish, for most people, is the greatest source of mercury exposure. Reducing mercury in fish will reduce exposure for most people.

The *Mercury Chemical Action Plan* is designed to ultimately reduce the effects of mercury on the health of people and wildlife. Since eating fish is the greatest source of mercury exposure for most people (as opposed to breathing mercury or absorbing it though the skin), preventing mercury from entering the environment is the best way to reduce mercury exposure.

Exposure to Mercury Vapor

Elemental (liquid) mercury can evaporate and cause exposure if the mercury is in an enclosed space. For instance, mercury spilled in a room can evaporate and reach exposure levels high enough to harm health even from short-term exposure.

Mercury spills from broken thermometers, blood-pressure cuff monitors, jewelry, thermostats, and switches containing mercury can result in air exposures to mercury vapor large enough to cause symptoms. Mercury in outdoor air is generally not at concentrations that cause health effects. Mercury that travels worldwide in the high atmosphere is not available for people to breathe. Exposure to it occurs when it returns to earth in the form of a mercury compound dissolved in rain or snow, since it can then enter the food web.

How Mercury Affects Health

Whether mercury will affect a person's health depends on the route and amount of exposure, and who the person is. Health problems caused by mercury are most severe for the developing fetus and for young children. Pregnant women who eat fish contaminated with large amounts of methylmercury run the risk that their babies will suffer damage to their central nervous systems and possibly in their hearts or blood vessels. Nervous-system changes can affect their babies' ability to learn. In adults, methylmercury can lead to problems of the central nervous system and possible adverse effects on the cardiovascular system. It typically takes weeks or months before effects are detectable after the adult person has been exposed.

Does Mercury Cause Cancer?

Based on human and animal data, the International Agency for Research on Cancer (IARC) and the U.S. Environmental Protection Agency (USEPA) have classified methylmercury as a "possible" human carcinogen. This means mercury has been found to produce cancer in two animal species, but that evidence is not adequate to say that it causes cancer in humans.

Preliminary Inventory of Anthropogenic (Human-Caused) Sources of Mercury in Washington State

Mercury releases and potential releases were calculated in two ways.

1. Mercury releases from point sources were estimated in Table 1.
2. Mercury in products disposed with solid waste or sewage was estimated in Table 2. The fate of mercury in disposed products is unknown. Ninety-one percent of municipal solid waste in Washington is landfilled. Presumably, many of the products listed in Table 2 are landfilled. The mercury contained, particularly in products that break easily, such as fluorescent lamps and thermometers, may be released prior to or during the waste collection process or on the face of the landfill before a daily cover layer is applied.

Table 1. Estimated Annual Releases of Mercury from Point and Area Sources

Sources	Estimated mercury releases – annual or potential (pounds)	Receiving Medium	Data Source	Confidence Level
Combustion of Distillate Fuel #2	733	Air	See Table 7 for emission factors	Low
Coal-fired power plants	436	Air, land	Toxics Release Inventory (TRI), 2000	High
Manufacturing	337	Air, land, water	TRI, 2000	Low
Publicly-operated treatment works	331	Land	Estimate of mercury in biosolids. See Table 16.	High
Oil refineries	125	Air, land, water	TRI, 2000	Medium
Medical waste autoclaves, retorts	106	Air, land	Derived from estimate of dental amalgam in red-bag waste	Low
Crematoria	57	Air	See Table 18 for estimate	Low
Sewage sludge incinerators	32	Air	Estimate of mercury in biosolids. See Table 19	High
Combustion of residual fuel	29	Air	See Table 7 for emission factors	Medium
Municipal waste combustors	18	Air	TRI, Spokane Solid Waste	High
Medical waste incinerators	0.3	Air	WA Dept. of Ecology Eastern Regional Office	High
Gold mining	0 - 777	Air, land, water	TRI, 2000	Low
TOTAL	2204 – 2981			

TRI = Toxics Release Inventory

Table 2. Estimated Mercury in Products Disposed of Annually in Washington State

Mercury Products	Estimated pounds of mercury disposed with solid or medical waste or sewage annually
Fluorescent lamps	437 - 505
Thermostats	412
Dental amalgam from dental facilities	>404
Auto convenience light switches	253
Button cell batteries	88
Dental amalgam in feces and urine	61
Household fever thermometers	11 - 300
TOTAL	1,666 – 2,023

Natural and Background Sources of Mercury - A Summary with Specific Reference to Washington State

by Bill Yake, Washington State Department of Ecology, Environmental Assessment Program

The Global Mercury Cycle

Mercury (Hg) is released to the environment from both natural and human-caused sources. Although it is released to air, water, and land, most research focuses on mercury releases to the atmosphere. The environmental cycling of mercury before and after industrialization is represented in Figures 2 and 3.

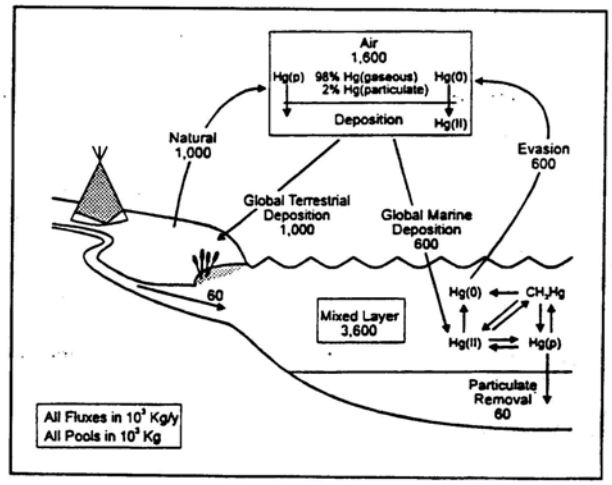

Figure 2. Pre-Industrial Mercury Budgets and Fluxes (USEPA, 1997; Mason et al., 1994).

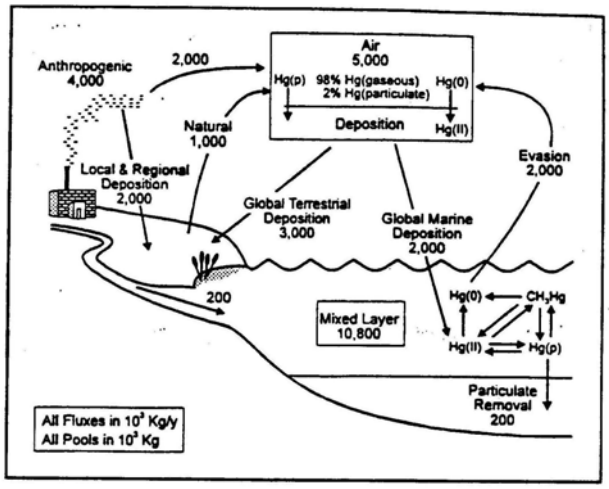

Figure 3. Current Mercury Budgets and Fluxes (USEPA, 1997; Mason et al., 1994).

Important points in comparing natural conditions (Figure 2) and recent conditions (Figure 3) are:

- Post-industrial increases in mercury emissions are estimated at 4,000 metric tons of mercury per year, about half of which is deposited locally and regionally. The other half enters the global atmosphere.
- A related increase in global atmospheric load has resulted – estimated in this figure as an approximate tripling of atmospheric mercury since pre-industrial times.
- Similar increases are reflected in other environmental media – an approximate tripling of mercury in oceans, freshwaters, and sediment remote from local and regional human-caused sources.
- Greater increases in mercury are projected in the local and regional vicinity of human-caused sources.

The magnitude of post-industrial increases in global mercury is of some debate. Figure 3 shows an approximate tripling. This means that about two-thirds (67 percent) of mercury in the global cycle in locations remote from local and regional sources is caused by humans. The Expert Panel on Mercury Atmospheric Processes (1994) estimated that human-caused sources may account for 50–75 percent of the total input to the global atmosphere.

Additional increases in mercury are associated with deposition of mercury near human-generated sources. Including all human-generated emissions (those deposited locally and regionally, as well as contributions to the global atmosphere), 70 to 80 percent of current mercury emissions may be due to human activities (USEPA, 1997; Mason et al., 1994; and Fitzgerald and Mason, 1996).

In discussing background, natural, and human-caused sources of mercury, it is important to define these terms. It is also important to recognize that mercury from human and natural sources mixes into and recycles among oceanic, atmospheric, and probably terrestrial pools. For this reason it is difficult to differentiate what portion of mercury in, say, rain falling on the Olympic Peninsula is from natural sources and what portion is from human sources. The distributions shown in Figure 3 serve as reasonable first-order estimates of this apportionment.

The following definitions (modified from USEPA, 1997) are used here:

- *Natural (or Pre-Industrial) Mercury Emissions:* The mobilization or release of mercury from environmental sources by natural biotic or abiotic activities that result in the mass transfer of mercury to atmospheric, aquatic, or terrestrial environments.
- *Anthropogenic (or Post-Industrial) Mercury Emissions:* The mobilization or release of mercury by human activity that results in a mass transfer of mercury to atmospheric, aquatic, or terrestrial environments.
- *Natural (or Pre-Industrial) Background Mercury Concentrations/Emissions:* Concentrations or emissions of mercury in the abiotic and biotic components of the environment that resulted from natural sources of mercury. These concentrations existed prior to the onset of human-caused activities that release significant amounts of mercury.

Natural Sources of Mercury in Washington

Washington is home to both human-caused and natural sources of mercury. Human sources are discussed elsewhere in this *Mercury Chemical Action Plan*.

Natural sources of mercury include volcanoes, geothermal systems, as well as degassing and erosion from mineral deposits and mercury-enriched soils. Some authors and researchers include oceans, forests, and forest fires as natural sources, and while they do emit mercury, much of this mercury was probably recycled from other sources. The same may be true for emissions from soils with concentrations of mercury elevated by human sources.

Volcanoes

Apparently the only direct measurements of mercury emissions from a Washington volcano were made at Mount St. Helens in September 1980, by Varekamp and Buseck (1981). Measurements of the mountain's "gas plume" were made on five days during an active, but non-eruptive, phase and yielded mercury emission estimates of 200 to 1,700 kg/day.

Few measurements of mercury in Mt. St. Helens ash have been reported. In the only data located, Sarna-Wojcicki et al. (1981) did not detect mercury in 11 analyses with detection limits of 1 and 5 parts per million (ppm).

As noted by Varekamp and Buseck (1981), "Most of the mercury initially present in the magma seems to be released into the atmosphere before solidification of the magma." It is possible that the solid material, including ash, may actually be depleted in mercury.

Goff (2002) used SO_2 emission rates from Mt. St. Helens (Pettit et al., 2000) and Hg:SO_2 ratios from other volcanoes (Goff et al., 1998) to estimate mercury emissions from Mt. St. Helens. His estimate of emissions in 1994 is equivalent to $\leq$ 25 kg/yr ($\leq$ 60 lbs/yr). Goff further states, "I'm sure that values are much less now." (Goff, 2002).

Recent work by Schuster et al. (2002) reports mercury concentrations in an ice core from the upper Fremont Glacier in Wyoming. This 270-year record includes a substantial mercury peak that the authors believe is associated with Mt. St. Helens activity in the early 1980s. This appears to be the first report of volcano-related mercury peaks in ice cores. Similar peaks have not been reported in sediment cores. Interpretation of these results is still somewhat controversial (Engstrom, 2002; Swain, 2002)

Geothermal Systems

Both atmospheric emissions of mercury and deposits of mercury-bearing ores are associated with hot springs and geothermal areas (Varekamp and Buseck, 1983; 1984). Varekamp and Buseck (1986) estimate global emissions from geothermal systems at less than 10 percent of those from active and passive volcanoes.

No information on mercury emissions to air or water from geothermal areas in Washington was located for this summary.

Degassing and Erosion from Mineral Deposits and Mercury-enriched Soils

Although emission of mercury to the atmosphere from mercury-enriched soils and minerals is a recognized phenomena, the magnitude of these emissions is disputed and uncertain (Zehner and Gustin, 2002; Engle et al., 2001). Mercury flux from soil is strongly influenced by incident radiation (sunlight), mercury speciation and concentration, temperature, and other variables (Gustin et al., 2000; Zehner and Gustin, 2002; Engle et al., 2001). To date, most measurements of mercury flux from mercury-enriched soils have been conducted in arid areas with little vegetative cover (e.g., parts of Nevada and California). Vegetation and shade – like that present

in western Washington – are likely to reduce emission rates, perhaps by as much as 90 percent (Zehner, 2002).

All else being equal, emissions from land surfaces increase with increasing mercury concentrations in soil and rock (Gustin et al., 2000; Zehner and Gustin, 2002). Gustin et al. (2000) consider land surfaces to be enriched when their mercury concentrations exceed 0.1 mg/Kg, noting that the average abundance of mercury in the earth's upper crust is ~0.06 mg/Kg. The Department of Ecology (San Juan, 1994) measured background concentrations of mercury in 166 statewide soil samples. *Natural background concentrations* in these soils (soils located 1.5 to 2 feet below the surface) had a median concentration of 0.024 mg/Kg. Only four of 166 soil samples exceeded 0.1 mg/Kg. The highest was 0.186 mg/Kg.

Areas enriched in mercury are concentrated near active plate tectonic boundaries and are associated with high heat flow, volcanism, hydrothermal systems, and subsequent mineral deposits (Zehner and Gustin, 2002). Huntting (1956) summarizes information on 85 "occurrences" of mineral mercury in Washington. Of the 53 of these "occurrences" mapped by Huntting (1956), 45 (80 percent) are located in the Cascades. Another eight (14 percent) are located in the northwest corner of the Olympic Peninsula. Thus the distribution of mercury-enriched sites in Washington is spatially quite limited.

The U.S. Bureau of Mines (1965) states "only two quicksilver [mercury] mining districts have produced commercially in Washington – the Morton District in Lewis County and the Green River District in King County." This source also reports little mercury production in Washington after 1943, and none after 1958.

One area of potential mercury enrichment is the upper Nooksack River Basin. Babcock and Kolby (1973) measured mercury in stream sediments and reported elevated concentrations (up to 0.84 mg/Kg) from Boulder Creek in the North Fork drainage. Falley (1974) found mercury-enriched sediments of several tributaries of the North and Middle forks, with the highest – 8 mg/Kg – in Clearcut Creek on the Middle Fork.

In summary, there appear to be only restricted areas of mercury enrichment in Washington and no major deposits. Degassing of soils and rocks is probably a minor source of mercury in the state, although erosion from isolated deposits may contribute to elevated mercury concentrations in selected drainages.

Oceans

Although some authors refer to the oceans as a natural source of mercury, oceans appear to serve instead as a pool of mercury fed by both natural and human sources. Most of this mercury is subsequently recycled back to the atmosphere. A small portion (estimated at less than 2 percent annually in Figure 2) is incorporated into sediments and removed from the cycle. In a recent evaluation, Mason and Shue (2001) suggest "that there is a net transfer of mercury from the terrestrial environment to the ocean, and that the concentration of mercury in the deep ocean is increasing at a few percent per year." The ocean is probably a net sink, rather than a net source, of mercury.

Forests and Forest Fires

Although forest fires have been reported as a source of mercury (Frieli et al., 2001), the mercury released, like that released by the oceans, appears to be largely recycled mercury absorbed by plants from the atmosphere. Mercury is exchanged between atmosphere and vegetation, with the main direction being from air to plants (Grayton et al., 2001; Lodenius et al., 2001, and Benesch et al., 2001). Plant uptake appears to take place by way of deposition and uptake through leaf stomata.

Out-of-State Sources of Mercury

Washington both receives and emits mercury. Examples of mercury entering the state include the mercury in rain from out-of-state weather systems and mercury transported in cross-boundary rivers (e.g., the Columbia and Spokane). As noted above, mercury from out-of-state comes from both natural and human sources. Out-of-state sources are briefly discussed here.

Rivers

Several rivers enter Washington from Idaho, Oregon, and British Columbia. The largest of these are the Columbia, Snake, Skagit, and Spokane. Smaller rivers include the Similkameen, Okanogan, Pend Orielle, Kettle, Grande Ronde, and South Fork Palouse.

Data from which incoming mercury loads could be calculated were located for the Columbia and Spokane rivers (Ecology, 2002). Mercury was monitored from the Columbia River (Northport) and Spokane River (Stateline) intermittently from 1994 through 1999. Mercury loads were estimated by averaging and summing monthly loads over the period of record. Table 3 reports the results.

Table 3. Mercury in Rivers Entering Washington State

River	Station Name	Period of Record	Mercury Load (lbs/yr)
Columbia River	Columbia River @ Northport	1994-1999	260
Spokane River	Spokane River @ Stateline	1994-1999	19

Air (Rain)

As noted above, oceanic and atmospheric mercury are part of a global cycle that includes both natural and atmospheric sources. The exchange of mercury between atmospheric and oceanic pools may include a net transfer to the oceans (oceans as a net mercury sink) with "the concentration of mercury in the deep ocean... increasing at a few percent per year" (Mason and Sheu, 2001). Oceanic sediments also serve as a mercury sink.

Winds and weather systems entering Washington carry mercury associated with the global cycle. Wet deposition (in rain and other precipitation) and dry deposition (in dust and aerosols) transport mercury from global and local atmospheric sources to land, water, and vegetation.

While assertions have been made about specific percentages of Washington's mercury load that is transported from specific geographical areas (e.g., Asia, East Asia, China), these assertions could not be verified.

The Mercury Deposition Network monitors wet deposition of mercury at a number of sites in the U.S. and Canada (Mercury Deposition Network, 2002). There is one active site and one inactive site in Washington. The inactive site (WA-14) was located at the Hoh Ranger Station on the Olympic Peninsula and reported data on *total* mercury deposition from May to November 1995. The active site (WA-18) is located at Sandpoint on Lake Washington and has provided data on *wet* deposition since 1996. Little can be concluded from comparisons of data from these two sites because of differences in monitoring techniques (*total* versus *wet* deposition) and period of record (no overlap in time coverage).

Atmospheric mercury was monitored at Cheeka Peak on the Olympic Peninsula from March 2001 to August 2002. This monitoring was funded by USEPA in cooperation with the University of Washington, and there are plans to soon restart this monitoring. Neither the data nor conclusions from these data have been published. Because the mercury monitored at Cheeka Peak is atmospheric, it is not necessarily deposited in Washington. At present there is no way to determine what portion of this mercury is deposited in Washington and what portion passes through to eventually reach adjoining states and provinces.

Other Out-of-State Sources

Theoretically, mercury is transferred into and out of the state in materials and consumer products, as well as in solid and hazardous wastes. The scope of this project did not allow for quantification of these transfers.

Natural Background Concentrations

It is not generally possible to obtain direct measures of natural (pre-industrial) background mercury in air and water. Fortunately it *is* possible to get measurements of natural background concentrations in soils and sediment. This is done by measuring mercury concentrations in materials laid down prior to the post-industrial increases in mercury associated with settlement, industrialization, and population growth.

Soils

The Department of Ecology (San Juan, 1994) measured and reported mercury concentrations in soils from 166 sites statewide. These samples were obtained from the bottom 6 inches of pits, 2 feet deep. Table 4 summarizes the results.

Table 4. Natural Background Mercury in Washington State Soils (mg/kg dw)

	Statewide Data	Group "W" - Subgroup of Western WA Sites	Clark County	Puget Sound Basin	Yakima Basin	Spokane Basin	Group "E" – Subgroup of Eastern WA Sites
n = Number of Samples	166	15	26	45	32	27	21
Mean	0.031	0.049	0.027	0.047	0.028	0.016	0.0089
Geometric Mean[1]	0.023	0.032	0.026	0.043	0.023	0.012	0.0074
Median	0.024	0.038	0.026	0.044	0.021	0.012	0.007
Range	0.004 – 0.185	0.009 – 0.185	0.012 – 0.048	0.012 – 0.095	0.007 – 0.116	0.004 – 0.131	0.004 – 0.025

[1] Recalculated from original data

In general, mercury appears to be higher in Western Washington soils than it is in Eastern Washington soils. As noted above, very few of the sites are enriched in natural mercury (e.g., greater than 0.1 mg/kg as defined by Gustin et al., 2000).

Sediments

Most sediments collected in Washington have been from the surface – often the top 2 centimeters. These recently deposited sediments do not represent natural background. However, a few sediment cores have been collected and the deeper horizons of some of these cores are old enough (Yake, 2001) to provide a good estimate of natural background conditions.

Lefkovitz et al. (1997) obtained dated records of mercury concentrations from three cores collected in central Puget Sound. One of these cores, taken north of Dash Point, provides data for sediments laid down since about 1811. Mercury concentrations in horizons dating from 1811 to 1850 average 0.052 mg/kg. This estimate of natural background agrees fairly well with natural background mercury measured in soils (mean 0.047 mg/kg; geometric mean 0.043 mg/kg) from the Puget Sound Basin, as reported above.

In the only other Washington State study of mercury in dated cores that may have reached natural background conditions, Van Meter (2000) found a concentration of 0.12 mg/kg in Lake Washington sediments dating from 1890-1905. It is possible, however, that these measurements are not old enough to represent true pre-settlement conditions, especially as this concentration would qualify as "enriched" as defined by Gustin et al., 2000.

Historical Perspectives

One way of estimating the relative magnitude of natural and human sources is by looking at historical records. Dated sediment cores provide this historical perspective.

Sediment Cores

Few dated sediment cores have been collected in Washington. Of these, only a handful provide extended records and report mercury concentrations. The results of these cores are summarized in Table 5.

Table 5. Mercury in Dated Sediment Cores from Washington State

Study	Site Location	Baseline Years	Baseline Concentration (mg/Kg dw)	Hg Concentration Ratio	
				Most Recent (year)	Peak (year)
Lefkovitz, 1997	Puget Sound off Dash Point	1811- 1850	0.052	5.33 (1990)	7.00 (1925)
Lefkovitz, 1997	Puget Sound off Seahurst	1811- 1850	0.052	3.44 (1990)	6.00 (1944)
Lefkovitz, 1997	Puget Sound off Elliott Bay	1811- 1850	0.052	4.10 (1991)	8.88 (1947)
VanMeter, 2000	Lake Washington	1890- 1905	0.12*	2.82* (~1997)	6.25* (~1965)

* Actual pre-settlement concentration may be lower; concentration ratios may be higher.

The columns on the right of Table 5 show the ratio between mercury concentrations recorded for natural background concentrations and those in the peak and most recent years recorded in the core. (For the Puget Sound cores, *natural baseline concentrations* are derived from the Dash Point core which reached into the first half of the 19th century.)

Peak mercury concentrations in the sediment records range from 6 to about 9 times background. Peak years range from 1925 to 1965. Visual review of graphs displaying the history of mercury concentrations contained in these cores (Yake, 2001) shows a plateau of high mercury concentrations from about 1915-1970 in Puget Sound and 1925-1970 in Lake Washington. After 1970, mercury concentrations decline somewhat.

Mercury concentrations in the most recent year represented by each core (1990 to 1997) range from about 3 to 5 times background.

From these data one could infer that human-caused emissions of mercury in the central Puget Sound region may have peaked from about 1925 to 1970, and during this period total emissions may have exceeded natural background contributions by 6 to 9 times. After 1970, the magnitude of human-caused sources appear to have declined somewhat. The most recent available records from these cores appear to show current concentrations exceeding natural background by 3 to 5 times. This compares to USEPA's (1997) estimate of a tripling of global background emissions between pre-industrial times and the present. The difference between the two estimates could be due to local and regional sources. Estimates that 70 to 80 percent of total (local, regional, and global) mercury emissions may be due to human activities (USEPA, 1997; Mason et al., 1994; and Fitzgerald and Mason, 1996) would be equivalent to an increase of 3.3 to 5 times over natural background.

Additional perspective is gained from the results of sediment cores collected in southwestern Alaska by Engstrom and Swain (1997). "There are no significant anthropogenic mercury sources anywhere in southeastern Alaska and very little human development within several hundred kilometers…Hg accumulation in the sediments can be viewed as an integrated sample of global Hg pollution in the Northern Hemisphere" (Engstrom and Swain, 1997).

Results summarized in Table 6 show an approximate doubling of mercury fluxes, probably due to human-caused increases in global mercury. If these results reflect changes in Washington State mercury deposition due to global influences, then the additional increases found in Washington State cores are likely due to local and regional sources.

Table 6. Comparison of Natural Baseline and Modern Mercury Fluxes
Based on Sediment Cores from Southeastern Alaska

"Provisional Lake Name"	Baseline Years	"Modern" Years	Mercury Flux Ratio
Dagelet	1800-1850	1980-1993	1.82
Brady	1800-1850	1980-1993	2.1
LaPerouse	1800-1850	1980-1993	2.05

Conclusions

1. Mercury in Washington State results from a mixture of in-state and out-of-state sources, as well as human-caused and natural sources.

2. Actual and potential natural sources include volcanoes, geothermal systems, and the degassing and erosion associated with mineral deposits and mercury-enriched soils.

3. Oceans and forest fires appear to largely recycle mercury.

4. Although general research on global mercury cycling and natural sources of mercury has improved markedly over the past decade, significant gaps remain. For instance:

    - Detailed information on actual and potential natural mercury sources in Washington is spotty.
    - Information on Washington's cross-border exchange of mercury in rivers, wastes, and products appears to be limited to water quality data from the Columbia and Spokane rivers.
    - Accurate conclusions about the relative contributions of specific geographical areas (Asia or China, for instance) to Washington's mercury load do not appear to be possible from available data.

5. Natural background concentrations in Washington's soils are somewhat higher in Western Washington than in Eastern Washington. On average, natural background concentrations throughout the state are somewhat lower than the average abundance of mercury in the earth's crust.

6. While the relative magnitude of natural and human-caused sources can be inferred from high-quality, dated sediment cores, there are few such records available for Washington State. Review of existing data (four sediment cores) is consistent with other information estimating an approximate tripling of mercury in locations remote from specific sources, with greater increases near local and regional mercury sources.

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International, National, and Local Context

Because mercury is a global pollutant that travels long distances, efforts to reduce mercury in the environment must take place at all levels of government. Many efforts are under way; a few are summarized below.

The United Nations Environment Programme (UNEP) is developing a Global Mercury Assessment, including an outline of options for addressing any significant global harm from mercury, to be presented to the UNEP Governing Council at its 22nd session in 2003. More information is available at http://www.chem.unep.ch/mercury/default.htm.

In 2000, the Phase II Report of the North American Regional Action Plan on Mercury (NARAP) was completed. NARAP was developed as a result of the North American Agreement on Environmental Cooperation (NAAEC) by the Commission on Environmental Cooperation. The NAAEC was signed as a parallel side agreement to the North American Free Trade Agreement in 1994. NARAP establishes a number of cooperative initiatives among Mexico, Canada, and the United States to improve the scientific understanding of the mass balance of mercury in North America, to promote pollution-prevention actions across the continent, and to assist Mexico in capacity building. The plan is available at http://www.cec.org/programs_projects/pollutants_health/smoc/pdfs/Hgnarap.pdf.

As part of USEPA's Persistent, Bioaccumulative and Toxic Chemicals Program, the agency is in the process of developing a PBT National Action Plan for Mercury. The working draft for this report is available at http://www.epa.gov/pbt/hgaction.htm.

The Great Lakes Binational Toxics Strategy, a Canada-U.S. strategy for virtually eliminating persistent, toxic substances in the Great Lakes signed in 1997, has set the goal of a 50 percent reduction nationally in the deliberate use of mercury and a 50 percent reduction in the release of mercury from sources resulting from human activity in the U.S. by 2006. Additional information is available at http://www.epa.gov/glnpo/p2/bnsintro.html.

In 1998, New England governors and Eastern Canadian premiers adopted a Regional Mercury Chemical Action Plan. The plan's goal is to virtually eliminate human-caused mercury releases, with an interim goal of a 50 percent reduction in mercury emissions by 2003.

In developing its Draft Mercury Report, California identified 33 states with mercury-reduction efforts. These are summarized in Appendix A on page 105 of the California report, available at http://www.dtsc.ca.gov/HazardousWaste/HWMP_REP_DraftMercury2.pdf.

Nineteen states, including Washington, have introduced legislation to control the use of mercury in products. Eleven states, including California and Oregon, have passed such legislation. A summary is contained in Appendix F of this report.

Many of the mercury-reduction efforts in Washington to date have taken place at the local level. Clark, King, Kitsap, Kittitas, Snohomish, and Thurston counties, as well as the cities of Seattle,

Spokane, Tacoma, and Vancouver, have all conducted mercury-reduction programs, detailed in the body of this report.

Mercury Chemical Action Plan: Development Process

This *Mercury Chemical Action Plan* is the first chemical action plan to be developed as part of the Department of Ecology's Persistent, Bioaccumulative Toxin (PBT) Strategy. The PBT Strategy Implementation Plan was completed in December 2001 and is available at http://www.ecy.wa.gov/programs/eap/pbt/pbtfaq.html. The Washington State Legislature provided funding to Ecology to implement the PBT Strategy during the 2001-03 biennium. Ecology selected mercury as the first PBT to be addressed.

In January 2002, due to the significance of health problems from mercury, a core group of staff from the departments of Ecology and Health (DOH) was formed to coordinate the *Mercury Chemical Action Plan* development process. The group met twice a month throughout the year. As a result of this close collaboration, the *Mercury Chemical Action Plan* has become a joint document of both Ecology and DOH.

From January to March, 2002, individual and small group interviews were held with Ecology staff to identify potential sources of mercury in Washington, ongoing and planned efforts to reduce those sources, and potential strategies for additional reductions. Information also was gathered from sources in other states and USEPA regarding mercury-reduction activities. This information was compiled into the draft background document, an initial working draft intended for review purposes.

In March 2002, at the direction of the Washington State Legislature, Ecology formed an external "Mercury Advisory Committee", initially composed of 12 members representing agriculture, business, environmental, local government, and public health sectors. Ecology also contracted with Ross and Associates to facilitate both the advisory committee meetings and public forums scheduled for the fall of 2002. The advisory committee met to review the draft background document in April, followed by a written comment period.

During April and May, 2002, an internal gap analysis committee, composed of Ecology and DOH staff, reviewed the draft background document, identified gaps in knowledge regarding the use of mercury in Washington, and identified potential strategies for mercury reduction. The comments of the advisory committee and the work of the gap analysis committee were applied to the draft background document to develop the preliminary draft action plan. Twelve potential areas for short-term action were identified.

In June 2002, a second advisory committee meeting was held. The advisory committee was expanded to 22 members at the request of advisory committee members, other interested parties, and legislative members. In adding members, Ecology made efforts to maintain balance among the sectors represented. At the June meeting, the advisory committee reviewed initial estimates of mercury releases from various sources, the 12 sources proposed for short-term action and possible mercury-reduction strategies. This meeting was followed by a three-week comment

period for the advisory committee on the preliminary draft action plan. Comments from parties not on the advisory committee were also accepted and considered.

In July and August 2002, external comments were incorporated. The preliminary draft action plan was reviewed by Ecology and DOH staff, and recommendations for action developed.

Recommendations for short-term action were developed for relatively large mercury sources where known, cost-effective solutions exist. Consistent with Ecology's goals and the goals of this action plan, pollution-prevention strategies (avoiding the use of mercury) were preferred over pollution-control strategies (minimizing the release of mercury to the environment). More detailed plans for implementing short-term action will be developed in consultation with interested parties. In some cases, such as removing and recycling convenience-light switches in vehicles, a key component of the more detailed plans will be allocating responsibility for costs involved among affected parties.

Because of the attention focused on mercury reduction around the United States and other countries, cost estimates for specific mercury-reduction strategies are changing rapidly. The development of new technology, such as in-office dental amalgam separators, and research, such as identifying accurate, cost-comparable non-mercury medical equipment, have reduced mercury-reduction costs by providing affected sectors with lower-cost options and greater certainty regarding their effectiveness. As additional mercury-reduction efforts continue to be implemented in locations around the country, it is anticipated that further cost reductions will be achieved by learning from the experience of others, by new technology, and, in some cases, by economies of scale. As the Department of Ecology implements mercury-reduction activities, it will continue to identify and – in cooperation with interested parties, the USEPA, other states, local governments, and research institutions – to help create cost-effective solutions to address the needs in Washington State.

The *Draft Mercury Chemical Action Plan* was released for public comment on September 4, 2002. Ecology and DOH held a 60-day public comment period, during which two public forums took place. The first was held in Tacoma at Henry Foss High School on September 26; the second was in Moses Lake at Big Bend Community College on October 3. Both public forums were facilitated by Ross and Associates.

The final meeting of the advisory committee took place in November 2002. In November and December, public comments were considered and incorporated. This final *Mercury Chemical Action Plan* is being completed for release in January 2003.

The background and draft documents and all external advisory committee meeting handouts and notes have been posted on Ecology's Web site at http://www.ecy.wa.gov/programs/eap/pbt/mercuryplan.html. Throughout the process of developing the action plan, meetings have been held with interested groups and individuals upon request. Through listservs, e-mail, and phone calls, Ecology and DOH staff have maintained close contact with staff from local governments, other states, and federal agencies working on mercury policy, working to ensure that the information and recommendations in Washington's *Mercury Chemical Action Plan* reflect the best and most updated thinking available.

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Human Use and Release of Mercury

1. Mercury Release from Fossil Fuel Combustion

Coal-Fired Power Plants

Identification and Description of Source

Nationally, coal-fired power plants are the largest known source of human-caused mercury emissions. Washington has fewer coal-fired power plants than the midwestern and eastern regions of the country, although the state has other sources that burn coal.

Ecology currently regulates one active coal-fired steam generator, TransAlta Centralia Steam Plant. A second facility, the Tacoma Steam Plant #2, is closed.

The TransAlta Centralia Steam Plant has two separate generating units that were constructed in 1971 and 1972. The total production capacity of the two units is 1,300,000 kilowatts, enough power to supply a city the size of Seattle. In generating electricity, the plant consumes approximately 5 million tons of coal per year.

As a part of its current air-emissions control measures, which meet existing national standards, the Centralia Power Plant uses large electrostatic precipitators (ESP) to remove fly ash from its endpoint emissions. Wet limestone scrubbers at the Centralia plant remove additional mercury beyond that removed in the ESPs. On each boiler at the plant are two ESPs, in series, followed by a wet limestone scrubber. Thus, at the coal-fired portion of the plant, there are four ESPs and two wet scrubbers.

The Tacoma facility, when operating, meets approximately 50 percent of its fuel needs with coal received from a Canadian source of low-sulfur coal. This amounted to just over 40,000 tons of coal in 2001. The Tacoma facility also is classified as a municipal-waste combustor and is discussed in detail in Section 4 of this report.

Quantity and Estimated Uncertainty

According to the federal Toxics Release Inventory (TRI), the TransAlta Centralia Steam Plant released 436 pounds of mercury in 2000. Of the mercury released, 374 pounds were reportedly emitted to air, 0.29 pounds to water, and 62 pounds to land. The air emissions were based on a combination of stack tests and sampling of the coal.

Based on stack testing done in 2002 and the capacity of the facility, the Centralia Power Plant would emit 350 to 360 pounds per year of mercury and mercury compounds.

The Centralia Power Plant has reported mercury emissions for 10 years to the Southwest Clean Air Agency. Emissions have been estimated from a stack test in 1992 and from coal mercury testing. In 1999, the USEPA required extensive coal mercury testing for coal-fired power plants. The coal burned by the Centralia Power Plant has a mercury content of about 60 ppb, primarily elemental mercury that is not collected well by control equipment for other emissions. The power plant has two electrostatic precipitators to remove coal-ash particulate; some mercury also is removed with the ash in the precipitators.

Groups Affected

Coal-fired power plants and regional air authorities.

Current Regulations and Policy

Mercury emissions from coal-fired power plants are not currently limited by law or regulation. The U.S. Department of Energy has set goals to reduce mercury emissions from coal plants by 50 to 70 percent by 2005 and 90 percent by 2010.

Recent Activities

In 1997, the Southwest Clean Air Agency (SWCAA) completed a Reasonably Available Control Technology (RACT) review of the Centralia Power Plant. Although the focus of the RACT review was on sulfur dioxide and nitrogen oxides, the evaluation included mercury and other hazardous air pollutants. The 1996 emissions of 390 pounds/year were modeled, and the resulting effect on ambient air was 0.3 percent of the acceptable level. The RACT review acknowledged that the proposed emissions controls should also remove some mercury; however, mercury was not identified as a pollutant of concern for RACT review.

As a result of the review, SWCAA ordered new emission controls installed under authority of RCW 70.94.154. The first of two scrubbers, or flue gas de-sulfurization units, started up in October 2001; the $200 million project was completed in July 2002. Although they are designed primarily to remove sulfur dioxide from the flue gas, they also will remove mercury due to cooling of the exiting gas temperature. The removed mercury will end up in wall board that will be manufactured from the waste products of this process.

In March 2002, TransAlta tested the mercury emissions of the scrubber unit. Initial results show the mercury removal is about one-third.

Ongoing Activities

The Bush Administration, Senator Jeffords of Vermont, and others have proposals to reduce mercury pollution from coal-fired power plants. It remains to be seen what will emerge from Congress. The final law will probably not be passed until sometime in 2003.

In December 2000, under the Clinton Administration, USEPA announced it had affirmatively decided that mercury air emissions from power plants should be regulated under the federal

Clean Air Act because mercury poses great hazards to public health. Under this decision, USEPA is to propose regulations by 2003 and issue final rules by 2004.[1]

Currently, several multi-pollutant bills are being considered in Congress that would either set mercury emissions limits for coal-fired power plants or, as the Bush Administration is proposing, establish a cap-and-trade program.

The U.S. Department of Energy is funding six research projects to develop innovative technologies to reduce mercury emissions from coal plants at a lower cost than current technologies.[2]

Reduction Options

Develop state regulations requiring reduced emissions.

Wait for federal regulations requiring mercury reduction at coal-fired utility boilers, then evaluate the need for more stringent requirements in Washington State.

Recommended Actions

Ongoing
Review pollution-prevention plans or new facilities reporting under lowered TRI thresholds for mercury.

Proposed, Short-term
Wait for federal regulations requiring mercury reduction at coal-fired utility boilers, then evaluate the need for more stringent requirements in Washington State.

Fuel Oil: Distillate, Residual, and Crude

Identification and Description of Source

Distillate fuels include jet fuels, diesel fuels, heating oil, and kerosene. Residual oil is composed of the heaviest components of crude oil. It is the portion of the crude oil that is left over when all other products are removed, hence the name "residual." Most residual oil is burned to generate electricity or to provide power to relatively large industrial processes. It is also the primary fuel source for ocean-going ships.[3]

Mercury is thought to exist as a contaminant in all fuel oils. It is assumed that all mercury present in fuel oils will be released into the atmosphere during the combustion process.

[1] http://yosemite.epa.gov/opa/admpress.nsf/, March 4, 2002.
[2] http://fossil.energy.gov/techline/tl_mercurysel2.shtml, March 4, 2002.
[3] New Jersey Task Force, New Jersey Mercury Task Force Report: Volume III, New Jersey Department of Environmental Protection, December 2001, pp. 60, 63.

Quantity and Estimated Uncertainty

Concentrations of mercury in fuel oil depend upon the type of oil used. No comprehensive oil characterization studies have been done, but data in the literature report mercury concentrations in crude oil ranging from 0.023 to 30 ppm by weight, while the range of concentrations in residual oil is 0.007 to 0.17 ppm by weight. Because USEPA found only a single mean value in the literature for mercury concentration in distillate oil, no conclusions can be drawn about the range of mercury in distillate oil.

Based on a review of available literature, three mercury-emission factors are presented for residual oil combustion: the 0.73 lb/10 Btu factor from AP-42, 0.46 lb/10 Btu from the Electric Power Research Institute (EPRI), and 0.21 lb/10 Btu from the EPRI residual oil analyses. On balance, these data provide little information for developing an emission factor.

The available information on uncontrolled mercury emissions from crude-oil combustion is ambiguous. Because the data are quite sparse and the relative quality of the data is uncertain, the midpoint of the range was selected as the best "typical" emission factor.

The uncontrolled emission factors for distillate, residual, and crude oil are presented in Table 7. Data are insufficient to develop controlled emission factors for fuel-oil combustion. There is considerable uncertainty in these estimates of emission factors, due to the variability of mercury concentrations in fuel oil, the incomplete database on distillate oil, and the uncertainty in sampling and analysis for detecting mercury. Therefore, these estimates should not be used to determine emissions from specific oil-fired units.

Table 7. Typical Mercury Emission Factors[4]

Fuel Oil Type	Typical Mercury Emission Factors					
	$Kg/10^{15}$ Joules	$Lb/10^{12}$ Btu	g/Mg fuel oil	10^{-3} lb/ton fuel oil	$g/10^{3}$ L fuel oil	$Lb/10^{6}$ gal fuel oil
Residual #6	0.02	0.46	0.009	0.017	0.0085	0.071
Distillate #2	2.7	6.2	0.12	0.24	0.10	0.86
Crude	41	95	1.7	3.5	1.7	14

According to the Energy Information Administration of the U.S. Department of Energy, in 1999 Washington consumed 20,305 thousand barrels of distillate fuel and 9,592 thousand barrels of residual fuel.[5] Applying the emission factors above, an estimated 733 pounds of mercury were released from the combustion of distillate fuel and 29 pounds for residual. No information was found on the volume of crude oil consumed in Washington.

Groups Affected

All public and private sectors use fuel oil, so all would be affected.

[4] http://www.hgtech.com/Information/Air%20Emissions.htm
[5] http://www.eia.doe.gov/pub/state.data/pdf/wa.pdf, September 1, 2002.

Current Regulations and Policy

Fuel oil is not currently regulated for mercury content.

Reduction Options

Any effort that would reduce energy use also would lessen the effect of this source.

It may become possible to remove mercury from fuel oil during the refining process.

Research, Development, and Monitoring Options

Further testing of mercury content in fuel oil would provide better information about quantities of mercury released from this source in Washington State. Testing of mercury in fuel oil would need to be for a variety of oils from different refineries and crude oils.

Recommended Actions

Ongoing
Promote efforts to reduce energy use.

Oil Refineries

Identification and Description of Source

The mercury present in petroleum crude is distributed to the petroleum products and waste materials produced in the refining process. The actual distribution depends on the chemical form of mercury present and the specific type of refining process. Some mercury will be present in the air and water emissions and in the solid- and dangerous-waste materials disposed of and treated off-site.

Quantity and Estimated Uncertainty

The quantity of mercury in crude oil is very dependent on source. The overall range in petroleum process in the United States is from 0.1 to 29,700 ppb, while the majority of reported values are less than 20 ppb.[6]

A recent report prepared for Ecology's Industrial Section regarding pollution-prevention opportunities for refineries in Washington included some data collected by the Washington refineries. Washington refineries primarily have been processing Alaska North Slope crude, and they have indicated a mean mercury content of 1.98 ppb. The number of samples analyzed by Washington State refineries was not provided in the report.

[6] U.S. Environmental Protection Agency, "Mercury in Petroleum and Natural Gas: Estimation of Emissions from Production, Processing and Combustion," September 2001 (EPA 600/R-01-066)

In the 2000 Toxics Release Inventory, four refineries reported releasing a total of 8.2 pounds of mercury compounds to air, 11.9 pounds to water, and 104.6 pounds to land, for a total of 124.7 pounds of mercury released.

Groups Affected

Refineries.

Current Regulations and Policy

- Chapter 70.95C RCW / Chapter 173-307 WAC, Pollution Prevention Plan
- 40 CFR part 72, Implemented through Toxic Chemical Release Inventory Reporting Forms and Instructions
- Chapter 118-40 WAC, Section 313 of the Emergency Planning and Community Right-to-Know Act (adopted by reference)

Recent Activities

As part of a grant from USEPA, Ecology has hired a contractor to prepare a report identifying pollution-prevention opportunities that might be applicable to Washington refineries. One of the pollutants to be discussed in the report is mercury. The report was published by Ecology in November 2002.[7]

Washington refineries have all been required to prepare pollution prevention plans for their facilities as part of their most recent NPDES permit renewal. The plans focus on wastewater discharges. At the next NPDES permit renewal cycle, Ecology will ask the refineries to review the Ecology report described above and identify pollution-prevention opportunities that might be applied at their facilities.

Action by Other Groups

When developing NPDES permits for the local refineries, the California Water Quality Control Board for the San Francisco Bay region determined that those discharges had reasonable potential to violate the water quality standard for mercury. To meet the objectives of the *Revised Water Quality Control Plan for San Francisco Bay Basin*, dated June 21, 1995, each refinery received water-quality-based limits for mercury. In 2001, the board examined the feasibility of establishing an interim concentration limit based on the overall performance of the California refineries. Following a study of mercury effluent data gathered using ultra-clean sampling techniques, board staff proposed a value of 75 ppb as the interim performance-based, monthly average, effluent-concentration limit for the five refineries in the Bay Area. The limit was expected to hold the refineries at current treatment plant performance.

[7] Washington State Department of Ecology, "Water Pollution Prevention Opportunities in Petroleum Refineries." Prepared by Jacobs Consultancy, Houston, Texas. Ecology Pub. No. 02-07-017.

The petroleum industry has been developing treatment systems for petroleum liquids primarily in gas processing facilities. Some petroleum products must meet stringent mercury criteria because of the damage to the equipment and catalysts in petrochemical manufacturing processes. Mercury-removal systems currently available rely on filtration and absorption processes. These systems are not suitable for treating crude oil or more complex hydrocarbon mixtures.

Reduction Options

None identified, due to lack of understanding of disposition of mercury in the crude once it is processed.

Planned Activities

At the next NPDES permit renewal cycle, Ecology will ask Washington refineries to review the 2002 pollution prevention report referenced above and identify and implement pollution-prevention opportunities applicable to their facilities.

Recommended Actions

Planned, next NPDES permit renewal cycle
Refineries will be asked to review the 2002 pollution prevention report prepared for Ecology and identify and implement pollution-prevention opportunities applicable to their facilities.

Wood-Fired Boilers and Stoves

Identification and Description of Source

Wood and wood wastes are used as fuel in both the industrial and residential sectors. In the industrial sector, wood waste is fired in industrial boilers to provide process heat, while wood is burned in fireplaces and wood stoves in the residential sector. Studies have shown that wood and wood wastes may contain mercury; however, insufficient data are available to estimate the typical mercury content in wood and wood wastes.

Quantity and Estimated Uncertainty

The primary source of mercury emissions from wood-combustion processes is the exhaust stack. Very small quantities of mercury also may be emitted with fugitive particulate-matter emissions from bottom- and fly-ash handling operations. The data on mercury emissions from wood combustion are limited. A report by the National Council of the Paper Industry for Air and Stream Improvement (NCASI) provided a range and average emission factor for boilers without electrostatic precipitators (ESPs) and for boilers with ESPs. The boilers without ESPs included a variety of control devices, such as cyclones, multiclones, and various wet scrubbers. The average emission factor reported for boilers without ESPs was 3.5×10^{-6} kg/Mg (6.9 x 10 lb/ton) of dry wood burned. The average emission factor reported for boilers with ESPs was 1.3×10^{-6} kg/Mg (2.6 x 10 lb/ton) of dry wood burned.

The most recent AP-42 section on wood-waste combustion in boilers provided an average uncontrolled emission factor for mercury emissions, based on four emission test reports. The AP-42 uncontrolled emission factor for mercury emissions from wood-waste combustion is 2.6×10^{-6} kg/Mg (5.2 x 10 lb/ton) of wet, as-fired wood burned.

The NCASI average emission factor reported for wood-fired boilers with ESPs of 1.3×10^{-6} kg/Mg (2.6 x 10 lb/ton) of dry wood burned is recommended for estimating mercury emissions from wood-waste combustion in boilers.

For residential wood combustion, only one emission factor was found in the literature. This emission factor is based on one test burning of one type of wood (pine) at a single location. In 1987, the U.S. Department of Energy estimated that 22.5 million households nationwide burned approximately 42.6 million cords of wood. Given that the density of wood varies greatly by wood species and moisture content, and that the above emission factor is from a single test, nationwide emissions of mercury from residential wood combustion were not estimated.

Total 1994 mercury emissions from wood combustion are estimated to be 0.1 Mg (0.1 tons) nationwide. In 1995, the Department of Ecology estimated that nearly half of Washington's households had wood-burning devices. Given available data, however, estimated mercury emissions from wood combustion for Washington cannot be calculated at this time.

Groups Affected

Households with wood stoves and industrial facilities that use wood fuel.

Current Regulations and Policy

Mercury emissions from wood combustion are not specifically regulated. However, Washington State Clean Air Act (Chapter 70.94 RCW) does set policy to control, reduce, and prevent air pollution caused by residential wood-stove emissions in the following ways:

- Wood fuel must have a moisture content of no more than 20 percent.
- Garbage, treated or painted wood, particle board, plastics, rubber, waste petroleum products, animal carcasses, asphalt products, paints, chemicals, or any substance that normally emits dense smoke or obnoxious odors may not be burned in a wood stove or fireplace.
- Smoke density is restricted.
- There is a $30 fee on the sale of new wood stoves to support wood stove education and enforcement programs.
- Installing new or used uncertified stoves is banned.
- New or substantially remodeled construction in urban growth areas or non-attainment areas for particulates must install non-wood heat sources.
- Sets conditions under which a local air-pollution control authority or Ecology may prohibit the use of uncertified stoves.
- Only state-certified stoves may be sold at retail.
- Local burn bans are called when wood-smoke pollution is measured at unsafe levels.
- Sets tighter emission standards for new fireplaces built and sold in Washington.

In 1999, the Department of Ecology discontinued its wood-stove coordinator position and no longer provides technical assistance or information on wood stoves. In the following counties, local air agencies can be contacted for information on wood stoves and fireplaces: Benton, Clallam, Clark, Cowlitz, Grays Harbor, Island, Jefferson, King, Kitsap, Lewis, Mason, Pacific, Pierce, Skagit, Skamania, Snohomish, Spokane, Thurston, Wahkiakum, Whatcom, and Yakima. In other counties, the building permit department should be contacted for information on fireplaces and wood stoves.

Research, Development, and Monitoring Options

For industrial wood-waste boilers, Ecology currently is analyzing the cross-media effects, i.e., air, land, water, effects of various Reasonably Available Control Technologies (RACT). This analysis will address the generation and management of various PBTs, i.e., dioxin and mercury.

Recommended Actions

Ongoing
Complete RACT for industrial wood-waste boilers.

Proposed, Mid-term
Evaluate cleaner fuel sources.

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2. Mining and Manufacturing

Mining

Mercury Mining

Identification and Description of Source

Nationally, in the past, mercury mining has been a source of mercury releases to the environment. While there is no current mercury mining in Washington State, it is possible that contamination from past activities still exists.

Cinnabar, the ore of mercury, is known to occur in 13 of Washington's 39 counties (see Appendix E), but the only production of any consequence has come from the Morton District of Lewis County. The first recorded production there was 75 flasks in 1916. The district later produced 6,438 flasks (76 pounds per flask) during the period 1926 through 1942, with production each year except 1939.[8]

In 1970, Ecology sampled water from the Tilton River, which receives drainage from the mining area. Concentrations were less than 0.5 ppb, which at the time was considered a background level. Fish tissue samples collected upstream and downstream of the mining area contained approximately 0.1 mg/l of mercury.[9] The mine is not listed as a state cleanup site in Ecology's database.

Quantity and Estimated Uncertainty

It is unknown whether mercury released as a result of mining still exists at the Morton District mine site or downstream. The mine does not appear in Ecology's database of hazardous-waste sites.

Groups Affected

Potentially, current or former owners of Washington mercury mines and people who eat fish downstream of the mines

Current Regulation and Policy

Model Toxics Control Act

[8] Marshall T. Hunting, "Inventory of Washington Minerals, Part II, Volume 1," State of Washington Department of Conservation and Development, Division of Mines and Geology, Olympia, Washington; 1956; p. 263.
[9] Ronald A. Lee, "Investigations: Mercury in Washington State," Office of Technical Services, Department of Ecology, Olympia, Washington, July 1971, p. 12.

Ongoing Activities

The Department of Ecology Central Regional Office is in the process of prioritizing abandoned mines throughout Washington as potential toxic-waste cleanup sites. Information on the abandoned mercury mine will be considered in this evaluation.

Research, Development, and Monitoring Options

Work with federal government agencies and the Washington State Department of Natural Resources to focus specifically on potential mercury releases in their assessments of abandoned mines for clean up.

Recommended Actions

Ongoing
Prioritize abandoned mines as potential toxic cleanup sites.

Gold Mining

Placer Gold Mining

Identification and Description of Source

Mercury has a chemical affinity for gold. When mercury is added to gold-bearing material, the two metals form an amalgam. Mercury is later separated from amalgam by retorting. Extracting gold and other precious metals from their ores by treatment with mercury is called amalgamation.[10]

According to the U.S. Geological Survey (USGS), miners used mercury to recover gold throughout the western United States at both placer (alluvial) and hard-rock (lode) mines. In a California study, USGS found that the vast majority of mercury lost to the environment was from placer-gold mines, which use hydraulic, drift, and dredging methods.

Placer gold was discovered in Blewett Pass and the northern and central sections of Washington from 1858 to 1860. Placer gold occurs in Chelan, Clallam, Ferry, Kittitas, Lincoln, Okanogan, and Whatcom counties.[11] Through 1969, 275 thousand troy ounces of placer gold were mined in Washington, only 0.2 percent of total placer gold mined in the United States from 1792 to 1969.[12]

[10] http://pubs.usgs.gov/gip/prospect1/goldgip.html, April 1, 2002.
[11] J. M. West, "How to Mine and Prospect for Placer Gold," http://imcg.wr.usgs.gov/usbmak/ic8517.html, March 29, 2002.
[12] J. M. West, "How to Mine and Prospect for Placer Gold," Table 1: Placer gold production, by States, 1792 – 1969," http://imcg.wr.usgs.gov/usbmak/8517t1.html, March 29, 2002.

Quantity and Estimated Uncertainty

According to the USGS, at hydraulic mines, placer ores were broken down with monitors or water cannons, and the resulting slurry was directed through sluices and drainage tunnels, where gold particles combined with liquid mercury to form gold-mercury amalgam. Loss of mercury in this process was 10 to 30 percent per season, resulting in highly contaminated sediments at mine sites. In California, where 60 percent of the nation's placer gold was mined through 1969,[13] elevated mercury concentrations in present-day mine waters and sediments indicate that hundreds to thousands of pounds of mercury remain at each of the many sites affected by hydraulic mining.[14] Contamination issues are likely considerably less serious in Washington State; however, historic gold mining has been identified as a source of mercury to Lake Roosevelt.

Groups Affected

Property owners and, potentially, people who fish in water bodies downstream from historic placer gold mines.

Current Regulations and Policy

Model Toxics Control Act

Recent Activities

In 1996, as part of the Spokane River Metals Project, Ecology's Eastern Regional Office produced 200 copies of a flyer on the proper disposal of mercury for hobby gold prospectors. These were distributed by Bowen's Hideout, a prospector's supply house, at meetings of the Spokane area Treasure Hunting Club and Prospector's Club. Flyers also were posted at the shop.

Ongoing Activities

Ecology's Environmental Assessment Program monitors freshwater streams across the state on a quarterly basis for toxins, including mercury.

Ecology's Central Regional Office is evaluating abandoned mines as potential toxic cleanup sites.

Research, Development, and Monitoring Options

Work with federal government agencies and the Washington State Department of Natural Resources to focus specifically on potential mercury releases in their assessments of abandoned mines for clean up.

[13] J. M. West, "How to Mine and Prospect for Placer Gold," Table 1: Placer gold production, by States, 1792 – 1969, http://imcg.wr.usgs.gov/usbmak/8517t1.html, March 29, 2002.
[14] http://water.wr.usgs.gov/mercury/fs06100.html, April 1, 2002.

Recommended Actions

Ongoing
Prioritize abandoned mines as potential toxic cleanup sites.

Proposed, Mid-term
Investigate whether existing gold-mine heap leach or other extractions, surface impoundments, and/or tailings disposal facilities meet dangerous-waste regulations, Chapter 173-303 WAC.

Lode Gold Mining

Identification and Description of Source

Lode, or hard-rock, gold mines process ore to remove gold (see Table 8). A search of Ecology's database of permitted sites and facilities resulted in several gold mines, most of which are not in operation.

Table 8. Gold Mines Permitted by the Washington State Department of Ecology

Facility Name	City	County	Reason for Interaction with Dept. of Ecology
Alder Mill	Twisp	Okanogan	State Cleanup Site
Asamera Minerals Cannon Mine	Wenatchee	Chelan	WDP Discharge to Ground Water
Delano Wind River Mine	Carson	Skamania	WDP Discharge to Ground Water
Azurite Mine Tailing Pile	Winthrop	Whatcom	State Cleanup Site
Echo Bay Minerals Co.	Republic	Ferry	Emergency/Haz Chem Rpt TIER2; Hazardous Waste Generator; WDP Discharge to Ground Water; WDP General Permit; Toxics Release Inventory
Gold Mountain Mine	Curlew	Ferry	Hazardous-Waste Generator (Inactive)
Hecla Knob Hill Mine	Republic	Ferry	WDP Discharge to Ground Water; State Cleanup Site
Lamefoot Mine Echo Bay Minerals Co.	Republic	Ferry	Hazardous Waste Generator; Toxics Release Inventory
Madre Mine		Stevens	Dam Sites for Tailings
Okanogan Minnie Mine Millsite	Carlton	Okanogan	Hazardous-Waste Generator

WDP = waste discharge permit

Quantity and Estimated Uncertainty

The metal mining industry first had to report to the Toxics Release Inventory (TRI) for activities taking place in 1998. Two gold mines in Washington reported releasing a combined 1,432 pounds of mercury to land in the 2000 TRI report. One of these, the Lamefoot Mine, has

since ceased operation. The other, K2 Mine, has closed temporarily for most of 2003. According to the 2000 TRI report, the K2 Mine released 777 pounds of mercury. According to the mines, these estimates were based on a back calculation of mercury in the mine's ore and the quantity of ore removed. The "land release" reported consists of the mercury contained in the scrap rock, put back into the mine, and the tailings, which are contained in tailing piles. The actual release of mercury to the environment from these sources through air or water is unknown.

The presence of mercury in the ore raises an interesting question, however. While no Washington gold mine reported air emissions of mercury, four Nevada gold heap-leach mines reported air emissions totaling 13,560 pounds. According to USEPA, the mercury that is emitted originates in the ore. Ore roasters and autoclaves can be point sources of air mercury emissions. The cyanide heap-leach solution that extracts gold from ore also extracts mercury. Processing the pregnant heap-leach solution can involve stripping units, electrowinning units, retorts, refining furnaces, and carbon regeneration kilns. All of these unit processes are potential sources of air emissions of mercury.[15]

Hecla Mining Company, which owns the now-closed Knob Hill Mine in Republic, reported that precipitates and sludges, both containing precious metals, could potentially be a feedstock to a refinery furnace. Hecla calculated the annual mercury content of sludges and precipitates to be 1.02 pounds. The refinery furnace is permitted by the Department of Ecology for air emissions, but the permit does not contain a mercury emission limit. The furnace does have pollution-control equipment in place, which may capture some of the mercury released.[16]

Groups Affected

Gold mines.

Current Regulations and Policy

- Chapter 70.95C RCW / Chapter 173-307 WAC, Pollution Prevention Plan
- 40 CFR part 72, Implemented through Toxic Chemical Release Inventory Reporting Forms and Instructions
- Chapter 118-40 WAC, Section 313 of the Emergency Planning and Community Right-to-Know Act (adopted by reference)
- Chapter 70.94 RCW, Washington State Clean Air Act

Research, Development, and Monitoring Options

- Work with USEPA and gold mines to improve characterization of mercury emissions.
- Work with USEPA and gold mines to improve characterization of control technologies.
- Work with USEPA and gold mines to investigate voluntary reduction initiatives.
- Work with the Washington State Department of Natural Resources / U.S. Bureau of Mines to characterize mercury in ores.

[15] USEPA Mercury Task Force PBT Mercury Work Group, Working Draft: PBT National Action Plan for Mercury, USEPA, March 15, 2002, pp. 39-40.
[16] Pers. comm., Dave Holland, Senior Environmental Analyst, Hecla Mining Company, June 5, 2002.

Recommended Actions

Proposed, Mid-term
Investigate whether existing or future gold-mine heap-leach or other extraction operations, surface impoundments, and/or other tailings-disposal facilities meet dangerous-waste regulations.

Proposed, Long-term
Evaluate mercury emissions from gold mines.

Manufacturing

Identification and Description of Source

Mercury may occur in manufacturing processes either through intentional use, where mercury is added to a product or a process for a particular purpose, or as a contaminant. For the purpose of exploring reduction options as part of this *Mercury Chemical Action Plan*, manufacturing has been grouped as one sector for consideration. Specific manufacturing sectors that use or release mercury, as identified through the federal Toxics Release Inventory (TRI), are then described in greater detail.

Quantity and Estimated Uncertainty

According to the TRI for the year 2000, instrument, pulp and paper, industrial inorganic chemicals, cement, lime, and aluminum manufacturers released 337 pounds of mercury.

The Department of Ecology has three sources of information on mercury and mercury compounds stored, disposed of, or released by manufacturers: the TRI, the hazardous chemical inventory (Tier Two), and the dangerous waste annual reports. A fourth source (PPRC, 2002) reviewed preliminary results from the pending 2001 TRI. These preliminary results appear to show continued reductions in mercury releases.

Hazardous Chemical Inventory

The reporting threshold for Tier Two includes any facility that stores 10,000 pounds or more of mercury or mercury compounds on-site at any one time. This is too high to be of much value. For calendar year 2000, two companies reported storing these chemicals.

Toxic Release Inventory

Under the TRI, companies that use 10 pounds or more per year of mercury and mercury compounds must report releases. (In this context "use" means to manufacture, process, or use in some other way.) Prior to the year 2000, this reporting limit was 25,000 pounds for manufacture or process and 10,000 pounds for use in some other way. Some exemptions apply (i.e., motor

vehicle, solid object, and personal use). In addition, to fall under these requirements, the company must employ 10 or more full-time employees and must be in one of the industry types listed in Table 9.

Table 9. Industries Required to Report to the Toxics Release Inventory (TRI) by Standard Industrial Classification (SIC) Code

SIC	Name	SIC	Name
10	Metal and coal mining	33	Primary metal products
12	Metal and coal mining	34	Fabricated metal products
20	Food and kindred products	35	Industrial, commercial machinery, and computers
21	Tobacco manufacturers	36	Electronic equipment and components
22	Textile mill products	37	Transportation equipment
23	Apparel and other textiles	38	Instruments and related products
24	Lumber and wood products	39	Misc. manufacturing industries
25	Furniture and fixtures	4911	Electric generating plants (combusting coal or oil)
26	Paper and allied products	4931	Electric generating plants (combusting coal or oil)
27	Printing and publishing	4939	Electric generating plants (combusting coal or oil)
28	Chemicals and allied products	4953	Hazardous waste and treatment firms
29	Petroleum refining	5169	Chemical wholesale distributors
30	Rubber and misc. plastic products	5169	Wholesale bulk petroleum distributors
31	Leather and leather products	7389	Solvent recyclers (commercial only)
32	Stone, clay and glass products		

The TRI also provides information on transfers to other locations by these facilities for recycling, treatment, or disposal. Additionally, the national TRI database can provide information on mercury or mercury compounds being transferred into Washington.

TRI data does not require additional efforts by the facility, only that they use the best available sources, which include calculations based on emission factors. Compliance efforts by USEPA for the PBT reporting have not started, so the industry compliance is an unknown. Ecology does not know how many non-reporting facilities there are nor the level of accuracy for the existing reporters.

Dangerous-Waste Reports

Ecology's dangerous-waste database contains information compiled from annual reports submitted by all companies that generate, use, or dispose of dangerous substances in Washington. Annual dangerous-waste reporting for people with a current RCRA site identification number is required by dangerous-waste regulations, WAC 173-303-060(5), WAC 173-303-070(8), WAC 173-303-220, and WAC 173-303-390.

Annual reports measure the amount and types of dangerous waste generated each year. The information reported is used to plan Washington's future capacity to store, transport, and dispose of dangerous wastes as well as to provide biennial information to USEPA. A recent search of the dangerous-waste database showed that 516 facilities in Washington reported generating waste mercury or mercury compounds.

Reduction Options

Investigate and determine whether known generators and sources of mercury-bearing dangerous wastes are getting a fee exclusion (disincentive) from the Ecology HWTR Program's "Education Fee". Conversely, explore a fee break (incentive) if the generator were mercury/PBT free.

Engage existing pollution-prevention planners to include mercury in prevention pollution plans.

Conduct multi-program compliance inspections (Ecology's Air Quality, Hazardous Waste and Toxics Reduction, Solid Waste and Financial Assistance, Toxic Waste Cleanup, and Water Quality programs).

Recommended Actions

Ongoing
Investigate where mercury enters Washington manufacturing processes, either intentionally or unintentionally, for what purpose, and possible alternatives (PPRC, 2002).

Proposed, to begin Short-term, then Ongoing
Identify facilities that have an opportunity to reduce mercury in processes and place more emphasis on this during review of their pollution prevention plans (PPRC, 2002).

Manufacturing of Mercury-Containing Products

A "mercury-containing product" is defined for this plan as a product, commodity, chemical, or a product with a component that contains mercury or a mercury compound intentionally added to the product, commodity, chemical, or component in order to provide a specific characteristic, appearance, or quality or to perform a specific function or for any other reason. This definition is used to be consistent with definitions in use by other states addressing the issue of mercury in

products.[17] Only one manufacturer of mercury-containing products was identified in Washington from sources available.

Instrument Manufacturers

Identification and Description of Source

Mercury is used in many medical and industrial instruments for measurement and control functions. These instruments include thermometers, pressure-sensing devices, and navigational devices. Mercury may be used as a component in a final product or as part of a manufacturing process.

One facility with a related SIC code (3812), Honeywell in Redmond, reported off-site mercury transfers to the 2000 Toxics Release Inventory. SIC code 3812 includes search, detection, navigation, guidance, aeronautical, and nautical systems and instruments.[18]

Quantity and Estimated Uncertainty

Honeywell reported off-site transfers of 84 pounds of mercury to the 2000 Toxics Release Inventory.

Groups Affected

Instrument manufacturers.

Current Regulations and Policy

- Chapter 70.95C RCW / Chapter 173-307 WAC, Pollution Prevention Plan
- 40 CFR part 72, Implemented through Toxic Chemical Release Inventory Reporting Forms and Instructions
- Chapter 118-40 WAC, Section 313 of the Emergency Planning and Community Right-to-Know Act (adopted by reference)

Recommended Actions

See *Manufacturing* in Chapter 2 of this document.

[17] Northeast Waste Management Officials' Association, "Revised Discussion Document: Mercury Education and Reduction Model Act," Section 3, 2000.
[18] http://www.census.gov/epcd/naics/NSIC3D.HTM#S38, April 12, 2002.

Manufacturing of Products where Mercury is a Contaminant

Pulp and Paper

Identification and Description of Source

According to the *1997 EPA Mercury Study Report to Congress*, mercury can be introduced to the pulping process through wood that is being pulped, in the process water used in the pulping process, and as a contaminant in chemicals added to the process. If the mercury is not purged from the process in waste water or as dregs, it can accumulate in the chemical recovery area and subsequently be emitted from chemical-recovery combustion sources. The amount of mercury emitted may depend on the degree to which the pulping process is closed (i.e., the degree to which process waters are recycled and re-used).[19]

Additionally, mercury may be released as a contaminant from wood fuel burned in an industrial waste boiler.

Quantity and Estimated Uncertainty

Three facilities reported releasing a total of 89.6 pounds of mercury to the 2000 Toxics Release Inventory.

Groups Affected

Pulp and paper manufacturers.

Current Regulations and Policy

- Chapter 70.95C RCW / Chapter 173-307 WAC, Pollution Prevention Plan
- 40 CFR part 72, Implemented through Toxic Chemical Release Inventory Reporting Forms and Instructions
- Chapter 118-40 WAC, Section 313 of the Emergency Planning and Community Right-to-Know Act (adopted by reference)

Recent Activities

Weyerhaeuser, Longview, closed its mercury chlor-alkali plant in the late 1980s. The plant has been dismantled and the site cleanup is completed. A consent decree is being developed to conduct some final sampling at the site.

Georgia Pacific West, Bellingham, closed its mercury chlor-alkali plant in 1999. The facility has been dismantled and the area capped with asphalt. A remedial investigation feasibility study for

[19] U.S. Environmental Protection Agency Office of Air Quality Planning and Standards and Office of Research and Development, "EPA Mercury Study Report to Congress, Volume II: An Inventory of Anthropogenic Mercury Emissions in the United States," Washington, D.C., December 1997, p. 4-45.

cleaning up the plant site is under way. Georgia Pacific West also has closed the pulp mill and is currently operating a facility that makes tissue from purchased pulp.

Current Activities

The current NPDES permit requires mercury monitoring of the final effluent from the Georgia Pacific tissue mill at a detection limit of 0.2 ug/L.

Planned Activities

Georgia Pacific West is also in the process of planning where to dispose of dredge spoils from the Bellingham Bay mercury cleanup project, a result of past practices. The project is administered through the Toxics Cleanup Program (TCP) in Ecology's Northwest Regional Office. The preferred option is to convert 21 acres of Georgia Pacific's 29-acre aerated stabilization basin (ASB) as a repository for dredge spoils. The ASB is listed by TCP as a possible mercury-contaminated cleanup site. If Georgia Pacific chooses this option, Ecology will require some additional sampling in the current and final ASB to determine the mercury levels in the sludge and its potential effect, both during construction and beyond.

Outreach, Development and Monitoring Options

Normal outreach is being conducted as required by the Model Toxics Control Act.

Industrial Inorganic Chemicals

Identification and Description of Source

Establishments primarily engaged in manufacturing industrial inorganic chemicals. Mercury may be a contaminant in feedstock.

Quantity and Estimated Uncertainty

Two facilities, Pq Corporation of Tacoma and General Chemical of Anacortes, reported releasing a total of 57.6 pounds of mercury to the 2000 Toxics Release Inventory.

Groups Affected

Manufacturers and users of products.

Current Regulations and Policy

- Chapter 70.95C RCW / Chapter 173-307 WAC, Pollution Prevention Plan
- 40 CFR part 72, Implemented through Toxic Chemical Release Inventory Reporting Forms and Instructions
- Chapter 118-40 WAC, Section 313 of the Emergency Planning and Community Right-to-Know Act (adopted by reference)

Recommended Actions

See *Manufacturing* in Chapter 2 of this document.

Cement Manufacturing

Identification and Description of Source

According to the *1997 EPA Mercury Study Report to Congress*, the primary sources of mercury emissions from Portland cement manufacturing are expected to be from the kiln and the preheating/precalcinating steps.[20]

Quantity and Estimated Uncertainty

One facility, Ash Grove Cement in Seattle, reported a release of 62 pounds of mercury in air emissions in the 2000 Toxics Release Inventory.

Groups Affected

Cement manufacturing

Current Regulations and Policy

- Chapter 70.95C RCW / Chapter 173-307 WAC, Pollution Prevention Plan
- 40 CFR part 72, Implemented through Toxic Chemical Release Inventory Reporting Forms and Instructions
- Chapter 118-40 WAC, Section 313 of the Emergency Planning and Community Right-to-Know Act (adopted by reference)

Recommended Actions

See *Manufacturers* in Chapter 2 of this document.

Lime Manufacturing

Identification and Description of Source

According to the *1997 EPA Mercury Study Report to Congress*, fuels, including primarily coal, oil, petroleum coke, or natural gas, are used to provide the energy for calcination. Petroleum coke is usually used in combination with coal. Auxiliary fuels may include shredded municipal garbage, chipped rubber, or waste solvent. Mercury is expected to be present in the coal, oil, and

[20] U.S. Environmental Protection Agency Office of Air Quality Planning and Standards and Office of Research and Development, "EPA Mercury Study Report to Congress, Volume II: An Inventory of Anthropogenic Mercury Emissions in the United States," Washington, D.C., December 1997, p. 4-42.

possibly in appreciable quantities in any waste-derived fuels. Any mercury emitted from fuel combustion will occur during the calcination step and will be discharged as vapor kiln exhausts.[21]

Quantity and Estimated Uncertainty

One lime manufacturer, Graymont Western U.S. in Tacoma, reported releasing 1.4 pounds of mercury in air emissions in the 2000 Toxics Release Inventory.

Groups Affected

Lime manufacturers.

Current Regulations and Policy

- Chapter 70.95C RCW / Chapter 173-307 WAC, Pollution Prevention Plan
- 40 CFR part 72, Implemented through Toxic Chemical Release Inventory Reporting Forms and Instructions
- Chapter 118-40 WAC, Section 313 of the Emergency Planning and Community Right-to-Know Act (adopted by reference)

Recommended Actions

See *Manufacturing* in Chapter 2 of this document.

Secondary Steel Smelters

See *Steel Recyclers* in Chapter 4 of this document.

Primary Production of Aluminum

Identification and Description of Source

Sodium hydroxide is apparently used in purifying bauxite, the ore of aluminum. Sodium hydroxide may be contaminated with mercury. Trace mercury may be present in alumina, petroleum coke, and pitch. Petroleum byproducts of coke and pitch are used to make anodes for production of aluminum.

[21] U.S. Environmental Protection Agency Office of Air Quality Planning and Standards and Office of Research and Development, "EPA Mercury Study Report to Congress, Volume II: An Inventory of Anthropogenic Mercury Emissions in the United States," Washington, D.C., December 1997, p. 4-56.

Quantity and Estimated Uncertainty

One facility, Reynolds Metals in Longview, reported 0.6 pounds of mercury released to air in the 2000 Toxics Release Inventory. Reynolds and Kaiser Aluminum and Chemical of Mead together reported off-site transfers of 41.82 pounds of mercury.

Groups Affected

Aluminum manufacturers.

Current Regulations and Policy

- Chapter 70.95C RCW / Chapter 173-307 WAC, Pollution Prevention Plan
- 40 CFR part 72, Implemented through Toxic Chemical Release Inventory Reporting Forms and Instructions
- Chapter 118-40 WAC, Section 313 of the Emergency Planning and Community Right-to-Know Act (adopted by reference)

Recommended Actions

See *Manufacturing* in Chapter 2 of this document.

3. Use of Products Containing Mercury

Mercury-Containing Products – General

Identification and Description of Source

Due to its unique properties, mercury has been and is found in a wide variety of products. A "mercury-added product" is defined for this strategy as a product, commodity, chemical, or a product with a component that contains mercury or a mercury compound intentionally added to the product, commodity, chemical, or component in order to provide a specific characteristic, appearance, or quality or to perform a specific function or for any other reason. Some mercury-added products in common use include: thermometers, thermostats, other measuring devices, some button cell batteries, mercuric oxide batteries, dental amalgam, fluorescent lighting, and some switches and relays. Pesticides, paint, and alkaline batteries manufactured before the early 1990s also may contain mercury.

Mercury also is found as a contaminant in some products, including those derived from caustic soda or chlorine manufactured using a mercury cell process. Examples of such products include soaps and detergents. If products containing mercury are broken or disposed of with solid waste, medical waste, or sewage, the mercury can be released to the surrounding environment.

Quantity and Estimated Uncertainty

The total amount of mercury released from products is unknown, because no complete inventory of mercury used in products exists to date. In 2001, New Hampshire and Rhode Island passed legislation that requires manufacturers selling products that intentionally contain mercury to notify the state of the product and the amount of mercury used. This information is being compiled through the Interstate Mercury Education and Reduction Clearinghouse (IMERC). It is expected that IMERC will provide the best estimate to date of mercury in use in products and potentially released to the environment.

In the meantime, estimates of releases from the most common mercury-containing products exceed 1,600 pounds annually in Washington State. For calculations and assumptions, see Tables 20-26. Based on these calculations, the general category of "mercury products" is by far the largest source of mercury releases in the state.

Current Regulations and Policy

WAC 173-303-573, Universal Waste Rule
The federal Universal Waste Rule was adopted by USEPA adopted in May 1995. *Universal wastes* are less hazardous and frequently generated wastes that can be managed appropriately under less stringent regulatory requirements. Many "generators" create universal wastes. The federal rule established some less stringent waste-management standards for batteries,

thermostats, and pesticides. For example, universal wastes do not need to be manifested or counted. Ecology adopted two categories of universal waste – batteries and mercury-added thermostats – in the dangerous-waste regulations at WAC 173-303-573 in February 1998.

Ecology also adopted a petition process in 1998. Through this process, other wastes can be added to the Universal Waste Rule if they meet certain criteria. If a petition to add other wastes is approved by Ecology, they will be added as universal wastes in future rule-makings. In June 2000, Ecology adopted the Universal Waste Rule for lamps. The state rule differs somewhat from the federal rule. See Ecology Publication No. 00-04-020, *Universal Waste Rule for Dangerous Waste Lamps WAC 173-303-573,* for more information.

The three most significant areas of relief for universal wastes are:

- The waste does not need to be counted toward waste generation totals to determine generator status.
- The waste does not need to be manifested when sent off-site.
- Both the accumulation limit and the length of time the waste may be accumulated have been increased.

It is important to note that universal wastes must go to a treatment, storage, and disposal (TSD) or recycling facility.

Recent Activities

All regulated facilities that generate mercury-bearing dangerous waste in Washington were identified using the dangerous-waste database. This list will complement the Toxics Release Inventory with information on mercury waste generated and potential releases, under the authority of Ecology's Hazardous Waste & Toxics Reduction (HWTR) Program.

As part of the Spokane River Metals Reduction Project, in 1996 Ecology's Eastern Regional Office developed a small booklet, "Mercury at Home and What to Do About It," for use by the Spokane County Recycling Hotline and for distribution to interested residents. The issue of mercury in products was publicized at the Spokane Interstate Fair; through ads in "Inland Northwest Family Magazine," "Kids Magazine," and Spokane Transit Authority buses; through public service announcements sent to 20 Spokane radio stations; and through news releases published in the newsletters "Inland Country" (sent to Inland Power and Light customers), "Kids Magazine," "From the Inside" (Empire Health Service's internal newsletter) and others.

Activities of Other Groups

In 1998, the Northeast Waste Management Officials' Association, contracted by the New England Governors' Conference, completed mercury education and reduction model legislation (Appendix G). The legislation focuses on promoting reductions and elimination of products containing mercury from the waste stream. At least some portions of the model legislation were introduced in all of the New England states in 2001.

In total, 33 states, including Washington, have introduced legislation focusing on mercury products. Eleven, including California and Oregon, have passed bills. A summary of these efforts can be found in Appendix F.

Reduction Options

Support mercury product legislation, including labeling provisions, manufacturer-funded collection systems, phase-out of mercury use in products, and selected bans on the sale of certain products, including mercury thermometers and novelties.

Investigate whether the HWTR Program's "education fee" excludes dental offices or other small generators. Determine if known generators/sources of mercury-bearing dangerous wastes are getting a fee exclusion (disincentive). Conversely, Ecology could explore a fee break (incentive) if the generator were mercury/PBT free.

Chapter 173-303 WAC includes standards for universal waste management (WAC 173-303-573). The current rules allow batteries, thermostats, and fluorescent lamps containing mercury to be managed as universal wastes. Ecology could investigate whether adding additional mercury-bearing waste streams, including switches, as universal wastes would encourage better management and/or prevent more mercury wastes from being mismanaged.

Outreach and Education Options

Conduct additional education and outreach, technical assistance, or compliance visits for regulated facilities that generate mercury-bearing dangerous wastes. Several successful educational/assistance efforts have been implemented to increase awareness and encourage proper management.

Recommended Actions

Proposed, Short-term
Support legislation to meet the following objectives:

1. Eliminate or reduce non-essential uses of mercury in household, institutional, and industrial products and processes. Segregate and recycle mercury attributable to the remaining uses and/or products to the maximum degree possible.
2. Reduce the overall amount of mercury-containing waste from household, commercial, and industrial sources through source reduction, segregation, and safe waste management, including recycling.

In order to meet these objectives, legislation may include the following principles:

- Requires manufacturers to notify the Department of Ecology of mercury-containing products sold in Washington.
- Requires the Department of Ecology to become a member of the Interstate Mercury Education and Reduction Clearinghouse.

- Requires the Department of Ecology to adopt Universal Waste Rules for largest feasible number of mercury-containing products and elemental mercury that is not contained in a product.
- Bans the sale of mercury-containing products that are clearly and immediately unnecessary.
- Gradually phases out mercury-containing products, starting with products that contain more than one gram of mercury down to those that contain 10 milligrams over a period of time. Exemptions would be allowed for products that meet one or more of the following criteria:
  - The product was manufactured prior to the effective date of the program.
  - Mercury is required to meet federal or state health and safety rules.
  - The product is beneficial to the environment or protects public health and safety.
  - There are no feasible alternatives to using mercury in the product.
  - There is no comparable non-mercury-added product available at a reasonable cost.
- Requires mercury-containing products, components, and packaging to have a label.
- Bans the disposal of mercury or mercury-containing products at a solid waste or wastewater treatment facility, unless allowed under a permit or license.
- Requires manufacturers of mercury-containing products to develop plans for and ensure the success of collection systems through whatever mechanisms they choose.
- Establishes disclosure requirements for certain products that are used by health care facilities and contain incidental mercury.
- Establishes controls on the sale of elemental mercury.
- Requires and provides funds the Department of Ecology and the Department of Health to conduct public education and outreach on mercury fish advisories and programs developed around principles outlined above.
- Requires state agencies in Washington to include a preference for non-mercury or low-mercury products that have comparable performance to mercury-containing products.

Specific Product Types

Mercury Fever Thermometers

Identification and Description of Source

Mercury fever thermometers contain 0.5 to 1.5 grams of mercury[22] and are used to measure body temperature in health care facilities, private homes, and schools.

[22] Bill Ravanesi, Health Care Without Harm, "Mercury in Medical Devices," Sustainable Hospitals Web site, http://www.sustainablehospitals.org/HTMLSrc/IP_mercury_amounts.html.

Quantity and Estimated Uncertainty

The estimated amount of mercury in thermometers broken per year in private homes ranges from 11 to 300 pounds, depending on assumptions used. Based on surveys from Thurston County and King County, it is assumed that this mercury is disposed of by pouring it down the drain or throwing it away with household trash.

No estimate is available for mercury thermometers broken in health care facilities or schools.

Alternatives

Non-mercury alternatives are readily available. These include digital thermometers, alcohol thermometers, card thermometers, and gallium-indium-tin thermometers. Digital thermometers may be powered by a button-cell battery containing up to 25 mg of mercury or be solar powered.

Groups Affected

Health care facilities, households, and schools.

Current Regulations and Policy

WAC 173-303-573, Dangerous-waste regulations

Current Activities

In the spring of 2002, Ecology awarded grants to four local governments – Tacoma, Kitsap County, Kittitas County, and Thurston County – to conduct mercury thermometer exchanges. These projects are ongoing.

Activities of Other Groups

Hi-School Pharmacy, the Oregon Center for Environmental Health, Clark County Environmental Services, the Southwest Washington Health District, and Vancouver's Solid Waste Services collaborated to conduct a mercury thermometer exchange in the spring of 2001, with Hi-School Pharmacy locations as collection points.

King County conducted a pilot mercury thermometer exchange in an office building during the summer of 2002.

Snohomish County has been exchanging mercury fever thermometers for two years at its fixed Household Hazardous Waste Collection site.

Major pharmacy chains, including CVS, Rite Aid, Walgreen, Wal-Mart, Eckerd, Albertson's, Kroger, K-Mart, Safeway, Winn Dixie, Ahold USA, Target, Longs, Costco, Brooks, Shopko, Duane Read, and Meijer, have all voluntarily agreed to stop selling mercury fever thermometers.[23]

[23] Health Care Without Harm, http://www.noharm.org/index.cfm?page_ID=26.

Bans prohibiting the sale of mercury fever thermometers, except by prescription, have been passed in the states of California, Oregon, Indiana, Maine, Maryland, Massachusetts, Minnesota, New Hampshire, and Rhode Island. Numerous similar local ordinances have been passed by cities and counties across the country, in many cases preceding state legislation.

King County is working to ban the sale of mercury fever thermometers. From February 1-28, 2003, more than 40 pharmacies in King County will collect mercury fever thermometers from King County residents and give each household a free digital thermometer.

Many local and state governments, medical facilities, non-profit groups, and others have conducted mercury thermometer exchanges over the past few years.

Reduction Options

Ban the sale of mercury thermometers, except by prescription.

Support mercury thermometer exchanges.

Outreach and Education Options

Conduct outreach and education on proper spill cleanup procedures.

Recommended Action

Ongoing
Support mercury thermometer exchanges.

Planned, Short-term
Investigate the feasibility of a statewide mercury-thermometer exchange in collaboration with pharmacy chains and other interested parties.

Batteries

Identification and Description of Source

Mercury is used to prevent gas from forming in batteries. It currently is used in mercuric-oxide batteries, also known as mercury-zinc batteries, which can be button-shaped or larger. The larger mercuric-oxide batteries are used by the military and hospitals. Other button-shaped batteries are zinc-air batteries and silver-oxide batteries.

Quantity and Estimated Uncertainty

It is estimated that 88 pounds of mercury annually are disposed of with button-cell batteries in solid waste.

Alternatives

Non-mercury alternatives are not currently available for button-cell batteries.

Groups Affected

Given the extensive use of button-cell batteries, all groups would be affected.

Current Regulations and Policy

WAC 173-303-573, Universal Waste Rule
The following types of batteries should be managed as universal waste: alkaline, mercuric-oxide, alkaline manganese, zinc-carbon, button-cell mercuric oxide, silver oxide, and lithium. Generators are encouraged to segregate their batteries by type, because all batteries are not managed in the same way. Consumer products that contain difficult-to-remove rechargeable batteries should also be managed as universal waste.

Reduction Options

Support the collection of button-cell batteries at household hazardous-waste collection facilities through Coordinated Prevention Grants.

Recommended Action

Ongoing
Support the collection of button-cell batteries at household hazardous-waste collection facilities through Coordinated Prevention Grants.

Wall Thermostats

Identification and Description of Source

Many heating, ventilation, and air-conditioning systems contain mercury switches. These switches may be disposed of improperly when the system is changed, or they may be disposed with construction and demolition debris if the building is demolished.

Groups Affected

Facility managers, local building inspectors, waste haulers, homeowners, home improvement stores, demolition firms, and property managers.

Quantity and Estimated Uncertainty

Wall thermostats contain three grams of mercury per switch, and units may contain up to six switches. An estimated 412 pounds of mercury from thermostats is disposed of with solid waste in Washington each year.

Alternatives

Mercury-free thermostats are readily available at comparable cost. Digital thermostats, operated properly, provide the added benefit of energy savings from improved performance. Honeywell plans to phase out mercury in its popular T87 residential model by 2006.[24]

Current Regulations and Policy

WAC 173-303-573, Universal Waste Rule
Thermostats that contain mercury should be managed as universal waste. This does not include all mercury switches. A thermostat is a temperature-control device that contains metallic mercury in an ampoule attached to a bimetal sensing element. Ampoules removed from these thermostats should also be managed under the universal-waste requirements. Other types of mercury switches must be managed according to all applicable dangerous-waste requirements.

Local building codes likely do not require removing mercury switches prior to demolition, although this has not been confirmed. Likewise, local building codes likely do not prohibit the use of mercury switches in heating, ventilation, and cooling (HVAC) systems.

Activities of Other Groups

The Thermostat Recycling Corporation (TRC), owned by three thermostat-manufacturing companies, aids the collection by HVAC wholesalers from contractors of all brands of used, wall-mounted, mercury-switch thermostats so the mercury can be purified for re-use. TRC provides containers for a minimal fee to wholesalers for collecting thermostats. When the container is full, TRC pays for shipping and provides a replacement container. TRC depends upon local and state governments to promote its services. As of January 2002, TRC listed only two locations in Washington State: Johnstone Supply in Spokane and Trane Parts Center of the Northwest in Bellevue.[25]

Reduction Options

Switches containing mercury could be monitored under the Universal Waste Rule, although management standards have not been used to regulate this yet.

Investigate benefits modifying building codes to prohibit the use of mercury switches and to require their removal prior to demolition.

As discussed in the Mercury Advisory Committee, changing the building code is a cumbersome process, which requires approval by the Legislature. It may be simpler to address the issue in separate legislation.

Support expansion of the Thermostat Recycling Corporation.

[24] http://twincities.bizjournals.com
[25] http://www.nema.org/index_nema.cfm/664/, accessed June 25, 2002.

Outreach and Education Options

Outreach and education to contractors.

Outreach and education to local building inspectors.

Recommended Actions

Proposed, Short-term
Include HVAC switches and gauges, beyond thermostats, as waste streams covered by the Universal Waste Rule.

Proposed, Short-term
Provide outreach and education to building inspectors on removing mercury equipment prior to demolishing buildings.

Proposed, Would require additional funding
Support expansion of the Thermostat Recycling Corporation.

Lamps

Identification and Description of Source

Mercury-added lamps include fluorescent tubes, compact fluorescent lamps, high-intensity discharge lamps, and neon lamps.

While mercury in fluorescent lamps has decreased steadily over the last 20 years, a certain amount of mercury is still required to ensure that the lamp operates properly. A typical fluorescent lamp has a phospor-coated glass tube with electrodes at either end. The tube contains mercury, a small amount of it in vapor form. When voltage is applied, the electrodes energize the mercury vapor, causing it to emit ultraviolet (UV) energy. The phosphor coating absorbs the UV energy, causing the phosphor to fluoresce and emit visible light.[26]

Quantity and Estimated Uncertainty

According to a recent study by the New Jersey Department of Environmental Protection, a typical discarded fluorescent tube releases between 3 and 8 mg of elemental mercury vapor over two weeks. Approximately 620 million fluorescent bulbs are discarded annually in the U.S., and many are broken during disposal.[27] Scaling for population and assuming a 20 percent recycling rate, discarded bulbs release approximately 437 to 505 pounds of mercury in Washington annually.

[26] National Electrical Manufacturer's Association (NEMA), Fluorescent Lamps and the Environment," 2001, www.nema.org/lamprecycle/nemafluorfinal.pdf.
[27] Aucott, Michael, Michael McLinden, and Michael Winka, "Release of Mercury from Broken Fluorescent Bulbs," Journal of Air Waste Management Association, in press.

Low-mercury fluorescent lamps are available. Whether a switch to low-mercury lamps will lead to a decrease in the total amount of mercury used in fluorescent lamps will depend on the lifespan of the newer lamps as compared to the old.

Household use of compact fluorescent lamps (CFLs) is increasing. For example, King County utilities distributed more than 300,000 CFLs in 2001 to promote energy conservation. Many retail stores stock large selections of energy-efficient, mercury-bearing CFLs. CFLs contain 5 to 10 mg of mercury and have a lifespan of about 10,000 hours. [28]

Estimates are not available for mercury entering the waste stream from CFLs, high-intensity discharge lamps, and neon lamps.

Alternatives

Waste lamps containing mercury are generated now and will continue to be generated in the foreseeable future because no non-mercury-containing alternatives currently exist for fluorescent lamps.

Current Regulations and Policy

WAC 173-303-573, Universal Waste Rule
The following are types of lamps that should be managed as universal waste unless information is available showing that they are not dangerous waste: fluorescent tubes, compact fluorescent, high-intensity discharge lamps (mercury vapor, metal halide, high-pressure sodium), neon lamps, and any other lamps that are dangerous waste. See Ecology Publication No. 00-04-020, *Universal Waste Rule for Dangerous Waste Lamps, WAC 173-303-573*, for more information.

The Universal Waste Rule for dangerous waste lamps provides a streamlined regulatory avenue for regulated generators to dispose of their mercury-containing lamps through recycling. Optionally, they can still handle mercury lamps as dangerous waste with all the requirements of counting, accumulation, labeling, manifesting, and annual reporting. Households and small quantity businesses are still able to dispose of these lamps at a municipal solid waste (MSW) landfill, if the local authority permits this activity.

Preliminary surveys have revealed that there are several MSW landfills that do accept these lamps, with varying degrees of restriction. Several counties accept mercury lamps at their moderate-risk-waste facilities for small-quantity generators. At least one such facility deposits collected lamps in its local landfill, since the nearest recycler is located a long distance away. In some of the more populated, urban areas of Washington, recycling options are more accessible (and affordable) and individuals, businesses, and counties are much more likely to recycle. In Washington, Ecolights Northwest (Seattle) is the only recycler that processes the lamps into their component parts to retrieve the glass, lead, aluminum, phosphor powder, and mercury.

[28] Local Hazardous Waste Management Program in King County, "Mercury in King County," August 2002.

Presently, several lamp manufacturers sell lines of low-mercury products that may not designate as dangerous waste. Designation of lamps is done through the Toxicity Characteristic Leaching Procedure (TCLP), a testing method that measures the amount of toxic chemical or metal that could be potentially leached from a hazardous waste (and to the ground) when contained inside a landfill. For mercury waste, the TCLP threshold level is 0.2 mg/L. Using this test method presents several problems when testing products such as lamps. Some of the mercury in a lamp is in the vapor form and will disappear to the air when broken. In a landfill situation, most lamps will be broken as they are disposed of, and a portion of the mercury will escape as a vapor. Another problem with the test is that lamp manufacturers use additives, thus allowing the tube to pass the TCLP test with much higher levels of total mercury. California requires a different testing procedure for lamp designation that measures the total amount of metals (lead and mercury).[29]

Activities of Other Groups

- Snohomish County collects fluorescent lamps at all of its transfer stations.
- King County is conducting outreach to businesses about using and recycling fluorescent lamps.
- Thurston County collects fluorescent lamps at its household hazardous-waste facility.
- The Association of Lamp Recyclers, the National Electrical Manufacturers Association, and the Solid Waste Association of North America recently received $750,000 to undertake a nationwide lamp-recycling promotional effort.

Reduction Options

Examine the option of requiring a total metals test (similar to a test required in California) for designating spent mercury-added lamps.

Evaluate standards used for government purchasing of lamps and facility lighting.

Study the possibility and consequences of a statewide ban on the land-filling of mercury-added lamps from households and small-quantity generators.

Research, Development, and Monitoring Options

Study the economics of recycling lamps to see if additional recycling facilities (where the actual component processing is done) can be built.

Combine efforts on the lamp issue, along with research on the recycling and land-filling of other mercury-containing products and cathode-ray tubes (electronic waste).

[29] Use of the total metals test to determine the Washington State dangerous waste regulatory level for lamps would, in effect, increase the number of lamps that would designate as dangerous waste, therefore reducing the number of mercury-containing lamps going to landfills.

Survey municipal solid-waste landfills and moderate-risk waste facilities to find out how they manage lamps and estimated quantities of lamps that they receive.

Support research to develop mercury-free, energy-efficient lighting alternatives (LEDs).

Outreach and Educations Options

Continue and expand state and local education efforts aimed at encouraging people to recycle lamps and increasing awareness of how dangerous mercury is to our health.

Recommended Actions

Ongoing
Make funding available for local governments to increase fluorescent lamp collection capacity through Coordinated Prevention Grants.

Planned, Short-term
Work with King County to conduct outreach and education for affected generators on the requirements of the Universal Waste Rule.

Proposed, Short-term
Conduct outreach and education statewide for affected generators on the requirements of the Universal Waste Rule.

Vehicle Switches

Identification and Description of Source

Historically, mercury has been used most in convenience lighting applications (e.g., the light that turns on when you open the trunk or hood) and anti-lock brake applications. According to the Alliance for Automobile Manufacturers, mercury-containing convenience light switches will be phased out by the end of 2002.

Vehicle manufacturers continue to employ new applications of mercury, primarily in high-intensity discharge headlamps and electronic equipment, including flat-screen panels and navigational systems. While these uses contain far less mercury than convenience light switches, they remain a concern.

A safe and effective program to collect mercury switches and other mercury-containing automotive parts does not currently exist in Washington. When vehicles are removed from service and recycled, the mercury in switches and other mercury-containing components are most likely released into the environment. Mercury enters the environment during the crushing and shredding of automobiles and, subsequently, when scrap steel is recycled in electric arc furnaces.

Quantity and Estimated Uncertainty

Although some mercury currently is found in other parts of a vehicle, over 85 percent of mercury is used in the vehicle's convenience lights. Based on this information, Ecology estimates that approximately 253 pounds of mercury from convenience-light switches in vehicles are disposed of (and potentially released) annually. Ecology currently does not have an estimate for mercury released from other sources in vehicles.

There are approximately 340 licensed auto recyclers in Washington.

Alternatives

Ball-bearing switches are available to replace mercury-tilt switches in convenience lighting at comparable cost. Switches are easy to remove and collect. It takes less than a minute to remove a switch from a vehicle. The removed capsules are easy to store (a properly labeled, gallon-sized container will safely store hundreds of them until disposal can occur.)

Groups Affected

Auto manufacturers, auto dealers, consumers, fleet managers, auto recyclers/dismantlers, steel recyclers, government procurement offices, importers, auto auctions, mercury disposal/refining facilities, and vehicle emission/inspection facilities.

Current Regulations and Policy

Washington's Water Pollution Control Act (RCW 90.48.010) requires the use of all known, available, and reasonable methods to prevent and control the pollution of waters of the state. RCW 90.48.030 provides that the Department of Ecology shall have the jurisdiction to control and prevent the pollution of stream, lakes, rivers, ponds, inland waters… and underground waters of the state of Washington. RCW 90.48.080 states that it is unlawful to cause or tend to cause pollution in waters of Washington. Federal and state water regulations also require automotive recycling yards to have a stormwater permit. Stormwater permits require yard owners to have a pollution prevention plan in which the yard owner details how releases of hazardous constituents (including mercury) will be prevented.

Model Toxics Control Act (Chapter 70.105D RCW). Some auto recyclers have contaminated their yards during the crushing process.

Dangerous-waste regulations (Chapter 173-303 WAC). Waste mercury switches designate as dangerous waste, and the cumulative quantities can make quite an environmental impact when they are crushed, dismantled, or melted. USEPA is in the process of adopting revised rules which will allow auto mercury switches, along with other equipment containing mercury, to be disposed of under the Universal Waste Rule. This will facilitate the collection of switches by reducing dangerous-waste management requirements. Other regulations, such as WAC 173-303-145 (Spills and discharges into the environment), also apply to this issue.

Recent Activities

Ecology's Hazardous Waste & Toxics Reduction Program has begun talking to auto recyclers about the existence of mercury switches and the necessity of removing them before crushing. Information concerning the proper collection and disposal of mercury switches was first printed in the *You Auto Recycle Manual, a Guide for Managing Solid and Hazardous Wastes for Vehicle Recyclers – 1997*. The manual is in English and Spanish. The issue of mercury switches has been pointed out during on-site technical assistance visits at auto recyclers and during past workshops given for the industry.

Information about mercury switches was provided during the mercury switch replacement project conducted recently for Vancouver, Washington, for its government fleet of vehicles.

Many Washington auto recyclers are already voluntarily removing and collecting mercury switches, since the capsules are not difficult to remove. Disposal either by hazardous waste disposal companies, local county small business collection sites, or direct shipment to a refinery is common and not problematic.

Ongoing Activities

The departments of Ecology and Health (DOH) are currently in discussion with Washington State Department of General Administration (General Administration) on replacing mercury switches in Ecology and DOH fleets and potentially extending to the entire state government fleet. General Administration has agreed to include language in future vehicle contract bids to avoid the purchase of mercury components.

In 2002, the Automotive Recyclers of Washington Association informed its members at six workshops throughout the state about many issues affecting auto recyclers. The issue of mercury switches was briefly discussed. A handout was provided listing the cars where mercury switches are most likely to be found.

Activities of Other Groups

The Clean Car Campaign organized a nationwide Switch-the-Switch Event in November 2001. Events took place in 13 states; government fleets (including the city of Vancouver, Washington), auto dealerships, and others replaced mercury switches with non-mercury switches. The Campaign was coordinated by the American Council for an Energy Efficient Economy, Ecology Center, Environmental Defense, Great Lakes United, Michigan Environmental Council, and the Union of Concerned Scientists.

Oregon and Rhode Island passed bills in 2001 that prohibit the sale of vehicles with mercury switches. The Rhode Island law also requires auto manufacturers to fund a collection system for existing mercury switches.

The Oregon Environmental Council, the Northwest Automotive Trades Association, the Oregon Department of Environmental Quality, Metro, and the Port of Portland are partners in the Switch OUT program, funded through a grant from the USEPA. More than 80 auto-repair shops in

Oregon are participating in the program, which offers drivers free replacement of their mercury switch for a ball-bearing switch. The program's goal is to replace 10,000 mercury switches.[30]

The Maine Department of Environmental Protection submitted a report called "A Plan to Reduce Mercury from Motor Vehicles in Maine" (www.state.me.us/dep/mercury/mercuryvehiclereport.htm) to its legislature in January 2002.

In July and August 2001, the attorneys general of 26 states and territories, not including Washington, sent two joint letters to Ford Motor Company, urging it to immediately stop installing mercury switches in new vehicles and to take specific steps to remove and replace mercury switches from existing vehicles.

Rhode Island replaced mercury switches in all government vehicles.

Minnesota replaced the mercury-containing light switches in vehicles of three state agencies and the vehicles put up for auction. Donated replacement switches cost about 20 cents each. The state is moving toward purchasing mercury-free vehicles. The automobile dealers in Minnesota are participating. A law requires auto recyclers to remove mercury switches from all autos before crushing. A manual about mercury switches and their proper management and disposal has been given to all auto recyclers. This information has been available for eight years.

Vermont is currently involved in a mercury phase-out program. A mercury switch removal manual was developed and distributed. The state is installing mercury-free switches in the 350 Agency of Natural Resources vehicles at a cost of less than 50 cents each. The state is calling on manufacturers to develop a national program to recover mercury in vehicles.

Michigan gave the Society of Automotive Engineer's mercury-switch removal manual to all auto salvage yards. The state has recently begun to implement the "Pull the Switch" campaign.

New York developed education materials on how to remove, collect, and recycle mercury switches. The material was given to all auto recyclers. The state conducted a voluntary removal-of-mercury switch program for taxi cab drivers and for the public at gas stations. At a cost of $38, they replaced mercury switches at public vehicle inspection stations. It took approximately a minute to install the replacement switch.

The National Auto Recycling Association has issued the following declaration that it wants: 1) Mercury use in switches and other components eliminated; 2) Manufacturers to take responsibility for removal and safe collection; 3) Manufacturers to label vehicles that have parts containing mercury; 4) Manufacturers to notify auto recyclers which models contain mercury; and 5) Manufacturers to use an alternative or not use mercury switches at all.

Over the past year, Ecology employees have spoken on the phone with many of the coordinators of the above state programs, and the coordinators all say the automotive mercury switch projects have been very successful to date.

[30] http://www.orcouncil.org/, August 13, 2002.

There are several other states that have programs dealing with the removal/elimination of mercury switches in vehicles.

Reduction Options

- Place bounty on mercury switches funded by car manufacturers.
- Require auto dismantlers to make a good faith effort to remove mercury switches.
- Support legislation to ban use of mercury in vehicles.
- Support voluntary exchange programs and incentives.
- Establish private-sector-based exchange programs located in automotive repair or lube shops. Vehicle owners would pay a fee to have their mercury switch removed and disposed.

Recommended Actions

Proposed, Short-term
Evaluate regulatory and voluntary programs for removing convenience switches from vehicles.

Proposed, Mid-term
Consider adding auto switches to the Universal Waste Rule either before or as USEPA adopts the federal rules.

User Groups

Medical Facilities

Identification and Description of Source

Medical facilities have traditionally used a number of devices, including thermometers and sphygmomanometers (blood pressure measuring devices), that contain mercury. If these devices are broken, they may pose a hazard to staff and patients and a financial liability for the facility. If they are improperly mixed and disposed of with solid waste, red-bag waste, or sewage, mercury may be released to the environment.

A more complete list of products containing mercury found in hospitals is available at http://www.noharm.org/library/docs/Going_Green_List_of_Mercury-Containing_Items_i.pdf.

Quantity and Estimated Uncertainty

It is likely mercury releases occur here, though data are lacking for Washington State. Several hospitals and medical facilities have reported as generators of dangerous waste since 1997.

In Boston, Massachusetts, medical facilities averaged mercury discharges of 22 ppb in their regulated effluent prior to concerted mercury-reduction efforts. Following reduction efforts, mercury levels were reduced to an average of 2 ppb.

Groups Affected

Doctors, nurses, medical procurement personnel, housekeeping staff, medical facility administration, solid waste facilities, patients, and lab technicians.

Current Regulations and Policy

- Pre-treatment program for publicly-operated treatment works.
- WAC 173-303, Dangerous-waste regulations.
- Pollution-prevention outreach.
- Local solid-waste permits for medical-waste disposal facilities.
- Biosolids permits for publicly-operated treatment works.

In 1998, the American Hospital Association and the USEPA signed a memorandum of understanding (MOU) to virtually eliminate mercury from hospital waste streams by 2005. This MOU led to the creation of Hospitals for a Healthy Environment (H2E): a partnership among the American Hospital Association, USEPA, Health Care Without Harm, and the American Nurses Association. H2E's goals are to (1) reduce the overall volume of hospital waste by 33 percent by 2005 and 50 percent by 2010, and (2) identify hazardous substances for pollution-prevention and waste-reduction opportunities. To achieve these goals, H2E has developed a pledge program. Participating hospitals commit to work toward achieving these goals. Tools, resources, and other information are available at www.h2e-online.org.

Recent Activities

As part of the Spokane River Metals Reduction Project, Ecology's Eastern Regional Office updated and published "Pollution Prevention in Medical Facilities," containing a section on mercury. The booklet was distributed to 34 facilities in Spokane County and to moderate-risk waste coordinators in all Eastern Region counties.

In 1996, Spokane Regional Solid Waste distributed "Managing Mercury in Medical Care Facilities" to 550 physicians in Spokane County.

Current Activities

The Medical Industry Waste Prevention Round Table (MIRT) was established in 1999 to provide a forum for medical industry professionals interested in exchanging ideas on and working to develop new ways of preventing and reducing waste. This group draws participants from hospitals and other medical industry support professions in the greater Puget Sound area. MIRT is led by a steering committee made up of representatives from the King County Local Hazardous Waste Management Program, King County Department of Natural Resources, the Business and Industry Resource Venture, the Washington State Department of Ecology, USEPA Region 10, the Washington Society for Healthcare Environmental Services, and the Northwest Pollution Prevention Resource Center.

MIRT presents numerous seminars of interest to the medical industry and organizes campaigns within the medical industry to address waste issues. In May 2001, MIRT offered a seminar about the issue of mercury in hospitals and biomedical facilities, and released a press release identifying those Puget Sound hospitals that have removed mercury from their neonatal intensive care units. MIRT held another seminar on mercury in October 2002, which was replicated in Spokane and Vancouver in November 2002.

MIRT also became an H2E Champion for Change and, as such, has committed to encouraging hospitals to strive to reach the goals set forth by H2E (see above section, *Current Regulations and Policy*). The Pollution Prevention Resources Center has received a grant from USEPA Region 10 to support the efforts of MIRT from 2002 to 2004. A large portion of this grant will be used to recruit hospitals to sign the H2E pledge.

Activities of Other Groups

Health Care Without Harm is an international campaign of health care workers trying to make health care more environmentally responsible. Reducing the use of mercury in health care is one of the group's major foci. Information and resources are available at www.noharm.org.

Reduction Options

Voluntary mercury-reduction program by medical facilities.

Mandatory mercury-reduction program by medical facilities.

Outreach and Education Options

Outreach and education for medical staff.

Recommended Actions

1. Develop a voluntary, collaborative program with the Washington State Hospital Association to encourage the association to adopt mercury-reduction policies for its members to install and follow best management practices. Include outreach and education, targeted technical assistance visits ("sweeps"), etc. Incorporate H2E membership as part of a recognition program. Consider developing a memorandum of understanding with the Hospital Association to reduce the use of mercury in hospitals.
   Time frame: approximately two years.

2. If voluntary program not successful at significantly reducing mercury discharges from these facilities, amend Chapter 173-216 RCW, the State Waste Discharge Permit Program, to include a default state local limit for mercury. The limit would reflect a reasonable level of pre-treatment by a facility and would apply to all facilities, not just hospitals.
   Time frame: longer than two years.

Other recommendations:

Outreach and education to publicly-operated treatment works.

Add mercury equipment such as thermometers and sphygmomanometers (though not lab products or drugs containing mercury) as waste stream covered by the Universal Waste Rule, as part of the dangerous-waste regulations.

As part of regular inspections, compliance inspectors can look for improper disposal of mercury equipment. Aside from looking for improper disposal of mercury products, the current inspection program would not otherwise be expanded.

Draft boilerplate language for use by local health departments in waste-facility permits, requiring that medical-waste facilities do not accept waste containing mercury. Contact local environmental health directors, presenting boilerplate language.

Consider special section on mercury in general biosolids permit (could be advisory). Consider requiring more frequent analyses for mercury as a permit condition, either for the general permit or on an as-needed basis with final approval of coverage.

Outreach and education to Northwest Biosolids Management Association and appropriate chapters/ committees of the Pacific Northwest Clean Water Agency to emphasize the importance of hospitals reducing their use of mercury products.

Dental Facilities

Identification and Description of Source

Silver-colored amalgam fillings used by dentists contain about 50 percent mercury by weight. Mercury from dental use can be released to the environment from amalgam fillings wearing, when old fillings are drilled out, or when new fillings are placed.

Quantity and Estimated Uncertainty

The Association of Metropolitan Sewerage Agencies (AMSA) estimates that mercury levels in dental waste water are approximately 56 mg per dentist per day, based on a review of several studies examining wastewater concentrations, water flow, and consumption rates.[31] AMSA concluded that dental discharges account for the largest source of mercury into publicly-operated treatment works (POTW) and, therefore, present the greatest opportunity for achieving measurable improvements.[32]

[31] Larry Walker Associates, "Mercury Source Control and Pollution Prevention Program Evaluation: Final Report," prepared for the Association of Metropolitan Sewerage Agencies under a grant from the U.S. Environmental Protection Agency, March 2002, p. 7.
[32] Walker, p. 51.

King County conducted a survey of dentists' waste disposal practices with regard to amalgam. Results are summarized in Table 10. These results do not include the quantity of mercury associated with trap amalgam and pump filter waste, which is unknown. Roughly 50 percent of the dentists in Washington State practice in King County. By doubling the amount shown in Table 10, the estimated mercury discharged from dental offices in Washington is greater than 404 pounds per year.

Table 10. Estimated Mercury Discharged from Dental Offices in King County (total pounds per year) [33]

Disposal Pathway	Sewer	Red Bag	Garbage	Unknown	Total
Amalgam scrap	0	53	58	40	151
Trap amalgam	Unknown	Unknown	Unknown	Unknown	Unknown
Pump filter	Unknown	Unknown	Unknown	Unknown	Unknown
Wastewater particles	51	0	0	0	51
TOTAL	51	53	58	40	>202

Beyond waste from dental offices, AMSA further estimated that 17.2 µg per/ day/person of mercury is released through feces and urine as amalgam fillings wear. "Person" in this estimate is defined as an adult over 20 years of age.[34]

Groups Affected

Dentists, hazardous-waste haulers, autoclaves, and publicly-operated treatment works.

Current Regulations and Policy

- 173-303-070, -1 WAC, Regulating dangerous wastes
- Chapter 173-216 WAC, State waste discharge permit program
- Local limits (local municipal ordinance)
- Local solid-waste permits for medical-waste disposal facilities
- Dept. of Labor and Industries' worker safety / infectious waste regulations

For dentists on septic systems:
- Local health department ordinance (domestic waste water)
- Chapter 173-216 WAC (non-domestic waste water)
- Chapter 246-290 WAC, State drinking water standards
- Chapter 173-340 WAC, Model Toxics Control Act cleanup standards

[33] Hazardous Waste Management Program, Water and Land Resources Division, Dept. of Natural Resources, King County, "Management of Hazardous Dental Wastes in King County, 1991 - 2000," October 5, 2000.
[34] Walker, pp. 9-10.

Recent Activities

As part of the Spokane River metals reduction project, in 1996 Ecology's Eastern Regional Office held two focus groups with members of the Spokane dental community on educating dentists to dispose of wastes properly. The Eastern Regional Office created a "dental waste" poster and sent it to members of the Spokane Dental Society and their assistants. As part of the same project, the city of Spokane initiated a drop-off program for amalgam waste at the waste-to-energy plant (incinerator) and its two transfer stations.

In 1995, the Washington Dental Service Foundation published and distributed a 60-page booklet called "Going Green," in part using grant funds from Ecology. The booklet includes a chapter on amalgam.

Ongoing Activities

Information on best management practices is being provided to dentists through increased generator-contact visits and other technical assistance visits by Ecology's regional offices, especially the Southwest Regional Office.

Activities by Other Groups

From 1995 to 2000, King County worked with dentists to achieve voluntary, proper disposal of wastes. In 2000, King County published a report that concluded that the voluntary program had not worked. A significant number of dental offices were still discharging waste water that did not comply with King County discharge limits for mercury and silver. In September 2001, King County required dentists to follow best management practices for amalgam wastes and to install a King County-approved amalgam separator at each chair or in a central location where amalgam is removed or placed. Existing offices are required to install separators by July 1, 2003.[35]

The Solid Waste and Envirostars programs in Kitsap and Snohomish counties have been involved in public education programs discouraging improper disposal of mercury from dental offices.

Many moderate-risk waste facilities offer mercury collection or diversion programs.

Reduction Options

Ecology's existing dangerous waste regulations provide adequate tools to discourage and prevent mercury discharge by dental offices. Compliance/enforcement presence can be stepped up. Mercury amalgam and fines collected from sink traps and in-line filter systems are hazardous wastes. The regulatory level is 0.2 ppm under the toxicity characteristic pursuant to WAC 173-303-090(8), waste code D009. Discharge of waste waters with mercury at or above the regulatory level is illegal and prohibited for all generators, including small-quantity generators.

[35] Industrial Waste Program, Water and Land Resources Division, Department of Natural Resources, King County, Washington, "Industrial Pretreatment Quarterly," September 2001.

Coordination is necessary between Ecology's HWTR and Water Quality programs to affirm and ensure compliance with dangerous-waste regulatory and state waste-discharge limitations. Local wastewater authorities that have delegated pre-treatment programs would be included.

Require amalgam separators and the use of best management practices in all dental offices.

Contact the state insurance commissioner to require funding of amalgam alternatives.

Outreach and Education Options

Conduct statewide dental office campaign and outreach effort.

Recommended Actions

1. Develop a program with the Washington State Dental Association (WSDA) to implement best management practices within two years statewide that comply with regulations. In most cases, these practices will include the installation and proper maintenance of amalgam separators certified under International Standards Organization (ISO) 14001.

2. Work with WSDA on outreach and education to dentists. This includes targeted technical-assistance visits, statewide or regional "sweeps," and normal compliance inspection visits. Include recognition program and possibly help with funding.

3. Work with waste collection companies to set up a one-time collection of leftover elemental mercury.

4. Clarify handling practices for amalgam cartridges and other dental waste.

Other recommendations:

- Conduct outreach and education to publicly-operated treatment works.

- Consider special section on mercury (could be advisory) in general biosolids permit.

- Conduct outreach and education to Northwest Biosolids Management Association and appropriate chapters/committees of the Pacific Northwest Clean Water Agency to emphasize the importance of amalgam separators.

- Draft boilerplate language in waste facility permits for use by local health departments, requiring that medical-waste facilities do not accept waste containing mercury. Contact local environmental health directors, presenting boilerplate language.

Veterinarians

Identification and Description of Source

Like the medical sector, veterinarians use equipment that contains mercury.

Quantity and Estimated Uncertainty

The quantity of mercury contained in equipment used by veterinary practices in Washington is unknown. It is expected that mercury from equipment is released when equipment is broken and the mercury spilled.

Groups Affected

Veterinarians

Current Regulations and Policy

- WAC 173-303-070, -145, -150, Dangerous-waste regulations
- Chapter 173-216 WAC, State Waste Discharge Permit Program
- Local limits (local municipal ordinance)
- Local solid-waste permits for medical-waste disposal facilities
- Dept. of Labor and Industries' Worker Safety / Infectious Waste Regulations

For veterinarians on septic systems:
- Local health department ordinance (domestic waste water)
- Chapter 173-216 WAC (non-domestic waste water)
- Chapter 246-290 WAC, state drinking water standards
- Chapter 173-340 WAC, Model Toxics Control Act cleanup standards

Recent Activities

In 1996, as part of the Spokane River metals reduction project, Ecology's Eastern Regional Office submitted two newsletter articles on the proper disposal of broken thermometers to the Spokane-area veterinary association. The articles also urged the use of newer alternatives to mercury thermometers.

Reduction Options

Encourage the replacement of mercury equipment with non-mercury alternatives.

Recommended Actions

Proposed, Long-term
Conduct outreach and education to encourage the replacement of mercury products with non-mercury products and to improve spill response.

K – 12 Schools

Identification and Evaluation of Source

In kindergarten through 12th-grade (K – 12) schools, mercury and mercury products are commonly found in medical offices; chemistry, physics, and biology laboratories and classrooms; school buildings and maintenance areas; and heating, ventilation, and air-conditioning shops and laboratories in vocational-technical schools. Items containing mercury commonly found in schools include fever, laboratory, candy, or oven thermometers; thermostats; blood pressure devices; mercury switches; relays; barometers; vacuum gauges; laboratory chemicals; thermostat probes; and fluorescent, mercury-vapor, metal-halide, and high-pressure-sodium lamps.

Items that contain mercury and jars of elemental mercury can be a liability for schools. At a school in Connecticut, the act of cleaning out a supply closet resulted in 12 broken mercury laboratory thermometers. The school was evacuated and paid cleanup costs of $6,000. At another school, a broken mercury barometer resulted in cleanup costs totaling $200,000.[36]

Quantity and Estimated Uncertainty

Washington's statewide Rehab the Lab Project conducted approximately 350 visits (some of these visits were follow-up visits to the same school) to schools throughout the state. The visits mainly focused on identifying and removing toxic old chemicals from schools and reorganizing shelves into a compatible chemical-storage system. Mercury, mercury salts, and oxides were some of the chemicals recommended for disposal by Ecology and King County staff. Approximately 100 to 200 pounds of mercury and mercury compounds have been removed from schools statewide, and likely another 100 to 200 pounds still need removal. Rehab the Lab staff have visited more than half the middle and high schools throughout the state. There are still schools needing assistance, but the project is not funded presently.

The public schools in Washington have not been surveyed. Other states have had surveys and chemical assessments done. Example surveys and assessments will be attached to mailed collected information.

Groups Affected

Affected: Students, teachers, and school staff.

Involved: Teachers, school staff, local health districts, educational school districts, fire marshals, and the Washington State departments of Health, Labor and Industries, Ecology, and the Office of the Superintendent of Public Instruction (OSPI).

[36] Northeast Waste Management Officials' Association, "Getting Mercury Out of Schools," developed on contract with the Massachusetts Department of Environmental Protection and the Massachusetts Executive Office of Environmental Affairs, 2002.

Current Regulations and Policy

- Chapter 173-303 WAC, Dangerous-waste regulations
- Health and Safety Guide for K-12 Schools in Washington. December 2000. Published by the state Department of Health and the state Office of Superintendent of Public Instruction.

Recent Activities

SB 6533 and HB 2686, introduced in the 2002 legislative session, would have prohibited "the purchase for use in a primary or secondary classroom bulk elemental mercury or bulk mercury compounds." Manufacturers that produced and sold bulk elemental or chemical mercury or mercury compounds would be required to "notify retailers and schools about provisions (prohibiting the sale of mercury to schools) and how to dispose of the remaining inventory properly."

Activities of Other Groups

Through its Rehab the Lab Program, the King County Local Hazardous Waste Management Program removes old, unneeded chemicals from science labs and provides technical assistance to help schools manage their hazardous chemicals.

Through the School Science Lab Chemical and Mercury Clean-out Project, the Vermont Agency of Natural Resources offered a one-time clean-out for middle and secondary school in cooperation with Vermont solid waste districts and alliances and the Association of Vermont Recyclers.

The Massachusetts Department of Environmental Protection contracted with the Northeast Waste Management Officials' Association (NEWMOA) to conduct a pilot project in Massachusetts public schools. Mercury devices were removed and replaced with non-mercury devices, and education about mercury was provided for students.

In Wisconsin, the following pamphlets were developed for distribution:

- "Mercury in Your School and Community: A National Issue," University of Wisconsin Extension.
- "Mercury in Your Community and the Environment (A Wisconsin Curriculum)."

Reduction Options

Complete the Rehab the Lab Program at remaining Washington schools. This would cost approximately $200,000 for disposing of chemicals. Staff would need to be funded and assigned to the project in each of the four Ecology regions.

Replace mercury thermostats in schools.

Recommended Actions

Proposed, Short-term
Work with USEPA and King County to remove mercury from schools as part of a more comprehensive clean-out program.

Universities

Identification and Description of Source

Universities use a variety of mercury products and compounds in their facilities, laboratories, clinics, and other locations.

Quantity and Estimated Uncertainty

The quantity of mercury in use and released by universities in Washington is unknown.

Groups Affected

Universities

Ongoing Activities

The Environmental Health and Safety Division of the University of Washington is replacing mercury equipment in its medical center and removing mercury from other parts of the campus, where possible.

Reduction Options

Identify and recycle unnecessary mercury stocks.

Replace mercury equipment with non-mercury alternatives.

Recommended Actions

Proposed, Long-term
Work with universities to reduce the use of mercury products.

Laboratories

Identification and Description of Source

Laboratories use both equipment containing mercury and mercury compounds.

Quantity and Estimated Uncertainty

It is unknown how much mercury is used or released by laboratories in Washington. Two laboratories reported disposing of a total of 1,310 gallons of waste water containing thimerasol, a mercury preservative, as part of reporting required under dangerous-waste regulations in 2000. This quantity indicates only the total volume of waste water, however, and does not indicate the volume of mercury.

Groups Affected

Independent laboratories, schools, and hospitals.

Current Regulations and Policy

WAC 173-303-070, -145, -150, Dangerous-waste regulations

Recent Activities

The city of Spokane prepared a booklet called "Best Management Practices for Laboratories" in 1995, which was mailed to the better-known laboratories in Spokane. In 1997, Ecology's Eastern Regional Office conducted site visits to distribute the booklet to additional laboratories in Spokane County.

In Seattle in 1996, Ecology conducted the first workshop for community-college, four-year college, and some high-school laboratories to discuss waste reduction, waste disposal, and housekeeping issues. The workshop covered the issues of dumping chemicals and metals, including mercury, down the drain. The workshop was repeated in Leavenworth in 1997.

The Department of Ecology's Environmental Laboratory Accreditation Program sets standards for conducting environmental analyses in approximately 380 labs in Washington, each of which has several thermometers, most of which are mercury. Historically, the lab accreditation program has advised labs to use mercury thermometers for methods involving incubation where close temperature tolerances are required (e.g., fecal coliforms, BOD). The program stopped doing that about a year ago and is now recommending use of alcohol stem thermometers, or digital thermometers using a thermocouple.

Current Activities

The Medical Industry Waste Prevention Round Table (MIRT) was established in 1999 to provide a forum for medical industry professionals, including those from laboratories, interested in exchanging ideas on and working to develop new ways of preventing and reducing waste. This group draws participants from hospitals and other medical industry support professions in the greater Puget Sound area. MIRT is led by a steering committee made up of representatives from the King County Local Hazardous Waste Management Program, King County Department of Natural Resources, Business and Industry Resource Venture, Washington State Department of Ecology, USEPA Agency Region 10, Washington Society for Healthcare Environmental Services, and the Northwest Pollution Prevention Resource Center. MIRT organizes and

presents numerous seminars of interest to the medical industry and organizes campaigns within the medical industry to address waste issues.

Reduction Options

Where possible, work with laboratories to replace mercury products and compounds.

Promote best management practices with regard to laboratory waste.

Recommended Actions

Proposed, Long-term
Work with labs to reduce the use of mercury products.

State Purchasing

Identification and Description of Source

State agencies purchase many products that may contain mercury. By choosing non-mercury products when possible, state agencies can create a greater market demand for these products and reduce the use of mercury. State agencies also contract with mercury recyclers and hazardous-waste haulers for the disposal or recycling of mercury products. Most state contracts also can be used by local governments and other jurisdictions, often providing local governments a discount on goods and services due to the dynamics of bulk purchasing. This combined purchasing power also can be leverage to get more environmentally preferable products on state contracts.

Products that may contain mercury purchased by state agencies include fluorescent lamps, button-cell batteries, medical equipment, dental supplies, vehicles, appliances, bilge pumps, thermostats, and HVAC equipment.

Quantity and Estimated Uncertainty

Releases may occur when products are broken or improperly disposed.

Agencies generally do not use the state contract to dispose of lamps. They go to a non-contract supplier for this service at a lower cost than is specified in the contract. No centralized records have been kept on this disposal activity. Ecology hopes to collect such data once the state's new contract 12201 for disposal of spent lighting is awarded

Typically, the vendors are asked to submit quarterly reports to General Administration, but they often do not do it. If they do, information is not broken down by purchasing entity.

Groups Affected

Washington State Department of General Administration, other state agencies, and local jurisdictions.

Current Regulations and Policy

The Department of Ecology has a Product Stewardship Task Force. The task force's mission is to incorporate product stewardship principles into Ecology's work, and in state procurement. The task force has developed a Product Stewardship Strategy, posted at http://www.ecy.wa.gov/sustainability/Resources/prod_steward.htm.

Ecology is a member of the Product Stewardship Institute. The institute assists state and local government agencies in establishing cooperative agreements with industry and developing other initiatives that reduce the health and environmental harm from consumer products. The Institute seeks out advice from, and cooperates with, environmental groups, business interests, academic institutions, the federal government, and related organizations to achieve product stewardship goals.[37]

Ecology participates in the Northwest Product Stewardship Council. The council endeavors to integrate product stewardship principles into the policy and economic structures of the Pacific Northwest.[38]

Ongoing Activities

Governor Gary Locke has signed an executive order on sustainable government (Executive Order 02-03). The executive order requires state agencies to, among other things, shift to non-toxic, recycled, and remanufactured materials in purchasing and construction.

Ecology will research state contracts to determine which products that the state purchases contain PBTs (broadly defined), and identify non-PBT products that should be purchased instead.

In the new lamps and ballast contract recently issued by General Administration, the vendor will offer recycling of mercury-containing lamps. Vendors also will be required to provide training for customers; Ecology has requested that information on fluorescent lamp recycling be included as part of the training.

General Administration included a specification in the 2002 invitation for bid for vehicles, requiring that vehicles not have mercury switches.

Activities of Other Groups

INFORM, Inc. is preparing a guide to help states reduce their purchase of PBTs.

The Massachusetts hospital and laboratory products-procurement management team decided to minimize mercury equipment available on state contracts in response to the state's Zero Mercury Strategy. Working with INFORM, Inc. and the state mercury coordinator, they developed

[37] http://www.productstewardshipinstitute.org/, March 4, 2002.
[38] http://www.productstewardship.net/, March 4, 2002.

specification language for soliciting major medical and surgical supply contracts, asking that vendors sell no products with added mercury except where no alternative was available and requesting that vendors offer other mercury-reduction services. The contract was awarded in March 2001.

The Minnesota vehicle-procurement management team has required vendors to disclose in their bids all mercury components in vehicles.

Reduction Options

Work with the Department of General Administration to include a preference or requirement for non-mercury products in future contracts.

Recommended Actions

Ongoing
Continue working with General Administration.

Dairies

Identification and Description of Source

Milk-producing dairies use mercury manometers to monitor pressure changes in automatic-milking systems. The two most common manometers, often referred to as J-shape and U-shape, contain one pound (approximately two tablespoons) of elemental mercury when installed. A third type, that is less common, contains four to five ounces of elemental mercury when installed. The manometers are potential sources of mercury spills if broken, or of mercury vapor released to the atmosphere if milking systems are malfunctioning.

Quantity and Estimated Uncertainty

The interagency team working on this issue roughly estimated that up to 20 percent (approximately 150) of the 730 milk-producing dairies that were operating in 2000 were using mercury manometers. Using a grant from USEPA to fund a rebate/replacement project, at least 110 farms had mercury manometers removed by June 2002.

From October 2000 through December 2001, 90 manometers were removed from dairies. Of those 90 manometers, 40 were J-shaped, 35 were U-shaped, and 15 were the smaller size. On an average, the J-shaped contained approximately 12 ounces of elemental mercury instead of the expected one pound. The average amount collected from the U-shape was 10 ounces instead of the expected one pound. The third type average was at 3 ounces instead of the expected 5 ounces. Therefore, instead of removing 80 pounds of elemental mercury, only 56 pounds were removed. Based on this information, approximately 24 pounds of elemental mercury cannot be accounted for.

Groups Affected

Dairy farms that have operating milk parlors or inactive milk parlors that still contain equipment are affected by this issue. In addition, there are some farms that may still have milking equipment stored on-site that have been sold to owners not interested in operating a dairy.

Alternatives

The manometers can be replaced with newer, digital gauges that are accurate to within 1 percent of a mercury manometer, are easier to set, and are resistant to wear and corrosion in humid conditions. By replacing the manometers, farmers can remove the potential danger and liability for mercury contamination and human exposure associated with spilled or vaporized mercury.

Current Regulations and Policy

- WAC 173-303-070, -145, -150, Dangerous-waste regulations
- Chapter 173-201A WAC, Water quality standards for surface waters of Washington State
- Chapter 173-216 WAC, State waste discharge permit program

Recent Activities

Ecology, Washington State University's Cooperative Extension, and the Washington State Department of Agriculture's (WSDA) Food Safety Program developed the mercury manometer replacement program, a project to remove mercury manometers at no cost to farmers and provide a $300 rebate for a mercury-free replacement gauge. The project received funding through a Pollution Prevention Incentives for States grant from the USEPA.

Initially, the project team mailed letters and brochures to 730 operating dairies to describe the potential danger and liability associated with mercury manometers and to explain the replacement program that could offer a limited number of $300 rebates to interested farmers. In addition, letters and brochures were sent to 31 dairy equipment vendors, 13 milk cooperatives, and 27 state jurisdictional health districts. Also, information about the project and the hazards associated with elemental mercury was published in WSDA newsletters, Cooperative Extension newsletters, and on the Web page for the state's conservation districts.

Activities of Other Groups

Many of the dairy equipment vendors through out the state actively supported the project and helped promote/persuade farmers to participate. To date, at least five of the dairy equipment vendors with the state have voluntarily discontinued stocking mercury manometers. WSDA milk inspectors encourage farmers to replace mercury manometers when they see them in use. Dairy inspectors with Ecology's Water Quality Program also encourage farmers to replace mercury manometers.

Recommended Actions

None. Mercury dairy manometers have been successfully collected in Washington.

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4. Products Containing Mercury at End-of-Life

Disposal of Products Containing Mercury

Solid Waste Combustion

Identification and Description of Source

The largest municipal-waste combustor currently operating in Washington State is the Spokane Waste-to-Energy facility, owned by the city of Spokane and operated by Wheelabrator.

The Tacoma Steam Plant is classified as a municipal-waste combustor by the Department of Ecology, but the city of Tacoma is contesting this classification, arguing that the facility should be considered a coal-fired power plant. The steam plant currently is not operating. It burns a combination of construction and demolition debris, wood waste, and coal.

Quantity and Estimated Uncertainty

The Spokane facility estimates recent emissions at 18.45 pounds per year. This is a considerable reduction from previous years; based on an eight-year average of mercury emissions, the facility released approximately 97 pounds of mercury annually. New pollution-control devices are likely responsible for the decrease. The facility accepts fluorescent lamps from residences and small businesses for incineration.

For 2000, the Tacoma Steam Plant reported mercury emissions of 49 pounds to the Toxics Release Inventory; however, this plant is currently not in operation.

Groups Affected

Cities and corporations owning municipal-waste combustors and their customers.

Current Regulations and Policy

- Federal Clean Air Act
- Chapter 70.95C RCW / Chapter 173-307 WAC, Pollution Prevention Plan
- 40 CFR part 72, Implemented through Toxic Chemical Release Inventory Reporting Forms and Instructions
- Chapter 118-40 WAC, Section 313 of the Emergency Planning and Community Right-to-Know Act (adopted by reference)
- Air Quality Local Authority Regulation, Ecology Air Quality Program

Ongoing Activities

The Spokane regional solid waste system operates a battery collection program and has begun a mercury-thermometer exchange program.

Reduction Options

Require collection and recycling of fluorescent lamps.

Outreach and Education Options

Outreach and education to local communities on mercury in products, proper disposal methods, and non-mercury alternatives.

Recommended Actions

Proposed, next permit renewal
Consider prohibiting the incineration of fluorescent lamps.

Medical Waste Incinerators

Identification and Description of Source

Washington has one medical waste incinerator, at Washington State University (WSU) in Pullman. The WSU medical waste, low-level radioactive waste, and pathological wastes are separated by type, because of different burning characteristics.

Medical waste (paper, plastic, bedding, glass, etc., that has come into contact with infected animals) and low-level radioactive waste (the same as medical, plus a few small animal carcasses) can sustain combustion and are burned under one set of conditions. Pathological waste (animal carcasses) cannot sustain combustion by itself and is burned under different conditions.

The facility does sorting what goes to the incinerator, but actual burning is based on the type of material.

Quantity and Estimated Uncertainty

Seven toxic air pollutants are addressed in the air quality permit: hydrogen chloride, dioxins, lead, cadmium, mercury, chromium, and nickel. Distribution of each toxic air pollutant has to be modeled to demonstrate that the acceptable source impact level will not be exceeded.

The source impact level for mercury or mercury compounds is limited to 0.17 micrograms per cubic meter, averaged over 24 hours. In addition, the permit limits mercury concentration at the stack to 0.24 grains per thousand dry standard cubic feet at 7 percent oxygen.

The permit requires that the incinerator be tested for each of the toxic air pollutants at startup and every 36 months thereafter.

The permit limits pathological waste throughput to 180,855 pounds per year and medical waste to 977,168 pounds per year. Based on results of the initial source test, that would result in mercury emissions of 2.8 and 0.03 pounds per year, respectively. Actual air mercury emissions for 2001 were calculated at 0.30 pounds, total.

Operators are required to transfer ash from the incinerator to sealable, non-melting, non-combustible containers. The containers must go to an approved site for disposal. These actions probably reduce mercury release.

The facility has a waste management plan as addressed in the environmental impact statement. It is unknown at present whether the plan includes a section that addresses mercury.

Groups Affected

Washington State University.

Current Regulations and Policy

- Federal Clean Air Act
- Washington State Clean Air Act (Chapter 70.94 RCW)
- Air Quality Local Authority Regulation, Ecology Air Quality Program

Reduction Options

Require facilities to establish a source-separation program.

Outreach and Education Options

Outreach and education to WSU and the local community on mercury in products, proper disposal methods, and non-mercury alternatives.

Recommended Actions

Given the very low levels of emissions, no recommendations for further reduction have been made at this time.

Landfills

Identification and Description of Source

When products containing mercury are disposed of in landfills, mercury may be released through air emissions or possibly in leachate. Air emissions may occur when mercury products are

dumped on the open face of the landfill and broken, prior to the application of a cover layer, or, later, with methane gas emissions. It is anticipated that most products containing mercury that are not recycled are landfilled.

Quantity and Estimated Uncertainty

The amount of mercury in discarded products in solid waste in Washington is conservatively estimated at 948 to 1305 pounds annually. This estimate includes thermometers used in private homes, fluorescent lamps, wall thermostats, and button-cell batteries. The estimate does not include products other than thermostats with mercury switches (e.g., it does not include appliances, other HVAC equipment, and bilge pumps). Ninety-one percent of municipal solid waste in Washington is landfilled. In all likelihood, not all of the mercury originally in the discarded products actually reaches the landfills. In particular, mercury in products that break easily, such as fluorescent lamps and thermometers, may be released before or during the waste collection process. Additionally, mercury in scrap dental amalgam that is disposed of as biomedical waste and treated at a medical waste autoclave or retort may partially or totally volatilize before being disposed at a landfill. Sterilized biomedical waste from dental offices currently is disposed at the landfill in Coffin Butte, Oregon. Additional mercury from broken products may volatilize on the face of the landfill, before the daily cover layer is applied.

The fate of mercury in landfills is not well understood. A recent study conducted in Florida showed that methylmercury was emitted with landfill gas.[39] Statistics currently are unavailable on the total volume, bioavailability, or the toxicity of the reduced mercury versus the oxidized mercury compounds from landfills in Washington.

Affected Groups

Municipalities, counties, landfill owners, and operators.

Current Regulations and Policy

- WAC 173-303-070, -145, -150, Dangerous-waste regulations
- Chapter 173-304 WAC, Minimum functional standards for solid-waste handling
- Chapter 173-308 WAC, Biosolids management regulations
- Chapter 173-340 WAC, Model Toxics Control Act cleanup standards

Research, Development, and Monitoring Options

Conduct sampling and speciation for mercury emissions at Washington landfills.

[39] Lindberg, S.E., D. Wallschläger, E.M. Prestbo, N.S. Bloom, J. Price, D. Reinhart, "Methylated mercury species in municipal waste landfill gas sampled in Florida, USA." Atmospheric Environment 35 (2001), 4011-4015, February 24, 2001.

Recommended Actions

Ongoing
Investigate mercury emissions in landfill gas and on the open face of active landfills.

Medical Waste Autoclaves and Retorts

Identification and Description of Source

There are two freestanding medical-waste facilities in Washington. One is an autoclave in Ferndale; the other is an Electro-Thermal Deactivation Plant in Morton. The autoclave is leased by Stericycle from Recomp.

An autoclave sterilizes medical waste through high-pressure and high-temperature steam. Once the medical waste has been sterilized, it is transported to the Roosevelt Landfill. There is no shredding or grinding of the medical waste.

The plant in Morton first grinds the medical waste, making it unrecognizable and reducing the volume. Next, through a patented process called Electro-Thermal Deactivation, the waste is rendered non-infectious with low-frequency radio waves. The non-infectious medical waste is hauled to Coffin Butte, Oregon, for disposal.

Some hospitals and perhaps biotech laboratories in Washington have their own autoclaves on-site, which they use to sterilize medical waste.

Quantity and Estimated Uncertainty

Information from dental office visits and other medical waste sources points to a potential problem at facilities involved in microwave/autoclave sterilization of medical and infectious wastes. Mercury amalgam is often inappropriately placed by dentists in "red bags" as infectious/medical waste. The current estimate of mercury amalgam inappropriately placed in "red bags" is 106 pounds per year.

Groups Affected

Medical facilities, dentists, medical-waste haulers, dangerous-waste haulers, medical-waste facilities.

Current Regulations and Policy

Both freestanding medical-waste facilities are licensed and regulated to accept medical waste, but not dangerous waste. Mercury waste is considered dangerous waste.

The Ferndale facility is currently regulated through the following permits:

- General Waste Discharge Permit, Ecology Water Quality Program
- Waste Discharge Permit for Discharge to a POTW, Ecology Water Quality Program
- Air Quality Local Authority Regulation, Ecology Air Quality Program

The Morton facility is listed in the Ecology facility database as being currently regulated through a landfill permit.

At the point of generation, dental wastes may be regulated as both a dangerous waste (Department of Ecology) and an infectious waste (Department of Labor and Industries). Some regulatory uncertainty exists for the dental sector on whether to treat mixed waste containing both mercury and infectious waste (teeth, saliva, etc.) as dangerous waste or infectious waste. The Interagency Regulatory Analysis Committee in King County, with representatives from the state Department of Labor and Industries, Public Health-Seattle and King County, state Department of Ecology, and the King County Hazardous Waste Program, examined this issue in 2000. The group determined that, from the perspective of waste disposal, the dangerous-waste designation takes precedence. If a particular waste is both dangerous and infectious, it must be disposed as dangerous waste.[40] The Department of Labor and Industries determined that dental offices could store used sink traps and vacuum filters on-site for up to six months if the following precautions were taken:

- Universal precautions must be observed.
- Containers must be red or labeled biohazard for storage and transport.
- Eating, drinking, applying cosmetics or lip balm, and handling contact lenses are prohibited in work areas where there is a reasonable likelihood of occupational exposure.
- Any potential splashing or spraying must be minimized. If a splash or spray exists, protective clothing must be worn.
- Gloves must be used.[41]

Activities of Other Groups

Stericycle is working to better educate the generators of medical waste in the proper disposal of different types of waste.

Research and Monitoring Options

Sample air and water at permitted facilities and at hospitals that have their own on-site autoclaves for mercury.

Monitor medical and dangerous-waste generators to ensure that they are complying with existing disposal regulations.

[40] Savina, G., King County Water and Land Resources Division, Hazardous Waste Management Program; memo to A. Peacock, R. Thompson, C. Grasso, S. Laughlin, L. Foster, D. Waddell, D. Davis, and J. Trohimnovich; May 30, 2000.

[41] Brodie, W., Industrial Hygiene Consultant, Washington Department of Labor and Industries; memo to Gail Savina, King County Hazardous Waste Dental Project; March 20, 2000.

Outreach and Education Options

Work with medical facilities, collection companies, and the medical and dental communities to conduct outreach and education for medical waste generators on properly disposing mercury waste.

Work with hospitals that have on-site autoclaves to conduct outreach and education to their employees on the proper disposal of mercury waste.

Recommended Actions

Proposed, Short-term
Work with medical-waste facilities and the Washington State Hospital Association to educate the medical community about disposing of mercury as hazardous waste.

Proposed, Short-term
Work with the Department of Labor and Industries to clarify the interpretation of infectious-waste and hazardous-waste regulations for the dental community, providing direction for the handling of mixed waste.

Proposed, Mid-term
Include requirement that medical-waste facilities not accept mercury as part of a medical waste facility permit template for local health departments.

Publicly-Operated Treatment Works

Identification and Description of Source

Mercury is present in waste water treated by publicly-operated treatment works (POTWs). Following treatment, mercury is present in POTW effluent, biosolids, and air emissions. The preferred method of biosolids management in Washington is beneficial use, which means that mercury in the biosolids is eventually recycled back to the environment. The state program standards and permitting requirements can be found in Chapter 173-308 WAC. The biosolids program is implemented by Ecology's Solid Waste and Financial Assistance Program. Loading and concentrations of mercury in effluent are regulated by NPDES permits, which are implemented through Ecology's Water Quality Program.

According to the Association of Metropolitan Sewerage Authorities (AMSA), the largest source of mercury in wastewater influent is discharges from dental offices. The next largest source is domestic, of which 83 percent is attributed to dental amalgam. Other domestic sources include laundry gray-water and household products. The third-largest source is hospitals.

The sources with the greatest potential for achieving measurable reductions in wastewater influent are dental offices and hospitals. Of the domestic sources, human waste is considered uncontrollable, and laundry gray water is considered very difficult to control effectively.

Household products are controllable to the extent that residents can be persuaded to stop using them or to the extent that their availability can be restricted through product bans. According to AMSA, legislative efforts to restrict the availability of certain mercury-containing products may prove effective in reducing discharges from household products.[42]

Quantity and Estimated Uncertainty

There are about 350 treatment works treating domestic sewage in Washington, most of which discharge 100 percent of their effluent to waters of the state and produce about 100,000 dry tons of biosolids per year. Most of these are publicly-owned treatment works. About 80 percent of the biosolids material is applied to the land in some manner.

Based on data contained in Ecology's Biosolids Data Management System (BDMS), the median value for mercury in biosolids in Washington is about 2 ppm. A report published by Ecology in 2001 (Publication No. 01-07-007) estimated the median value for septage to be slightly higher, around 3.1 ppm, also based on information contained in BDMS. Studies from the city of Tacoma in the early 1990s showed a mercury range of 1 ppm to 1430 ppm in septage. Biosolids that are applied to the land must be analyzed for mercury and other pollutants (sampling of septage is generally not required). Measured values in biosolids are typically well below the maximum limit of 57 ppm for biosolids which are applied to the land. This standard is based on risk analysis done in support of federal rules.

Nineteen sewage treatment plants that discharge to surface waters have effluent limits that regulate the amount of mercury in the discharge (Table 11). These discharges are regulated through the NPDES program. Discharges to ground can be regulated using state waste discharge permits.

Effluent limits for mercury are included in NPDES permits if monitoring data indicate that there is a reasonable potential for the mercury criteria to be violated at the edge of the allowed mixing zone. The 19 plants with mercury limits fit this scenario. However, discharges that receive enough dilution in the receiving water to ensure compliance with numeric criteria during critical condition at the boundary of the mixing zone are not given water-quality-based effluent limits. In this case, mercury could be present in the discharge and is allowed by the NPDES permit.

The current estimate of mercury in POTW biosolids is 298 pounds per year. This estimate is based on data from 84 wastewater treatment facilities that produced biosolids and reported mercury data for 2000 (Table 16). An additional 98 wastewater treatment facilities that reported biosolids production in 2000, but are not required to report mercury content, release an estimated additional 33 pounds of mercury per year. As calculated in Table 16 (page 119), this results in a total estimated 331 pounds of mercury per year.

Groups Affected

Publicly-operated treatment works, cities, and counties.

[42] "Mercury Source Control and Pollution Prevention Program Evaluation," Association of Metropolitan Sewerage Authorities, March 2002, p. ES-4.

Table 11. Sewage Treatment Plants with Mercury Limits in NPDES Permits

Sewage Treatment Plant	Reporting frequency	Number of mercury violations, 4/1/01 – 1/1/02
Northwest Region		
Duvall	monthly	2
Everett	monthly	0
Ferndale	monthly	0
Granite Falls	monthly	1
Monroe	monthly	0
North Bend	monthly	2
Southwest Region		
Cowlitz	monthly	0
Enumclaw	monthly	0
Puyallup	monthly	0
Sumner	monthly	3
Yelm	monthly	0
Central Region		
Entiat	monthly	1 (failure to report)
Eastern Region		
Diamond Lake	annually	0
Moses Lake Larson	every other yr	0
Othello	annually	0
Quincy	annually	0
Royal City	every other yr	0
Spokane	monthly	0
Walla Walla	monthly	1

Current Regulations and Policy

- Chapter 173-308 WAC, Biosolids management regulations
- Chapter 173-201A WAC, Water quality standards for surface waters of the state of Washington
- Chapter 70.95J RCW, Municipal sewage sludge - biosolids
- Chapter 90.48 RCW, Water pollution control
- 40 CFR Part 503, USEPA, Standards for the use or disposal of sewage sludge

Recent Activities

In Ecology's Northwest Region, King County and the cities of Lynnwood and Everett have delegated pre-treatment authority. Dentists in King County will be required to meet the county's pre-treatment standard of 0.2 mg/L by installing one of several approved amalgam separators and following best management practices. Delegated pre-treatment programs, as well as a number of non-delegated pre-treatment programs, have established ordinances with mercury standards. Dental operations and hospitals are not exempted in these ordinances and technically are subject

to the standards. However, due to practical considerations, mainly the number of dischargers, there is no permitting, sampling, or enforcement activity targeted at these dischargers.

In 1996, Ecology received a grant to fund a position in its Eastern Regional Office to help the Spokane Advanced Wastewater Treatment Plant with the pollution-prevention portion of its pre-treatment program. The project focused on two metals of concern: silver and mercury. The treatment plant was under a compliance order to reduce discharge of silver and mercury into the Spokane River because the plant had exceeded its limits for both. The goal of the project was to identify the types of businesses most likely to discharge these metals and work with them to find ways to reduce, recapture, recycle, or otherwise safely dispose of the metals. All efforts were voluntary.

Activities by Other Groups

The city of Tacoma is developing a mercury-reduction plan for both sewage and solid waste.

King County has required all dentists to install amalgam separators by June 2003.

The Association of Metropolitan Sewerage Agencies conducted a study to determine the extent to which pollution-prevention and source-control programs could achieve measurable reductions in POTW influent, and if these reductions would enable POTWs to comply with proposed new, lower effluent limits. Influent load reductions for mercury achievable through pollution-prevention activities for POTW case studies on average ranged from 12 to 90 percent depending on the agency's existing pollution-prevention efforts and the extent of additional pollution prevention conducted.[43]

Reduction Options

To further reduce the mercury in biosolids, one effective approach may be to establish a voluntary pollution-prevention program for POTWs. Ecology could survey the treatment works, look for those with mercury levels that are approximately two or more standard deviations above the mean, and focus on them. Ecology would work with the facilities to determine why the values are high and how to reduce them.

The Ecology Pre-Treatment Workgroup, composed of the four Ecology regional pre-treatment coordinators, could coordinate with Northwest Biosolids Management Association Pre-Treatment Committee members to develop pollution-prevention and mercury-reduction strategies.

Ecology could set a lower regulatory threshold for mercury in biosolids. To do this, Ecology probably would need to show that the risk posed by mercury in biosolids is greater than USEPA calculated to set the current limit. The success of a strict policy approach (i.e., mercury reduction without risk analysis) is not certain.

[43] "Mercury Source Control and Pollution Prevention Program Evaluation," Association of Metropolitan Sewerage Authorities, March 2002, pp. ES-2,3.

Along with other potential water-quality rule changes in the future, Ecology could consider the feasibility of eliminating mixing zones.

Recommended Actions

Proposed, Mid-term
Coordinate with the Northwest Biosolids Management Association Pre-Treatment Committee members to develop pollution-prevention and mercury-reduction strategies.

Consider the feasibility of eliminating mixing zones in the next round of regulatory review.

Septic Systems

Identification and Description of Source

Mercury is known to be present in septage, probably from a number of sources including human waste as a result of the deteriorating mercury-amalgam fillings, disposal of broken mercury thermometers, mercury fungicides in paint products, and other sources. When septage is ultimately disposed, whether by land application, incineration, or land filling, mercury may be reintroduced to the environment.

Approximately one-third of the households in Washington are served by on-site systems. The total amount of septage generated and the portions disposed through wastewater treatment plants or recycled by direct application to the land are not known. About 300 to 350 pumpers service on-site systems in Washington.

Quantity and Estimated Uncertainty

Sampling and analysis of septage for mercury and most other pollutants is not typically required under federal or state laws. Studies from the city of Tacoma in the early 1990s showed a mercury range of 1 ppm to 1430 ppm in septage**.** AMSA data from Ohio in "Mercury in Household Products" showed a median concentration of 6.95 ppm.

Groups Affected

Homeowners with septic systems, treatment facilities that accept septage or treat sewage, and farmers and other land owners who apply septage and biosolids to the land.

Septic-tank pumpers are not directly affected but are an important interest group for on-site systems.

Current Regulations and Policy

Chapter 70.95J RCW, Municipal sewage sludge - biosolids
Chapter 173-308 WAC, Biosolids management regulations

Reduction Options

To implement a successful pollution-prevention strategy for mercury in septage, Ecology would need to identify which products contain mercury and conduct outreach and education on safer alternatives or proper disposal, where possible.

Ecology could write a chapter on mercury to include in the Biosolids Management Guidelines, which could be an effective outreach tool. Ecology generally does not permit septage application though, so this would be more effective for biosolids and less so for septage. This could change as Ecology's septage-management advisory group works through the issue.

Recommended Actions

Proposed, Mid-term
Provide outreach material to septic pumping firms to distribute to customers.

Sewage Sludge Incinerators

Identification and Description of Source

In sewage, mercury tends to combine with sludge rather than remain ambient in water. When the sludge is incinerated, mercury may be released with stack emissions. Mercury not released may remain in ash. In years past, at least one facility gave its ash residual away as a free fill, but incinerator ash should be disposed of in a municipal solid-waste landfill. It may be stored on-site temporarily. Anacortes, Bellingham, Edmonds, Lynnwood, and Vancouver have sludge incinerators.

Quantity and Estimated Uncertainty

Table 12 shows the amount of sewage sludge incinerated in 2000. The current estimate of mercury released from these sewage sludge incinerators is 32 pounds per year (Table 19).

Groups Affected

Cities with sludge incinerators include Bellingham, Lynnwood, Anacortes, Edmonds, and Vancouver. A few smaller communities send their biosolids to these cities to be incinerated.

Current Regulations and Policy

In Washington State, USEPA has authority to permit sludge incinerators for their air emissions. So far, USEPA has not taken any action in Washington. Ecology is working with USEPA on a partnering approach to permitting these facilities under the state biosolids program, because sludge incinerators produce biosolids, treat biosolids, and send and receive biosolids from other facilities. Permitting of the incinerator portion of the operation would still fall to USEPA.

Table 12. Sewage Sludge Incinerated in 2000

Facility	Dry Tons	Incinerated at
Anacortes WWTP	604	Anacortes
Edmonds WWTP	2,674	Edmonds
LaConner WWTP, Skagit Co SD #1	8	Bellingham
Longview Fibre Company	125	Longview Fibre
Lynnwood WWTF	1,843	Lynnwood
North Bend WWTP	95	Edmonds
Post Point WWTP- Bellingham	3,806	Bellingham
Skagit County Sewer Dist #2	7	Bellingham
Sumner WWTP	57	Edmonds
Vancouver Westside TP	6,827	Vancouver
Whatcom County Water Dist #13	13	Bellingham
TOTAL	15,879	

WWTP – Wastewater Treatment Plant
WWTF – Wastewater Treatment Facility

Reduction Options

Any pollution-prevention programs designed to keep mercury out of sewage will result in lower emissions from sewage sludge incinerators.

Auto Recyclers

See *Vehicle Switches* in Chapter 3 of this document.

Steel Recyclers

Identification and Description of Source

Scrap metal is often contaminated with mercury, as mercury is used in auto switches and other equipment recycled in electric arc furnaces in steel mills.

Quantity and Estimated Uncertainty

Birmingham Steel reported a release of 0.7 pounds of mercury through air emissions in the 2000 Toxic Release Inventory.

Groups Affected

Auto manufacturers, auto recyclers, steel recyclers, and white-goods (appliance) recyclers.

Current Regulations and Policy

- Chapter 70.95C RCW / Chapter 173-307 WAC, Pollution Prevention Plan
- 40 CFR part 72, Implemented through Toxic Chemical Release Inventory Reporting Forms and Instructions
- Chapter 118-40 WAC, Section 313 of the Emergency Planning and Community Right-to-Know Act (adopted by reference)
- Steel recyclers are issued air permits by local air authorities under the federal Clean Air Act.

Reduction Options

Work with steel recyclers and other affected parties to develop comprehensive programs to remove auto and appliance switches.

Recommended Actions

Proposed, Short-term
Evaluate regulatory and voluntary programs for removing convenience mercury switches from vehicles.

Crematoria

Identification and Description of Source

There are 66 crematories in Washington,[44] none of which are currently permitted by the Department of Ecology.

Quantity and Estimated Uncertainty

The United Kingdom estimates that the average body contains 4.9 grams of mercury; Sweden estimates the amount at 4.4 grams. Cremations account for approximately 11 percent of all mercury emissions in the UK and 32 percent of mercury emissions in Sweden. Fifty-nine percent of deaths are cremated in Washington State, compared to 26 percent nationally. Using the British estimate for average mercury in human bodies, approximately 57 pounds of mercury are released in Washington annually through crematory stack emissions. Crematories are not regulated for mercury.

Groups Affected

Crematoria and their customers.

Research, Development, and Monitoring Options

Test stack emissions from crematoria to develop better data on mercury releases.

[44] http://www.cremationassociation.org/docs/00data-projtest-new.pdf, March 28, 2002.

Recommended Actions

Proposed, Mid-term
Work with the crematory industry in a collaborative approach to identify the most productive way to reduce mercury emissions from crematoria.

Recycling and Disposal as Hazardous Waste of Products Containing Mercury

Household Hazardous-Waste Facilities

The following household hazardous-waste facilities (Table 13) are listed in the recycling database as accepting mercury products. This does not necessarily include fluorescent lamps. The Solid Waste Program encouraged local governments to submit proposals for mercury-reduction projects as part of the Coordinated Prevention Grants program in 2002. Five proposals for mercury-reduction projects were funded.

Recommended Actions

Ongoing
Make funding available for local governments to increase collection of mercury products through Coordinated Prevention Grants.

Mercury Retirement

Issue Summary

A considerable amount of effort is being spent to prevent mercury release to the environment by collecting it from products for recycling. Large stocks of elemental mercury currently owned by the private sector, including recycling facilities, and the federal government do not have (or soon will not have) a market in this country. There are questions about whether exporting large quantities of mercury to other countries is environmentally responsible. There is a need to develop a solution for the long-term storage of elemental mercury.

Mercury collection programs are based on the need to prevent mercury release to the environment. USEPA considers elemental mercury to be a product. The price of elemental mercury has fallen considerably on the world market since the 1960s, making it more accessible to more people. Anecdotal evidence points to widespread contamination of the Amazon River as a result of mercury used by gold miners.

As chlor-alkali plants close, large volumes of elemental mercury will be available on the market.

Table 13. Household Hazardous-Waste Facilities Accepting Mercury Products

County	City	Name or Location of HHW Site	Address
Adams	Othello	Bruce Transfer Station	Lucy Rd 509-488-6171
Adams	Ritzville	Ritzville Transfer Station	Danekas Rd 509-659-1540
Asotin	Clarkston	Asotin Co. Landfill	2901 6th Ave 509-758-9230
Benton	Richland	Richland Landfill	Hwy 240, 3 miles NW of Richland 509-942-7498
Clark	Vancouver	Central Transfer and Recycling Center	11034 NE 117th Ave 360-256-8482
Clark	Vancouver	West Van Materials Recovery	6307 Lower River Rd 360-737-1727
Franklin	Pasco	Household Hazardous Waste Facility	Basin Transfer Station, 1721 Dietrich Rd 509-547-2088
Grays Harbor	Aberdeen	Central Transfer Station	4201 Olympic Hwy E at Transfer Station 360-533-1251
Island	Camano Island	Camano Is. Transfer Station/Recycle Park	75 E Camano Hill Rd 360-387-9696
Island	Coupeville	Coupeville Landfill/Recycle Park	630 West State Hwy 20 360-678-0504
Island	Langley	Bayview Transfer Station	5790 S Kramer Rd 360-321-4505
Island	Oak Harbor	Oak Harbor Transfer Station	3155 N Oak Harbor Rd 360-675-6161
Jefferson	Port Townsend	Jefferson Co. Moderate Risk Waste Facility	282 10th St 360-379-6911
King	Seattle	South Transfer Station	8100 Second Ave South 206-386-9790
Kitsap	Port Orchard	Kitsap Co. Moderate Risk Waste Facility	Olympic View Ind. Park: 5551 SW Imperial Way 360-337-5777
Kittitas	Ellensburg	Kittitas Co. Moderate Risk Waste Facility	925 Industrial Way 509-962-7542
Klickitat	Dallesport	Dallesport Transfer Station	136 Tidyman Rd 509-773-4448
Klickitat	Goldendale	Goldendale Transfer Station	Highway 142, west of town 509-773-4448
Klickitat	Roosevelt	Roosevelt Regional Landfill	Roosevelt Landfill 509-773-4448
Klickitat	White Salmon	BZ Corners Transfer Station	5 Fir Tree Rd 509-773-4448
Lewis	Centralia	Hazo Hut	Across street from 1411 S. Tower Ave 360-740-1221
Okanogan	Okanogan	Okanogan Co. Central Landfill Recycling	240 B&O Rd North 509-422-4530
Pend Oreille	Ione	North County Transfer Station	1712 Sullivan Lake Rd 509-442-3051

Groups Affected

USEPA, U.S. Department of Defense, U.S. Department of Energy, chlor-alkali facilities, consumers recycling mercury products, household hazardous-waste programs, mercury recyclers, and groups abroad (e.g., gold miners in the Amazon, thermometer manufacturers in India).

Current Regulations and Policy

The U.S. Department of Defense maintains the country's largest stocks of elemental mercury, 11 million pounds, in four facilities. Its current policy is to refuse accepting additional stocks of elemental mercury from the public for storage.

In February 2001, the Environmental Council of States (ECOS) passed a resolution calling on the federal government to recommend a "long-term storage plan" for mercury stocks.

On November 2, 2001, a joint letter was sent from the Association of State and Interstate Water Pollution Control Administrators, ECOS, the Association of State and Territorial Solid Waste Managers, the State and Territorial Air Pollution Program Administrators, and the Association of Local Air Pollution Control Officials to USEPA Administrator Christine Todd Whitman calling on USEPA to work with state officials to develop an integrated approach to reducing mercury contamination. Such a strategy would include creating a stewardship approach for the safe, long-term storage of elemental mercury.

Ongoing Activities

On November 14, 2001, USEPA Assistant Administrator G. Tracy Mehan, III, sent a memo to USEPA Administrator Christine Todd Whitman, proposing that USEPA senior managers develop policy recommendations on management of surplus mercury for her consideration.

Ecology staff will participate in multi-state discussions on creating a national mercury repository.

Activities of Other Groups

In September 2002, the Commission of European Communities released a report.

Recommended Actions

Ongoing
Work with the Quicksilver Caucus to develop proposals for long-term mercury management infrastructure.

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Mercury in the Environment

Air

Laws/Regulations Pertaining to Mercury in Water

- Chapter 173-400 WAC, General Regulations for Air Pollution Sources
- Chapter 173-460 WAC, Controls for New Sources of Toxic Air Pollutants
- 173-400-045 WAC, Control Technology Fees

Research and Monitoring

Washington has two monitoring stations as part of the National Atmospheric Deposition Program Mercury Deposition Network. One station is located at the Hoh Ranger Station in the Olympic National Park and the other is located in Seattle. Both are operated by Frontier Geosciences, Inc.

Water

Laws/regulations Pertaining to Mercury in Water

- Chapter 173.201A WAC, Water Quality Standards for surface waters of the state of Washington

  Thirty water bodies in Washington do no meet water quality standards for mercury. These have been placed on the 303(d) list, the list of water bodies failing to meet the state's water quality criteria.

  Bear-Evans Creeks
  Inner Bellingham Bay and Whatcom Waterway
  Inner Budd Inlet
  Inner Commencement Bay
  Outer Commencement Bay
  Duwamish Waterway and River (5 sections)
  Dyes Harbor and Port Washington Narrows
  Eagle Harbor
  Elliott Bay
  Franklin D. Roosevelt Lake
  Port Gardner and Inner Everett Harbor
  Green River (3 sections)
  North Hood Canal
  Central Puget Sound
  Sinclair Inlet
  Springbrook (Mill) Creek

Snohomish River
White (Stuck) River
Yakima River (5 sections)

- Chapter 173.200-040 WAC, Water Quality Standards For Ground Waters Of The State Of Washington
- Chapter 90.48 RCW, Water Pollution Control
- Federal Clean Water Act

Water quality regulations allow mixing zones because there are criteria levels of mercury. A mixing zone is an area around discharge where ambient water mixes with discharge. The mixing zone is used as a way of meeting criteria, and modeling by water quality is used in determining what pollutant levels are allowed in the zone.

Sediment

In 1991, Ecology adopted the Sediment Management Standards (Chapter 173-204 WAC). To date, Washington remains the only state with adopted standards for sediment quality. The Sediment Management Standards address three major points:

1. Procedures for cleaning up historic sediment contamination
2. Procedures for preventing future sediment contamination from discharges
3. Standards for defining sediment contamination

Planned Research and Monitoring Activities

Lake Whatcom Mercury Source Identification

A team of scientists from the U.S. Geological Survey (USGS) will be developing a scope of work for an agreement with Whatcom County Health and Human Services to investigate mercury sources in Lake Whatcom. USGS will conduct a preliminary study in the next year and provide intermittent work products.

In the late summer and fall of 2001, Ecology's Environmental Assessment Program (EAP) collected fish for tissue analysis from several lakes within a 50-mile radius of Lake Whatcom. These data will be published in early 2003 as part of the Washington State Toxics Monitoring Program annual report.

In September 2002, EAP also conducted surface sediment sampling and sediment coring, in conjunction with USGS, from Lake Whatcom and several surrounding lakes. As part of this study, surface water from 10 tributaries to the lake is being monitored for mercury every other month for one year. Data from the Lake Whatcom sediment investigation will provide important clues about the extent to which mercury contamination in the lake resulted from global deposition or more regional air and water sources.

EAP has been and continues to sample extensively to identify how widely distributed contaminants, including mercury, are in the sediment throughout Puget Sound and into the Strait of Georgia and the Strait of Juan de Fuca. Work conducted by the PSAMP sediment component includes examining the health of the communities of small animals living in or on the sediment, which are the primary food items of many of the fish humans eat and which are themselves affected by mercury.

Toxic-Waste Cleanup Sites

Washington's Model Toxics Control Act became law in 1989 with passage of Initiative 97. The purpose of the act was to establish a cleanup law and provide funding to clean up contaminated sites, improve management of hazardous wastes, and prevent future contamination through pollution prevention. From this law, Ecology's Toxics Cleanup Program (TCP) was founded.

The main purpose of the TCP is to get and keep contaminants out of the environment. Using money from the fund established by the act, the program has identified more than 9,000 contaminated sites in Washington. Of those, nearly 5,000 sites require no further action as of 2003.

Under state law, TCP has the ability to investigate, or require an investigation of, any release or threatened releases of hazardous substances. This investigation is intended to determine the types of hazardous substances and the extent they have spread, if at all. This is followed by actions to clean up the site.

Many of the sites TCP works on are listed on the USEPA's National Priority List (Superfund). TCP provides regulatory assistance to USEPA at 63 federal Superfund sites in the state. In specific instances, the state is the principal regulatory agency responsible for cleaning up the sites. Washington is one of the few states that has this type of relationship with USEPA.

The first step in the cleanup process is to investigate a site. Once the TCP receives a complaint about a piece of property or the practices of an owner of operator, a TCP inspector will conduct an initial investigation, which involves looking at the present conditions of the site for signs of possible spills and the use and storage of hazardous waste. Some sampling may be involved.

If it is determined that further work is required at a site after the initial investigation, a site-hazard assessment may be conducted. A site hazard assessment provides basic information about a site. TCP then uses the Washington Ranking Method to estimate the potential threat the site poses, if not cleaned up, to human health and the environment. A score of one represents the highest level of concern relative to other sites, and a score of five represents the lowest.

High-priority sites are Superfund sites and sites Ecology has ranked 1 or 2. Due to greater health and environmental concerns, Ecology works primarily on high-priority sites. A site becomes involved in the Natural Resource Damage Assessment process when its natural resources

(such as fish and shellfish) or services provided (edible fish or recreational fishing days) become damaged or lost as a result of contamination. The state, along with federal and tribal trustees, can require compensation for the injury caused, from the time of release to the time of full recovery. Compensation is used to restore, replace, or acquire the equivalent habitat. To date, sites with natural-resource damage assessment activities have been mainly in marine areas and are often Superfund sites. TCP oversees contaminated sites with a ranking of 3, 4, or 5.

TCP has identified the cleanup of persistent, bioaccumulative toxins (PBTs) and abandoned mines as two of six major challenges the program will continue to face in future years.

The Integrated Site Information System, Ecology's contaminated-sites database, has identified 36 counties with multiple sites contaminated with metals and priority pollutants affecting all environmental media (air, land, water). Mercury may be one of the metals and/or priority pollutants. Snohomish and Pierce counties have more than 100 sites, while King County has 475 sites potentially contaminated with mercury.

Until very recently, TCP has not consistently tracked mercury as an individual contaminant at cleanup sites. As a result, Ecology does not have comprehensive records on which toxic cleanup sites have or have had mercury contamination. TCP is moving to a system that will require reporting to a level of detail such that mercury can be tracked (PRO 840 Handling Environmental Data Submittals). Special efforts would be required to identify the sites statewide where mercury has been a contaminant and to populate the new data fields.

Based on an informal survey of project coordinators in August 2000, TCP identified a partial list of the sites having mercury or multiple PBTs (Table 14).

Table 14. Partial List of Sites that Have or Had Mercury as of August 2000.

Site name	City	Contaminants	Status
Cameron	Yakima	Multiple PBTs	Cleaned up
Eagle Harbor	Bainbridge	Benzo(a)pyrene, mercury	Cleaned up or in process of cleanup
Former Lake Hills Sewage Treatment Plant	Redmond	Mercury, PCBs	Cleanup complete. Excavation and off-site disposal.
Georgia Pacific	Bellingham	Mercury	Remedial investigation, some cleanups completed, some in process
King County Metro, Lake Union site	Seattle	Benzo(a)pyrene, mercury	Cleanup in progress. Excavation and off-site disposal at a subclass C landfill.
Lake Union	Seattle	Dieldrin, benzo(a)pyrene, mercury, PCBs	Pre-remedial investigation stage, waiting to be cleaned up
Lower Duwamish Waterway	Seattle/ Tukwila	PCBs, benzo(a)pyrene, furans, mercury, hexachlorobenzene	Remedial investigation/final studies planned
Martin Airfield	Walla Walla	Agricultural chemicals	Cleaned up
Noble Metals	Seattle	Mercury	Remediation complete
Puget Sound Naval Shipyard (Op. Unit B)	Bremerton	PCBs, mercury	Process of cleanup
Wenatchee Tree Fruit Research Station	Wenatchee	Multiple PBTs	Cleaned up
Western Farm Services	Pasco	Agricultural chemicals with PBTs	Remedial investigation
Weyerhaeuser	Longview	Mercury	Majority of mercury on-site removed, final studies under review
Whatcom Waterway	Bellingham	Mercury in sediments	Draft cleanup action plan in development, proposes containment/possible treatment
Wood Industries	Yakima	Multiple PBTs	Cleaned up

PBTs - persistent, bioaccumulative toxins
PCBs - polychlorinated biphenyls

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Mercury in the Food Chain

Humans

Although mercury comes from many sources (both human-caused and natural), the most common way people are exposed to enough mercury to cause them harm is through eating certain predatory, long-lived fish that can accumulate methylmercury (an organic compound of mercury) into their tissues at levels above what the human body can safely tolerate.

Mercury discharged to land, air, or water can eventually find its way to lakes, rivers, and the ocean where it settles into sediments. Here, bacteria convert the inorganic mercury compound to methylmercury. Fish accumulate most of the methylmercury in their tissues from the prey they eat.

Fish

Two recent studies have addressed the risks associated with consuming mercury-containing fish from specific locations in Washington:

- "Exposure Analysis of Five Fish Consuming Populations for Overexposure to Methylmercury"; Washington State Department of Health, Environmental Health Programs; Olympia, Washington; January 2001.

Based on a detailed analysis of fish consumption rates, this report concludes that some Native American fish consumers are likely to exceed the Department of Health's tolerable daily intake (TDI) for methylmercury. The report also states that such overexposure to methylmercury can be reduced below the TDI by people eating a variety of salmon species, in order to limit the amount of chinook salmon consumed. Chinook contain the highest levels of methylmercury of all the salmon species analyzed.

- "Public Health Assessment: Lower Duwamish Waterway;" Seattle, King County, Washington; Washington State Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry; 2002.

Mercury was included in a study of four contaminants in fish from the Lower Duwamish Waterway and Elliott Bay. Consumption of anadromous species (chinook and coho salmon), bottomfish (English sole), other finfish (quillback rockfish and shiner perch), and crab was evaluated. Using fish consumption rates taken from a survey of the Suquamish Tribe, the high-end consumption dose calculated for all salmon types was found to be 1.9 times higher than the oral reference dose for methylmercury. Because salmon are migratory fish, their mercury concentrations are not thought to be site-related. The report also found relatively high levels of mercury in quillback rockfish in non-urban areas of Puget Sound. Limited sampling indicated that both red rock and Dungeness crab also contain elevated levels of mercury.

Fish-eating Birds

No information has been identified regarding the effect of mercury on fish-eating birds in Washington State.

Fish-eating Mammals

No information has been identified regarding the effect of mercury on fish-eating mammals in Washington State.

Mercury in the Human Body

Once mercury enters the body it is not easily eliminated in the urine or feces. Mercury tends to accumulate over time with continued exposure.

Methylmercury enters the brain readily, passing through the "blood-brain barrier," attached to an amino acid. Here methylmercury is slowly converted to inorganic mercury, which is very persistent (long-lived). Mercury also can be carried to other tissues and be recirculated between the liver and intestine, attached to a sulfur-containing compound (glutathione).

Methylmercury's primary toxic effect is on the brain. The developing brain is especially sensitive to the harmful effects of methylmercury. In the brains of fetuses and infants, mercury affects all cells within the brain and causes a general disturbance in both normal development and brain growth by interfering with cell division of neurons and the migration of neurons to various functional parts of the brain. In studies looking at young children in Minamata, Japan, and in Iraq, damage was manifested by delayed development and changes in anatomy. In other studies of fish-eating groups, neuropsychological effects, measured by tests of reasoning, reflexes, and behavior, showed harm at especially low doses.

In the adult brain, there is a delay of weeks or months between exposure and the onset of symptoms. The first symptoms are strange physical sensations ("pins and needles," numbness). With continuing exposure and accumulation of mercury, balance and coordination deteriorate, and speech can falter. Constricted of visual fields and hearing loss may follow. These problems are caused by changes in sensation that are processed through the cerebellum (which maintains balance and smooth functioning of muscles). Some of these symptoms may result from the inability of some neural cells to repair initial damage because new proteins cannot be made. Whether adults suffer damage depends greatly on whether individuals have inherent protective mechanisms, such as whether they can make enough of certain molecules (glutathione) that can bind mercury and prevent it from interacting with neural cells.

Other organ systems, especially the heart and blood vessels, also are affected by methylmercury. Studies of fish-consuming populations in Finland have shown statistically significant associations with risk of cardiovascular disease, especially increased progression of carotid atherosclerosis. In a study of seven-year-old children, elevation in both systolic and diastolic blood pressure was associated with increased exposure to mercury from their mothers' consumption of certain fish tissues and meats during pregnancy.

Health Advisory for Women of Childbearing Age

The Washington State Department of Health (DOH) has issued a consumption advisory for women of childbearing age (see Appendix B). The DOH recognizes that fish is good food that is low in fat, and is a good source of proteins and certain fish oils that are good for the heart and cardiovascular system. Catching, cooking, and eating fish are important cultural and family practices. The DOH recommends that people eat a variety of fish and shellfish as part of a balanced, healthy diet.

However, because of health concerns due to mercury in fish, women of childbearing age and children under six are advised:

- Do not eat any shark, swordfish, tilefish, king mackerel, or either fresh-caught or frozen tuna steaks.
- Limit the amount of canned tuna eaten, based upon bodyweight. Guidelines are:
  - Women of childbearing age should limit the amount of canned tuna they eat to about one can (six ounces) per week. A woman who weighs less than 135 pounds should eat less than one can of tuna per week.
  - Children under six should eat less than one half a can of tuna (three ounces) per week. Specific weekly limits for children under six range from one ounce for a child who weighs about 20 pounds, to three ounces for a child who weighs about 60 pounds.

Other Sources of Mercury Exposure

Other sources of mercury exposure that could possibly occur include:

- Breathing vapors in air from spills.
- Breathing contaminated workplace air or skin contact during use in the workplace (dental, health services, chemical, and other industries that use mercury).
- Practicing rituals that include the use of mercury.
- Release of mercury from dental work and medical treatments.

Education and Outreach

Several sections of this plan call for focused education and outreach efforts. Important groups where education and outreach activities are to be directed include the general public, dental and health care communities, schools and certain industries, and state and local government agencies.

In October 2002, the Department of Ecology, in partnership with the King County Hazardous Waste Management Program, conducted a statewide survey to determine the level of public's awareness of issues associated with mercury. The baseline established by this survey revealed a low level of public awareness in several areas: the prevalence and nature of mercury-containing products, proper disposal procedures, and environmental and health effects of mercury. The full survey results are posted in a report on Ecology's Web site at http://www.ecy.wa.gov/programs/eap/pbt/pbtfaq.html.

Where feasible, education and outreach activities proposed under this plan will be developed and implemented by Ecology in conjunction with representatives from each target group. In each case a brief plan outlining goals, objectives for specific activities, criteria for evaluation, costs, and staff time will be written.

A key strategy for encouraging education at the community level is the use of the Department of Ecology's Coordinated Prevention Grants. Currently five jurisdictions are developing programs:

- Kittitas County – Mercury thermometer exchange.
- Yakima County – Purchase of a crusher for fluorescent tubes.
- Kitsap County – Mercury thermometer exchange
- City of Tacoma – Mercury thermometer exchange
- Thurston County – Phone survey on mercury issues and thermometer exchange

Additionally, DOH will continue to expand its education and outreach efforts with health care providers and the public, regarding the statewide advisory for mercury in fish, and other fish advisories that exist or may occur. Nutrition consultants with the DOH Women, Infant and Child health program will continue to be instrumental in reaching young women and small children with this information.

Research and Monitoring

Ongoing Research

Washington State Toxics Monitoring Program

Department of Ecology

The goal of the Toxics Monitoring Program is to investigate the occurrence and concentrations of toxic contaminants in edible fish tissue and surface waters from freshwater environments in Washington where contamination is suspected. The objectives of the program are to provide information about the level of toxic contamination in the surface water and edible fish tissue from freshwater lakes, rivers, and streams that have not yet been monitored or where relevant data are greater than 10 years old; to provide a screening-level assessment of the potential for harm by toxic chemicals on aquatic biota and other wildlife; to provide screening level information to the Washington State Department of Health that could be used to trigger additional studies for evaluating health risks associated with consuming fish; and to provide information for resource managers and the public about the status of toxic contamination in water and edible fish from freshwater environments in Washington.

Monitoring Program to Verify 303(d) Metals Listings for Selected Rivers and Creeks

Department of Ecology

In January 1998, Ecology, USEPA, Northwest Environmental Advocates, and the Northwest Environmental Defense Center agreed to a cleanup schedule directing how Washington will improve the health of nearly 700 water segments on the 303(d) list. In light of this agreement, Ecology's Environmental Assessment Program has been reviewing the 1998 303(d) list to determine how to best address the various listings. During the course of this review, 13 metals listings for five rivers and one creek were identified as needing verification sampling before resources were committed to cleanup plans, also called total maximum daily loads (TMDLs). The listings are based on old or questionable data.

The goal of the monitoring program is to verify the validity of the metals listings. Following Ecology (2001) guidance, the decision to recommend retaining a water body or water-body parameter on the 303(d) list will be based on finding at least one violation of state standards.

Puget Sound Ambient Monitoring Program

Puget Sound Water Quality Action Team, Department of Ecology, Department of Fish and Wildlife, Department of Health, Department of Natural Resources, King County Department of Natural Resources, National Marine Fisheries Service, U.S. EPA, U.S. Fish and Wildlife

The Puget Sound Ambient Monitoring Program (PSAMP) brings together local, state, and federal agencies, coordinated by the Puget Sound Water Quality Action Team, to assess trends in environmental quality in Puget Sound. As a member of PSAMP, the Department of Fish and Wildlife monitors the levels of mercury in the edible muscle tissue, liver, or whole bodies of fish and crabs. The Department of Ecology monitors the levels of mercury in Puget Sound sediments.

Statewide Mercury in Edible Fish Tissue Project

Department of Ecology

Several studies in recent years have found problem levels of mercury in freshwater fish from Washington State. These studies were limited to specific water bodies (Lake Whatcom and Lake Roosevelt); consequently, limited information is available on the distribution and magnitude of mercury in edible fish tissue statewide. In addition, regional information is lacking on other factors that might influence the uptake of mercury into freshwater fish.

To address the lack of information on fish tissue concentrations, Ecology's Environmental Assessment Program (EAP) has collected and is in the process of analyzing game fish from approximately 20 water bodies, mainly lakes, distributed statewide. The target species for this work is bass, due to its wide distribution and capacity to bioaccumulate mercury. A target of 10 fish of a single species, either smallmouth bass or largemouth bass, were collected from each lake or river and analyzed individually for mercury. Aging structures also were collected from the fish to allow for mercury content correlation with fish age, weight, and length. Muscle fillet from each bass were separately.

To evaluate other factors affecting mercury uptake, surface sediments from three locations in each lake also were analyzed for total mercury. Single measurements for pH, dissolved oxygen, conductivity, and temperature were taken, approximately one meter from the bottom. The water depth was measured at each sampling location, the secchi depth was measured, and a single water sample was collected for hardness and alkalinity, also approximately one meter from the bottom. Surface sediments from three locations in each lake/river were collected and analyzed for mercury. A final project report is being prepared that discusses the study findings. In addition, the data generated will be entered into Ecology' environmental information management system.

Lake Whatcom Mercury in Sediment Project

Department of Ecology

Fish tissue sampling conducted by EAP in previous studies has found mercury levels of potential concern in game fish (primarily bass) from the lake. Mercury concentrations are high enough that the lake will probably be listed on the next version of the federal Clean Water Act Section 303(d) list of impaired water bodies. To address the issue of whether ongoing sources of mercury are present or if natural conditions are promoting the uptake of mercury, EAP will conduct a joint study with USGS in fiscal-year 2003. EAP will collect approximately 30 surface sediments and three cores from the lake to evaluate current and historic mercury concentrations. Analysis will include total mercury in all samples. Methylmercury levels also will be determined in approximately 15 of the surface sediment samples. In addition, as part of the Lake Whatcom dissolved-oxygen cleanup plan (TMDL), water samples will be collected quarterly from 10 tributaries to the lake and analyzed for total mercury. The USGS will review existing information on the watershed and supplement funding (via Whatcom County Health Department) to collect an additional five cores from surrounding lakes. Together these efforts may provide information to determine the current status of sources of mercury to the Lake Whatcom watershed. The need for a more formal cleanup plan to address mercury also will be evaluated.

Transport of Mercury and Other Metals to the West Coast of the U.S.

University of Washington and Frontier Geosciences, Inc., funded by USEPA

Previous work of researchers has shown that combustion-derived air pollutants from Asia can be transported to the U.S. in 6 to 8 days. This discovery was made based on observations of a number of gaseous and aerosol species at the Cheeka Peak Observatory on the northwestern tip of Washington State. Recently, the project has shown that the largest flux of these pollutants often occurs in the free troposphere, above the marine boundary layer. Since Asia is also a region of high mercury emissions, the USEPA-NERL and Office of International Activities have sponsored a project to measure mercury and coarse and fine aerosol chemistry at Cheeka Peak Observatory. Measurements began in the spring of 2001 and continued until August 2002. Preliminary "near-real time" data from Cheeka Peak can be viewed at http://faculty.washington.edu/djaffe/data.htm.

Quicksilver Caucus – USEPA Mercury Stewardship Initiative

Department of Ecology, Environmental Council of States, USEPA

Ecology is participating as part of the Quicksilver Caucus, a coalition of state government organizations formed to highlight their concerns about mercury pollution. The group includes state air, water, and waste associations, the Environmental Council of States (ECOS), the National Governors' Association, and other state organizations. ECOS is providing logistical support to the Quicksilver Caucus. USEPA is working with states, through the Quicksilver Caucus, to resolve two difficult mercury issues: How to meet mercury-reduction goals for specific water bodies where mercury water pollution is caused primarily by air deposition, and how to ensure safe stewardship of mercury supplies and wastes.

USEPA Region 10 Mining Workgroup

USEPA, Department of Ecology, Department of Natural Resources, U.S. Department of Agriculture Forest Service, U.S. Department of Interior Bureau of Land Management.

The USEPA Region X mining coordinator has brought these agencies together as part of an effort to begin coordinating abandoned mine issues. To date, this activity has focused on identifying what information is presently available regarding mine locations and existing problems, and identifying of each agency's authorities and capabilities for dealing with mine issues. The present outcome of this work is an effort being coordinated by the Washington State Department of Natural Resources to gather all agency data into a single multi-agency database/geographic information system (GIS) system. Other agencies, including the U.S. Forest Service and the U.S. Bureau of Land Management, have recently received USEPA-delegated authority to apply the Comprehensive Environmental Response, Compensation, and Liability Act to manage sites on lands under their authority.

Mercury Deposition Network

National Atmospheric Deposition Program, Frontier Geosciences, Inc.

The objective of the Mercury Deposition Network is to develop a national database of weekly concentrations of total mercury in precipitation and the seasonal and annual flux of total mercury in wet deposition. The data will be used to develop information on spatial and seasonal trends in mercury deposited to surface waters, forested watersheds, and other sensitive receptors. There are two monitoring sites in Washington: The Hoh Ranger Station in Olympic National Park has been inactive since 1995, and the National Oceanographic and Atmospheric Administration's facility in Seattle is operated by Frontier Geosciences, Inc.

Potential Research Questions

- How accurate is reporting for mercury on the Toxics Release Inventory?
- Is mercury released during the processing of gold ore in Washington? If so, how much is released, what is the fate of the released, and what control options exist?
- What is the fate of mercury at crematoria?
- What is the effect of mercury on Washington wildlife (e.g., orcas, eagles)?
- What is the fate of mercury in biosolids?
- How much mercury is in effluent verses biosolids?

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Source Tables and Calculations for Mercury Release Estimates

Table 15. 2000 Toxics Release Inventory for Mercury and Mercury Compounds (in lbs)

SIC	Facility Name	City	County	Hg or Hg compounds	Air	Water	Land	Total
1041	K2 Mine	Curlew	Ferry	Hg compounds	0.00	0.00	776.60	776.60
1041	Lamefoot Mine	Republic	Ferry	Hg compounds	0.10	0.00	655.20	655.30
2611	Kimberly Clark Corp.	Everett	Snohomish	Hg compounds	1.00	26.00	10.00	37.00
2611	Georgia-Pacific West, Inc.	Bellingham	Whatcom	Hg compounds	3.00	10.00	0.00	13.00
2621	Weyerhaeuser Company	Longview	Cowlitz	Hg compounds	38.00	1.60	0.00	39.60
2819	PQ Corporation - Tacoma	Tacoma	Pierce	Hg compounds	40.64	0.00	0.00	40.64
2819	General Chemical	Anacortes	Skagit	Hg compounds	0.00	0.00	17.00	17.00
291	BP Cherry Point Refinery	Blaine	Whatcom	Hg compounds	0.10	0.00	37.80	37.90
2911	Tosco Refining Company Ferndale Refinery	Ferndale	Whatcom	Hg compounds	0.01	0.00	0.00	0.01
2911	Tesoro Northwest Company	Anacortes	Skagit	Hg compounds	4.40	11.00	41.00	56.40
2911	Puget Sound Refining Company	Anacortes	Skagit	Hg compounds	3.70	0.90	25.80	30.40
3241	Ash Grove Cement Co	Seattle	King	Hg compounds	62.00	0.00	0.00	62.00
3274	Graymont Western U.S., Inc. Tacoma	Tacoma	Pierce	Hg compounds	1.40	0.00	0.00	1.40
3312	Birmingham Steel Corp. Seattle, WA. Steel Div.	Seattle	King	Hg compounds	0.70	0.00	0.00	0.70
3334	Kaiser Aluminum & Chemical Corporation – Mead Works	Mead	Spokane	Hg	0.00	0.00	0.00	0.00
3334	Intalco Aluminum Corporation	Ferndale	Whatcom	Hg	0.00	0.00	0.00	0.00
3334	Reynolds Metals Co. Longview Reduction Plant	Longview	Cowlitz	Hg	0.60	0.00	0.00	0.60
3499	Honeywell Electronic Materials, Inc.	Spokane	Spokane	Hg compounds	0.10	0.00	0.00	0.10
3812	Honeywell	Redmond	King	Hg	0.00	0.00	0.00	0.00
4911	City of Tacoma Steam Plant No 2	Tacoma	Pierce	Hg compounds	49.00	0.00	0.00	49.00
4911	TransAlta Centralia Generation / Mining	Centralia	Lewis	Hg	374.00	0.29	62.00	436.29
4953	Burlington Environmental, Inc.	Seattle	King	Hg compounds	0.00	0.00	0.00	0.00
4953	Burlington Environmental, Inc	Tacoma	Pierce	Hg compounds	0.00	0.00	0.00	0.00
4953	Allied Technology Group, Inc.	Richland	Benton	Hg	0.00	0.00	2.00	2.00

SIC = standard industrial classification

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Table 16. Pounds of Mercury in Biosolids not Incinerated in 2000

Summary: Calculated pounds of mercury in non-incinerated biosolids for facilities reporting mercury. Took ratio of this number to total of non-incinerated biosolids to give 331.3 pounds of mercury in non-incinerated biosolids for year 2000.

(71859.7 tons/64702.5 tons) x 298.3 lbs = 331.3 lbs Hg in non-incinerated biosolids

List of 84 facilities that produced biosolids and reported mercury data in 2000, not including facilities that incinerated sludge: Anacortes, Edmonds, Longview Fibre, Lynnwood, Post Point-Bellingham, Vancouver (east and west), and Whatcom Co. #13.

(Tons of biosolids) x (ppm Hg) x (0.002 factor) = lbs Hg

Facility	Biosolids (tons)	Mercury (ppm)	Factor	Mercury (lbs)
Aberdeen & Cosmopolis, Cities	508.50	2.50	0.002	2.54
Arlington WWTP	251.98	1.53	0.002	0.77
Asotin WWTF	22.00	0.92	0.002	0.04
Bainbridge Island WWTF	81.15	3.09	0.002	0.50
Bio Recycling LSP - Centralia	860.45	0.70	0.002	1.20
Birch Bay Water & Sewer District	144.00	0.38	0.002	0.11
Bremerton WWTP	645.00	1.29	0.002	1.66
Bridgeport WWTP	4.50	1.90	0.002	0.02
Buckley WWTP	62.20	1.30	0.002	0.16
Castle Rock WWTP	25.00	3.90	0.002	0.20
Cedar Creek Corrections Center	6.20	1.20	0.002	0.01
Central Kitsap WWTP	942.18	3.10	0.002	5.84
Central WWTP #1	3594.00	1.42	0.002	10.21
Centralia WWTP	287.10	1.04	0.002	0.60
Chambers Creek WWTP	1986.36	1.06	0.002	4.21
Chehalis WWTP	112.80	7.55	0.002	1.70
Chelan WWTP	235.90	2.33	0.002	1.10
Cheney Biosolids Compost Facility	1772.36	0.90	0.002	3.19
Cherrywood Mobile Home Manor	1.25	0.01	0.002	0.00
Clark Public Utilities WWRP	105.70	0.35	0.002	0.07
Clarkston WWTP	160.83	3.90	0.002	1.25
Cowlitz Water Pollution Control	1400.00	1.23	0.002	3.44
Des Moines Creek TP	449.36	0.61	0.002	0.55
Douglas County Sewer Dist#1 WWTP	160.00	1.75	0.002	0.56
Ellensburg, City of	359.89	2.09	0.002	1.50
Enumclaw WWTP	145.00	3.95	0.002	1.15
Everett Water Pollution Control Facility	2500.00	2.39	0.002	11.95
Everson WWTP	66.43	0.49	0.002	0.07
Ferndale WWTP	55.00	1.80	0.002	0.20
Fort Lewis WWTP	360.00	4.96	0.002	3.57
Friday Harbor WWTP	49.00	3.37	0.002	0.33
Gig Harbor WWTP	154.00	2.17	0.002	0.67
Grandview WWTP	857.00	0.64	0.002	1.10
Granite Falls WWTP	90.00	1.18	0.002	0.21
Hartstene Pointe WWTP	4.25	1.43	0.002	0.01
Ilwaco WWTP	62.00	0.90	0.002	0.11

Facility	Biosolids (tons)	Mercury (ppm)	Factor	Mercury (lbs)
Kalama, City of, WWTP	14.50	0.02	0.002	0.00
Kingston WWTP	34.08	4.76	0.002	0.32
Lakota WWTP	760.72	1.43	0.002	2.18
Long Beach WWTP	30.00	0.33	0.002	0.02
LOTT WWTF	2296.00	4.20	0.002	19.29
Mabton WWTP	18.00	1.20	0.002	0.04
Manchester WWTP	33.48	0.66	0.002	0.04
McNeil Island WWTP	29.38	0.30	0.002	0.02
Medical Lake WWTP	3.40	1.60	0.002	0.01
Miller Creek WWT & Composting	320.00	1.30	0.002	0.83
Monroe WWTP	155.00	1.22	0.002	0.38
Morton WWTP	18.00	2.70	0.002	0.10
Mount Vernon WWTP	495.00	0.74	0.002	0.73
Oak Harbor RBC WWTP	47.87	2.30	0.002	0.22
Oak Harbor Seaplane Lagoon WWT	500.00	6.08	0.002	6.08
Olympus Terrace WWTP	261.70	1.93	0.002	1.01
Omak WWTP	122.25	0.93	0.002	0.23
Pasco WWTP	206.00	3.99	0.002	1.64
Picnic Point POTW (Alderwood)	360.47	0.48	0.002	0.35
Port Angeles, City of	245.30	1.26	0.002	0.62
Port Orchard/Karcher Ck WWTF	224.00	3.18	0.002	1.42
Port Townsend WWTP	259.15	4.04	0.002	2.09
Prosser, City of	151.60	1.72	0.002	0.52
Pullman WWTP	448.00	3.10	0.002	2.78
Puyallup WPCP	592.00	0.78	0.002	0.92
Rainier State School WWTP	6.90	3.33	0.002	0.05
Redondo WWTP	211.00	0.75	0.002	0.32
Richland WWTF	878.00	0.85	0.002	1.49
Ridgefield WWTP	34.83	0.12	0.002	0.01
Salmon Creek WWTP	696.79	3.38	0.002	4.71
Salmon Creek WWTP - Burien	245.00	1.17	0.002	0.57
Sedro-Woolley WWTP	165.16	2.79	0.002	0.92
Selah WWTP	221.79	1.55	0.002	0.69
Shelton WWTP	367.49	1.20	0.002	0.88
South Treatment Plant (Renton)	13483.00	2.73	0.002	73.62
Spokane Advanced WWTP	6852.00	2.19	0.002	30.01
Stevens Pass Sewer Dist WWTP	4.00	5.18	0.002	0.04
Sumner WWTP	225.00	1.42	0.002	0.64
Sunnyside, City of	273.00	3.46	0.002	1.89
Suquamish WWTP	45.26	0.44	0.002	0.04
Tjoelker Enterprises WWTP	433.00	0.90	0.002	0.78
Twisp WWTP	44.50	0.93	0.002	0.08
Walla Walla WWTP	322.00	3.73	0.002	2.40
Washougal WWTP	100.00	0.40	0.002	0.08
Wenatchee WWTP	511.00	4.09	0.002	4.18
West Point WWTP	13283.00	2.71	0.002	71.99
Winlock WWTP	50.00	0.60	0.002	0.06
Woodland WWTP	102.53	1.14	0.002	0.23
Tons Biosolids - 64702.41				Lbs Hg - 298.36

Table 17. List of Facilities that Reported Biosolids Production in 2000

List of 182 facilities, not including facilities that incinerated sludge: Anacortes, Edmonds, Longview Fibre, Lynnwood, North Bend, Post Point-Bellingham, Vancouver (east and west), Whatcom Co. #13.

Facility	Tons Biosolids
Aberdeen & Cosmopolis, Cities	508.50
Alcoa Wenatchee Works	1.00
Alderbrook Inn Resort Sewage Treat. Plant	1.00
Arco Cherry Point Refinery	4.00
Arlington WWTP	251.98
Asotin WWTF	22.00
Bainbridge Island WWTF	81.15
Barnes Point WWTP	1.30
Beverly Beach	0.70
Bingen WWTP	29.30
Bio Recycling LSP - Centralia	860.45
Birch Bay Water & Sewer Dist	144.00
Bishop Sanitation, Inc.	38.20
Blaine STP	59.00
Boston Harbor WWTP	2.00
Bremerton WWTP	645.00
Brewster WWTP	146.00
Bridgeport WWTP	4.50
Buckley WWTP	62.20
Burkey Enterprises	38.40
Camas WWTP	29.39
Carlyon Beach WWTP	8.60
Castle Rock WWTP	25.00
Cedar Creek Corrections Center	6.20
Central Kitsap WWTP	942.18
Central WWTP #1	3594.00
Centralia WWTP	287.10
Chambers Creek WWTP	1986.36
Chehalis WWTP	112.80
Chelan WWTP	235.90
Cheney Biosolids Compost Facility	1772.36
Cherrywood Mobile Home Manor	1.25
Cheyne Landfill STP	827.70
Clallam Bay Sekiu POTW	0.08
Clark Public Utilities WWRP	105.70
Clarkston WWTP	160.83
Consol. Support Serv Lv1	1.84
Country View Water & Sewer District	8.50
Coupeville WWTP	48.80
Cowlitz Water Pollution Control	1400.00
Crystal Mountain Inc WWTP	5.70
Curlew Job Corps WWTP	3.00

Facility	Tons Biosolids
Dayton WWTP	9.50
Des Moines Creek Treatment Plant	449.36
Diablo WWTP	0.70
Diamond Lk. W&S Dist WWTP	2.10
Douglas County Sewer Dist#1 WWTP	160.00
Duvall WWTP	77.00
Eastsound S&W District WWTP	8.80
Echo Glen Children's Center	6.94
Electric City WWTP	26.27
Ellensburg, City Of	359.89
Endicott WWTP	2.00
Entiat WWTP	11.80
Enumclaw WWTP	145.00
Everett Water Pollution Control Facility	2500.00
Everson WWTP	66.43
Ferndale WWTP	55.00
Fisherman Bay STP	1.50
Fort Lewis WWTP	360.00
Friday Harbor WWTP	49.00
Garfield STP	4.00
Gig Harbor WWTP	154.00
Grand Mound WWTP	8.60
Grandview WWTP	857.00
Granite Falls WWTP	90.00
Hartstene Pointe WWTP	4.25
Holloway Farms	86.00
Holmes Harbor WWTP	3.50
Ilwaco WWTP	62.00
Indian Ridge WWTP	0.50
Kaiser Aluminum Mead Works	2.50
Kalama, City Of, WWTP	14.50
Kingston WWTP	34.08
Kitsap County Sewer Dist #7 WWTP	3.81
Klickitat WWTP	3.00
LaConner WWTP, Skagit Co SD #1	138.10
Lake Stevens Sewer District STP	375.00
Lakota WWTP	760.72
Langley WWTP	31.30
Leavenworth WWTP	52.97
Lewis County Water Dist #2 WWTP	1.00
Lind WWTP	7.00
Log Cabin Treatment Plant	0.25
Long Beach WWTP	30.00
Longmire WWTP	1.60
Longview Aluminum LLC	5.45
LOTT WWTF	2296.00
Lyle WWTP	3.00

Facility	Tons Biosolids
Lynden WWTP	626.00
Mabton WWTP	18.00
Manchester WWTP	33.48
McCleary WWTP	15.00
McNeil Island WWTP	29.38
Medical Lake WWTP	3.40
Messenger House STP	0.58
Metaline WWTP	1.00
Miller Creek WWT & Composting	320.00
Monroe WWTP	155.00
Montesano WWTP	15.12
Morton WWTP	18.00
Mount Vernon WWTP	495.00
Moxee WWTP	22.50
Mullen Hill Terrace Mobile Home Park	0.80
Naselle Youth Camp STP	3.00
Nestle Regional Training Center	0.14
Newhalem WWTP	0.60
Newport WWTP	10.10
North End Plant #3	2340.00
Oak Harbor RBC WWTP	47.87
Oak Harbor Seaplane Lagoon WWT	500.00
Okanogan WWTP	17.45
Olympic Water & Sewer WWTP	30.00
Olympus Terrace WWTP	261.70
Omak WWTP	122.25
Oroville WWTP	60.00
Pacific Beach WWTP	14.70
Palouse WWTP	12.00
Paradise WWTP	2.20
Pasco WWTP	206.00
Pe Ell WWTP	2.50
Penn Cove Sewer Dist WWTP	5.50
Peshastin WWTP	2.00
Picnic Point POTW (Alderwood)	360.47
Port Angeles, City Of	245.30
Port Gamble WWTP	1.49
Port Of Kalama WWTP	25.00
Port Orchard/Karcher Ck WWTF	224.00
Port Townsend Paper Corp	1.82
Port Townsend WWTP	259.15
Prosser, City Of	151.60
Pullman WWTP	448.00
Puyallup WPCP	592.00
Rainier State School WWTP	6.90
Redondo WWTP	211.00
Richland WWTF	878.00

Facility	Tons Biosolids
Ridgefield WWTP	34.83
Rocky Reach Dam STP	0.70
Royal City WWTP	22.00
Rustlewood WWTP	2.44
Salmon Creek WWTP	696.79
Salmon Creek WWTP - Burien	245.00
Seashore Villa WWTP	1.60
Sedro-Woolley WWTP	165.16
Selah WWTP	221.79
Selkirk WWTP	0.07
Sequim WWTP	99.60
Shelton WWTP	367.49
Skagit County Sewer Dist #2 WWTP	16.30
South Prairie WWTP	2.80
South Treatment Plant (Renton)	13483.00
Spokane Advanced WWTP	6852.00
Stehekin Dist WWTP	2.50
Stevens Pass Sewer Dist WWTP	4.00
Stevenson WWTP	24.20
Sultan WWTP	58.00
Sumner WWTP	225.00
Sunnyside, City Of	273.00
Suquamish WWTP	45.26
Surfside Inn Condo #1 STP	1.30
Tahoma Woods WWTP	0.07
Tamoshan WWTP	1.35
Taylor Bay WWTP	0.19
Tekoa WWTP	8.60
Tjoelker Enterprises WWTP	433.00
Toutle WWTP	11.60
Twisp WWTP	44.50
W/W Pumping Service, Inc	41.26
Walla Walla WWTP	322.00
Warm Beach Campground WWTP	12.20
Washington Corrections Center	26.20
Washougal WWTP	100.00
Wenatchee WWTP	511.00
West Point WWTP	13283.00
Westport WWTP	109.35
Whidbey Island STP	203.00
Winlock WWTP	50.00
Wollochet Harbor WWTP	0.50
Woodland WWTP	102.53
Yakima Regional WWTP	1152.80
Yelm WWTP	10.31
Zillah WWTP	10.00
Tons Biosolids	71859.68

Table 18. Estimated Annual Mercury Releases from Dental Amalgam at Crematoria in Washington State

Number of deaths in Washington, 2000	43,904	Washington State Department of Health, Center for Health Statistics
Cremations as a percent of deaths in Washington	59%	The Internet Cremation Society, http://www.cremation.org/
Number of cremations in Washington, 2000	25,903	
Grams of mercury released per cremation[a]	1	John Reindl, "Summary of References on Mercury Emissions from Crematoria," Dane County, Wisconsin, March 2002.
Grams of mercury released during cremations in Washington, 2000	25,903	
Pounds of mercury released during cremations in Washington, 2000	57	

[a] Estimates of the amount of mercury released during a cremation vary greatly, from less than one gram to more than 5 grams. Not all mercury is emitted to the air during cremation. Some stays in the crematoria, on the walls, etc.[45]
This calculation is courtesy of King County Local Hazardous Waste Management Program.

Table 19. Estimated Annual Mercury Emissions from Sewage Sludge Incinerators in Washington State

Lynnwood		Anacortes	Bellingham	Edmonds	Vancouver	Source
Test Date	Mercury in sludge, ug/g					
1/15/2001	1.60					City of Lynnwood Report in Accordance with 40 CFR 503 for 2001, NPDES Permit No. WA-002403-1, Table IV
3/7/2001	0.90					as above
5/3/2001	0.24					as above
7/11/2001	1.30					as above
9/13/2001	1.30					as above
11/5/2001	0.76					as above
Average:	1.02	(1.02)	(1.02)	(1.02)	(1.02)	
Dry tons incinerated, 2000	1843	604	3833	2826	6827	
Estimated mercury load (lbs/yr)*	3.76	1.23	7.82	5.77	13.9	Estimated total mercury (lbs/yr) 32.5 lbs.

* This estimate includes mercury emitted into air, ash, and fly ash; also includes any material captured by air-pollution control devices.

[45] John Reindl, "Summary of References on Mercury Emissions from Crematoria," Dane Co., WI, March 2002.

Table 20. Estimated Mercury Disposed of Annually from Fluorescent Lamps in Washington State

Estimate #1

Number of lamps discarded in U.S. annually	620,000,000	Aucott, M., M. McLinded, and M. Winka, "Release of Mercury from Broken Fluorescent Bulbs," Journal of Air Waste Management Association, in print.
Percent of U.S. population in Washington	2%	
Estimated mercury released per lamp (grams)	0.02	
Conversion to pounds	0.002204	
Estimated mercury in lamps disposed in Washington annually (lbs)	546	
Estimated percent of lamps recycled	20%	Paul Abernathy, Press Release: "AMLR Launches New Website," Association of Lighting and Mercury Recyclers, 2001.
Estimated mercury disposed with solid waste (lbs)	437	

Estimate #2

Mercury used in lamp manufacturing, 1997 (lbs)	30,000	Ric Erdheim, National Electrical Manufacturer's Association, personal communication., July 8, 2002
Percent of U.S. population in Washington	2%	
Estimated mercury from lamps discarded in Washington , 2002 (lbs, assumes 5-year lifespan)	631	
Estimated percent of lamps recycled	20%	Paul Abernathy, Press Release: "AMLR Launches New Website," Association of Lighting and Mercury Recyclers, 2001.
Estimated mercury disposed with solid waste (lbs)	505	

Table 21. Estimated Mercury Disposed of Annually from Thermostats in Washington State

Tons of mercury in discarded thermostats annually in U.S.	10.3	http://www.epa.gov/ttn/oarpg/t3/reports/volume2.pdf p. 4-19
Percent of U.S. population in Washington	2%	
Tons of mercury in discarded thermostats annually in Washington	0.206	
Pounds of mercury in discarded thermostats annually in Washington	412	

Table 22. Estimated Annual Mercury Releases from Dental Amalgam in Urine and Feces in Washington State

Mercury released in feces and urine, µg/day/person	17.2	Larry Walker Associates, "Mercury Source Control and Pollution Prevention Program Evaluation: Final Report," prepared for the Association of Metropolitan Sewerage Agencies under grant from USEPA, March 2002, pp. 9-10
Days in year	365	
Washington population estimate, 2001	5,987,973	U.S. Census Bureau, State and County Quick Facts, http://quickfacts.census.gov/qfd/states/53000.htm
Percent of Washington population over 18 years	74%	U.S. Census Bureau, State and County Quick Facts, http://quickfacts.census.gov/qfd/states/53000.htm
Estimated total grams released annually in feces and urine	27,800	
Estimated total pounds released annually in feces and urine	61.3	

Table 23. Estimated Mercury Disposed of Annually from Dental Offices in Washington State (in pounds)

Data from King County:

	Sewer	Red Bag	Garbage	Unknown	Total
Amalgam scrap	0	53	58	40	151
Trap amalgam	Unk.	Unk.	Unk.	Unk.	Unk.
Pump filter amalgam	Unk.	Unk.	Unk.	Unk.	Unk.
Wastewater particles	51	0	0	0	51
Totals	51	53	58	40	> 202

Source: Hazardous Waste Management Program, Water and Land Resources Division, Dept. of Natural Resources, King County, "*Management of hazardous dental wastes in King County, 1991 - 2000*," October 5, 2000.

Percent of Washington State dentists in King County = ~ 50%

Estimated mercury discharged from dental offices in Washington State (total lbs. per year) = > 404

Estimated mercury disposed of to retorts and autoclaves in red bag waste = 106 pounds per year

Table 24. Estimated Mercury Disposed of Annually from Convenience Vehicle Light Switches in Washington State

Number of vehicles in Washington reported wrecked, damaged, or destroyed, 2001	221,060	Washington State Dept. of Licensing
Grams of mercury per convenience vehicle light switch	0.8	http://www.state.me.us/dep/mercury/Auto%20Releases.pdf, p.2
Estimated switches per registered vehicle	0.65	http://www.state.me.us/dep/mercury/Auto%20Releases.pdf, p. 5
Estimated pounds of mercury released from convenience vehicle light switches in Washington annually	253	

Table 25. Mercury Disposed of Annually from Household Fever Thermometers in Washington State

Estimate #1

% of households with mercury fever thermometer	43%	King County Hazardous Waste Sound Stats, Sept 2001
Number of households in Washington	2,271,398	http://quickfacts.census.gov/qfd/states/53000.html
Number of households with mercury fever thermometers	976,701	
Amount of mercury in one thermometer (g)	0.5	
Est. mercury in fever thermometers (g)	488,351	
Conversion factor	0.00220462	http://www.remote-control.net/convert/tables/general/index.html
Est. mercury in fever thermometers (lbs)	1,077	
% of households breaking a mercury fever thermometer per year	1%	King County Hazardous Waste Sound Stats, Sept 2001
Amount of mercury in broken thermo-meters per year in Washington (lbs)	11	

This calculation courtesy of King County Local Hazardous Waste Management Program.

Estimate #2

Number of thermometers sold per household per year	0.24	Barr Engineering Co., 2001. "Substance Flow Analysis in Products," prepared for Minnesota Pollution Control Agency. Also, in http://www.state.in.us/idem/oppta/p2
Number of households in Washington	2,271,398	http://quickfacts.census.gov/qfd/states/53000.html
Number of thermometers sold per year in Washington	545,136	
% of thermometers sold that replace broken thermometers	50%	Barr Engineering Co., 2001
Number of broken thermometers per year in Washington	272,568	
Amount of mercury in one thermometer (g)	0.5	
Amount of mercury in broken thermometers per year in Washington (g)	136,284	
Amount of mercury in broken thermometers per year in Washington (lbs)	300	

This calculation courtesy of King County Local Hazardous Waste Management Program.

Table 26. Mercury Disposed of Annually from Batteries in Washington State

Mercury in all batteries (domestic and imported) sold in U.S. in 2000 (kg)	2,000	Barr Engineering Co., 2001, "Substance Flow Analysis in Products," prepared for Minnesota Pollution Control Agency. Also at http://www.pca.state.mn.us/publications/hg-substance.pdf.
% of U.S. population in Washington	2%	
Mercury in batteries sold in Washington in 2000 (kg)	40	
Mercury in batteries sold in Washington in 2000 (lbs)	88	

This estimate assumes that batteries purchased replace batteries disposed.

Appendices

A. Regulatory Overview

B. Department of Health Fish Advisory Talking Points

C. Department of Health Fish Advisories Frequently Asked Questions and Answers

D. Mercury Spills Reported to the Washington State Department of Ecology, January 2001 – April 2002

E. Occurrences of Cinnabar in Washington State

F. Status of Local, State, and Federal Mercury Product Legislation and Laws, 2001-2002 Legislative Sessions

G. Outline of Model Mercury Legislation Prepared by the Northeast Waste Management Officials' Association

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Appendix A

Regulatory Overview

Table A-1. USEPA Authority Relative to Mercury

Air	Water	Waste	Use Limitations	Reporting Requirements/ Spills
Clean Air Act Section 112 provides authority to regulate hazardous air pollutants - Section 112(c)(6) requires promulgation of emission standards by 2000 for sources that account for 90% of aggregate mercury emissions[1] - Section 112(n)(1)(C) requires a study of hazardous air pollutant emissions from electric utility plants and requires a finding on the need for regulation - Section 112(n)(C) requires study of mercury from all sources - Section 112(m) requires study of hazardous air pollutants to Great Waters and recommendations **Clean Air Act Section 129** requires regulatory actions for the solid waste combustion industry[1]	**Safe Water Drinking Act** provides authority for National Primary Drinking Water Regulations **Clean Water Act** provides authority on priority pollutants for: - Ambient water quality criteria[2] - Effluent limitation guidelines[2] - Pre-treatment of discharges to publicly owned sewage treatment plants[2]	**Resource Conservation and Recovery Act** provides authority to regulate storage, treatment, transport, and disposal of mercury wastes **Comprehensive Environmental Response, Compensation, and Liability Act** provides authority to clean up past waste **Superfund Amendment Reauthorization Act**	**Toxic Substances Control Act** provides authority to regulate chemical substances and mixtures that present an unreasonable health risk to the environment[2] **Federal Insecticide, Fungicide, and Rodenticide Act** provides authority to regulate pesticides that cause unacceptable risk (mercury use as a fungicide in paint) **Mercury-Containing and Rechargeable Battery Management Act** prohibits the sale of alkaline-manganese batteries containing mercury that was intentionally introduced; limits mercury content in alkaline-manganese button cells to 25 milligrams of mercury per button cell; prohibits the sale of button-cell mercuric oxide batteries; limits the sale of other mercuric-oxide batteries	**Emergency Planning and Community Right-to-Know Act** - Section 313 requires qualifying facilities to report amounts of toxic substances released or managed as waste. Information maintained in the Toxic Release Inventory[3] **Pollution Prevention Act** provides national policy directing the U.S. to focus on preventing or reducing pollution at the source whenever feasible (e.g. facilitate the adoption of source reduction techniques by business, identify opportunities to utilize federal procurement to encourage source reduction)[2] **Comprehensive Environmental Response, Compensation, and Liability Act** - Section 103 requires reporting of releases. Reporting requirements for spills > 1 lb in organic mercury/day

[1] Indicates authority for implementing this section has been delegated to local air authorities in Washington State, with the exception of regulating sewage sludge incinerators.

[2] Indicates authority for implementing this section has been delegated to the Washington State Department of Ecology.

[3] Indicates responsibility for implementing this section is shared by USEPA and the Washington State Department of Ecology.

The following is a brief summary of laws and regulations that apply to mercury use and release in Washington State.

Chapter 173-303 WAC, Dangerous-Waste Regulations

The P and U wastes are federal Resource Conservation and Recovery Act (RCRA) codes for unused, commercial chemical products with only one sole active ingredient. In the regulations, they are in -081 on page 30, and the actual chemicals are listed in -9903. P092 and P065 are found on page 199. All of the P wastes are acute hazardous wastes [see -081 (2) (a) (i)] and regulated at 2.2 pounds. U-151 elemental mercury is found on page 203.

K071 is also a listed RCRA waste. K wastes are from specific industrial processes and are defined in -082 (p. 31). This particular waste is listed on page 209.

The D codes are for federal characteristic wastes. When designating (i.e., deciding what waste codes apply to a hazardous waste) a waste stream for characteristics, a person decides if it is ignitable (D001), corrosive (D002), reactive (D003) or toxic (D004-D043, which are lists of actual toxic chemicals and Toxicity Characteristic Leaching Procedure threshold limits). The waste code could be a combination of these four different characteristics or just one. Characteristics are found in -090 on page 32.

For the state toxicity (WTO1) and persistence (WP01 and WP03) criteria, section -100 in the regulations (page 34-36) uses fish/rat mortality studies to determine the toxicity and chemical concentration percentage to determine if it is a persistent state waste.

40 CFR part 72, Implemented through Toxic Chemical Release Inventory Reporting Forms and Instructions

Mercury and mercury compounds are reportable by facilities under both the annual hazardous chemical inventory (Tier Two) and the Toxics Release Inventory (TRI). Reporting thresholds for Tier Two are the storage of 10,000 pounds (on-site at any one time) or more of mercury or mercury compounds. For calendar year 2000, two companies reported storage of these chemicals.

Under the TRI, mercury and mercury compounds are reportable at 10 pounds. This threshold is for use of the chemical, where use means manufacture, process, or otherwise use. This threshold was reduced from 10,000 or 25,000 pounds for reporting year 2000. Some exemptions apply (i.e., motor vehicle, solid object, and personal use). The other qualifications for TRI reporting also apply. There must be ten or more full-time employees or the equivalent, and they must be in one of the listed industry types (by SIC).

For reporting year 2000, 24 individual companies reported for either mercury or mercury compounds. The TRI also provides information on transfers to other locations by these facilities for recycling, treatment, or disposal. Additionally, the national TRI database can provide information on mercury or mercury compounds being transferred into the state of Washington.

Data gaps associated with Emergency Planning and Community Right-to-Know Act data are:

1. TRI is limited to facilities with 10 or more employees and only certain industries.
2. TRI data do not require additional efforts by the facility, only that they use the best available sources, which include calculations based on emission factors.
3. Compliance efforts by USEPA for the PBT reporting have not started, so the industry compliance is an unknown. It is not known how many non-reporting facilities there are or the level of accuracy for the existing reporters.
4. The threshold for reporting on Tier Two is 10,000 pounds. This is too high to be of much value.

Chapter 118-40 WAC, Section 313 of the Emergency Planning and Community Right-to-Know Act (adopted by reference)

This applies to companies that are storing chemicals in large quantities. This requires the company to register with the Department of Ecology, although the USEPA generally is the agency that enforces the act. When registering, the company must send information to Ecology, USEPA, and the local firehouse. If a company generates or discharges 10 pounds or more of mercury, it is required to report under the Community Right-to-Know Act.

Chapter 173-400 WAC, General Regulations for Air Pollution Sources

There are local agencies, such as the Puget Sound Clean Air Agency (PSCAA), that regulate different counties. PSCAA was established by state law in 1967 (Chapter 70.94 RCW). There are seven similar organizations/agencies in Washington. These agencies are government-affiliated and get funding through fees from local counties, federal state and local grants, and fees for notice of construction. These organizations have the ability to write and enforce regulations, write permits, and have their own board of directors, often with mayors and council members.

Chapter 173-460 WAC, Controls for New Sources of Toxic Air Pollutants

This rule requires, "a) Best available control technology for toxics; (b) Toxic air pollutant emission quantification; (c) Human health and safety protection demonstration.
(3) Policy. It is the policy of Ecology to reduce, avoid, or eliminate toxic air pollutants before they are generated, whenever economically and technically practicable."

Chapter 173-460 WAC is a rule that was adopted in June 1991.

With air quality, any source that existed before a rule is in effect can stay at those emissions, or be "grandfathered" in. This is true until the source decides to make a modification. An example of a modification would be adding a new part to an industrial plant. At this point, Ecology's Air Program will apply BACT (Best Available Control Technology), which is a requirement of this Chapter 173-460 WAC.

WAC 173-400-045, **Control Technology Fees, RACT (Reasonably Available Control Technology)**

Under Chapter 173-460 WAC, a company must apply for a permit and must notify Ecology's Air Quality Program (AQP) of what kind of emissions they are putting out, including what kind of toxins. The AQP then reviews the information with an USEPA computer modeling program, and, if approved, will issue the permit. All sources must be at RACT.

Permit applicants have the incentive to be honest about emissions because it takes time and money to get the permit. There is no penalty or fee if the company is found to have not notified the AQP of a certain toxin. If an unreported toxin is found, the process only takes longer.

Chapter 70.95J RCW, Biosolids Management

The purpose of this chapter is to provide the Department of Ecology and local governments with the authority and direction to meet federal regulatory requirements for municipal sewage sludge. Ecology may seek delegation and administer the sludge permit program required by the federal Clean Water Act as it existed on February 4, 1987.

40 CFR Part 503: Federal standards for biosolids management. These rules are implemented by USEPA or by delegated states, and come from authorities in the federal Clean Water Act. USEPA does not use the term "biosolids" in its rules, but acknowledges it in guidance. Sewage sludge that meets standards to be applied to the land can be called biosolids. The state program follows the federal program closely, by design. USEPA manages biosolids under its Water Programs, although at the state level biosolids are managed from Ecology's Solid Waste and Financial Assistance Program.

Chapter 173-308 WAC, Biosolids Management

This chapter is adopted under the authority of Chapters 70.95J and 70.95 RCW. The purpose of this chapter is to protect human health and the environment when biosolids are applied to the land. This chapter encourages the maximum beneficial use of biosolids, and is intended to conform to all applicable federal rules adopted under the federal Clean Water Act as it existed on February 4, 1987.

These are the state rules for biosolids management. They include both technical standards for biosolids quality as well as permitting requirements. There is a *ceiling* concentration above which biosolids cannot be applied to the land. The ceiling concentration for mercury in biosolids is 57 ppm. There is also a lower threshold, or a *pollutant* concentration limit. Certain regulatory requirements are relaxed or suspended when pollutants in biosolids fall below the concentration limit. The lower threshold for mercury is 17 ppm. Based on data collected from annual biosolids reports, the median concentration of mercury in biosolids in Washington is about 2 ppm.

Chapter 173.201A WAC, Water Quality Standards for Surface Waters of the State of Washington

The purpose of this chapter is to establish water quality standards for surface waters of Washington consistent with public health and public enjoyment thereof, and the propagation and protection of fish, shellfish, and wildlife, pursuant to the provisions of Chapter 90.48 RCW and the policies and purposes thereof.

WAC 173.200-040, Water Quality Standards for Ground Waters of the State of Washington

This chapter implements Chapter 90.48 RCW, the Water Pollution Control Act, and Chapter 90.54 RCW, the Water Resources Act of 1971. This chapter applies to all groundwaters of the state that occur in a saturated zone or stratum beneath the surface of land or below a surface water body.

Chapter 90.48 RCW, **Water Pollution Control**

Under this law, the Department of Ecology shall have the jurisdiction to control and prevent the pollution of streams, lakes, rivers, ponds, inland waters, salt waters, watercourses, and other surface and underground waters of Washington State.

Federal Clean Water Act

Ecology's Water Quality Program regulates this under different facets of the act; the act supplies different tools for Ecology to regulate.

Under the National Toxics Rule, 40 CFR 131.36, the following levels of mercury are allowed in Washington:

- 173-201A-040 – Toxic Substances, levels allowed for aquatic life
- Levels allowed for human health, in a freshwater scenario where drinking water may be involved is 0.14 ppb.
- Levels allowed for organisms only, in a marine scenario where drinking water will not be involved is 0.14 ppb.
- 173-200-040 – Groundwater, 2 ppb is allowed.

Chapter 70.105D RCW, Model Toxic Control Act

The purpose of this chapter is to establish a comprehensive, statewide framework for the planning, regulating, controlling, and managing previously released or disposed hazardous waste to prevent land, air, and water pollution and conserve the natural, economic, and energy resources of the state. To this end, it is the purpose of this chapter to:

1. Provide broad powers of regulation to Ecology relating to managing hazardous wastes and releases of hazardous substances.

2. Promote waste reduction and encourage other improvements in waste management practices.
3. Promote cooperation among state and local governments by assigning responsibilities for hazardous-waste planning to the state, and moderate-risk-waste planning to local governments.
4. Provide for preventing problems related to improperly managing hazardous substances before such problems occur.
5. Assure that needed hazardous-waste management facilities may be sited in the state, and ensure the safe operation of the facilities.

- **173–340–100 WAC, Model Toxics Control Act - Cleanup**

This chapter is promulgated under the Model Toxics Control Act. It establishes administrative processes and standards to identify, investigate, and clean up facilities where hazardous substances have come to be located. It defines the role of the Department of Ecology and encourages public involvement in decision making at these facilities. The goal of this chapter is to implement the policy declared by Chapter 70.105D RCW. This chapter provides a workable process to accomplish effective and expeditious cleanups in a manner that protects human health and the environment. This chapter is primarily intended to address releases of hazardous substances caused by past activities, although its provisions may be applied to potential and ongoing releases of hazardous substances from current activities.

Ecology's Toxics Cleanup Program generally does not deal with mercury until after it is released into the environment. The program generally deals with mercury after it was used in an industrial manner. It also may deal with mercury in farming communities, and with gold and silver mining, when it is been released into the environment.

- **WAC 173-340-708, Human Health Risk Assessment Procedures**

This section defines the risk assessment framework that shall be used to establish cleanup levels, and remediation levels using a quantitative risk assessment, under this chapter. The chapter defines certain default values and methods to be used in calculating cleanup levels and remediation levels.

This section defines:

1. Selection of indicator hazardous substances
2. Reasonable maximum exposure
3. Cleanup levels for individual hazardous substances
4. Multiple hazardous substances
5. Multiple pathways of exposure
6. Reference doses
7. Carcinogenic potency factor
8. Bioconcentration factors
9. Exposure parameters
10. Probabilistic risk assessment

Appendix B

Department of Health Fish Advisory Talking Points

Washington State Fish Advisory for Mercury

Talking Points
April 12, 2001

Recently, the Food and Drug Administration (FDA) warned against eating certain large, long-lived predator fish due to high levels of mercury. The Washington State Department of Health (DOH) and the health agencies of several other states also advise women of childbearing age and children under six to limit the amount of tuna they eat for the same reason. Too much mercury can have health impacts on everyone, but women of childbearing age and children under six are especially at risk.

It is important that our messages reinforce the tremendous health benefits of eating fish while balancing those messages with specific warnings about mercury in certain fish.

- Fish is a healthy food, and the Department of Health recommends that people eat a variety of fish as part of a balanced diet. Health benefits of eating fish are:
  - Fish is an excellent low-fat food, a great source of protein, vitamins, and minerals.
  - The oils in fish are important for unborn and breastfed babies.
  - Eating a variety of fish helps to reduce your chances of stroke or heart attack.

- Methylmercury is the kind of mercury that is commonly found in many kinds of fish, especially large fish that eat smaller fish and fish that live long lives. Because of health concerns due to high levels of methylmercury in certain fish, DOH advises women of childbearing age and children under six:
  - Do not eat any shark, swordfish, tilefish, king mackerel, or either fresh caught or frozen tuna steak.
  - Limit the amount of canned tuna you eat, based upon your bodyweight. Guidelines are:
    - Women of childbearing age should limit the amount of canned tuna they eat to about one can per week (six ounces). A woman who weighs less than 135 pounds should eat less than one can of tuna per week.

    - Children under six should eat less than one half a can of tuna (three ounces) per week. Specific weekly limits for children under six range from one ounce for a child who weighs about twenty pounds, to three ounces for a child who weighs about sixty pounds.

- Women who are or who may become pregnant, and parents of children under six should be especially aware of this information, although mercury can cause health problems for everyone.

- Health problems caused by mercury are:
    - Babies of women who eat fish contaminated with large amounts of mercury when pregnant are at greater risk for changes in their nervous system. These changes can affect their ability to learn.
    - In adults, mercury can lead to problems of the central nervous system and possible adverse effects on the cardiovascular system.

- Mercury contamination is a worldwide problem. It can come from many sources:
    - It occurs naturally in the environment in rocks, soils, water, and air. Mercury may be released into the environment as a result of volcanic activity.
    - It can come from industrial pollution, especially the burning of coal and other fossil fuels and from burning household or industrial wastes.
    - Mercury released into the air settles onto oceans, lakes, and rivers where it is absorbed by fish.

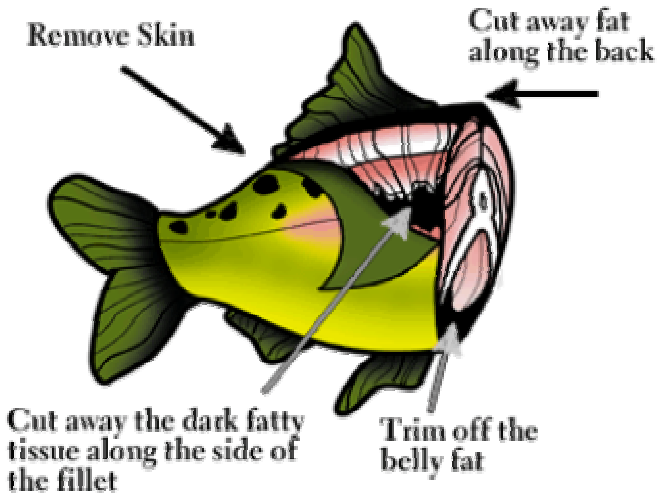
- Mercury is bound to fish muscle, so it cannot be reduced by cutting off the skin or preparing fish in any special way.

Other Contaminants and Local Fish Advisories

- There is not a lot of information statewide on mercury contamination on fresh water fish. We do know on a national basis that bass, pike, and walleye tend to have higher levels of mercury than other species.

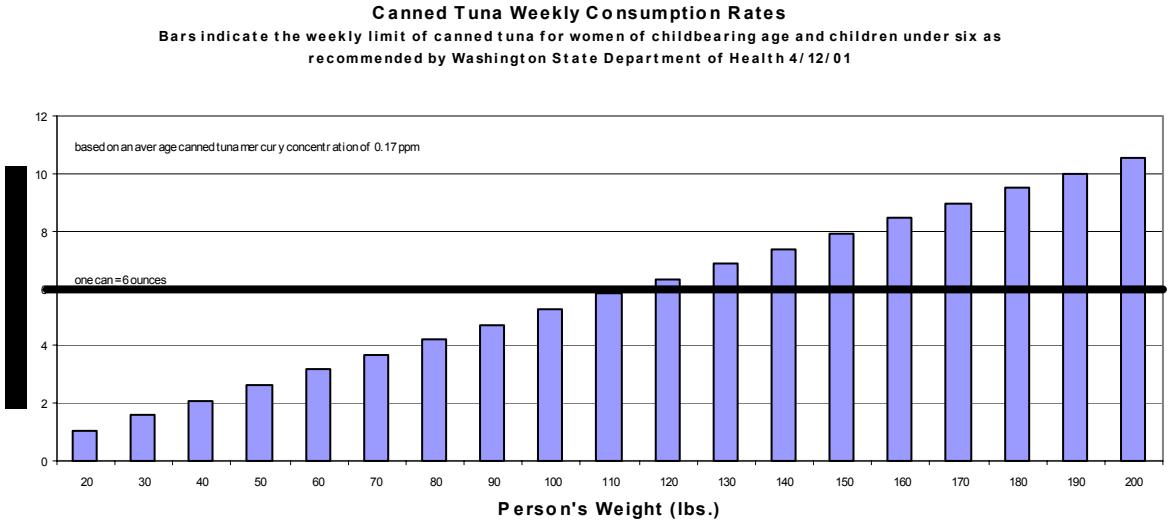
- Contaminants other than mercury may be a problem for fish in certain areas of the state. But unlike mercury, the amounts of contaminants like PCBs and many pesticides are stored mostly in the fat of fish, and so they can be reduced by preparing it in ways that reduce the fat.

- Prepare your fish according to the diagram below, then broil, grill, or bake it on a rack so the fat drips off the fish. Do not use the drippings for sauces or gravies.



- Learn more about "Fish Advisories" in your location by contacting your local health department or through the DOH website at www.doh.wa.gov/fish.

- The DOH contact for questions about this advisory is Dave McBride. He can be reached by phone at (360) 236-3176 or 1-877-485-7316 or through e-mail: dave.mcbride@doh.wa.gov.



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Appendix C

Department of Health Fish Advisories
Frequently Asked Questions and Answers

Washington State Fish Advisory for Mercury
Questions and Answers
April 12, 2001

Mercury contamination is a worldwide problem. Methylmercury is the type of mercury that gets into fish. It is commonly found in many kinds of fish, especially large fish that eat smaller fish and fish that live long lives. Last year, the National Research Council reported on the toxicological effects of methylmercury. In January the Food and Drug Administration (FDA) issued a "consumer advisory" to women of childbearing age, recommending that they not eat certain kinds of sport fish due to elevated levels of methylmercury. In March 2001 the Centers for Disease Control and Prevention (CDC) published data that supports efforts to reduce mercury exposure.

Fish Advisory in Effect for Mercury

Fish is an excellent low-fat food and a great source of protein, vitamins, and minerals. In Washington State, fish not only offer a tremendous source of nutrition, catching, cooking, and eating fish are important cultural and family practices. The Washington State Department of Health (DOH) recommends that people eat a variety of fish and shellfish to maintain a balanced, healthy diet. Because of health concerns due to mercury in fish, women of childbearing age and children under six are given specific guidelines (see Appendix B).

Too much mercury can have health impacts on everyone, but women of childbearing age and children under six are especially at risk. Learn about this statewide advisory and other advisories which might exist for fish caught from local water bodies by contacting your local health department or through the DOH "Fish Facts for Healthy Nutrition" website at www.doh.wa.gov/fish.

Answers to Frequently Asked Questions

What is the difference between mercury and methylmercury?

Mercury is a metal that has several forms. Most commonly, people recognize mercury as the shiny, silver-white fluid in thermometers. Methylmercury is the kind of mercury that gets into

fish. In water, the inorganic form of mercury is converted to methylmercury by bacteria or chemical reactions. Methylmercury is produced when a carbon with three hydrogen molecules attached to it (called a methyl group) is united with the element mercury.

How does mercury get into fish?

Mercury contamination is a worldwide problem. It can come from many sources. It occurs naturally in the environment in rocks, soils, water, and air. It may be released into the environment as a result of volcanic activity. Mercury also comes from industrial pollution, especially the burning of coal and other fossil fuels and from burning household or industrial wastes. Mercury compounds settle into sediments of lakes, rivers, and oceans, where bacteria convert the inorganic mercury compound to methylmercury. Fish absorb methylmercury from water as it passes over their gills. Fish primarily absorb methylmercury from the prey they eat.

How might I be exposed to mercury?

The Centers for Disease Control and Prevention (CDC) recently published data that indicated that most of the exposure in young children and women of childbearing age in the United States happens as a result of eating fish contaminated with methylmercury. Other sources of mercury exposure that could possibly occur include:

- Breathing vapors in air from spills, incinerators, and industries that burn mercury-containing fuels.
- Breathing contaminated workplace air or skin contact during use in the workplace (dental, health services, chemical, and other industries that use mercury).
- Practicing rituals that include the use of mercury.
- Release of mercury from dental work and medical treatments.

How can mercury affect health?

Health problems caused by mercury are most severe for the developing fetus and for young children. Pregnant women who eat fish contaminated with large amounts of methylmercury run the risk that their babies will have unhealthful changes in their central nervous system and possibly in their heart or blood vessels. Nervous system changes can affect their baby's ability to learn. In adults, methylmercury can lead to problems of the central nervous system and possible adverse effects on the cardiovascular system.

Does mercury cause cancer?

Based on human and animal data, the International Agency for Research on Cancer (IARC) and the Environmental Protection Agency (EPA) have classified methylmercury as a "possible" human carcinogen. This means that mercury has been found to produce cancer in two animal species, but that evidence is not adequate to say that it causes cancer in humans.

Why shouldn't I just stop eating any fish?

Fish is a healthy food. Eating fish provides tremendous health benefits. It is often low cost and is an easy to prepare source of good nutrition. Health benefits of eating fish include:

- Fish is an excellent low-fat food, a great source of protein, vitamins, and minerals.
- The oils in fish are important for unborn and breastfed babies.
- Eating a variety of fish helps to reduce your chances of stroke or heart attack.

DOH recommends that you follow the guidelines in this advisory, which include eating a variety of fish and shellfish as a part of a healthy, balanced diet.

I hope to start a family soon. Should I breastfeed my baby if I eat fish?

Yes! Breastfeeding provides your baby with many health benefits that will last a lifetime. Unless you know that you have been exposed to high levels of mercury or some other contaminant through some kind of serious accident, the benefits of breastfeeding far outweigh any risks that your baby may receive from these through breast milk.

Will I get rid of the mercury if I cook the fish longer?

Mercury is tightly bound to proteins in all fish tissue including muscle. There is no method of cooking or cleaning fish that will reduce the amount of mercury in a meal.

What about contaminants other than mercury?

Unlike mercury, the amounts of contaminants like PCBs and many pesticides are stored mostly in the fat of fish. Preparing fish in ways that reduce the fat can also reduce these other contaminants. Cut off the skin and most available fat before cooking fish. Then broil, grill, or bake it on a rack so the fat drips off the fish. Do not use the drippings for sauces or gravies

What about salmon: is it safe to eat?

Most species of salmon tend to have very low levels of mercury and are safe to eat. Chinook have higher levels of mercury than other salmon, but these levels are still below those found in the kinds of fish named in this advisory. Women of childbearing age who eat six ounces of tuna fish may choose not to eat any other fish during that week.

What about fish sticks?

Fish sticks are fine as long as they aren't made from shark, swordfish, tilefish, king mackerel, or tuna, which most don't appear to be. If you are pregnant, or are planning to become pregnant, you should check the package to make sure the processed fish you are buying is not made from any of the fish mentioned in the health advisory. Also, if you've already eaten six ounces of canned tuna, you are very close to what is considered a tolerable daily intake for mercury and may choose to wait a week before eating any other kind of fish.

Does it make a difference what kind of canned tuna I eat?

The type of tuna can make a difference. Read the label on canned tuna and choose "Chunk Light" or "Chunk" tuna. They have less mercury than the "Solid White" or "Chunk White" canned tuna. Canned tuna composed of smaller species of tuna such as skipjack and albacore, has much lower levels than most tuna steaks.

Can I be tested for mercury exposure?

Yes. There are reliable and accurate ways to measure mercury in your body. These tests involve taking blood, urine, or hair samples, and must be performed in a doctor's office or in a health clinic. Most tests do not determine the form of mercury to which you were exposed. Hair analysis is considered useful for exposures to methylmercury, and may yield results for exposures having occurred within the past year. Consult your health care provider if you would like to learn more about testing for mercury exposure.

What can be done to keep mercury from getting into fish?

Choosing to eat fish low in mercury is an important strategy to protect health. The long-term strategy for reducing exposure to mercury is to lower concentrations of methylmercury in fish by limiting mercury releases into the atmosphere from burning mercury-containing fuel and waste and from other industrial processes. Contaminants like mercury that are released into the atmosphere today, may end up on our dinner table tomorrow.

Where can I find out more about this?

For more information, contact your local health department, or refer to the DOH "Fish Facts for Healthy Nutrition" website at www.doh.wa.gov/fish.

The DOH contact for this fish consumption advisory is:

Dave McBride
Washington Department of Health
Office of Environmental Health Assessments
PO Box 47846
Olympia, WA 98504-7846

Email: dave.mcbride@doh.wa.gov
Phone: (360) 236-3176
OEHA toll free phone: 1-877-485-7316
Fax: (360) 236-2251

Fish Advisory for Mercury
Resource List
April 2001

Washington State Department of Health (DOH) developed this list of resources to facilitate your search for various views and information on the subject.

Disclaimer: "The opinions or information presented by these resources may not necessarily be shared by DOH."

Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road NE, Mailstop E-29
Atlanta, GA 30333
FAX: 404-639-6359
ToxFaqs. On the Internet at http://www.atsdr.cdc.gov/tfacts46.html
ATSDR Information Center Phone 1-877-422-8737.

American Dietetic Association
http://www.eatright.org or
http://www.eatrigth.org/ncnd.html

Centers for Disease Control and Prevention. Phone 1-800-311-3435
MMWR Weekly 3/2/01
Blood and Hair Mercury Levels in Young Children and Women of Childbearing Age - United States, 1999
http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5008a2.htm

Food and Drug Administration. Phone 1-800-SAFEFOOD
Mercury in Fish & Pregnancy
http://www.fda.gov/opacom/catalog/mercury.html

National Fisheries Institute
http://www.nfi.org

National Research Council. Toxicological Effects of Methylmercury. Copyright 2000.
National Academy of Sciences. National Academy Press. Phone 1-800-624-6242
http://books.nap.edu/catalog/9899.html

Puget Sound Water Quality Action Team. Phone 1-800-54-SOUND
Outside Washington, call 360-407-7300
http://www.wa.gov/puget_sound/

U.S. Environmental Protection Agency. Phone 206-553-4273
National Advice on Mercury in Freshwater Fish for Women Who Are or May Become Pregnant, Nursing Mothers, and Young Children.
http://www.epa.gov/ost/fishadvice/advice.html

U.S. Environmental Protection Agency. Phone 206-553-4273
National Advice on Mercury in Fish Caught by Family and Friends: For Women Who Are Pregnant or May Become Pregnant, Nursing Mothers, and Young Children. January 2001
http://www.epa.gov/ost/fishadvice/factsheet.html

Washington State Department of Health, Office of Environmental Health Assessments.
Phone 1-877-485-7316.
"Evaluation of Evidence Related to the Development of a Tolerable Daily Intake for Methylmercury." May 1999.
http://www.doh.wa.gov/ehp/oehas/hg99.pdf

Washington State Department of Health, Office of Environmental Health Assessments.
Phone 1-877-485-7316.
"Exposure Analysis of Five Fish Consuming Populations for Overexposure to Methylmercury." January 2001.

Washington State Department of Ecology. Phone 360-407-7006
http://www.ecy.wa.gov/
"Proposed Strategy on Persistent, Bioaccumulative Toxins"
http://www.ecy.wa.gov/programs/eap/pbt/pbtfaq.html

Washington State Department of Fish and Wildlife. Phone 360-902-2200
http://www.wa.gov/wdfw

Washington State Department of Health
Office of Environmental Health Assessment. Phone 1-877-485-7316 or 360-236-3200
Fish Facts For Healthy Nutrition
http://www.doh.wa.gov/fish

Appendix D

Mercury Spills Reported to the Washington State Department of Ecology, January 2001 – April 2002

Date Call Received	Date of Incident	Notes
1/31/01	1/18/01	An employee reports finding 5 pounds of mercury.
2/12/01	2/12/01	A spill of mercury has occurred to the pavement in the 13400 block of Agate Beach Road. The source of the spill is unknown at this time. The spill is approximately 6 inches in diameter. Exact quantity is unknown. This road is located on the south side of the island. It is believed that all the residents in that area use wells for their drinking water. The fire department is aware of the exact location.
3/16/01	3/16/01	During an arrest the McCleary Police Department found a bottle of mercury. It is being stored at the McCleary Police Station until it can be picked up.
3/22/01	3/22/01	Mercury spilled inside building from a broken blood-pressure reader. Local Haz Mat will clean up, no response requested.
3/28/01	3/28/01	Thermometer broke, spilling half of the mercury onto carpet.
4/13/01	4/13/01	UNET and Lewis County Health are responding to a drug lab in a mobile home on 4/16/01. Lab has been abandoned by the cook. Caller requests Ecology assistance. 4/16/01 1000 hours- UNET unavailable. Steve Garrett of the Lewis County Health Department will transport the items to the Lewis County Animal Shelter. There is a quart jar of liquids and a jar of mercury. The lab will be stored until it can be picked up at a later date.
4/25/01	4/25/01	County crew found a container of mercury. Request Ecology assistance in its safe disposal.
5/10/01	5/10/01	1 gram of mercury spilled by worker from something a little larger than a thermometer. Building has been evacuated. Fire department is on scene. Will take to Haz Mat facility for pick up. Would like contractor info. to clean up/cut out carpet.
5/11/01	5/10/01	Caller says that somebody's been dumping something in some of the puddles on the trail where she hikes up by Lake Desire. There's a silver-metallic residue left in the puddles. She walked past there once yesterday afternoon (5/10/01) and it wasn't there, and when she returned later on that afternoon, it was there. She took samples from the puddle, and she is wondering if there is any way to have it tested. It doesn't look like an oil residue, it's real silvery like mercury. She'd really appreciate a call back to find out this information. Please contact the complainant for more information about the specific location.
5/22/01	5/22/01	Caller reports that about 1/2 cup of mercury was spilled. All but about a tablespoon was recovered. The property is on a wetland. The spill occurred less than 100 feet from the spring and is possibly close to the property well.
5/29/01		Caller voiced his concern about some batteries he and his sons found while fishing in Lake Roosevelt about 3 weeks ago. They are Edison carbonaire mercury zinc (lead??) Batteries dumped in the lake near the channel light across from seven bays. He said they found them just at the water line when the lake was about 1230 feet.

Date Call Received	Date of Incident	Notes
6/6/01	6/6/01	Contractor notice a sprinkling of silver liquid on the surface of the soil before digging in the ditch. Once he began digging he discovered a 10 inch in diameter pool of silver liquid on the soil. Fire District 6 is on scene. The liquid has been identified as mercury. The ditch is next to a water pipe. The location is next to a cell phone tower. Clark County dem requests that they be kept posted on the situation.
6/14/01	5/1/01	City of Auburn purchased property for road work/bypass and during excavation discovered contaminated soils. City had environmental assessment done by Landau Associates earlier and Sound Environmental Strategies Corp was hired to conduct investigation and cleanup. After sampling results are reviewed city will determine to enter the vcp or do an independent cleanup and submit report to Ecology. Preliminary work with soil and groundwater sampling at 6 geoprobe locations showed pcbs at 2.2 ppm, lead 800 ppm and mercury at 16.5 ppm. Site had small backyard 50 ft x 75 ft with a shed where someone reprocessed electrical transformers and electric switches where mercury was collected. "Cottage" industry was neat and orderly with everything in containers; estimated to be less than a small quantity generator.
6/26/01		Caller contacted us regarding possible contamination. He heard that perhaps we have already visited this site, which is known as hits hill (?) in Seattle. He heard that maybe mercury and other environmental problems were found. His property is on the opposite side of this site, which was formerly a fireworks factory, and the property in the middle is the biggest problem. From the property in between the park (which is a new city park) and this property in question, is his property on the other side. Spilling off of this property, from a big pile (6 x 6 feet) of black powder - it is somewhat powdery, and lighter than soil - he believes there is a slight sulfur smell. He thinks the pile is spreading, and he does not know what it is, and he thinks that there could be other things leaching onto his property.
7/9/01	7/9/01	They had a small mercury release there this morning (7/9/01). A manometer (?) broke in a Conex (?) box - 1 pound release. NRC and state dem have been called. The incident is under control, it is all contained, no threat to human health or the environment. Please call if you need more info.
7/30/01	7/30/01	Mercury has been taken to the Clark County hazardous-waste storage building and is waiting for Ecology to pick it up and dispose of it.
8/24/01	8/24/01	Caller reports that they found a container of mercury in their garage. The container was spilled. Approximately 0.5 cups was spilled on the floor. Caller is requesting help with the clean up. This caller was directed to us via the Cowlitz County Health Department.
8/28/01	8/28/01	Caller is calling for neighbor who spilled mercury from glass jar. Wanted to know what to do.
10/5/01	10/5/01	WSP reported mercury in an impounded vehicle. There is also a cooler that needs to be disposed of and a gallon container with approx. one quart of possibly mercury.
11/5/01		WC parcel # 380315286032 Waste type: woodyard waste Years of use/comments: 6/11/76 and again beyond 12/76 (unapproved)-late 70s Concerns: possible mercury and diolcins in wood waste

Date Call Received	Date of Incident	Notes
11/8/01	11/8/01	Caller reports that there has been 50 ccs of mercury on the paved roadway in front of the listed address. Trooper wishes to speak with a responder. The only means of communication is via Bremerton radio. Please call.
11/17/01	11/17/01	Liquid mercury at the Little Rock Fire Department.
12/5/01		Caller worked at the veterinary office in south Seattle until Dec. 2, 2001, and quit after mercury was spilled on the ground and not cleaned up to her satisfaction. The spill occurred on Dec 1st. The caller fears that the mercury was dumped down the drain and may have gotten into the water supply. Also, the cleanup was unsatisfactory in that the spill occurred in the bath room of the clinic and the driers were still on, thus blowing the mercury around. Caller also complains of the blowers being too loud and damaging not only human ears but also the animals. No protection has been given to any of the workers. Employee education is also a concern for the caller as pesticides are used on the animals and employees are provided with no education on handling these chemicals. Finally the caller notes that rat poison has been spread throughout the office and is concerned that it will poison both animals and humans.
12/7/01	12/7/01	Cowlitz County Health Dept. called. There has been about a dime size of mercury spilled onto carpet at a residence in Cowlitz County.
3/2/02	3/2/02	Homeowner broke a thermometer and has mercury on floor. Would like our help.
3/18/02		Caller states that a thermostat for the heating system broke sometime ago. They believe that is when the mercury was released to their wall to wall carpet in the house. Caller reports that it was probably a little more than a tablespoon of mercury released. He states that there is probably less than a teaspoon left in the carpet. The caller is requesting assistance in getting the mercury cleaned up out of the carpet. Please call.

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Appendix E

Occurrences of Cinnabar in Washington State

Source: Bart Cannon, Minerals of Washington, Cordilleran;
Mercer Island, Washington; 1975; pp. 74-5.

Chelan County

Blewett Pass area – Cinnabar occurs in "nickel ledge" rocks of the area

Clark County

Golden Wonder prospect, Yale – Cinnabar crystals are reported to occur scattered in a volcanic tuff

King County

Royal and Cardinal Reward mines, Franklin – Tiny but sharp crystals of cinnabar occur in vugs and coat fracture surfaces with regular, meta-cinnabar, stibnite, and quartz

Kittitas County

H-O-M-E claim, north of Cle Elum – Occurs with native mercury

Lewis County

Barnum McDonald, Lytle, Lynch, Roy, and Spencer mines, Morton area – Occurs in crusts and seam fillings with marcasite and opal in veins cutting volcanics and sandstones

Fisher claim, Morton area – Cinnabar occurs in sharp crystals to one-eighth inch in cavities

Pierce County

Marshel River, Eatonville – Reported to have occurred as a cavity filling and druse material on quartz

Snohomish County

Menzel Lake area, south of Granite Falls – Cinnabar veinlets occur in "nickel ledge" rock

Yakima County

Indian Creek prospect, 34 miles from Naches – Cinnabar occurs in "nickel ledge" rock with ankerite and dolomite

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Appendix F

Status of Local, State and Federal Mercury Product Legislation and Laws
2001-2002 Legislative Sessions
July 29, 2002

The following was compiled by John Reindl, Recycling Manager, Dane County, Wisconsin Department of Public Works

Source: Internet Web pages of the various legislative bodies, along with updates via the e-mail lists Mercury Policy, Legislation, and Regulations (mercury_policy@lyris.newmoa.org) and Hg-WG (mwg-mercury@igc.topica.com).

The regulation of mercury in products at the state and federal level is increasing rapidly. A good summary of existing state and federal laws on mercury product legislation is found in Appendix A of a draft report on mercury by the California Department of Toxic Substances Control, and found on the Internet at http://www.dtsc.ca.gov/PublicNotices/HWMP_REP_DraftMercury2.pdf. Local ordinances and state laws also are available on the Web page of Health Care Without Harm at http://www.noharm.org/index.cfm?page_ID=14#local.

For mercury product legislation currently under consideration, the following is a summary of the bills found, along with their status and Web page links. While the goal is to be complete, it is known that there are other measures – especially at local government levels – that have been missed.

Local and State Legislation

California

AB 712 would prohibit the sale of high-mercury fluorescent lamps (unless a specific exemption is provided), ban the disposal of all fluorescent lamps with mercury, and impose a 3¢ per lamp fee on the retail sale of fluorescent lamps for use by the state. Adopted by the Assembly; recommended for adoption by the Senate Environmental Quality Committee on June 24, 2002 and referred to Appropriations. http://www.leginfo.ca.gov/bilinfo.html or http://www.leginfo.ca.gov/pub/bill/asm/ab_0701-0750/ab_712_bill_20020611_amended_sen.pdf

AB 751 would require that mercury-containing lamps be managed as universal waste from commercial facilities generating 30 or more a month. The bill has died. http://www.leginfo.ca.gov/cgi-bin/postquery?bill_number=ab_751&sess=CUR&house=B&author=jackson

AB 2237 would limit the amount of mercury that is permitted in packaging. Recommended for adoption by the Assembly Committee on Environmental Safety and Toxic Materials; currently in

the Committee on Appropriations. http://www.leginfo.ca.gov/bilinfo.html or http://www.leginfo.ca.gov/pub/bill/asm/ab_2201-2250/ab_2237_bill_20020418_amended_asm.pdf

AB 2253 would modify existing state law on the responsibilities of the state agency for providing assistance and reports for the removal of mercury switches from autos. In Assembly Committee on Environmental Safety and Toxic Materials. http://www.leginfo.ca.gov/bilinfo.html or http://www.leginfo.ca.gov/cgi-bin/postquery?bill_number=ab_2253&sess=CUR&house=B&author=cohn

AB 2270 would ban the use of mercury amalgam fillings by January 1, 2007; prior to that date, dentists would need to provide patients information if the use of mercury amalgam fillings is proposed. In the Assembly Committee on Health. http://www.leginfo.ca.gov/bilinfo.html or http://www.leginfo.ca.gov/cgi-bin/postquery?bill_number=ab_2270&sess=CUR&house=B&author=dickerson

SB 529 would modify the state's definition of novelties or which mercury is prohibited to exclude products with mercuric-oxide batteries. Currently in the Office of the Secretary of the Senate. http://www.leginfo.ca.gov/bilinfo.html or http://www.leginfo.ca.gov/pub/bill/sen/sb_0501-0550/sb_529_bill_20020107_amended_sen.pdf

SB 633 was adopted. It prohibits the sale of a number of products with mercury in them, including fever thermometers except by written prescription, novelties, autos with mercury light switches, specific products in schools, and establishes procedures for the handling of mercury switches when removed from autos. Chaptered as Chapter 656. http://www.leginfo.ca.gov/pub/bill/sen/sb_0601-0650/sb_633_bill_20010914_enrolled.pdf

SB 1011 would prohibit the collection of items containing mercury, including fluorescent lamps over 4 feet in length, unless the mercury is specifically contained. Recommended for adoption by committee, and referred to Committee on Appropriations. http://www.leginfo.ca.gov/bilinfo.html or http://www.leginfo.ca.gov/pub/bill/sen/sb_1001-1050/sb_1011_bill_20020513_amended_asm.pdf

Connecticut

The 2002 legislative session is over, but with the passage of major legislation in HB 5539.

HB 5539 has as its goal "to restrict the sale and use of products containing mercury to work toward the virtual elimination of the discharge of anthropogenic mercury," and is a comprehensive bill based on the NEWMOA model. Was signed by the Governor on June 3, 2002. http://www.cga.state.ct.us/asp/cgabillstatus/cgabillstatus.asp?selBillType=Bill&bill_num=HB05539 or http://prdbasis.cga.state.ct.us/2002/cbs/h/hb-5539.htm or http://www.cga.state.ct.us/default.asp

HB 5540 has the same goal as HB 5539, "to restrict the sale and use of products containing mercury to work toward the virtual elimination of the discharge of anthropogenic mercury", and has had a hearing in the House Environment Committee, but has not proceeded further. http://www.cga.state.ct.us/asp/cgabillstatus/cgabillstatus.asp?selBillType=Bill&bill_num=HB05540 or http://prdbasis.cga.state.ct.us/2002/cbs/h/hb-5540.htm or http://www.cga.state.ct.us/default.asp

In the 2001 session of the Connecticut Legislature, four mercury product bills were introduced, but none were adopted, as follows:

1. HB 5179 would have banned the sale of mercury thermometers. Referred to Joint Committee on Environment, where no action was taken.
2. HB 5181 would have discouraged the disposal of mercury-containing products. Referred to Joint Committee on Environment, but no action was taken.
3. HB 6197 would have regulated mercury products and mercury emissions. Referred to the Joint Committee on Environment, where no action was taken.
4. HB 6687 restricts the sale of products with mercury. Recommended for passage by the Joint Committee on Environment and several other committees, but did not get voted on by the full House. http://www.cga.state.ct.us/2001/cbs/H/HB-6687.htm

SB701 is known as the Omnibus Mercury Reduction Act. Referred to Joint Committee on Public Health, which held a public hearing. http://www.cga.state.ct.us/2001/cbs/S/SB-0701.htm

Illinois

HB 3637 would prohibit the manufacture, sale or give away of mercury fever thermometers, except to a health care facility. Adopted by the House, in the Senate Rules Committee, with the last action on April 16, 2002.
http://www.legis.state.il.us/scripts/imstran.exe?LIBSINCWHB3637

Indiana

HB 1901 was adopted to prohibit the sale and distribution of most mercury-containing novelties after July 1, 2003. Limits the circumstances under which a mercury fever thermometer may be sold or supplied to an individual after July 1, 2003. Restricts a public or nonpublic school from using or purchasing a mercury commodity, mercury compounds, or mercury-containing instructional equipment and materials after July 1, 2003. Provides that a person may sell or provide a mercury commodity to another person after July 1, 2003, only if the person meets certain conditions. Requires the department of environmental management and solid-waste management districts to implement mercury education programs. Permits local units of government to implement such programs. Requires the environmental quality service council to review various issues concerning mercury before January 1, 2004.
http://www.state.in.us/serv/lsa_billinfo?year=2001&request=getBill&docno=1901

Maine

In the second regular session of the 120th Maine Legislature (which adjourned April 17, 2002), two mercury product bills were adopted and signed into law, building upon the two bills adopted in the first regular session.

1. LD 1921 "An Act to Prevent Mercury Emissions when Recycling and Disposing of Motor Vehicle" was enacted as PL 2001, c. 656. It prohibits the sale of mercury switches in automobiles as of January 1, 2003 and requires automobile manufacturers to establish a statewide system to collect, consolidate, and recycle the switches. A bounty of $1 is provided for people who remove switches and return them for recycling, with the money to be provided by the auto manufacturers.
   http://janus.state.me.us/legis/status/gateway.asp?LD=1921

2. LD 2004 "An Act to Phase Out the Availability of Mercury-added[46] Products" was enacted as PL 2001, c. 620. As introduced, the bill proposed a stepped-down phase out of products containing mercury, with those products having the most mercury phased out first. However, the bill was amended in committee to ban only mercury thermostats (effective January 1, 2006), and to postpone phase out of other mercury-added products pending DEP analysis of manufacturer data submitted under PL 2001, c. 373. The DEP analysis is due January 1, 2003. http://janus.state.me.us/legis/status/gateway.asp?LD=2004

In the first regular session of the 120th Maine Legislature (which adjourned June 22, 2001), two mercury product bills were adopted and signed into law:

1. LD 1665 "An Act to Further Reduce Mercury Emissions from Consumer Products" was enacted as PL 2001, c. 373. It bans sale of mercury fever thermometers; requires manufacturers to provide written notice to the department before offering a mercury-added product for sale in Maine; prohibits the purchase of mercury or mercury compounds for use in schools; and requires manufacturers who sell products to hospitals to provide a certificate of mercury content upon hospital request.
   http://janus.state.me.us/legis/bills/billtexts/LD166501-1.asp

2. LD1409 "An Act To Address The Health Effects of Mercury Fillings" was enacted as PL 2001, c. 385. It requires the state Department of Human Services, Bureau of Health to prepare a brochure and a poster on alternative dental restorative materials and procedures and their health and environmental effects, and for dentists who use mercury to display the poster and provide patients with the brochure.
   http://janus.state.me.us/legis/ros/lom/LOM120th/8Pub351-400/Pub351-400-72.htm#P11191_797452

The Town of Freeport, Maine was the first municipality in Maine to ban the sale of mercury fever thermometers in January 2001. Contact the Freeport town clerk to obtain a copy of the ordinance at (207)865-4743, or e-mail johanna@freeportmaine.com.

[46] Mercury-containing

Maryland

HB 75 was signed into law as Chapter 639. It prohibits marketers from selling or providing to consumers, beginning October 1, 2002, fever thermometers containing mercury, except under specified circumstances; prohibiting primary and secondary schools from using or purchasing for use in a primary or secondary classroom, beginning October 1, 2003, elemental or chemical mercury; requiring the Department of the Environment to provide outreach assistance to schools relating to the proper management, recycling, and disposal of mercury and mercury-added products; etc. http://mlis.state.md.us/2001rs/billfile/hb0075.htm

Massachusetts

Massachusetts has a two-year session. Four bills were introduced on mercury products, with two of them combined.

H 1555 would ban the use of mercury in public schools. Referred to the Committee on Education, Arts and Humanities, which has held a hearing on it. There has been no action since June 2001. http://www.state.ma.us/legis/bills/house/ht01555.htm and http://www.state.ma.us/legis/history/h01555.htm.

H 2217 contains provisions to phase out use of mercury in certain products, and requires such products to be recycled rather than landfilled or incinerated; prohibits the sale of mercury fever thermometers except by prescription; restricts schools from purchasing or using mercury, mercury compounds, commodities, or instructional equipment; bans the sale or distribution of mercury-added novelties; requires manufactures to disclose the mercury content of products used in hospitals on request; mandates labeling of mercury-added products; requires manufacturers to establish and fund (directly or indirectly) mercury collection/recycling programs; mandates the state Department of Environmental Protection to implement environmental education programs; and authorizes its participation in the establishment and implementation of a multi-state mercury clearinghouse to help achieve regional coordination. Referred to the Joint Committee on Natural Resources and Agriculture, which has held a hearing and recommended its adoption. It was renumbered as H 4717, and the House Committee on Science and Technology recommended adoption and changed the number to H 5173 -HJ 1911, sending it to Ways and Means. http://www.state.ma.us/legis/history/h05173.htm and http://www.state.ma.us/legis/bills/house/ht04717.htm.

H 3772 prohibits the sale of mercury fever thermometers, except by prescription. It has been signed into law by the Governor. http://www.state.ma.us/legis/bills/house/ht03772.htm and http://www.state.ma.us/legis/history/h03772.htm.

Michigan

HB 4599 would prohibit the sale of mercury thermometers. H-1 was adopted by the House on March 12, 2002 on a vote of 97-9. The substitute amended version allows trace mercury in button batteries for digital fever thermometers, and exempts the sale of mercury thermometers for use in applications required by state or federal law or rule, and fever thermometers for which

a prescription is provided. A Senate amended version was adopted by a vote of 36-0 on June 19, 2002. The two versions must be reconciled before being sent to the Governor. http://michiganlegislature.org/documents/2001-2002/billengrossed/house/pdf/2001-HEBH-4599.pdf and http://michiganlegislature.org/mileg.asp?page=getObject&objName=2001-HB-4599&userid=

HB 5861 would do the following: provide for mercury disposal capacity in each county, allow several possible options for funding the program, require a localized public education component, incorporate mercury P2 in county solid-waste management plans, ban the disposal of mercury and mercury-containing products in solid waste, and require product labeling for the above. Introduced on April 9, 2002, it is now in the Committee on Land Use and Environment, where no action has been taken. http://www.michiganlegislature.org/documents/2001-2002/billintroduced/house/pdf/2002-HIB-5861.pdf and http://michiganlegislature.org/mileg.asp?page=getObject&objName=2002-HB-5861&userid=

SB 6 would require that hospitals not use mercury after December 31, 2005 unless no mercury-free alternatives are available. Referred to Committee on Health Policy, where there has been no action since January 2001. http://michiganlegislature.org/mileg.asp?page=getObject&objName=2001-SB-0006&userid=

In the 1999-2000 legislation session, Michigan adopted legislation to phase mercury out of use in school classrooms by 2004. See SB 1262, now known as Act No. 376, Public Acts of 2000 on the Web at http://michiganlegislature.org/

Minnesota

HF 274 and SF 70 prohibit the sale of mercury thermometers. Adopted into law as Chapter 47. http://www.revisor.leg.state.mn.us/cgi-bin/getbill.pl?session=ls82&version=latest&number=H274

Nebraska

The Nebraska Legislature is adjourned until 2003 and did not adopt any mercury product legislation. It had one bill under consideration. LB 40 would have banned the sale of fever thermometers with mercury in them. http://www.unicam.state.ne.us/PDF/INTRO_LB40.pdf

New Hampshire

HB 253 establishes limits for mercury emissions from municipal waste incinerators. Signed into law. http://gencourt.state.nh.us/legislation/2002/HB0253.html

HB 654 would have required the removal of certain mercury products from the waste stream prior to the incineration of the waste, as well as limiting mercury emissions from waste incineration. Its status is listed as “interim study.” http://gencourt.state.nh.us/.

HB 655 would have established an advance disposal fee to fund local mercury presorting and recycling programs. Status is listed as "inexpedient to legislate." http://gencourt.state.nh.us/

HB 675 covered the reduction of mercury in products in a NEWMOA-style bill and incorporated elements of HB 654 and HB 655. Its status is listed as "interim study," and will probably not be acted upon further. http://gencourt.state.nh.us/, http://www.gencourt.state.nh.us/ie/billstatus/quickbill.html

HB 1251 had prohibited the use of mercury amalgam fillings in certain people and required dentists to provide information on mercury amalgam fillings prior to use in a patient as well as requiring mercury waste management equipment in dental offices. The prohibitions on the use of mercury amalgam were removed and then the bill was signed into law by the Governor as Chapter 0096. http://gencourt.state.nh.us/, http://gencourt.state.nh.us/legislation/2002/HB1251.html.

HB 1413, signed into law, makes several modifications to the information that the state would provide on the use of mercury amalgam fillings and in the rules that the state would develop to allow the use of equipment or methods to trap and dispose of mercury in amalgam waste at dental offices. http://gencourt.state.nh.us/legislation/2002/hb1413.html, http://www.gencourt.state.nh.us/ie/billstatus/quickbill.html

New Jersey

The New Jersey Legislature has a two-year session that begins in January of the even numbered years.

S371 in the 2002 session is the same as A3250 and S2315 from the 2000 session, and would ban the sale of mercury thermometers within 180 days of passage. The bill is in the Senate Environment Committee, with no action since January 2002. http://www.njleg.state.nj.us/2002/Bills/S0500/371_I1.pdf, http://www.njleg.state.nj.us/

New York

S 03084 and A 04209 are the same bills in the two houses entitled "The Mercury Free Water Resources and Mercury Reduction Management Strategy Act of 2001." The bills provides for: disclosure of mercury content, phase-out of mercury-added products, disposal prohibition, labeling, source separation, collection, requirements for sewage treatment plants, point source release containment traps, ban on sale or distribution of certain mercury products, replacement of manometers and gas pressure regulators (agriculture department to handle for dairy industry); regulates dental use and bans health insurance discrimination therein; requires lamp recycling; adds all mercury-added products to state universal waste rules; provides for a state advisory committee on mercury pollution; provides for penalties for violations. The Senate version had advanced to the third reading in an amended form, restored to the original form and referred back to the Water Resources Committee, while the Assembly version has been ordered to a third reading and was sent to the Environmental Conservation Committee. Neither has seen any action since January 2002. http://assembly.state.ny.us/leg/?bn=S03084,

http://assembly.state.ny.us/leg/?bn=A04209, or
http://assembly.state.ny.us/leg/?by=k&qs=mercury

A10263 bans the sale of mercury fever thermometers without a prescription. In Environmental Conservation Committee, amended in April 2002. http://assembly.state.ny.us/leg/?bn=A10263 or http://assembly.state.ny.us/leg/?by=k&qs=mercury

A10707 and S06233 require dentists to recycle amalgam. On June 20, the Assembly agreed on the amended Senate version of the bill, which had adopted the bill on June 19. As of June 28, 2002, it is waiting for the Governor's signature.
http://assembly.state.ny.us/leg/?bn=A10707
http://assembly.state.ny.us/leg/?bn=S06233
http://assembly.state.ny.us/leg/?by=k&qs=mercury

S06986 prohibits the use of mercury-containing gauges and manometers. In Environmental Conservation Committee. No action since April 2002.
http://assembly.state.ny.us/leg/?bn=S06986 or
http://assembly.state.ny.us/leg/?by=k&qs=mercury

Oregon

The Oregon Legislature is adjourned for this session, as of July 7, 2001, but adopted major legislation on mercury products.

HB 2816 would have prohibited the sale of mercury fever thermometers, mercury-added novelties, and motor vehicles containing mercury light switches. Prohibits installation of thermostats containing mercury in commercial or residential building. Provides exception. Prohibits sale of thermostats containing mercury. Provides exception. Prohibits certain actions relating to mercury and mercury products. Directs Oregon Department of Administrative Services to remove mercury light switches from state-owned motor vehicles. Directs Department of Environmental Quality to work with local agencies to provide technical assistance to wrecking businesses concerning removal of mercury light switches from motor vehicles. Adopted by the House on a vote of 55-3, with 2 absent. Sent to the Senate and referred to Business, Labor, and Economic Development. The bill stalled there and was replaced by HB 3007, which was adopted and signed into law.
http://www.leg.state.or.us/01reg/measures/hb2800.dir/hb2816.intro.html

HB 3007. This is a replacement for HB 2816 and passed both the House (47-4, with 9 absent or excused) and the Senate (26-2, with 2 absent or excused) in early July 2001. Signed into law on August 8, 2001. http://www.leg.state.or.us/01reg/measures/hb3000.dir/hb3007.b.html

SB 903 creates a task force to conduct or sponsor research to address possession of hazardous substances, including mercury waste. Requires Department of Environmental Quality to allocate money to task force from monies appropriated to its budget for biennium beginning July 1, 2001. Referred to Natural Resources, Agriculture, Salmon, and Water; then Ways and Means.
http://www.leg.state.or.us/01reg/measures/sb0900.dir/sb0903.intro.html

Rhode Island

HB 6161 and SB 661 prohibit the landfill disposal of mercury and provide for the collection and proper handling of mercury. Sub A, which has many of the elements of the NEWMOA Mercury Model Legislation, was adopted into law on July 13, 2001.
http://www.rilin.state.ri.us/PublicLaws/law01/law01234.htm

SB 153 bans the sale of mercury-containing fever thermometers except with a prescription. It was adopted into law, effective July 13, 2001.
http://www.rilin.state.ri.us/Billtext/BillText01/SenateText01/S0153A.htm

SB 649's goal was to achieve significant reductions in environmental mercury by encouraging the establishment of effective waste reduction, recycling, management and education programs. It has died due to lack of action by the end of the session.
http://www.rilin.state.ri.us/Billtext/BillText01/SenateText01/S0649.htm

Texas

HB 3085 regulates the sale and use of products containing mercury. Voted out of Public Health Committee to Calendars in May 2001. http://www.capitol.state.tx.us/tlo/billnbr.htm. The Texas Legislature has adjourned, so this bill is dead for this session.

Vermont

H. 111 proposes to establish a comprehensive approach to reducing the exposure of citizens to mercury in the environment, including bans on the use of mercury in certain products, such as fever thermometers, dairy manometers and novelties, elimination of mercury in schools, labeling requirements for mercury-containing products, and related requirements. Currently in the House Natural Resources & Energy Committee. No action since January 2001.
http://www.leg.state.vt.us/database/status/status.cfm?Session=2002

H. 283 establishes an advanced disposal fee for certain mercury-added products at a value of 8 percent of the wholesale price, and financing municipal presorting of those products when discarded. Currently in the House; no action since February 2001.
http://www.leg.state.vt.us/database/status/status.cfm?Session=2002

S. 91 covers comprehensive management of human exposure to mercury. Bans the sale of thermometers, dairy manometers, and novelties with mercury. Bans several uses of mercury in schools and the disposal of mercury in landfills and incinerators. Requires the separation of mercury-containing products prior to disposal or recycling. Requires manufacturers to report the amounts of mercury in products. Currently in the Senate Committee on Appropriations, having been reported out of the Committee on Natural Resources and Energy. A third reading was ordered on January 23, 2002.

The bill has been incorporated into H. 14, which had initially passed the House, sent to the Senate, amended to include the provisions of S. 91, and then sent back to the House, where no action has been taken since April 2002.

http://www.leg.state.vt.us/docs/2002/bills/intro/S-091.htm
http://www.leg.state.vt.us/docs/2002/bills/senate/H-014.HTM
http://www.leg.state.vt.us/database/status/status.cfm?Session=2002 and

Washington

The state legislature in 2002 did not adopt any mercury product legislation. However, in the state budget bill, the Department of Ecology was directed to establish an advisory committee to develop a state mercury action plan.

House Bill 2686 and Senate Bill 6533, entitled "Reducing the Release of Mercury into the Environment" would have required labeling of mercury-containing products when sold, called for the sellers of mercury thermometers and thermostats to establish recycling systems, prohibited the knowing disposal of mercury-containing products with other solid waste, prohibited selling mercury-containing novelties, prohibited the purchase of bulk mercury by schools, required the development of a mercury-reduction plan for health care facilities, and prohibited the use of mercury switches in autos.

http://www.leg.wa.gov/wsladm/billinfo/dspBillSummary.cfm?billnumber=2686 and
http://www.leg.wa.gov/wsladm/billinfo/dspBillSummary.cfm?billnumber=6533

HB 2786 and SB 6678 would have set up a task force to evaluate the scientific and clinical studies on dental amalgams with mercury, with a report due by June 30, 2003. Introduced in January 2002, the House bill was referred to the Committee on Health Care, while the Senate bill was referred to the Committee on Health and Long-Term Care.
http://www.leg.wa.gov/wsladm/billinfo/dspBillSummary.cfm?billnumber=2786 and
http://www.leg.wa.gov/wsladm/billinfo/dspBillSummary.cfm?billnumber=6678

On July 1, 2002, the city of Seattle adopted a resolution declaring that preventing PBT (persistent, bioaccumulative toxins) pollution is a high priority and is setting forth a work plan.

Wisconsin

NR 446 is an administrative rule that is being modified to limit mercury emissions from coal burning plants and industrial operations that have mercury emissions of more than 10 pounds a year. A 15-year phase-in of a 90 percent reduction is called for. As proposed, part of the required mercury reductions can be offset by removing mercury-containing products from use, with recovery of the mercury. The rule has gone to public hearings throughout the state and was expected to go back to the Natural Resources Board for final action.

NR 106.145 (7) is an administrative rule for wastewater treatment plants to allow establishment of community mercury product waste-reduction programs as an alternative to removing mercury from the wastewater stream. Approved by the Natural Resources Board at its meeting on June 25-26, 2002, the last remaining step is a potential review by the state legislature.
http://www.dnr.state.wi.us/org/water/wm/ww/mercury/order_wt-12-02_for_adopt.pdf
http://www.dnr.state.wi.us/org/water/wm/ww/mercury/bkgd_memo_adopt.pdf

A bill on reducing mercury in products was prepared but not introduced by Rep. DuWayne Johnsrud, who chairs the Assembly Committee on Natural Resources and is vice-chair of the Assembly Committee on Environment, as well as being on both the Committee on Health and the Committee on Public Health.

AB 793 and SB 435 would have banned the sale of mercury thermometers, with exceptions granted for food research or processing, agricultural climate control or industrial measurement, calibration thermometers, and electronic thermometers with mercury-containing batteries. This measure was included in the Senate version of the Budget Repair Bill (SA 2 to SSA 1 of AB 1 of the 2002 special session), but was not accepted in the list of items agreed to between the Assembly and Senate. The Internet address for Wisconsin legislation as well as state statutes and administrative codes is http://www.legis.state.wi.us/.

At the local level, one county and 12 villages and cities throughout the state have adopted local ordinances banning the sale of mercury fever thermometers. In May 2002, Dane County adopted an ordinance to require retailers of mercury thermostats and fluorescent lamps to take them back from consumers for recycling.

The city of Superior has banned the landfilling of fluorescent light bulbs from all sources and included them in the city's mandatory recycling program.

The city of Ashland has adopted an ordinance to ban the sale of all products containing more than 50 milligrams of mercury, with the exception of amalgam fillings. The ordinance took effect August 2002.

Federal Legislation

S. 351 would phase out sales of mercury thermometers, except by prescription, within 180 days after enactment and improve management of surplus mercury. The bill authorizes $20 million in funds for a grant program to states and other appropriate parties for collection of mercury thermometers and a thermometer exchange program. In addition, S.351 creates a federal interagency task force to make recommendations regarding the proper management of surplus mercury. The bill also authorizes the USEPA to spend $1 million per year to manage surplus mercury. It has 12 co-sponsors. A substitute was recommended unanimously by the Committee on Environment and Public Works for adoption on June 27, 2002. http://thomas.loc.gov/cgi-bin/bdquery/z?d107:s.00351: .

H.R. 2266 would reduce the risk of the accidental release of mercury into the environment by providing for the temporary storage of private sector supplies of mercury at facilities of the U.S. Department of Defense currently used for mercury storage, to require the Administrator of the USEPA to appoint a task force to develop a plan for the safe disposal of mercury, and for other purposes. Has one co-sponsor. Last major action August 2001. http://thomas.loc.gov/cgi-bin/bdquery/z?d107:HR02266:@@@P .

H.R. 2729 would ban manufacturers from selling any mercury-containing product three years after adoption, along with controlling emissions of mercury from fossil fuel fired utilities, incinerators, chlor-alkali plants, and cement manufacturers. It has 27 co-sponsors. In the House Energy and Commerce Committee, referred to the Subcommittee on Energy and Air Quality on August 16, 2001 which is the date of its last major action. http://thomas.loc.gov/cgi-bin/bdquery/z?d107:h.r.02729: .

H.R. 4163 U.S. Congresswoman Diane Watson (D-Calif) and Congressman Dan Burton (R-Indiana) introduced legislation in April 2002 with the following goals: 1) no mercury amalgam for children under 18, or for pregnant women, or for nursing mothers – effective July 1, 2002; 2) "disclosure before exposure" health warning for all – effective July 1, 2002; and 3) a phase out of all amalgam use, for anyone in the USA, in five years. Last major action April 2002. Five co-sponsors. http://thomas.loc.gov/cgi-bin/bdquery/z?d107:h.r.04163: .

Appendix G

Outline of Model Mercury Legislation
Prepared by the Northeast Waste Management Officials' Association

The following information was obtained directly from the NEWMOA Web site at http://www.newmoa.org

Background

The Conference of New England Governors/Eastern Canadian Premiers (NEGC/ECT) Mercury Action Plan included the following objectives and recommendations for the development of mercury reduction in waste model programs:

1. Eliminate or reduce non-essential uses of mercury in household, institutional, and industrial products and processes. Segregate and recycle mercury attributable to the remaining uses and/or products to the maximum degree possible.

2. By 2003, reduce the overall amount of mercury-containing waste from household, commercial, and industrial sources, through source reduction, segregation, and safe waste management, including recycling

Recommendations:

- Reduce/eliminate the use of mercury in medical and consumer products to the extent feasible.
- Identify and implement source reduction programs and develop model legislation.
- Draft model legislation implementing coordinated labeling and manufacturer take-back programs to help consumers identify products containing mercury and how to properly dispose of them.
- Eliminate the use of mercury in school science programs through initiation of programs and/or legislation.
- Adopt measures to curtail the sale of elemental mercury.

The Northeast Waste Management Officials' Association (NEWMOA) Mercury Task Force has been developing model legislation to implement these recommendations. The intent of the model legislation is to present specific program ideas that could substantially advance the region toward the Action Plan goals and objectives. NEWMOA developed the Mercury Education and Reduction Model Act at the request of the Mercury Task Force in 1999.

As a synthesis of numerous complementary approaches, the model legislation outlined below provide a comprehensive framework to help states develop more consistent approaches to managing mercury-containing wastes. By sharing their experiences and expertise, the states can

avoid duplication of effort and research, thereby saving time and money. Product manufacturers also can benefit from having more consistent programs throughout New England and eastern Canada.

The model legislative elements reflect current efforts in the U.S. and Canada to reduce mercury in waste streams. Each jurisdiction would not need to implement all of the identified programs together or at the same time. This model is designed to be a flexible set of concepts from which the states can choose those that meet their jurisdictional priorities. Many of the elements in the model have already been included in legislation that has been adopted or proposed in one or more states.

The following are proposed elements of the Mercury Education and Reduction Model Legislation. Each of the program elements described below includes a brief description of the program function and a rationale for the approach.

Model Legislation for Mercury Education and Reduction

Notification

Program: Require manufacturers and wholesalers to inform the state of the mercury-added[47] products they sell and specify the type of product, name, and address of manufacturer, amount of mercury in each unit, and total amount of mercury in all of the mercury-added products produced by the manufacturer. Establishes confidential business information procedures.

Rationale: Would inform the states about the universe of mercury-added products to enable the jurisdictions to administer other elements of the model legislation. Data on the total quantity of mercury in all of the products would enable the states to assess some of the effects of the model programs.

Interstate Clearinghouse

Program: Establish a clearinghouse to coordinate key elements of the model legislation, including manufacturers' product notifications, applications for phase-out exemptions, collection plan reviews, applications for alternative labeling, mercury content disclosures, and public education and outreach.

Rationale: Would promote cooperation and efficiency in implementing key sections of the model legislation. Would provide a single point for submission and management of data and applications from manufacturers.

Bans on Certain Mercury-Added Products

Program: Ban the sale of mercury-added toys, games, cards, ornaments, apparel, and novelties in the state. Restrict the sale of mercury fever thermometers, allowing consumers to purchase them

[47] mercury-containing

only with a prescription. Require manufacturers of mercury fever thermometers to include instructions on the careful handling, disposal, and cleanup of the thermometers sold through prescriptions. Ban the sale of dairy manometers in the state, and authorize the state to establish collection and exchange programs for these products. Prohibit primary or secondary schools from using or purchasing elemental chemical mercury or mercury compounds in the classroom.

Rationale: Would prevent mercury from frivolous uses from entering solid waste. Products, such as toys, games, cards, novelties, ornaments, and apparel, are not durable and therefore quickly end up in the waste stream. The addition of mercury to these products is frivolous and non-essential. Thermometer breakage in homes and schools and mercury spills in classrooms are common. Mercury-added dairy manometers contain a large amount of mercury that can be easily eliminated in the future. There are currently available alternative non-mercury manometers that are in widespread use in the dairy industry.

Phase-out and Exemptions

Program: Gradually phase out mercury-added products, starting with those products that contain more than one gram of mercury down to those that contain 10 milligrams over a period of time. Manufacturers of fluorescent lamps with greater than 10 milligrams of mercury would have a longer period of time to apply for an exemption. Exemptions would be allowed for products that meet one or more of the following criteria:

- Manufactured prior the effective date of the program
- Mercury required to meet federal or state health and safety rules
- Is beneficial to the environment or protective of public health and safety
- Are no feasible alternatives to use of mercury in the product
- Are no comparable non-mercury-added products available at a reasonable cost

Applications for exemptions would need to justify their exemption request and include a plan to collect and manage used mercury-added products through manufacturer take-back or by funding other private or public collection programs.

Rationale: Would substantially move toward virtual elimination of mercury from products where this is feasible. Would establish a collection system for those products that receive an exemption, so that these materials do not end up in solid-waste management facilities. Would have regional coordination among states on exemption requests.

Labeling

Program: Require mercury-added products, components, and packaging to have a label. At a minimum, labels would inform the purchaser that the product contains mercury and requires proper management practices, be clearly visible, and be sufficiently durable to remain legible. Manufacturers or their representatives would be responsible for affixing the labels. Would allow for applications for alternative labeling or notification systems that meet certain specifications. Administrative procedures that specifically define the label's content and location, and establish

a waiver or alternative labeling/notification requirement, would be adopted. Thermometers and button batteries would be exempt from product labeling. Appliances would be exempt from packaging labeling. Special provisions would be required for the labeling of cars. Cosmetics and pharmaceuticals would be exempt from these provisions.

Rationale: Would inform purchasers that the product contains mercury and how to properly dispose of the product at the end of its life. Labeling needs to be uniform among jurisdictions to make it reasonable for manufacturers to implement. For technical reasons all products may not be able to have the same label. Labeling may need to vary with the different types of products.

Disposal Ban

Program: Prohibit mercury-added products from disposal in a solid-waste management or wastewater treatment facility, unless allowed under a permit or license. Such products can only be accepted at state-permitted or otherwise approved household hazardous-waste facilities, recycling, or permitted hazardous-waste facilities. Would require separation of mercury components by scrap metal processing facilities. Also, identifies the obligations of the owners and operators of solid-waste facilities under the ban. Products intended to be consumed in use, such as cosmetics and pharmaceuticals, would be exempted.

Rationale: Would reduce the amount of mercury allowed to enter waste combustors, wastewater treatment, and solid-waste management facilities. In the northeastern U.S., one of the largest sources of mercury emissions is waste combustors. There is also at least one study under way that suggests that transfer stations and waste handling practices also may be important local sources of mercury emissions.

Collection

Program: Require that manufacturers develop a plan and ensure the implementation of a system for the collection of mercury-added products through whatever mechanisms they choose. Manufacturers would submit a collection plan to the state that covers the jurisdiction. Legislation designates key elements of the plan. Also requires manufacturers to periodically report on the success of the collection system.

Rationale: Would establish an acceptable alternative recycling/disposal infrastructure, which is necessary for successful implementation of the disposal ban. States do not have the financial resources or knowledge to carry out the necessary collection programs; manufacturers are much better suited to efficiently implement collection programs.

Disclosure Requirements for Certain Products That Are Used by Health Care Facilities and Contain Incidental Mercury

Program: Require manufacturers of specified formulated product categories that are used in health care facilities to disclose the mercury content of tested batches of their formulated product. These formulated products include acids; alkalis; bleach; materials used for cleaning, maintenance and disinfection; pharmaceutical products; stains; reagents; preservatives; fixatives;

buffers; and dyes. This would apply to the formulated products in those categories that contain incidental amounts of mercury above one part per billion.

Rationale: Would assist health care facilities that are struggling to meet stringent wastewater standards, which can be one part per billion or lower. Part of the problem is the mercury that comes from the chemicals they purchase for their laboratories and maintenance activities. They need better information on the mercury content of these formulated products. Evidence from some studies conducted by Boston-area hospitals indicate that the product categories listed above can contain incidental amounts of mercury and contribute to mercury in wastewater discharges. Hospitals can choose substitute products that have no mercury or lower mercury levels, but they need to have the necessary information from the manufacturers.

Control on the Sale of Elemental Mercury

Program: Limit the sale of elemental mercury except for medical, dental amalgam, research, or manufacturing purposes and require provision of safety information, including a material safety data sheet.

Rationale: Would limit the availability of elemental mercury. Elemental mercury is readily available to the public and is sometimes used in rituals with young children and babies, who are especially susceptible to mercury poisoning.

Public Education and Outreach

Program: Implement educational and outreach programs to support the implementation of the program elements outlined above. Establish an awards programs. Require state to develop best management practices guidance for dental offices and laboratories to help them comply with the disposal ban.

Rationale: Would establish education and outreach programs that are critical to the success of the other programs elements outlined above.

Universal Waste Rule

Program: Require state to adopt Universal Waste Rules for the largest feasible number of mercury-added products and elemental mercury that is not contained in a product. Promote regional cooperation in development and implementation of these rules.

Rationale: Would create the regulatory framework for the collection of mercury-added products and elemental mercury.

State Procurement

Program: Implement a state procurement initiative that would allow for state contracts for goods and services to explicitly include a preference for low- or non-mercury-added products that have comparable performance to mercury-added products. The preference shall apply to all state

purchases, as well as to any purchases made by others with state funds. Energy efficient lamps would have preference over less efficient lighting, and preference would be given to the lights that contain the lowest total mercury per lumen hour content available. The spent bulbs would be collected to the extent economically feasible. State contracts for dental services for state employees would provide equal coverage for non-mercury and mercury amalgam fillings at no additional expense to the employee.

Rationale: Would create a financial incentive for companies to produce low- or non-mercury-added products. States are important consumers of goods and services. Through these procurement programs, those firms that have developed low- or non-mercury-added products can be rewarded through the marketplace for making the necessary investments in those alternatives.