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Washington State

Mercury Chemical Action Plan

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DRAFT for Public Comment

Washington State Mercury Chemical Action Plan

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Purpose of this Document

The purpose of this document is to identify sources of anthropogenic mercury in Washington State, outline the existing regulatory structure around mercury and existing mercury reduction efforts, identify possible strategies for further mercury reduction and make preliminary recommendations for action to be taken by the Departments of Ecology and Health.

This is a draft document. The Departments expect that it will be modified over the coming months as a result of further research by Department staff, comments from the Mercury Advisory Committee, and comments received during the public comment period.

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Abbreviations

CESQG	conditionally exempt small quantity generator
CPG	Coordinated Prevention Grant
DOH	Washington State Department of Health
EPA	United States Environmental Protection Agency
Hg	mercury
HVAC	heating, ventilation and cooling systems
MRW	moderate risk waste
MSW	municipal solid waste
P2	pollution prevention
POTW	publicly owned treatment works (sewage treatment facility)
SQG	small quantity generator
TRC	Thermostat Recycling Corporation
TRI	Toxics Release Inventory
UWR	Universal Waste Rule

Summary of Recommendations

Source	Recommended Actions	Status
1. Mercury Release from Fossil Fuel Combustion		
Coal-Fired Power Plants	Wait for federal regulations requiring mercury reduction at coal fired utility boilers, then evaluate the need for more stringent requirements in Washington State. Review P2 Plans for new facilities reporting under lowered TRI thresholds for Hg (e.g., TransAlta, Tacoma Steam Plant).	proposed, short-term*. ongoing.
Fuel Oil: Distillate, Residual and Crude	Promote efforts to reduce energy usage.	ongoing
Oil Refineries	Refineries will be asked to review the Pollution Prevention report prepared for Ecology and identify and implement pollution prevention opportunities applicable to their facilities.	planned, next NPDES permit renewal cycle
Wood Stoves	Evaluate cleaner fuel sources.	proposed, mid-term*
2. Mining and Manufacturing		
Mining		
Mercury Mining	Prioritize abandoned mines as potential toxic waste cleanup sites.	ongoing
Gold Mining	Investigate whether existing/future gold mine heap leach or other extraction operations, surface impoundments, and/or tailings disposal facilities meet DW Regulations.	proposed, mid-term
Abandoned Placer Gold Mines	Prioritize abandoned mines as potential toxic waste cleanup sites.	ongoing
Lode Gold Mines	Evaluate mercury emissions.	proposed, long-term*
Manufacturing	Investigate where mercury enters Washington manufacturing processes, either intentionally or unintentionally; for what purpose; and possible alternatives.	ongoing
	Identify facilities that have an opportunity to reduce mercury in processes and place more emphasis on this during Pollution Prevention Plan review.	ongoing
Manufacturing of Mercury-Added Products		
Instrument Manufacturers	See "Manufacturing."	
Manufacturing of Products where Mercury is a Contaminant		
Pulp and Paper	See "Manufacturing."	
Industrial Inorganic Chemicals	See "Manufacturing."	
Cement Manufacturing	See "Manufacturing."	
Lime Manufacturing	See "Manufacturing."	
Primary Production of Aluminum	See "Manufacturing."	
3. Use of Products Containing Mercury		
Specific Products and User Groups	Draft legislation	proposed, mid-term
Medical Facilities	See proposed scope.	proposed, short-term
Dental Facilities	See proposed scope.	proposed, short-term
Veterinarians	Conduct outreach and education to encourage the replacement of mercury products with non-mercury products and to improve spill response.	proposed, long-term
Batteries	Existing source. Covered by Universal Waste Rule when generated by non-households.	ongoing
HVAC systems	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 demolition of buildings.	proposed, short-term proposed, would require additional funding
	Support expansion of the Thermostat Recycling Corporation.	
Fluorescent Lamps	Make funding available for local governments to increase fluorescent collection capacity through CESQG grants.	ongoing
	Conduct outreach and education statewide for large quantity generators on requirements of Universal Waste Rule. Existing source, currently part of Universal Waste Rule	proposed, short-term ongoing
K – 12 Schools	Work with EPA and King County to remove mercury from schools as part of more comprehensive clean-out program.	proposed, short-term
Universities	Work with universities to reduce use of mercury products.	proposed, long-term
Laboratories	Work with labs to reduce use of mercury products.	proposed, long-term
Mercury Products in Cars	Evaluate regulatory and voluntary programs for removing convenience switches from vehicles. Consider adding auto switches to Universal Waste Rule	proposed, short-term. ongoing. mid-term.
State Purchasing	Work with General Administration to review state contracts as they come up for bid, exploring ways to reduce the state's purchase of mercury products.	ongoing
4. Products Containing Mercury at End-of-Life		
Disposal of Products Containing Mercury		
Solid Waste Combustion	Consider prohibiting incineration of fluorescent lamps.	proposed, next permit renewal
Landfills	Investigate mercury emissions in landfill gas.	planned, short-term
Medical Waste Autoclaves and Retorts	Include requirement that medical waste facilities not accept mercury as part of a medical waste facility permit template for local health departments.	proposed, short-term
	Work with medical waste facilities and Hospital Association to educate medical community about disposing of mercury as hazardous waste.	proposed, short-term
	Clarify interpretation of infectious waste and hazardous waste regulations for dental community, providing direction for handling of mixed waste.	proposed, short-term
Publicly Operated Treatment Works (POTW's)	Consider eliminating mixing zones in next round of reg review.	proposed, mid-term
Septic Systems	Provide outreach material to septic pumping firms for distribution to customers.	proposed, mid-term
Auto Recyclers	Evaluate regulatory and voluntary programs for removing convenience switches from vehicles. Consider adding auto switches to Universal Waste Rule	proposed, short-term
Steel Recyclers	Evaluate regulatory and voluntary programs for removing convenience switches from vehicles.	proposed, short-term
Crematoria	Work with crematory industry in collaborative approach to identify the most productive way to reduce mercury emissions from crematoria.	proposed, mid-term
Recycling and Long Term Management of Products Containing Mercury		
Household Hazardous Products Facilities	Make funding available for local governments to increase collection of mercury products through CESQG grants.	ongoing
Mercury Retirement	Work with Quicksilver Caucus to develop proposals for mercury retirement infrastructure.	ongoing

*Short-term = 01-03 biennium

*Mid-term = 03-05 biennium

*Long-term = > 03-05 biennium

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, co-equal goals:

1. Virtual elimination of the use and release of anthropogenic mercury in Washington State.
2. Minimize human exposure to anthropogenic mercury.

“Virtual elimination” is defined for this document as a reduction of mercury releases to the air, water and land from anthropogenic, or man-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 US EPA 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 US and Mexico.

The Mercury Chemical Action Plan has the purpose of preventing new mercury from entering the environment, and reducing 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 through 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 use of consumer products that use mercury, trading in mercury-using products for those that don't, also helps to prevent spills that contribute to environmental mercury contamination. Mercury that is released into the atmosphere today may end up on our dinner table tomorrow. 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 cost. Heart disease is a major killer of adults. There is evidence that early exposure to mercury damages blood vessels in the heart and those leading to the brain. Prevention of mercury exposure has great public benefit in health and well-being. Damage to wildlife that is similar in nature to damage in humans has also been reported. Reducing mercury benefits our ecosystems as well.

Mercury: what it is

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 that are 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 as well as 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 of exposure:

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.

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 cause health effects even from short-term exposure.

Spills of mercury from broken thermometers, blood-pressure cuff monitors, jewelry, thermostats, and switches containing mercury are among the things that 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 travel worldwide in the high atmosphere is not available for people to breathe. Its importance to exposure 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 Enters the Environment

The most common source of exposure to mercury for most people is eating of fish that contain methyl mercury, a carbon-containing (organic) compound of mercury. While other foods are known to contain trace amounts of mercury, consumption of 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. In order to understand why eating some fish may be a health concern, the question of how mercury gets into fish needs to be answered. Understanding how mercury gets into the environment is essential to understanding how mercury gets into fish.

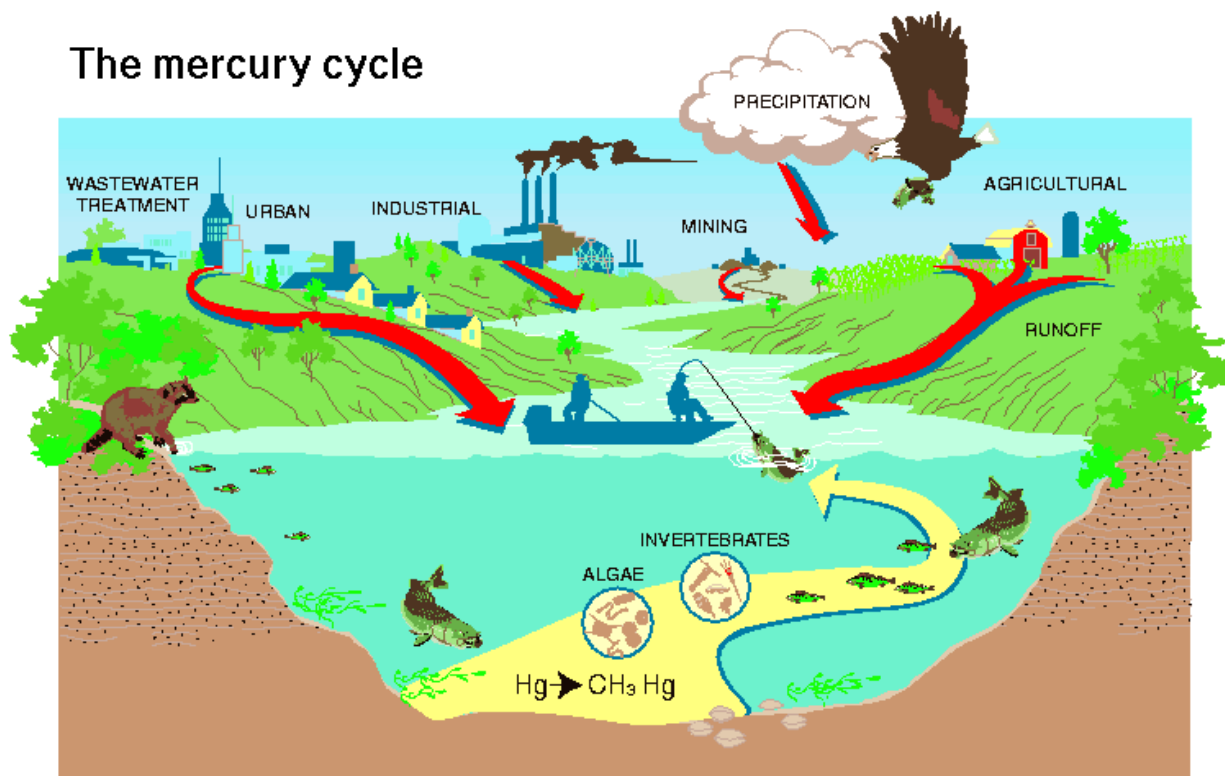
Elemental mercury can evaporate and enter the air even at ambient temperatures, but especially when heated. Compounds of mercury (that are found in coal, for instance) can undergo chemical reaction during combustion and release elemental mercury to the air. Elemental mercury can also be released slowly 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. The mercury circulating like this cannot be breathed, and does not present a route of exposure to humans or other living things while it is in the atmosphere. Once it reacts and precipitates, its compounds can enter other routes of exposure, especially 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 from the ingestion route, in which people swallow mercury compounds accidentally or deliberately. The corrosive nature of the mercury compounds can damage the stomach and digestive tract. Inorganic mercury compounds can also 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. 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 the land that makes up a watershed. 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, change it chemically to the organic form (methyl mercury), which does not readily leave the bacteria.

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 in amount. 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 concentration in those fish species they choose to eat.

The mercury cycle



(Illustration by Connie J. Dean, U.S. Geological Survey)

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 reduce mercury concentrations in fish. Likewise, reducing the use of mercury-containing consumer, and trading in mercury-using products for those that don't, also helps to prevent spills that contribute to environmental mercury contamination. Eating fish, for most people, is the greatest source of mercury exposure. Reducing mercury in fish will reduce most people's exposure.

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 through the skin), preventing the entry of mercury into the environment is the best way to reduce mercury exposure.

How Mercury Affects Health

Whether or not 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 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. Such problems typically take 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 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.

Preliminary Inventory of Anthropogenic Sources of Mercury in Washington State

Mercury releases and potential releases were calculated in two ways. First, releases from point sources were estimated in Table 1. Second, 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 from Point and Area Sources

Sources	Estimated annual mercury releases or potential releases (pounds)	Receiving Medium	Data Source	Confidence Level
Combustion of Distillate Fuel #2	733	Air	See Table x for estimate.	Low
Coal-fired power plants	436	Air	Toxics Release Inventory, 2000	High
POTW's	298	Land	Estimate of mercury in biosolids.	High
Manufacturing	296	Air, Land, Water	Toxics Release Inventory, 2000	Low
Municipal Waste Combustors	146	Air	TRI, Spokane Solid Waste	High
Medical Waste Autoclaves, Retorts	106	Air, Land	Derived from estimate of dental amalgam in red bag waste.	Low
Sewage Sludge Incinerators	79	Air	Estimate of mercury in biosolids.	High
Crematoria	57	Air	See Table 14 for estimate	Low
Combustion of Residual Fuel	29	Air	See Table x for estimate.	Medium
Medical Waste Incinerators	0.3	Air	WA Dept. of Ecology Eastern Regional Office	High
Gold Mining	0 - 777	Air, Land, Water	Toxics Release Inventory, 2000	Low
TOTAL	2,180 – 2,957			

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

Mercury Products	Estimated pounds of mercury disposed with solid or medical waste or sewage annually
Fluorescent lamps	505 – 1,839
Thermostats	444
Dental Amalgam from Dental Facilities	404
Auto Convenience Light Switches	219
Button Cell Batteries	88
Dental Amalgam in Feces and Urine	62
Household fever thermometers	11 - 300
TOTAL	1,733 – 3,356

Natural Sources of Mercury in Washington State

Currently, no summary exists describing natural sources of mercury in Washington State and sources of mercury deposited in Washington originating outside the state. As part of ongoing research efforts, the Department of Ecology is in the process of reviewing existing studies to develop such a summary. This is expected to be included as part of the background information for the final version of the Mercury Chemical Action Plan. Citations for known studies and ongoing research efforts are included in the Research and Monitoring section of this document. Occurrences of cinnabar, the ore from which mercury is mined, are listed in Appendix E.

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 underway; a few are summarized below.

The United Nations Environment Program is in the process of developing a Global Mercury Assessment, including an outline of options for addressing any significant global adverse impacts of mercury, to be presented to the UNEP Governing Council at its twenty-second 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 (NARAP) on Mercury 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 EPA'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 goal for the Washington Mercury Chemical Action Plan is identical to that expressed in the EPA draft.

The Great Lakes Binational Toxics Strategy, a Canada-US strategy for the virtual elimination of 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 US by 2006. Additional information is available at <http://www.epa.gov/glnpo/p2/bnsintro.html>.

In 1998, New England Governors and the Eastern Canadian Premiers adopted a Regional Mercury Chemical Action Plan. The Plan's goal is the virtual elimination of anthropogenic 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 have passed such legislation, including California and Oregon. A summary is contained in Appendix G 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 to Date

The 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 2001-2003 Biennium. Ecology selected mercury as the first PBT to be addressed.

In January 2002, due to the importance of health effects of mercury, a core group of staff from the Departments of Ecology and Health was formed to coordinate the Mercury Chemical Action Plan development process, and has met bi-weekly throughout the year. As a result of this close collaboration, the Mercury Chemical Action Plan has become a joint document of both the Department of Ecology and the Department of Health.

From January to March, 2002, individual and small group interviews were held with Ecology staff to identify potential sources of mercury in Washington State, ongoing and planned efforts to reduce those sources, and potential strategies for additional reductions. Information was also gathered from sources in other states and EPA 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 Department of Ecology and Department of Health 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, a second Advisory Committee meeting was held. The Advisory Committee was expanded at this point to 22 members at the request of Advisory Committee members, other stakeholders, 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 twelve 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, external comments were incorporated. The Preliminary Draft Action Plan was reviewed by Department of Ecology and Department of Health 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 the Department of Ecology's agency goals and the goals of this action plan, pollution prevention strategies, or avoiding the use of mercury, were preferred over pollution control strategies, or minimizing the release of mercury to the environment following use. More detailed plans for implementing short-term action will be developed in consultation with stakeholders. In some cases, such as the removal and recycling of 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 the identification of accurate, cost-comparable non-mercury medical equipment, have reduced mercury reduction costs by providing impacted 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, new technology, and, in some cases, economies of scale. As the Department of Ecology proceeds with implementation of mercury reduction activities, it will continue to identify and, in cooperation with stakeholders, the EPA, other states, local governments, and research institutions, to help create cost-effective solutions to address the needs in Washington State.

The current draft, the Draft Mercury Chemical Action Plan, will be released for public comment on September 4. Ecology and Health will hold a 60 day public comment period, during which two public forums will take place. The first will be held in Tacoma at Henry Foss High School

on September 26; the second will be held in Moses Lake at Big Bend Community College on October 3. Both public forums will be facilitated by Ross and Associates.

The final meeting of the Advisory Committee will take place in late October. In November and December, public comments will be considered and incorporated, and the Action Plan will be finalized for release at the end of 2002.

The Draft Background Document, the Preliminary Draft Action Plan, the Draft Action Plan, 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 Action Plan development process, individual meetings have been held with stakeholders upon request. Through list serves, e-mail, and phone calls, Ecology and Health 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.

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 anthropogenic mercury emissions. Washington has fewer coal fired power plants than the Midwest and the Eastern regions of the country, although the state has other sources that burn coal.

Ecology regulates two active facilities classifiable as coal-fired steam generators. One is the Transalta Centralia Steam Plant, and the other is the City of Tacoma Steam Plant #2. A third coal-fired power plant in Shuffleton is listed on the EPA Acid Rain program listing of facilities.

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 the generation of the 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 ESP's. On each boiler at the plant are two ESP's, in series, followed by a wet limestone scrubber. Thus, at the coal-fired portion of the plant there are four electrostatic precipitators 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 is classified primarily as a municipal waste combustor and is discussed in greater detail in that section of this report.

Quantity and Estimated Uncertainty

According to the Toxics Release Inventory, the Transalta Centralia steam plant released 436 pounds of mercury in 2000. Of the mercury released, 374 pounds was reported 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 this year and the maximum utilization (capacity factor) of the facility, the Centralia Power Plant would emit 350 – 360 pounds per year of mercury and mercury compounds.

Centralia Power Plant has reported mercury emissions for 10 years to Southwest Clean Air Agency. Emissions have been estimated from a stack test in 1992 and from coal mercury testing. In 1999, the EPA 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 parts per billion; primarily elemental mercury which is not collected well by control equipment for other emissions. The coal mined at Centralia is washed before combustion, which will remove some mercury. The power plant has two electrostatic precipitators to remove coal ash particulate; some mercury is also removed with the ash in the precipitators.

Groups Affected

Coal-fired power plants, Regional Air Authorities

Current Regulations and Policy

Mercury emissions from coal-fired power plants are not currently limited by law or regulation. The US 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 ambient air impact was 0.3 % of the Acceptable Source Impact Level (ASIL). 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 will be complete in July 2002. Although they are designed primarily to remove sulfur dioxide from the flue gas, they will also 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 scrubbed 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, EPA announced it had affirmatively decided that mercury air emissions from power plants should be regulated under the Clean Air Act, because mercury poses great hazards to public health. Under this decision, EPA 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 US 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

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.

Ongoing

Review Pollution Prevention Plans or new facilities reporting under lowered TRI thresholds for mercury.

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 can be thought of as that 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 prime fuel source for ocean-going ships.³

¹ <http://yosemite.epa.gov/opa/admpress.nsf/>, 3/4/02.

² http://fossil.energy.gov/techline/tl_mercurysel2.shtml, 3/4/02.

³ New Jersey Task Force, New Jersey Mercury Task Force Report: Volume III, New Jersey Department of Environmental Protection, December 2001, pp. 60, 63.

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.

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 parts per million by weight, while the range of concentrations in residual oil is 0.007 to 0.17 parts per million by weight. Because EPA 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 emission factor development.

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 the table below. Data are insufficient to develop controlled emission factors for fuel oil combustion. There is considerable uncertainty in these emission factor estimates 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 3: Typical Mercury Emission Factors

Fuel Oil Type	Typical mercury emission factors					
	Kg/10 ¹⁵ J	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.⁴ Applying the emission factors above, 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.

⁴ <http://www.eia.doe.gov/pub/state.data/pdf/wa.pdf>, September 1, 2002.

Groups Affected

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

Current Regulations and Policy

Fuel oil is not currently regulated for mercury content.

Reduction Options

Any effort that would reduce energy usage would also 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 usage.

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 is dependent 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.⁵

A recent draft report prepared for Ecology's Industrial Section regarding pollution prevention opportunities for refineries in Washington State included some data collected by the Washington

⁵ 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)

refineries. Washington refineries primarily have been processing Alaska North Slope crude. The refineries have indicated a mean mercury content of 1.98 ng/g. The number of samples analyzed by Washington State refineries was not provided in the draft report.

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.

Groups Affected

Refineries

Current Regulations and Policy

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

Recent Activities

As part of a grant from EPA, 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 will be final in the fall of 2002.

Washington refineries have all been required to prepare Pollution Prevention Plans for their facilities as part of their most recent NPDES permit renewal. This plan focuses on the 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, 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 ng/l 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.

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 negative impacts 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 the Washington State refineries to review the 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 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 combustion gas exhaust stack. Very small quantities of mercury also may be emitted with the fugitive PM emissions from bottom and fly ash handling operations. The data on mercury emissions from wood combustion are limited. A National Council of the Paper Industry for Air and Stream Improvement (NCASI) report provided a range and average emission factor for boilers without electrostatic precipitators (ESP's) and for boilers with ESP's. The boilers without ESP's included a variety of control devices including cyclones, multiclones, and various wet scrubbers. The average emission factor reported for boilers without ESP's was 3.5×10^{-6} kg/Mg (6.9×10 lb/ton) of dry wood burned. The average emission factor reported for boilers with ESP's was 1.3×10^{-6} kg/Mg (2.6×10 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 (5.2×10 lb/ton) of wet, as-fired wood burned.

The NCASI average emission factor reported for wood-fired boilers with ESP's of 1.3×10^{-6} kg/Mg (2.6×10 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 one type of wood (pine) at a single location. In 1987, the 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 State cannot be calculated at this time.

Groups Affected

Households with wood stoves, industrial facilities that use wood fuel

Current Regulations and Policy

Mercury emissions from wood combustion are not specifically regulated. However, RCW 70.94, the Washington State Clean Air Act, does set policy to control, reduce, and prevent air pollution caused by 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 which normally emits dense smoke or obnoxious odors may not be burned in a wood stove or fireplace.
- Smoke density is restricted.
- \$30 fee on the sale of new wood stoves to support wood stove education and enforcement programs.
- Ban on the installation of new or used uncertified stoves.
- Requires non-wood heat sources in new or substantially remodeled construction in urban growth areas or nonattainment areas for particulates.
- Sets conditions under which a local air pollution control authority or Ecology may prohibit the use of uncertified stoves.
- Only Washington State level 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 county building permit department should be contacted for information on fireplaces and wood stoves.

Recommended Actions

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 1939.⁶

In 1970, Ecology sampled water from the Tilton River, which receives drainage from the mining area. Concentrations were less than 0.5 ppb, at the time, considered a background level. Fish tissue samples collected upstream and downstream of the mining area contained approximately 0.1 mg/l of mercury.⁷ 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 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, people who eat fish downstream of the mines.

Current Regulation and Policy

Model Toxics Control Act, WA Dept. of Ecology

⁶ 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.

⁷ 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 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 waste 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. Extraction of gold and other precious metals from their ores by treatment with mercury is called amalgamation.⁸

According to the United States Geological Survey (USGS), miners used mercury to recover gold throughout the western United States at both placer (alluvial) and hardrock (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 State from 1858 to 1860. Placer gold occurs in the counties of Chelan, Clallam, Ferry, Kittitas, Lincoln, Okanogan, and Whatcom.⁹ Through 1969, 275 thousand troy ounces of placer gold was mined in Washington, only 0.2 percent of total placer gold mined in the United States from 1792 to 1969.¹⁰

⁸ <http://pubs.usgs.gov/gip/prospect1/goldgip.html>, 4/1/02.

⁹ J. M. West, "How to Mine and Prospect for Placer Gold," <http://imcg.wr.usgs.gov/usbmak/ic8517.html>, 3/29/02.

¹⁰ 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>, 3/29/02.

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 1969,¹¹ 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.¹² 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

Potentially, people who fish in water bodies downstream from historic placer gold mines, property owners

Current Regulations and Policy

Model Toxics Control Act

Recent Activities

In 1996, as part of the Spokane River Metals Project, the 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 were also posted at the shop.

Ongoing Activities

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

The Ecology Central Regional Office is evaluating abandoned mines as potential toxic waste cleanup sites.

Research, Development, and Monitoring Options

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

¹¹ 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>, 3/29/02.

¹² <http://water.wr.usgs.gov/mercury/fs06100.html>, 4/1/02.

Recommended Actions

Ongoing

Prioritize abandoned mines as potential toxic waste cleanup sites.

Proposed, mid-term

Investigate whether existing gold mine leach heap leach or other extractions, surface impoundments, and/or tailings disposal facilities meet Dangerous Waste regulations.

Lode Gold Mining

Identification and Description of Source

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

Table 4. 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 Groundwater
Delano Wind River Mine	Carson	Skamania	WDP Discharge to Groundwater
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 Groundwater; WDP General Permit; Toxics Release Inventory
Gold Mountain Mine	Curlew	Ferry	Hazardous Waste Generator (Inactive)
Hecla Knob Hill Mine	Republic	Ferry	WDP Discharge to Groundwater; 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

Quantity and Estimated Uncertainty

The metal mining industry first had to report to TRI for activities taking place in 1998. Two gold mines in Washington State reported releasing a combined 1,432 pounds of mercury to land. One of these, the Lamefoot Mine, has since ceased operation. According to the mines, this estimate was 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 State gold mine reported air emissions of mercury, four Nevada gold heap leach mines reported air emissions totaling 13,560 pounds. According to EPA, the mercury that is emitted originates in the ore. Ore roasters and autoclaves can be point sources of air mercury emissions. The cyanide leach heap solution that extracts gold from ore also extracts mercury. Processing of 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.¹³

Hecla Mining Company, which owns the one active gold mine identified, 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.¹⁴

Groups Affected

Gold mines

Current Regulations and Policy

Ch 70.95C RCW / 173-307 WAC Pollution Prevention Plan

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

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

RCW 70.94, Washington State Clean Air Act

Research, Development, and Monitoring Options

Work with EPA and gold mines to improve characterization of mercury emissions.

Work with EPA and gold mines to improve characterization of control technologies.

Work with EPA and gold mines to investigate voluntary reduction initiatives.

Work with DNR/ Bureau of mines to characterize mercury in ores.

¹³ US EPA Mercury Task Force PBT Mercury Work Group, Working Draft: PBT National Action Plan for Mercury, US EPA, March 15, 2002, pp. 39-40.

¹⁴ Pers. comm., Dave Holland, Senior Environmental Analyst, Hecla Mining Company, June 5, 2002.

Recommended Actions

Proposed, mid-term

Investigate whether existing/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 the 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 Toxics Release Inventory, are then described in greater detail.

Quantity and Estimated Uncertainty

The Department of Ecology has three sources of information on mercury and mercury compounds stored, disposed of or released by manufacturers: the Toxic Release Inventory and the Hazardous Chemical Inventory (Tier 2), and the Dangerous Waste Annual Reports.

Hazardous Chemical Inventory

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. This is too high to be of much value. For calendar year 2000, two companies reported storage of these chemicals.

Toxic Release Inventory

Under the Toxics Release Inventory (TRI), mercury and mercury compounds are reportable at 10 lbs. 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). In addition, the company must employ ten or more full-time employees or the equivalent and it must be in one of the industry types listed in Table 5.

Table 5. Industries Required to Report to the Toxics Release Inventory by Standard Industrial Code (SIC)

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 & 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		

For reporting year 2000, 24 individual companies reported for either mercury or mercury compounds (Appendix E). 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.

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 EPA 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 or the level of accuracy for the existing reporters.

Dangerous Waste Reports

The Dangerous Waste Database contains information compiled from annual dangerous waste reports. Annual dangerous waste reporting for persons with a current RCRA Site ID# 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 State's future capacity to store, transport, and dispose of dangerous wastes as well as to provide biennial report information to the

Environmental Protection Agency. 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 HWTR Program's "Education Fee". Conversely, explore a fee break (incentive) if the generator were mercury/PBT free.

Engage existing P2 planners to include mercury in P2 plans.

Multi- program compliance inspections (Ecology Air Quality, Hazardous Waste and Toxic Reduction, Solid Waste and Financial Assistance, Toxic Waste Cleanup, Water Quality Programs).

Recommended Actions

Ongoing

Investigate where mercury enters Washington manufacturing processes, either intentionally or unintentionally; for what purpose; and possible alternatives.

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 Pollution Prevention Plan review.

Manufacturing of Mercury – Added 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. This definition is used to be consistent with definitions in use by other states addressing the issue of mercury in products.¹⁵ Only one manufacturer of mercury-added products was identified in Washington from sources available.

¹⁵ Northeast Waste Management Officials' Association, "Revised Discussion Document: Mercury Education and Reduction Model Act," Section 3; 2000.

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. There is potential for mercury emissions from all instruments containing mercury.¹⁶

One facility with a related SIC code (3812), Honeywell in Blaine, reported off-site mercury transfers to TRI for 2000. SIC code 3812 includes Search, Detection, Navigation, Guidance, Aeronautical, and Nautical Systems and Instruments.¹⁷

Quantity and Estimated Uncertainty

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

Groups Affected

Instrument Manufacturers

Current regulations and policy

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

Recommended Actions

See “Manufacturing.”

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

¹⁶ 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, DC; December 1997; p. 4-45.

¹⁷ <http://www.census.gov/epcd/naics/NSIC3D.HTM#S38>, 4/12/02.

process, and as a contaminant in makeup chemicals added to the process. If the mercury is not purged from the process in wastewater 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 reused).¹⁸

Quantity and Estimated Uncertainty

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

Groups Affected

Pulp and paper manufacturers

Current regulations and policy

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

Recent Activities

Weyerhaeuser, Longview, closed its mercury chlor-alkali plant in the late 1980's. 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. An RIFS for phase 2 relating to the cleanup of the plant site is in the public comment period. Georgia Pacific West has also 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

¹⁸ 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, DC; December 1997; p. 4-45.

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 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 impact, 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, reported releasing a total of 58 pounds of mercury in 2000 to the Toxics Release Inventory.

Groups Affected

Manufacturers, users of products

Current regulations and policy

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

Recommended Actions

See "Manufacturing."

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/precalcining steps.¹⁹

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

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

Recommended Actions

See “Manufacturing.”

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 possibly in appreciable quantities in any waste-derived fuels. Any mercury emitted from fuel

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, DC; December 1997; p. 4-42.

combustion will occur during the calcination step and will be discharged as vapor kiln exhausts.²⁰

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

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

Recommended Actions

See “Manufacturing.”

Secondary Steel Smelters

See *Steel Recyclers* section in this document.

Primary Production of Aluminum

Identification and Description of Source

Primary producers of aluminum. *To be developed: source of mercury in process.*

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.

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, DC; December 1997; p. 4-56.

Groups Affected

Aluminum manufacturers

Current Regulations and Policy

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

Recommended Actions

See “Manufacturing.”

3. Use of Products Containing Mercury

Mercury Added Products – General

Identification and Description of Source

Due to its unique properties, mercury has been and is found in a wide variety of products. Some 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 1990's may also contain mercury. Mercury 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 in use 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 Reduction and Education 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-added products exceed 1,600 pounds annually in Washington State. For calculations and assumptions, see the Mercury Release Inventory section of this report. 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 Universal Waste Rule is a federal rule that EPA adopted in May 1995 for three types of waste. Universal wastes are certain dangerous wastes that are frequently generated, and that can be managed appropriately under less stringent regulatory requirements. They are generated by many types of generators and are considered to be less hazardous than other wastes. The federal rule set forth some reduced waste management standards for batteries, thermostats, and pesticides. For example, they do not have to be manifested or counted. Ecology adopted two categories of universal waste, batteries, and mercury-containing 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 rulemakings. In June 2000, Ecology adopted the Universal Waste Rule for lamps. The state rule differs somewhat from the federal rule. See Ecology publication # 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, disposal (TSD) or recycling facility.

Recent Activities

All regulated mercury-bearing dangerous waste generators in Washington State were identified using the Dangerous Waste (DW) Annual Report Database. This list will complement the TRI list with information on mercury waste generated and potential releases, under the authority of the HWTR Program.

As part of the Spokane River Metals Reduction Project, in 1996 the 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. The legislation focuses on promoting reductions and elimination of mercury-containing products 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 G.

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 mercury-bearing dangerous waste generators. Several successful educational/assistance efforts have been implemented to increase awareness and facilitate proper management.

Recommended Actions

Proposed, short-term

Draft legislation that will seek to reduce the use and release of mercury in products in Washington State.

Specific Product Types

Mercury Fever Thermometers

Identification and Description of Source

Consumer mercury fever thermometers contain 0.5 to 1.5 grams of mercury²¹ and are used to measure body temperature in health care facilities, private homes, and schools.

²¹ Bill Ravanese, Health Care Without Harm, "Mercury in Medical Devices," Sustainable Hospitals website, 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 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, which 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, schools

Current regulations and policy

Dangerous Waste Regulations

Current Activities

In the spring of 2002, Ecology awarded grants to four local governments; the City of 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 the City of Vancouver 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. The county is planning a larger exchange for the fall 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.²²

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 cities and counties across the country, in many cases preceding state legislation.

King County is working to ban the sale of mercury fever thermometers.

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 clean up 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 formation in batteries. It is currently 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.

²² Health Care Without Harm, http://www.noharm.org/index.cfm?page_ID=26.

Quantity and Estimated Uncertainty

It is estimated that 88 pounds of mercury annually are disposed 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 CPG grants.

Recommended Action

Ongoing

Support the collection of button cell batteries at household hazardous waste collection facilities through CPG 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. While unusual

Groups Affected

Facility managers, local building inspectors, waste haulers, homeowners, home improvement stores, demolition firms, 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 431 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 2006.²³

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 ampule 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 removal of mercury switches prior to demolition, though this has not been confirmed. Likewise, local building codes likely do not prohibit the use of mercury switches in HVAC systems.

Activities of Other Groups

The Thermostat Recycling Corporation (TRC) is owned by three thermostat manufacturing companies facilitates the collection by HVAC wholesalers from contractors of all brands of used, wall-mounted mercury-switch thermostats so that the mercury can be purified for re-use. TRC provides containers for a minimal fee to wholesalers for the collection of 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.²⁴

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

²³ <http://twincities.bizjournals.com>

²⁴ http://www.nema.org/index_nema.cfm/664/, accessed 6/25/02.

As discussed in the 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 Thermostat Recycling Corporation

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 demolition of buildings.

Proposed, would require additional funding

Support expansion of the Thermostat Recycling Corporation.

Lamps

Identification and Description of Source

Mercury-containing 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 twenty years, a certain amount of mercury is still required to ensure that the lamp operates properly. A typical fluorescent lamp has a phosphor-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.²⁵

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

²⁵ National Electrical Manufacturer's Association (NEMA), Fluorescent Lamps and the Environment," 2001, www.nema.org/lamprecycle/nemafluorfinal.pdf.

two weeks. Approximately 620 million fluorescent bulbs are discarded annually in the U.S., and many are broken during disposal.²⁶ Scaling for population and assuming a 20 percent recycling rate, discarded bulbs release approximately 690 to 1,839 pounds of mercury in Washington annually.

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 (CFL's) is increasing. For example, King County utilities distributed more than 300,000 CFL's in 2001 to promote energy conservation. Many retail stores stock large selections of energy-efficient, mercury-bearing CFL's. CFL's contain 5 to 10 mg of mercury, and have a lifespan of about 10,000 hours.²⁷

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

Alternatives

Lamps will be continuously generated now and in the foreseeable future because no alternatives currently exist.

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, HID lamps (mercury vapor, metal halide, high pressure sodium), neon lamps, and any other lamps that are dangerous waste. See Ecology Publication #00-04-020 for more information.

The Universal Waste Rule (UWR) for Dangerous Waste lamps provides a streamlined regulatory avenue for regulated generators to dispose of their mercury added 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 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 SQG moderate risk waste facilities. At least one such facility deposits these collected lamps in their local MSW landfill, since the nearest recycler is located a long distance from them. 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 State, Northwest Ecolights (Seattle) is the only recycler

²⁶ Aucott, Michael, Michael McLinden, and Michael Winka, "Release of Mercury from Broken Fluorescent Bulbs," Journal of Air Waste Management Association, in press.

²⁷ Local Hazardous Waste Management Program in King County, "Mercury in King County," August 2002.

that processes the lamps into their component parts so as to retrieve, the glass, lead, aluminum, phosphor powder and mercury.

Presently, all the major lamp makers have a line of low mercury products that are not designated 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 potential 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. Use of this test method presents several problems when testing products such as lamps. 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 thrown in, and the mercury vapor goes off as an air emission, not to the ground. Another problem with the test is that lamp manufacturers are able to bind up the mercury in the tube with an additive, 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).

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 a \$750,000 to undertake a nationwide lamp recycling promotion effort.

Reduction Options

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

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

Study the possibility and consequences of a state-wide 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 of lamps to see if additional recycling facilities (where the actually 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 added products and CRT's (electronic waste).

Complete survey of MSW landfills and MRW 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.

Outreach and Educations Options

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

Recommended Actions

Ongoing

Make funding available for local governments to increase fluorescent collection capacity through CPG grants.

Planned, short-term

Work with King County to conduct outreach and education to large quantity generators on the requirements of the Universal Waste Rule.

Proposed, short-term

Conduct outreach and education statewide for large quantity 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, convenience light switches will be phased out by the end of 2002.

Vehicle manufacturers continue to employ new applications of mercury, primarily in HID 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-added automotive parts does not currently exist in the state of Washington. When vehicles are removed from service and recycled, the mercury in switches and other mercury-added 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

Ecology estimates that approximately 263 pounds of mercury are disposed and potentially released from convenience light switches in vehicles each year. Ecology does not currently have an estimate for mercury released from other sources in vehicles. When melted in electric arc furnaces, 6-10 tons of mercury emitted nationally each year, primarily as a result of mercury from switches in scrap steel from vehicles and, to a lesser degree, appliances.

The Columbia Ridge Landfill at Arlington, Oregon received 41,550 tons of auto fluff was received from Washington State in 2001. None of that fluff came from Schnitzer Steel in Tacoma, however.

Between Schnitzer Steel, Pacific Coast Shredding and Seattle Iron & Metals the approximate amount of auto fluff generated and disposed of each year in Washington State is between 127,000 – 150,000 tons.

There are approximately 340 licensed auto recyclers in the state.

Alternatives

Ball bearing switches are available to replace mercury tilt switches in convenience lighting at comparable cost.

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 State'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 the state of Washington. Federal & State water regulations also require automotive recycling yards to have a Storm Water Permit. Storm waster permits require yard owners to have pollution prevention plan in which yard owner provides detail on how releases of hazardous constituents (including mercury) will be prevented.

Dangerous Waste Regulations (WAC 173-303), e.g. 173-303-145 – Spills and discharges into the environment apply to this issue.

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

Recent Activities

The Hazardous Waste and 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 concerning mercury switches was given out during the mercury switch replacement project conducted recently for the City of Vancouver for their government fleet of vehicles.

Ongoing Activities

The Departments of Ecology and Health are currently in discussion with General Administration on replacing mercury switches in Ecology and Health fleets and potentially extending to the entire Washington state 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 (AROW) will inform their membership at six workshops throughout the state concerning many issues affecting auto recyclers. The issue of mercury switches will be briefly discussed. A handout will be provided listing the cars where mercury switches are most likely to be found.

Activities of Other Groups

The Clean Car Campaign, 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, organized a nationwide Switch-the-Switch Event in November 2001. Events took place in 13 states, with government fleets, including the City of Vancouver, Washington, auto dealerships and others replaced mercury switches with non-mercury switches.

Oregon and Rhode Island passed bills in 2001 that will 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 (DEQ), Metro and the Port of Portland are partners in the Switch OUT program, funded through a grant from the US EPA. Over 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.²⁸

²⁸ <http://www.orcouncil.org/>, August 13, 2002.

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 3 state agencies and the vehicles put up for auction. Donated replacement switches cost about \$.20 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 with information has been given to all auto recyclers with information concerning mercury switches and their proper management and disposal. This information has been available for eight years.

Vermont is current involved in a mercury phase-out program. A mercury switch removal manual was developed and distributed. They are installing mercury free switches in the Agency of Natural Resources’ 350 vehicles at a cost of less than \$.50 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 procedure 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. The person I spoke with said it took less than a minute to install the replacement switch.

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

Ecology staff have spoken on the phone over the past year with many of the coordinators of the above state programs and they all say the automotive mercury switch projects have been very successful to date. There are several other states that have programs that are dealing with the removal/elimination of mercury switches in vehicles.

Reduction Options

Replace switches at state emission testing stations.

Place bounty on switches funded by car manufacturers.

Require auto dismantlers to make reasonable effort to remove switches.

Support legislation to ban use of mercury in vehicles.

Voluntary exchange programs and incentives.

Establish private sector based exchange programs located in automotive repair or lube shops. Vehicle owners would pay the 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.

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), which 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 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

There is likely a mercury release involved, though data is lacking for Washington State. A number of 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, lab technicians

Current Regulations and Policy

Pre-treatment Program for POTW's
Dangerous Waste Regulations
Toxics Reduction Program
Pollution Prevention Outreach
Local solid waste permits for medical waste disposal facilities
Biosolids permits for POTW's

In 1998, the American Hospital Association and the US EPA signed a memorandum of understanding to virtually eliminate mercury from hospitals' waste streams by 2005; to reduce overall volume of hospital waste by 33 percent by 2005 and 50 percent by 2010, and to identify hazardous substances for pollution prevention and waste reduction opportunities. The memorandum of understanding led to the creation of Hospitals for a Healthy Environment, a partnership between the American Hospital Association, US EPA, Health Care Without Harm, and the American Nurses Association, to help hospitals meet these goals. Tools, resources, and other information is available at www.h2e-online.org.

Hospitals for a Healthy Environment has developed a pledge program whereby participating hospitals commit to work toward achieving the goals set forth in the memorandum of understanding between the American Hospitals Association and the Environmental Protection Agency. While over 335 hospitals have made the commitment, only one hospital in Washington State, Mark Reed Hospital in McCleary, has signed the pledge.

Recent Activities

As part of the Spokane River Metals Reduction Project, the Eastern Regional Office updated and published "Pollution Prevention in Medical Facilities, containing a section on mercury." The booklet was 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 Pollution 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, Environmental Protection Agency Region 10, the 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. 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 Neo-Natal Intensive Care Units. MIRT will be holding another seminar on mercury in October or November 2002. This seminar will be replicated around the state.

MIRT also became a Hospitals for a Healthy Environment (H2E) Champion for Change and, as such, has committed to encouraging hospitals to strive toward reaching the goals set forth by H2E (see above section, “Current Regulations and Policy”). The Pollution Prevention Resources Center has received a grant from EPA 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 working 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 by medical facilities

Outreach and Education Options

Outreach and education for medical staff.

Recommended Actions

(1) Develop a voluntary, collaborative program in cooperation with the Washington State Hospital Association to encourage the adoption of mercury reduction policies by the Association and the installation and following of BMPs. Include outreach and education, targeted technical assistance visits, “sweeps”, etc. Include a recognition program. Consider developing a

memorandum of understanding with the Hospital Association to reduce the use of mercury in hospitals.

Time frame: at least two years.

(2) If voluntary program not successful at significantly reducing mercury discharges from these facilities, amend RCW 173-216, 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 POTW's.

Add mercury equipment such as thermometers and sphygmomanometers (though not lab products or mercury-containing drugs) 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. Have affirmative contact with local environmental health directors, presenting boilerplate language.

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

Outreach and education to NW Biosolids Management Association and appropriate chapters/committees of the Pacific NW 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 wastewater are approximately 56 mg/dentist/day, based on a review of several studies

examining wastewater concentrations, water flow and consumption rates.²⁹ AMSA concluded that dental discharges account for the largest portion of POTW influent loadings and, therefore, represent the source for which pollution prevention and source control efforts would be expected to be most effective with respect to measurable results.³⁰

King County conducted a survey of dentists' waste disposal practices with regard to amalgam. Results are summarized in Table 6. Roughly 50 percent of the dentists in Washington State practice in King County.

Table 6. Estimated Mercury Discharged from Dental Offices in King County, Washington Total Pounds per Year³¹

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/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.³²

Groups Affected

Dentists, hazardous waste haulers, autoclaves, POTWs

Current Regulations and Policy

Pre-treatment Program for POTW's

Dangerous Waste Regulations

Toxics Reduction Program

Pollution Prevention Outreach

Local solid waste permits for medical waste disposal facilities

Biosolids permits for POTW's

Dept. of Labor and Industry Worker Safety/ Infectious Waste Regulations

²⁹ Larry Walker Associates, "Mercury Source Control and Pollution Prevention Program Evaluation: Final Report," prepared for the Association of Metropolitan Sewerage Agencies under grant from U.S. Environmental Protection Agency, March 2002, p. 7.

³⁰ Walker, p. 51.

³¹ 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.

³² Walker, pp. 9 – 10.

Recent Activities

As part of the Spokane River Metals Reduction Project, in 1996, the Eastern Regional Office held two focus groups with members of the Spokane dental community on educating dentists to dispose of wastes properly. ERO created a “Dental Waste” poster and sent it both 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 at the waste-to-energy plant and its two transfer stations for amalgam waste.

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 Ecology’s regional offices, especially the Southwest Regional Office through increased Generator Contact (IGC) visits and other technical assistance visits.

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, which concluded that the voluntary program had not worked. A significant number of dental offices were still discharging wastewater 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, 2003.³³

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 MRW 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. DW regulatory level is 0.2 ppm under the Toxicity Characteristic (TC) pursuant to WAC 173-303-090(8), waste code D009. Discharge of wastewaters with mercury at or above the regulatory level is illegal disposal and prohibited for all generators, including SQGs.

³³ 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 HWTR and Water Quality Programs to affirm and ensure compliance with DW regulatory and State Waste Discharge limitations. Local wastewater authorities that have delegated pretreatment 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.

As discussed in the Advisory Committee, this approach may have problems, given the way dental insurance is structured. (More specific information and alternative suggestions encouraged.)

Outreach and Education Options

Conduct state-wide dental office campaign and outreach effort.

Recommended Action

Implement a tiered strategy:

1) Develop a voluntary, collaborative program in combination with the Washington Dental Association to encourage the adoption of mercury policies by the Association and the installation of amalgam separators and follow best management practices.

Work with Dental Association on outreach and education to dentists. This includes targeted tech assistance visits, state-wide or regional “sweeps,” and normal compliance inspection visits. Include recognition program and possibly help with funding.

Work with Stericycle or other waste collection companies to set up one-time collection of leftover elemental mercury.

Clarify handling practices for amalgam cartridges and other dental waste.

Time frame: at least two years.

2) If voluntary program above is not successful at significantly reducing mercury discharges to POTWs, develop a monitoring program for public sewage treatment plants to determine if mercury limits in the effluent or biosolids are appropriate.

3) Amend RCW 173-216, 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 dentists. In order to meet the limit, dentists could be encouraged to install amalgam separators and follow best management practices. Time frame: longer than two years.

4) Develop a general permit for dentists, requiring them to install amalgam separators and follow best management practices. This would not apply to dentists in the nine areas that have delegated authority for pretreatment programs. Time frame: longer than two years.

Other recommendations:

Conduct outreach and education to POTW's.

Consider special section in general biosolids permit on mercury, which could be advisory.

Consider requiring more frequent analyses for mercury as permit condition, either for the general permit, or on an as needed basis with final approval of coverage..

Outreach and education to NW Biosolids Management Association and appropriate chapters/committees of the Pacific NW Clean Water Agency to emphasize the importance of amalgam separators.

Draft boilerplate language for use by local health departments in waste facility permits, requiring that medical waste facilities do not accept waste containing mercury. Have affirmative contact with 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 State 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

Dangerous Waste Regulations

Recent Activities

In 1996, as part of the Spokane River Metals Reduction Project, the Eastern Regional Office submitted two newsletter articles to the Spokane area veterinary association on the proper

disposal of broken thermometers. The article 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 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; fluorescent lamps; mercury vapor lamps; metal halide lamps; 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 clean up costs of \$6,000. At another school, a broken mercury barometer resulted in clean-up costs totaling \$200,000.³⁴

Quantity and Estimated Uncertainty

The statewide Rehab the Lab Project conducted approximately 350 visits (note: some of these visits were follow up visits to the same school) to schools throughout the state. The visits mainly focused on the 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 100-200 lbs. of mercury and mercury compounds have been removed from schools statewide, and likely another 100-200 lbs. still needing removal. Rehab the Lab staff have visited over half the middle and high schools throughout the state. There are still schools needing assistance but this project is not funded presently.

³⁴ 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.

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

Groups Affected

Impacted Students/Teachers/School Staff. Involved- Teachers, School Staff, Dept. of Health, Dept. Labor and Industries, Local Health Districts, Educational School Districts, Fire Marshall, Office of the Superintendent of Public Instruction and Department of Ecology

Current Regulations and Policy

Rehab the Lab (visits and teacher workshops)

OSPI/Dept. of Health, Health and Safety Guide for Schools

Sample- Fact Sheets about Mercury from other states

Sample- Ban Mercury in Schools from other states

Sample-Survey/ Assessments from other states

Sample- pledges from schools to eliminate Mercury from other states

Sample- Mercury curriculum/audits from other states

Sample- legislation that paid for chemicals including mercury to be removed and disposed of from schools

Recent Activities

SB 6533 and HB 2686, introduced in the 2001 legislative session, would prohibit “the purchase for use in a primary or secondary classroom bulk elemental mercury or bulk mercury compounds.” Manufacturers that produce and sell 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, 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 for students on mercury was provided.

“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 disposal 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 EPA 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.

Groups Affected

Independent laboratories, schools, hospitals

Current Regulations and Policy

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. The Eastern Regional Office conducted site visits to a more complete list of laboratories in Spokane County in 1997 to distribute the booklet.

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.

Current Activities

The Medical Industry Waste Pollution 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, the Business and Industry Resource Venture, the Washington State Department of Ecology, Environmental Protection Agency Region 10, the 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 can also 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 can also 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 GA, but they do not offer do it. If they do, information is not broken down by purchasing entity.

Groups Affected

General Administration, state agencies, local jurisdictions

Current Regulations and Policy

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.

The Department of Ecology is a member of the Product Stewardship Institute. The Product Stewardship Institute assists state and local government agencies in establishing cooperative agreements with industry and developing other initiatives that reduce the health and environmental impacts from consumer products. The Institute seeks out the active input from, and cooperates with, environmental groups, business interests, academic institutions, the federal government, and related organizations to achieve product stewardship goals.³⁵

The Department of Ecology participates in the Northwest Product Stewardship Council. The Northwest Product Stewardship Council endeavors to integrate product stewardship principles into the policy and economic structures of the Pacific Northwest.³⁶

Ongoing Activities

Governor Locke has called for an Executive Order on Sustainable Government. Ecology will participate in the multi-agency group to draft the executive order. The intent is that the executive order would require state agencies to purchase environmentally preferable products when they meet price and performance needs. Additionally, it will ask for life cycle considerations to be made for some product purchases, which includes potential impacts from product manufacture through ultimate disposition.

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

Ecology has contacted General Administration regarding its current Invitation for Bid for Lamps and Ballasts. The contract requires that the vendor employ a "Lamp Specialist" to be the

³⁵ <http://www.productstewardshipinstitute.org/>, 3/4/02.

³⁶ <http://www.productstewardship.net/>, 3/4/02.

customers' primary and single point of contact for product use issues. Ecology has requested that information on fluorescent lamp recycling be provided as part of the Lamp Specialist's technical assistance. Vendors are also required to provide training for customers; Ecology has requested that information on fluorescent lamp recycling be included as part of the training.

Ecology and Health plan to approach General Administration about including specifications in the next invitation for bid for vehicles, requiring that vehicles not have mercury switches and requiring vendors to disclose all mercury devices in vehicles on the contract. [Question: Are you still considering the replacement idea?]

Activities of Other Groups

INFORM is preparing a guide to assist 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 and the state mercury coordinator, they developed specification language for the solicitation for the major medical and surgical supply contract, asking that the 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 General Administration to review contracts as they come up for renewal to include a preference or requirement for non-mercury products.

Recommended Actions

Ongoing

Work with General Administration to review contracts as they come up for renewal to include a preference or requirement for non-mercury products.

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% (approximately 150) of the 730 milk-producing dairies that were operating in 2000 were using mercury manometers. Using a grant from EPA to fund a rebate/replacement project, at least 110 farms will have had mercury manometers removed by June 2002.

Between October 2000 and 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 oz. of elemental mercury instead of the expected one pound. The average amount collected from the U-shape was 10 oz instead of the expected one pound. The third type average was at 3 oz. instead of the expected 5 oz. Therefore, instead of removing 80 pounds of elemental mercury, only 56 pounds was 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 impacted 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 one 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 atomized mercury.

Current Regulations and Policy

Dangerous Waste Regulations

Recent Activities

Ecology, WSU Cooperative Extension and 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 expects to collect at least 110 mercury manometers by June 2002. The project received funding through a Pollution Prevention Incentives for States (PPIS) grant from the US Environmental Protection Agency.

Initially, the project team mailed letters and brochures to 730 operating-dairies in order 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, to 13 milk cooperatives, and to 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 webpage for the States Conservation Districts.

As part of the Mercury Manometer Replacement Program, WSDA milk inspectors are noting how many mercury manometers are still in use at milk-producing dairies. Also, a more accurate count of the number of manometers that may be still located onsite at farms that are no longer operating dairies. This will be done by coordinating with milk cooperatives and dairy equipment vendors and by reviewing archive mailing lists from the WSDA.

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 5 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 the Department of Ecology 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 in operation 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 municipal waste combustor by the Department of Ecology. The City is contesting this classification, arguing that the facility should be considered a coal-fired power plant. The steam plant is currently not in operation. It burns a combination of construction and demolition debris 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 releases 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 to the Toxics Release Inventory of 49 pounds.

Groups Affected

Cities and corporations owning municipal waste combustors, customers

Current Regulations and Policy

Clean Air Act

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 State has one medical waste incinerator, at Washington State University in Pullman. The WSU Medical Waste, Low-level Radioactive Waste and Pathological Waste separates waste by type, because of different burning characteristics.

Medical waste (paper, plastic, bedding, glass, etc. which have 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 do sorting in terms of what actually 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 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 (ASIL) will not be exceeded.

The lowest ASIL for mercury or mercury compounds is 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 @7% 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.

They are required to transfer ash from the incinerator to sealable, non-melting, non-combustible container. The containers must go to an approved site for disposal. That would probably reduce mercury release by a certain amount.

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

Clean Air Act

Reduction Options

Require facility to establish a source separation program.

Outreach and Education Options

Outreach and education to university 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. Ninety-one percent of municipal solid waste in Washington is landfilled. 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 sent to landfills is conservatively estimated at 1,076 to 2,553 pounds annually. This estimate includes thermometers used in private homes, fluorescent lamps, wall thermostats, and scrap dental amalgam. It does not include products other than thermostats with mercury switches, including appliances, other HVAC equipment,

bilge pumps, or others. 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. Mercury in scrap dental amalgam that is disposed of as biomedical waste and treated at a medical waste autoclave or retort may volatilize before ultimate disposal at a landfill. Sterilized biomedical waste from dental offices is currently disposed of 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.

Table 7. Estimated Mercury in Products Landfilled Annually in Washington State

Mercury Products Assumed Landfilled	low estimate (lbs)	high estimate (lbs)
Fluorescent lamps	505	1,839
Thermostats	444	444
Dental Amalgam from Dental Facilities (solid waste)	116	116
Dental Amalgam from Dental Facilities (biomedical waste)	106	106
Household fever thermometers	11	300
Total pounds of mercury in discarded products in Washington	1,182	2,805
Percent of municipal solid waste landfilled	91%	91%
Total pounds of mercury in discarded products landfilled	1,076	2,553

The fate of mercury in landfills is not well understood. A recent study conducted in Florida showed that methylmercury was emitted with landfill gas.³⁷ Statistics are currently 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

Dangerous Waste Regulations

³⁷ Lindberg, S.E., D. Wallschlager, 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, 24 February 2001.

Research, Development, and Monitoring Options

Conduct sampling and speciation for mercury emissions at Washington landfills.

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 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 regulated 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, with subsequent landfill. Mercury amalgam is often placed in “red bag” as infectious/medical waste by dentists.

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
Landfill (?), Ecology Solid Waste and Financial Assistance Program

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

Dental wastes may be regulated as both a dangerous waste and an infectious or medical waste. Some regulatory uncertainty exists for the dental sector on whether to treat mixed waste containing both mercury and medical waste (teeth, saliva, etc.) as dangerous waste or medical waste. The Interagency Regulatory Analysis Committee in King County, with representatives from the Washington State Department of Labor and Industries, Public Health-Seattle and King County, the Washington 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.³⁸ The Department of Labor and industry determined that dental office 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.³⁹

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 the facilities for mercury.

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

³⁸ 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. Trohimovich; May 30, 2000.

³⁹ 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 waste facilities and the medical and dental communities to conduct outreach and education for medical waste generators on the proper disposal of 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 Industry 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 (POTW's)

Identification and Description of Source

Mercury is present in wastewater treated by POTW's. Following treatment, mercury is present in POTW's 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. Loading and concentrations of mercury in effluent are regulated by NPDES permits.

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 graywater 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 graywater is considered very difficult to effectively control. 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.⁴⁰

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% of that 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 (WDOE 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 1990's showed a mercury range of 1 ppm to 1430 ppm in septage. Biosolids which are applied to the land must be analyzed for mercury and other pollutants. Measured values are well below Ecology's regulatory limit of 57 ppm for mercury in biosolids, which is risk-based.

Twenty sewage treatment plants that discharge to surface waters have effluent limits for mercury that regulate the amount of mercury in the discharge (Table 8). 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 20 plants with extant 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.

⁴⁰ "Mercury Source Control and Pollution Prevention Program Evaluation," Association of Metropolitan Sewerage Authorities; p. ES-4.

Table 8. Sewage Treatment Plants with Mercury Limits in NPDES Permits

Sewage Treatment Plant	Reporting Frequency	Number of Mercury Violations, 4/1/01 – 1/1/02
<i>Northwest Region</i>		
Duvall	monthly	2
Everett	monthly	0
Ferndale	monthly	0
Granite Falls	monthly	1
Monroe	monthly	0
North Bend	monthly	2
<i>Southwest Region</i>		
Cowlitz	monthly	0
Enumclaw	monthly	0
Puyallup	monthly	0
Sumner	monthly	3
Yelm	monthly	0
<i>Central Region</i>		
Entiat	monthly	1 (failure to report)
<i>Eastern Region</i>		
Diamond Lake	?	0
Moses Lake Larson	bi-annually	0
Othello	? annually	0
Quincy	?	0
Royal City	?	0
Spokane	monthly	0
Walla Walla	monthly	1

Groups Affected

POTW's, cities, counties

Current Regulations and Policy

Chapter 173-308 WAC, Dept. of Ecology

Chapter 173-201A WAC, Dept. Ecology

70.95 RCW

90.48 RCW

40 CFR Part 503, EPA

In the Northwest Region, the City of Lynwood, King County, and the City of 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 are technically 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.

Recent Activities

In 1996, Ecology received a grant to fund a position in the Eastern Regional Office to help the Spokane Advanced Wastewater Treatment Plant with the pollution prevention portion of its pretreatment 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 POTW's 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% depending on the agency's existing pollution prevention efforts and the extent of additional pollution prevention conducted.⁴¹

Reduction Options

To further reduce the mercury in biosolids, one effective approach may be to establish a voluntary pollution prevention program for POTW's. 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, how to reduce them.

The Ecology Pre-Treatment Workgroup, which is composed of the four Ecology regional pre-treatment coordinators, could coordinate with the NBMA Pretreatment Committee members to develop pollution prevention and mercury reduction strategies.

Ecology could set a lower regulatory threshold for mercury in biosolids. In order to do this, Ecology would need to show that the risk posed by mercury in biosolids is greater than EPA calculated to set the current limit.

⁴¹ "Mercury Source Control and Pollution Prevention Program Evaluation;" Association of Metropolitan Sewerage Authorities; pp. ES-2,3.

Ecology could consider eliminating mixing zones along with other potential water quality rule changes.

Recommended Actions

Proposed, mid-term

Consider 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 deterioration of mercury-amalgam fillings, disposal of broken mercury thermometers, mercury fungicides in paint products, and others sources. When septage is ultimately disposed, whether by land application, incineration, or land filling, mercury may be reintroduced to the environment. If septage is not pumped and removed from an onsite system in a timely manner the system may deteriorate, and pollutants may then enter the environment around the septic system. It is unknown whether mercury would remain with solids in the tank or leach to the surrounding 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 – 350 pumpers service onsite 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 1990's 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 which treat sewage, farmers and other land owners who apply septage and biosolids to the land. Septic tank pumpers are not directly affected, but are an important stakeholder group for on-site systems.

Current Regulations and Policy

Chapter 70.95J RCW

Chapter 173-308 WAC

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 uses its Biosolids Management Guidelines to make decisions on permit conditions.

Reduction Options

Ecology could write a chapter on mercury for inclusion in the Biosolids Management Guidelines, which could be an effective outreach tool.

Recommended Actions

Proposed, mid-term

Provide outreach material to septic pumping firms for distribution 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 the past at least one facility has give it away as free fill, but the ash should be going to a municipal solid waste landfill. It may be stored on site temporarily. Anacortes, Bellingham, Edmonds, Lynwood, and Vancouver have sludge incinerators

Quantity and Estimated Uncertainty

U.S. Filter in Vancouver reports mercury emissions dated 96/05/29-30 as 25.9 g/day from their incineration of sewage sludge.

Table 9. Sewage Sludge Incinerated in 2000

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

Groups Affected

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

Current regulations and policy

In Washington State, sludge incinerators are permitted by US EPA Region X under the Clean Air Act.

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* section in 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, white goods recyclers

Current Regulations and Policy

Ch 70.95C RCW / 173-307 WAC Pollution Prevention Plan

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

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

Steel recyclers are issued air permits by local air authorities under the Clean Air Act.

Reduction Options

Work with steel recyclers and other stakeholders to develop comprehensive auto and appliance switch removal program.

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;⁴² none of them 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. Mercury in human bodies is contained primarily in dental fillings (SOURCE?). Cremations account for approximately 11% of all mercury emissions in the

⁴² <http://www.cremationassociation.org/docs/00data-projtest-new.pdf>, 3/28/02.

UK and 32% of mercury emissions in Sweden. Fifty-nine percent of deaths are cremated in Washington State, compared to 26% 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 customers

Research, Development, and Monitoring Options

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

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 Products Facilities

The following household hazardous waste facilities are listed in the recycling database as accepting mercury products. This does not necessarily include fluorescent lamps.

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 County Landfill	2901 6 th 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 117 th 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 East at Transfer Station 360-533-1251
Island	Camano Island	Camano Island Transfer Station/Recycle Park 75 E. Camano Hill Road	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 County Moderate Risk Waste Facility	360-379-6911
King	Seattle	South Transfer Station	8100 Second Ave South 206-386-9790
Kitsap	Port Orchard	Kitsap County MRW Facility	Olympic View Ind. Park: 5551 SW Imperial Way 360-337-5777
Kittitas	Ellensburg	Kittitas County 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 Cty 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

The Solid Waste Program encouraged local governments to submit proposals for mercury reduction projects as part of the CPG grant 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 CESQG grants.

Mercury Retirement

Issue Summary

A considerable amount of effort is being spent to prevent mercury's 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 and 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's release to the environment. EPA considers elemental mercury to be a product. The price of elemental mercury has fallen considerably on the world market since the 1960's, making it more accessible to more groups of 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 come on the market.

Groups Affected

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

Current Regulations and Policy

The Department of Defense maintains the country's largest stocks of elemental mercury, 11 million pounds, in four facilities. DOD's 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 US EPA Administrator Christine Todd Whitman, calling on EPA 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, US EPA Assistant Administrator G. Tracy Mehan, III, sent a memo to US EPA Administrator Christine Todd Whitman, proposing that EPA senior managers develop policy recommendations on management of surplus mercury for her consideration.

Ecology staff will be participating in multi-state discussions on the creation of a national mercury repository.

Recommended Actions

Ongoing

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

Mercury in the Environment

Air

Laws/regulations pertaining to mercury in water

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

Research and monitoring

Washington State 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 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

173.201A WAC, Water Quality Standards For Surface Waters Of The State Of Washington

Thirty sections of a total of ten water bodies in Washington State exceed water quality standard 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.

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

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

- 173.200-040 WAC, Water Quality Standards For Ground Waters – Of The State Of Washington
- 9048 RCW, Water Pollution Control
- Federal Clean Water Act

How effectively does each tool currently deal with the issue of mercury use, release, and exposure?

Water quality regulations allow because there are criteria levels of mercury and allow mixing zones. 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.

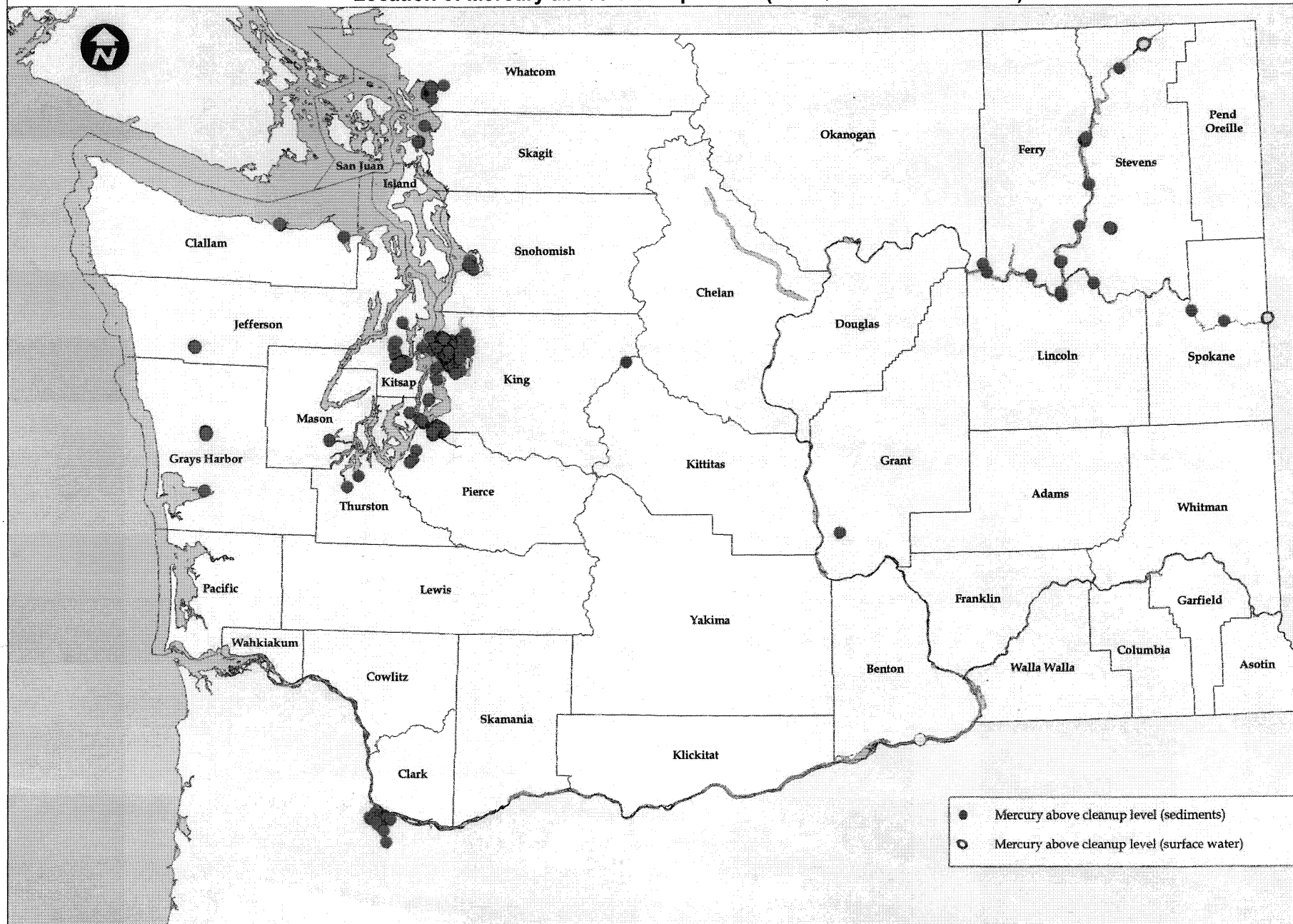
Unless a body of water is listed, or mercury is regulated from the source, it may not be found by water quality. At this point the solid waste program may find mercury and regulate it where water quality did not. Better detection limits of priority pollutants scans may be a way to find mercury more easily.

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 cleanup of historic sediment contamination
2. Procedures for preventing future sediment contamination from discharges
3. Standards for defining sediment contamination

Location of Mercury above Cleanup Levels (SEDQUAL & EIM Records)



Planned research and monitoring activities

Lake Whatcom Mercury Source Identification: A team of USGS scientists 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.

By June 2002, Ecology's Environmental Assessment Program expects results from its sampling of tissue from fish captured in lakes within a 50 mile radius of Lake Whatcom. EAP will likely begin surface sediment sampling and sediment coring during the summer of 2002 with USGS. This information 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 is also considering funding sampling in tributaries to Lake Whatcom.

Toxic Waste Cleanup Sites

The Model Toxics Control Act became law in 1989 with passage of Citizen's Initiative I-97. Voted in by an overwhelming majority, 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 was founded.

The main purpose of the Toxics Cleanup Program was and still is to get and keep contaminants out of the environment. With the assistance of cleanup fund dollars, the program has identified over 9,000 contaminated sites in the state of Washington. Of those, nearly 5,000 sites require no further action.

Under State law, the Toxics Cleanup Program (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 it has spread – if at all. This is followed by actions to begin cleaning up the site.

Many of the sites the program works on are listed on the Environmental Protection Agency's (EPA) National Priority List. The program provides regulatory assistance to EPA 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 State is one of the few states in the nation that has this type of relationship with EPA.

The first step in the cleanup process is to investigate a site. Once the Toxics Cleanup Program receives a complaint about a piece of property or the practices of an owner or operator, a program inspector will go to the site and conduct an initial investigation. This 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 the Toxics Cleanup Program with basic information about a site. The program 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 comprised of 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. The Toxics Cleanup Program oversees contaminated sites with a ranking of 3, 4, or 5.

The Toxics Cleanup Program has identified the cleanup of PBTs and abandoned mine cleanup as two of six major challenges the program will continue to face in coming 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 media. Mercury may be one of the metals and/or priority pollutants. Snohomish and Pierce counties have over 100 sites while King County has 475 sites potentially contaminated with mercury.

Until very recently, the Toxics Cleanup Program has not consistently tracked mercury as an individual contaminant at cleanup sites. As a result, Ecology does not have comprehensive records on which toxic waste cleanup sites have or have had mercury contamination. The Toxics Cleanup Program 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, the Toxics Cleanup Program identified a partial list of the sites in Table 10 as having mercury or multiple PBTs.

Table 10. Partial List of Specific 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 clean up
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'		Mercury	Remediation complete
Puget Sound Naval Shipyard OUB	Bremerton	PCBs, mercury	Process of clean up
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 site	Bellingham	mercury in sediments	draft cleanup action plan in development, proposes containment/possible treatment
Wood Industries		Multiple PBTs	Cleaned up

Mercury in the Food Chain

Fish

Research and monitoring

1. “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

Average and high dose exposures associated with fish consumption from the Lower Duwamish River were calculated for methylmercury and three other contaminants of concern for anadromous species (Chinook and Coho Salmon), bottomfish (English Sole), other finfish (Quillback Rockfish and Shiner Perch), and crab. Fish consumption rates were taken from a survey of the Suquamish Tribe and used to calculate the high-end dose estimate. 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, chemical 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 compared to other species. Limited sampling indicated that both red rock and Dungeness crab contain elevated levels of mercury.

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

Report concluded that some Native American fish consumers are likely to exceed DOH’s tolerable daily intake (TDI) for methylmercury based on a detailed analysis of fish consumption rates. The report also states that such overexposure to methylmercury needs to be reduced below the TDI by consuming 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.

Fish-eating Birds

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

Fish-eating Mammals

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

Humans

With enough exposure, mercury as an element, or as any of its compounds, can affect health of humans and other animals. 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 methyl mercury. Fish absorb methyl mercury from water as it passes over their gills. However, fish accumulate most of the methyl mercury that gets into their tissue from the prey they eat.

The most common way that people are exposed to enough mercury to cause them harm is through eating certain predatory, long-lived fish that have accumulated methyl mercury (an organic compound of mercury) into their tissues at levels above what the human body can handle. Mercury does not easily leave the body again either through the urine or feces, but tends to accumulate over time with continued exposure. Methyl mercury is slowly changed to inorganic mercury that stays for a long period of time in the central nervous system (primarily the brain).

Methyl mercury enters the brain readily, passing through the “blood-brain barrier” attached to an amino acid. It can also be carried to other tissues and is recirculated between the liver and intestine attached to a sulfur-containing compound (glutathione). It stays for a long-time.

Methyl mercury’s primary toxic effect is on the brain. The developing brain is more sensitive to the harmful effects of methyl mercury, and the compound behaves differently in the adult brain. Other organ systems, especially the heart and blood vessels, are also affected by methyl mercury.

In the developing brain (of fetuses and infants) mercury affects all different cells within the brain and causes a general disturbance in both normal development and growth of the brain by interfering with cell division of neurons and the migration of neurons to various functional parts of the brain during development. In studies that looked at damage to young children in Minamata, Japan and in Iraq, this damage was manifested in delayed developmental milestones and changes in anatomy. In studies of fish-eating populations, effects were seen at even lower levels and were detected as functional damage, that is, in neuropsychological change that can be detected through tests of reasoning, reflexes, and behavior.

In the adult brain, there is a time period between exposure and the onset of symptoms, which can be weeks or months in length. Strange sensations (“pins and needles,” numbness) are the first symptoms that appear at the lowest exposure dose. With continuing exposure and accumulation of mercury, changes in sensation that are processed through the cerebellum (which maintains balance and smooth functioning of muscles), difficulty in co-ordination of the muscles used in speaking, constriction of visual fields, and loss of hearing may follow. Some of these symptoms may result from the inability of some neural cells to repair initial damage because new proteins cannot be made. Whether or not adults suffer damage depends greatly on whether individuals

have inherent protective mechanisms such as whether or not they can make enough of certain molecules (glutathione) that can bind mercury and prevent it from interacting with neural cells.

Once in the brain, methyl mercury is changed to the inorganic mercury form, which seems to be the form that does the damage to the brain.

Studies of fish consuming populations in Finland have also shown statistically significant associations with risk of cardiovascular disease, especially increased progression of carotid atherosclerosis. In a study of 7-year-old children, elevation in both systolic and diastolic blood pressure was associated with increased exposure from mercury from their mothers consuming certain fish tissues and meats during pregnancy.

Of the concern that eating large amounts of certain fish that have accumulated methyl mercury either because they live a long time or have preyed on and eaten many smaller fish that have taken up mercury from smaller organisms, Washington Department of Health has issued a consumption advisory for women of child-bearing age. The Department of Health recognizes that fish is good food, that is low in fat, 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 Department of Health recommends that people eat a variety of fish and shellfish as part of a balanced, healthy diet.

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 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 20 pounds, to three ounces for a child who weighs about 60 pounds.

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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.

During the spring of 2001, the state Department of Health (DOH) issued a fish-consumption advisory for women of childbearing age and children under age six due to high levels of mercury. The advisory states that these groups should avoid eating shark, swordfish, tilefish, king mackerel, or tuna steak. It also recommends limiting the amount of canned tuna consumed, depending on a person's weight. For example, a 135-pound woman should eat no more than a can (6 ounces) of tuna per week. Specific weekly limits of canned tuna for children range from one ounce for a child who weighs about 20 pounds to three ounces for a child who weighs about 60 pounds.

Too much mercury is not healthy for anyone, but children are particularly impacted. If exposed during fetal development or early childhood, mercury can cause central nervous system changes that affect a child's ability to learn. Since issuing the advisory, DOH staff has worked with representatives from populations of special concern to develop health messages and activities within their communities. DOH issued a news release and developed a question-and-answer fact sheet and a "fish facts" web site (www.doh.wa.gov/fish). In addition, DOH worked with the Washington State Public Health Association, local health departments, community and migrant health centers, and nutritionists from the Women, Infants and Children (WIC) Program.

Native Americans and Asian and Pacific Islanders in Washington may be at increased risk for mercury exposure, because they rely on fish as a key source of dietary protein. To address the potential for increased mercury exposure among these populations, DOH has focused action to communicate the advisory within these communities. These actions include presentations before the American Indian Health Commission, consultation with the Governor's Councils on Native American and Asian Pacific American Affairs, and discussion with several other key organizations and individuals from these communities.

From these discussions DOH has learned that, while communicating fish advisories is important, efforts to reduce mercury in fish are crucial for effective public-health protection.

It is important that 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..

Shellfish: While the major source of methylmercury exposure in humans is consumption of fish, consumption of shellfish tends to contain much lower amounts than most predatory fish species. As stated by the EPA (EPA 1996), out of the top 10 most commonly consumed types of fish by the U.S. population, clams ranked as having the lowest mercury concentration. Regional data from Puget Sound Ambient Monitoring Program (PSAMP) and NOAA supports this notion. Methylmercury accumulates up the food chain, so that fish at the top of the food chain will have the most mercury in their flesh. Of these fish, the largest (i.e., oldest) fish will have the highest levels. Shellfish, which are generally filter feeders and low on the food chain, tend to have much lower levels of mercury compared with predatory fish and therefore their consumption is thought not to be of concern. Despite their relatively low levels, certain populations such as recreational and subsistence fishers who routinely consume shellfish may be at increased risk due to their high consumption rates.

EPA 1996. Mercury study report to Congress Volume VI: Characterization of human health and wildlife risks from anthropogenic mercury emissions in the United States. U.S. Environmental Protection Agency. EPA452/R-96-001f.

Education and Outreach

Focused education and outreach efforts are called for under many separate sections of this plan. The general public, the dental and health care communities, schools and certain industries, as well as state and local government agencies all have been identified as being important groups where education and outreach activities must be directed.

Principles of effective and equitable community education include the early involvement of representative members or key leaders and organizations that represent the particular group, in the development of educational goals, strategies and in setting criteria for success. Education and outreach activities proposed under this plan, shall be defined and where feasible, implemented and evaluated in conjunction with existing leadership and other stakeholders from within the particular community group, professional group, industry or agency to which it pertains.

For each targeted group, a brief plan that defines the goals, objectives of specified activities, and that contains criteria and plan for evaluation will be written. Costs and staff time associated for developing and carrying out these plans will be specified and funding secured (wherever possible.)

A key strategy for fomenting education at the community level is the CPG grant opportunities made available by Department of Ecology for mercury reduction work at the community level. Currently five counties are developing programs appropriate for their residents. These are:

Kittitas County – Mercury thermometer exchange project.
Yakima County – Purchase of a crusher for fluorescent tubes.
Kitsap County – Mercury fever thermometer exchange
City of Tacoma –
Thurston County –Mercury phone survey and thermometer exchange

Additionally, the Department of Health will continue to expand their 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. (See plan attached.) Nutrition consultants with the DOH Women, Infant and Child health program will continue to be instrumental to reaching young women and small children in the state, with this information.

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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 ten years old; to provide a screening level assessment of the potential for adverse effects of 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 the consumption of fish; and to provide information for resource managers and the public about the status of toxics 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, US EPA, 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 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 waterbody or waterbody parameter on the 303(d) list will be based on finding at least one exceedance 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, US EPA, US Fish and Wildlife

The Puget Sound Ambient Monitoring Program (PSAMP) brings together local, state, and federal agencies, coordinated by the 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.

Statewide Mercury in 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 waterbodies (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 EAP will collect and analyze game fish from approximately 20 waterbodies, mainly lakes, distributed statewide. The target species for this work will be bass due to their wide distribution and capacity to bioaccumulate mercury. The target is 10 bass to from each waterbody. Muscle fillet from each bass will be analyzed separately. To evaluate other factors effecting mercury uptake, surface sediments from three locations in each lake will also be analyzed for total mercury. A single depth integrated water column sample for pH, dissolved oxygen, and hardness, along with a vertical profile of temperature and secchi depth will also be collected from each lake. A final project report will be prepared that discusses the study findings. In addition, the data generated will be entered into Ecology's 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 clean water act section 303(d) list of impaired waterbodies. 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 FY03. EAP will collect approximately 30 surface sediments and 3 cores from the lake to evaluate current and historic mercury concentrations. Analysis will include total mercury in all samples. Methyl-mercury levels will also be determined in approximately 15 of the surface sediment samples. In addition, as part of the Lake Whatcom dissolved oxygen 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 5 cores from surrounding lakes. Together these efforts will provide information to hopefully determine the current status of sources of mercury to the Lake Whatcom watershed. The need for a more formal TMDL to address mercury will also 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 US EPA

The researchers' previous work has shown that combustion derived air pollutants from Asia can be transported to the US in 6-8 days. This discovery was made based on observations of a number of gaseous and aerosol species at the Cheeka Peak Observatory (CPO) 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 US EPA-NERL and Office of International Activities have sponsored a project to measure Hg⁰ and coarse and fine aerosol chemistry at CPO. Measurements began in the spring of 2001 and are planned to continue until 2002. Preliminary "near-real time" data from Cheeka Peak can be viewed at <http://faculty.washington.edu/djaffe/data.htm>.

Quicksilver Caucus – EPA Mercury Stewardship Initiative

Department of Ecology, Environmental Council of States, US EPA

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. EPA is working with states, through the Quicksilver Caucus, to resolve two difficult mercury issues: (1) How to meet mercury reduction goals for specific water bodies where mercury water pollution is caused primarily by air deposition; and (2) How to ensure safe stewardship of mercury supplies and wastes.

EPA Region 10 Mining Workgroup

US EPA, Department of Ecology, Department of Natural Resources, US Department of Agriculture Forest Service, US Department of Interior Bureau of Land Management,

The EPA 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, existing problems, and the identification of each agency's authorities and capabilities for dealing with mine issues. The present outcome of this work is an effort being coordinated by WDNR to gather all agency data into a single multi-agency database/GIS system. Other agencies including the USFS and BLM have recently received EPA delegated authority for the use of CERCLA 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. One is at the Hoh Ranger Station in Olympic National Park and has been inactive since 1995. The second is at the National Oceanographic and Atmospheric Administration's facility in Seattle and is operated by Frontier Geosciences, Inc.

Planned Research

Survey of Mercury Research Activities in Washington State

Department of Ecology

The Department of Ecology plans to survey other institutions in Washington State to determine other research being conducted on the topic of mercury over the summer and fall of 2002.

Literature Review: Impact of Fish Consumption Advisories on Consumer Behavior

Department of Health

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 State? 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 impact of mercury on Washington wildlife (e.g., orcas, eagles)?

What is the fate of mercury in biosolids?

How much mercury is in effluent versus biosolids?

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Source Tables and Calculations for Mercury Release Estimates

Table 11. 2000 Toxics Release Inventory for Mercury and Mercury Compounds

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

SIC	Facility Name	City	County	Chemical Name	Air	Water	Land	Total
4911	Transalta Centralia Generation / Mining	Centralia	Lewis	Mercury	374.00	0.29	62.00	436.29
4953	Burlington Environmental Inc.	Seattle	King	Mercury Compounds	0.00	0.00	0.00	0.00
4953	Burlington Environmental Inc	Tacoma	Pierce	Mercury Compounds	0.00	0.00	0.00	0.00
4953	Allied Technology Group, Inc.	Richland	Benton	Mercury	0.00	0.00	2.00	2.00

Table 12. 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.

$$(71859.7 \text{ TONS}/64702.5 \text{ TONS}) \times 298.3 \text{ LBS} = 331.3 \text{ LBS Hg IN NON-INCINERATED BIOSOLIDS}$$

List of 87 facilities that produced biosolids and reported mercury data in 2000. Delete facilities that incinerated: Anacortes, Lynnwood, Post Point - Bellingham = 84 left
(Tons of biosolids) X (ppm Hg) X (0.002 factor) = lbs Hg

Facility	Tons Biosolids	Hg PPM	Factor	Lbs Hg
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 DIST	144.00	0.38	0.002	0.11
BREMERTON WWTP	645.00	1.29	0.002	1.67
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	5.85
CENTRAL WWTP #1	3594.00	1.42	0.002	10.22
CENTRALIA WWTP	287.10	1.04	0.002	0.60
CHAMBERS CREEK WWTP	1986.36	1.06	0.002	4.19
CHEHALIS WWTP	112.80	7.55	0.002	1.70
CHELAN WWTP	235.90	2.33	0.002	1.10
CHENEY BIOSOLIDS COMPOST FACIL	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 CONTRL	1400.00	1.23	0.002	3.45
DES MOINES CREEK TP	449.36	0.61	0.002	0.55
DOUGLAS CNTY 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 POLN CONTROL FAC	2500.00	2.39	0.002	11.97
EVERSON WWTP	66.43	0.49	0.002	0.07
FERNDAL 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

Facility	Tons Biosolids	Hg PPM	Factor	Lbs Hg
ILWACO WWTP	62.00	0.90	0.002	0.11
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	2.17
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	1.48
RIDGEFIELD WWTP	34.83	0.12	0.002	0.01
SALMON CREEK WWTP	696.79	3.38	0.002	4.70
SALMON CREEK WWTP - BURIE	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	73.48
SPOKANE ADVANCED WWTP	6852.00	2.19	0.002	29.99
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	72.10

Facility	Tons Biosolids	Hg PPM	Factor	Lbs Hg
WINLOCK WWTP	50.00	0.60	0.002	0.06
WOODLAND WWTP	102.53	1.14	0.002	0.23
TONS BIOSOLIDS	64702.54		LBS Hg	298.30

Table 13. List of 191 Facilities that Reported Biosolids Production in 2000

Delete facilities that incinerated: Anacortes, Edmonds, Longview Fibre Company, Lynnwood, North Bend, Post Point - Bellingham, Vancouver (East and West), Whatcom Co. #13 = 182 left.

Facility	Tons Biosolids
ABERDEEN & COSMOPOLIS, CITIES	508.50
ALCOA WENATCHEE WORKS	1.00
ALDERBROOK INN RESORT STP	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 FACIL	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 DIS	8.50
COUPEVILLE WWTP	48.80
COWLITZ WATER POLLUTION CONTRL	1400.00
CRYSTAL MOUNTAIN INC WWTP	5.70
CURLEW JOB CORPS WWTP	3.00

Facility	Tons Biosolids
DAYTON WWTP	9.50
DES MOINES CREEK TP	449.36
DIABLO WWTP	0.70
DIAMOND LK. W&S DIST WWTP	2.10
DOUGLAS CNTY SEWER DIST#1 WWTP	160.00
DUVALL WWTP	77.00
EASTSOUND S&W DIST 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 POLN CONTROL FAC	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 CNTY SEWER DIST #7 WWTP	3.81
KLICKITAT WWTP	3.00
LACONNER WWTP, SKAGIT CO SD #1	138.10
LAKE STEVENS SEWER DIST STP	375.00
LAKOTA WWTP	760.72
LANGLEY WWTP	31.30
LEAVENWORTH WWTP	52.97
LEWIS CNTY 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 L.L.C.	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 MH PARK	0.80
NASELLE YOUTH CAMP STP	3.00
NESTLE REGIONAL TRAINING CENTR	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 CNTY 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
WW 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 14. 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 Co., WI, 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.⁴³

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

⁴³ John Reindl, "Summary of References on Mercury Emissions from Crematoria," Dane Co., WI, March 2002

Table 15. Estimate of Annual Mercury Emissions from Sewage Sludge Incinerators in Washington State.

	Lynnwood	Anacortes	Bellingham	Edmonds	Vancouver	source
Hg 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					
average, g/g:	0.00102000					
grams to pounds conversion:	0.002204623					http://www.remote-control.net/convert/tables/general/index.html
average, lb/lb:	0.00000225					
total solids destroyed in pounds, 2001:	3,651,000.00					
dry tons incinerated, 2000:		603.89	3833.30	2826.00	6827.00	
long ton to pound conversion factor:	2,240.00					http://www.remote-control.net/convert/tables/general/index.html
pounds incinerated, 2000:		1,352,713.6	8,586,592.0	6,330,240.0	15,292,480.0	
est. total pounds of Hg released in stack air and in ash*	8.21	3.04	19.31	14.23	34.39	

* This estimate does not account for some mercury likely being captured in air pollution control technology. The estimate is therefore probably high.

Table 16. 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 US population in Washington	2%	
Estimated mercury released per lamp, g (low)	0.03	Aucott, M. M. McLinded and M. Winka, "Release of Mercury from Broken Fluorescent Bulbs," Journal of Air Waste Management Association, in print.
Estimated mercury released per lamp, g (high)	0.08	Aucott, et al.
Est. mercury in lamps disposed in Washington annually, lbs (low)	862	
Estimated mercury in lamps disposed in Washington annually, lbs (high)	2,299	
Estimated % 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 (low)	690	
Estimated mercury disposed with solid waste, lbs (high)	1,839	

Estimate #2

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

Table 17. Estimated Mercury Disposed of Annually from Thermostats in Washington State

Tons of mercury in discarded thermostats annually in US	10.3	http://www.epa.gov/ttn/oarpg/t3/reports/volume2.pdf p. 4-19
Percent of US population in Washington	2%	
Tons of mercury in discarded thermostats annually in Washington	0.22	
Pounds of mercury in discarded thermostats annually in Washington	444	

Table 18. Estimated Annual Mercury Releases from Dental Amalgam in Urine and Feces in Washington State

Hg released in feces and urine g/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 U.S. Environmental Protection Agency, March 2002, pp. 9 - 10
Days in year	365	
Washington population estimate, 2001	5,987,973	US Census Bureau, State and County Quick Facts, http://quickfacts.census.gov/qfd/states/53000.htm
Percent of Washington population over 18	74%	US Census Bureau, State and County Quick Facts, http://quickfacts.census.gov/qfd/states/53000.htm
Estimated total µg released annually in feces and urine	27,931,223,409	
Estimated total lbs. released annually in feces and urine	62	

Table 19. Estimated Mercury Disposed of Annually from Dental Offices in Washington State.

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 WA dentists in King County ~ 50%

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

Table 20. 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 21. Mercury Disposed of Annually from Household Fever Thermometers in Washington State:

Estimate #1

% of households with mercury fever thermometer	0.43	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. Hg in fever thermometers (gms)	488,351	
Conversion factor	0.00220462	http://www.remote-control.net/convert/tables/general/index.html
Est. Hg in fever thermometers (lbs)	1,077	
% of households breaking a mercury fever thermometer per year	0.01	King County Hazardous Waste Sound Stats Sept 2001
Amount of mercury in broken thermometers 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	0.5	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 22. Mercury Disposed of Annually from Batteries in Washington State.

Mercury in all batteries (domestic and imported) sold in US 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 US 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

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Appendix A

Regulatory Overview

Table A-1. EPA Authority Relative to Mercury

Air	Water	Waste	Use Limitations	Reporting Requirements/ Spills
<p>Clean Air Section 112 provides authority to regulate hazardous air pollutants (HAPs);</p> <ul style="list-style-type: none"> - Section 112(c)(6): requires promulgation of emission standards by 2000 for sources that account for 90% of aggregate mercury emissions¹ - Section 112(n)(1)(C): requires a study of hazardous air pollutant emissions from electric utility plants & 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 HAPs to Great Waters and recommendations - Clean Air Act Section 129: requires regulatory actions for the solid waste combustion industry¹ 	<p>Safe Water Drinking Act provides authority for National Primary Drinking Water Regulations</p> <p>Clean Water Act provides authority on priority pollutants for:</p> <ul style="list-style-type: none"> - Ambient Water Quality Criteria² - Effluent limitation guidelines² - Pretreatment of discharges to publicly owned sewage treatment plants² 	<p>Resource Conservation and Recovery Act provides authority to:</p> <ul style="list-style-type: none"> - regulate storage, treatment, transport and disposal of mercury wastes <p>Comprehensive Environmental Response, Compensation, and Liability Act provides authority clean up past waste</p> <p>Superfund Amendment Reauthorization Act</p> <ul style="list-style-type: none"> - Section 110: Superfund Site Priority Contaminants 	<p>Toxic Substances Control Act provides authority to regulate chemical substances and mixtures which present an unreasonable health risk to the environment²</p> <p>Federal Insecticide, Fungicide, and Rodenticide Act provides authority to regulate pesticides that cause unacceptable risk (mercury use as a fungicide in paint)</p> <p>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</p>	<p>Emergency Planning and Community Right-to-Know Act</p> <ul style="list-style-type: none"> - Section 313: requires qualifying facilities to report amounts of toxic substances released or managed as waste. Information maintained in the Toxic Release Inventory³ <p>Pollution Prevention Act provides national policy directing 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</p> <p>Comprehensive Environmental Response, Compensation, and Liability Act</p> <ul style="list-style-type: none"> - Section 103: Requires reporting of releases. Reporting requirements for spills > 1 lb in organic mercury/day

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

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

³ Indicates responsibility for implementing this section is shared by EPA and the Department of Ecology in Washington State.

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

- **WAC 173-303 Dangerous Waste Regulations**

The P and U wastes are federal 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 lbs. 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, you decide if it is ignitable (D001), corrosive (D002), reactive (D003) or toxic (D004- D043, which is a list of actual toxic chemicals, and given a Toxicity characteristic leaching procedure [TCLP] threshold limit). 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, look at section -100 in the regulations (page 34-36). Washington state looks at fish/rat mortality studies to determine the toxicity, and chemical concentration percentage to determine if it is a persistent state waste.

The question on determining whether a specific waste is a federal or a state waste requires some designation training. The short of it is that there is a hazardous waste flowchart that a person follows to determine what waste codes apply. Designation procedures are on p.18, -70 (3). First decide if it is federally listed discarded chemical or a listed waste (from -082). If it is one of these listed wastes then you ask if it will be land disposed. If it will be land disposed, you check to see if it has any of the federal characteristics. From that point you continue on to determine if it meets state waste criteria. If the waste is not land disposed, then you go directly to checking the state criteria. It just gets more complicated from there.

To sum this up, first check the federal characteristics. If none of those apply, you still need to check to see if it is a state waste. A waste can have both federal and state waste codes

- **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. 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 (see attached list).

Under TRI, mercury and mercury compounds are reportable at 10 lbs. 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 (list attached). The TRI also provides information on transfers to other locations by these facilities for recycling, treatment, or disposal. Listing attached. Additionally, the national TRI database can provide information on mercury or mercury compounds being transferred into the State of Washington. This data will not be available until EPA's national data releases which will probably be in May 2002.

The data gaps associated with EPCRA data are:

1. TRI is limited to facilities with 10 or more employees and only certain industries.
2. 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.
3. Compliance efforts by EPA for the PBT reporting have not started, so the industry compliance is an unknown. We don't know how many non-reporting facilities there are and we don't know 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.

- **Section 313 of the Emergency Planning and Community Right-to-Know Act, WAC 118-40 (adopts 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 EPA generally is the agency that enforces the act. When registering, the company must send information to Ecology, EPA, 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.

173-400 WAC General Regulations for Air Pollution Sources

There are local agencies such as Puget Sound Clean Air Agency (PSCAA) which regulate different counties. PSCAA was established by state law in 1967 (chapter 70.94 RCW). There are 7 organizations/agencies like this 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 regulations, enforce regulations, write permits, and have their own board of directors, often with mayors, and council people on them.

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 prior to their generation whenever economically and technically practicable.”

173-460 WAC is a rule that came out in June, 1991. This is after federal amendments to the Clean Air Act, but before state amendments.

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

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

RACT should in theory regulate mercury to a certain extent, but they have been struggling to implement it (reasons follow). All sources must be at RACT.

Under 173-460 WAC, a company must apply for a permit and must notify air quality, of what kind of emissions they are putting out, including what kind of toxins. Air quality then reviews the information, with computer modeling (an EPA modeling program), and if approved will issue the permit if they qualify.

The companies have incentive to do this and be honest about emissions because it takes time and money to wait and get the permit. There is no penalty or fee if the company is found to have not notified Air Quality of a certain toxin. If an unreported toxin is found, the process only takes longer.

An area that seems to be “falling short” is 173-400-045 WAC, which deals with RACT, and is part of the 173-400 rule. It is much easier to define the “best” in BACT, but they are having a very hard time defining “reasonable” in Reasonable Available Control Technology, which is making it difficult to implement it. Tom said that it isn’t even understood which of the BACT or RACT WAC’s is more “strict” because they are having such difficulty defining “reasonable”.

- **75.95J 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. The Department of Ecology may seek delegation and administer the sludge permit program required by the federal clean water act as it existed February 4, 1987.

40 CFR Part 503, EPA

Publicly-owned non-industrial sewage treatment plants are under jurisdiction of Ecology’s Solid Waste Program. The program regulates the sludge from the plants, and if it meets the standards, then it’s called biosolids.

- **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 laws and regulations evaluate the quality of biosolids for pollutants. There is a concentration above which biosolids cannot be beneficially used, or a ceiling threshold. The ceiling concentration of mercury is 57ppm. There is also a lower threshold, or a pollutant concentration limit. Below this limit, regulations cannot be used. An example of this is when the pollutant cannot be used on land at all, but must be disposed into a sludge landfill. The lower threshold of mercury is 17 ppm. The median concentration of mercury is 2ppm.

- **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 the state 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.

- **173.200-040 WAC, 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.

- **90.48 RCW, Water Pollution Control**

The department 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 the state of Washington under this law.

- **Federal Clean Water Act**

The water quality program regulates this under different facets of the act; the act supplies different tools for them to regulate.

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

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 parts per billion.

Levels allowed for organisms only, in a marine scenario where drinking water will not be involved is 0.14 parts per billion.

173-200-040 – groundwater, 2 parts per billion is allowed.

- **Ch. 70.105D RCW, Model Toxic Control Act**

The purpose of this chapter is to establish a comprehensive state-wide framework for the planning, regulation, control, and management of previously released or disposed hazardous waste which will 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:

- (1) To provide broad powers of regulation to Ecology relating to management of hazardous wastes and releases of hazardous substances;
- (2) To promote waste reduction and to encourage other improvements in waste management practices;
- (3) To promote cooperation between state and local governments by assigning responsibilities for planning for hazardous wastes to the state and planning for moderate-risk waste to local government;
- (4) To provide for prevention of problems related to improper management of hazardous substances before such problems occur; and
- (5) To assure that needed hazardous waste management facilities may be sited in the state, and to ensure the safe operation of the facilities.

- **WAC 173-340-100, 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 cleanup facilities where hazardous substances have come to be located. *It* defines the role of the department 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.

The toxics cleanup program doesn't generally deal with mercury until after it's 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's 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. This 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

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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.

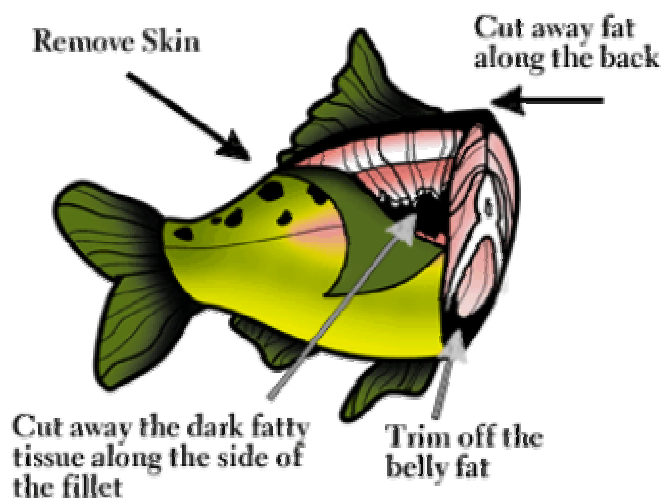
- Fish is a healthy food, and the Department of Health recommends that people eat a variety of fish as part of a balanced diet. Health benefits of eating fish are:
 - Fish is an excellent low-fat food, a great source of protein, vitamins, and minerals.
 - The oils in fish are important for unborn and 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.

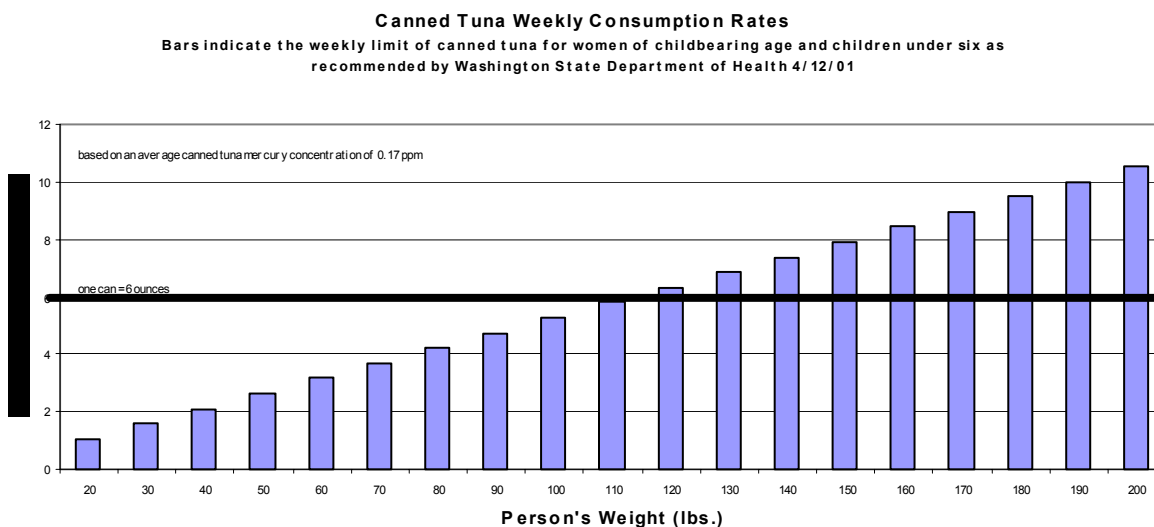
Other Contaminants and Local Fish Advisories

- 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 advised:

- Do not eat any shark, swordfish, tilefish, king mackerel, or either fresh caught or frozen tuna steaks.
- 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 20 pounds, to three ounces for a child who weighs about 60 pounds.

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 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.eatright.org/ncnd.html>

Centers for Disease Control and Prevention - 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>

Environmental Protection Agency - 206-553-4273
National Advice on Mercury in Freshwater Fish for Women Who Are or May Environmental Protection Agency, Office of Water. Become Pregnant, Nursing Mothers, and Young Children.
<http://www.epa.gov/ost/fishadvice/advice.html>

Environmental Protection Agency- 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>

Food and Drug Administration - 1-800-SAFEFOOD
Mercury in Fish & Pregnancy
<http://www.fda.gov/opacom/catalog/mercury.html>

National Fisheries Institute
<http://www.nfi.org>

Puget Sound Water Quality Action Team - 1-800-54-SOUND
Outside Washington, call: 360-407-7300
http://www.wa.gov/puget_sound/

Toxicological Effects of Methylmercury. National Research Council. Copyright 2000. National Academy of Sciences. National Academy Press, Phone: 1-800-624-6242
<http://books.nap.edu/catalog/9899.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 - 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 - 360-902-2200
<http://www.wa.gov/wdfw>

Washington State Department of Health
Office of Environmental Health Assessment - 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
1/31/2001	1/18/2001	An employee reports finding 5 pounds of mercury.
2/12/2001	2/12/2001	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.
3/16/2001	3/16/2001	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.
3/22/2001	3/22/2001	Mercury spilled inside building from a broken blood-pressure reader. Local Haz Mat will clean up, no response requested.
3/28/2001	3/28/2001	Thermometer broke, spilling half of the mercury onto carpet.
4/13/2001	4/13/2001	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.
4/25/2001	4/25/2001	County crew found a container of mercury. Request ecology assistance in its safe disposal.
5/10/2001	5/10/2001	1 gram of mercury spilled by worker from something a little larger than a thermometer. Building has been evacuated. Fire dept. Is on scene. Will take to Haz Mat facility for pick up. Would like contractor info. To clean up/cut out carpet.
5/11/2001	5/10/2001	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. I t 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.
5/22/2001	5/22/2001	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.

Date Call Received	Date of Incident	Notes
5/29/2001		Caller called to voice 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.
6/6/2001	6/6/2001	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.
6/14/2001	5/1/2001	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.
6/26/2001		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.
7/9/2001	7/9/2001	They had a small mercury release there this morning (7/9/01). A manometer (?) Broke in a conex (?) Box - 1 pound release. NRC & 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.
7/30/2001	7/30/2001	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.
8/24/2001	8/24/2001	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.
8/28/2001	8/28/2001	Caller is calling for neighbor who spilled mercury from glass jar. Wanted to know what to do.

Date Call Received	Date of Incident	Notes
10/5/2001	10/5/2001	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.
11/5/2001		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
11/8/2001	11/8/2001	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.
11/17/2001	11/17/2001	Liquid mercury at the little rock fire department.
12/5/2001		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.
12/7/2001	12/7/2001	Cowlitz co. Health dept called. There has been about a dime size of mercury spilled onto carpet at a residence in Cowlitz County.
3/2/2002	3/2/2002	Homeowner broke a thermometer and has mercury on floor. Would like our help.
3/18/2002		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 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 are also available on the web page of Health Care Without Harm, 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 that this compiler has 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.

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 to this law. 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 and 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:

HB 5179 would have banned the sale of mercury thermometers. Referred to Joint Committee on Environment, where no action was taken.

HB 5181 would have discouraged the disposal of mercury-containing products. Referred to Joint Committee on Environment, but no action was taken.

HB 6197 would have regulated mercury products and mercury emissions. Referred to the Joint Committee on Environment, where no action was taken.

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-added 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-added 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/lisa_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.

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>

LD 2004 “An Act to Phase Out the Availability of Mercury-added 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:

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>

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 impacts, 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 Town of Freeport Town Clerk to obtain a copy of the ordinance at (207)865-4743, or email johanna@freeportmaine.com.

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, requires such products to be recycled rather 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, which 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 or mercury emergency. 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.
- 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

Nebraska's 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 persons 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"; 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&q=mercury>

A10707 and S06233 require dentists to recycle amalgam. On June 20th, the Assembly agreed on the amended Senate version of the bill, which had adopted the bill on June 19th. 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&q=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&q=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. 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 moneys 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% 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 & 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 has adjourned until January , without adopting 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.

HB 2686 and companion bill SB 6533 are titled “Reducing the Release of Mercury into the Environment”. This bill would required labeling of mercury containing products when sold, the establishment of recycling systems by the sellers of mercury thermometers and thermostats, prohibitions on the knowing disposal of mercury containing products with other solid waste, a prohibition on the sale of mercury containing novelties, a prohibition on the purchase of bulk mercury by schools, require the development of a mercury reduction plan for health care facilities, a prohibition on the use of mercury switches in autos, and related measures.

The Senate bill has gone through two committees and two substitute bills. The second substitute, among other things, would prohibit the knowing disposal of mercury containing products with other waste, require the development of a mercury reduction plan for health care facilities, require state purchasing to give priority and preference to buying products with no added mercury, and require the state to develop a strategy for the elimination of mercury from the environment.

<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 companion bill 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 & 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 pollution prevention for PBTs is a high priority item and sets 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% 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 is expected to go back to the Natural Resources Board this summer.

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 removal of 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 Representative 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 becomes effective in August 2002.

Federal

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 Environmental Protection Agency 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 Department of Defense currently used for mercury storage, to require the Administrator of the Environmental Protection Agency 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, 2001m which is the date of its last major action. <http://thomas.loc.gov/cgi-bin/bdquery/z?d107:h.r.02729:> .

H.R. 4163 United States 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:> .

Source: Internet Web pages of the various legislative bodies along with updates via the email lists Mercury Policy, Legislation, and Regulations (mercury_policy@lyris.newmoa.org) and Hg-WG (mwg-mercury@igc.topica.com).

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