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WASHINGTON STATE  
DEPARTMENT OF  
E C O L O G Y

**PRELIMINARY DRAFT**  
**Washington State**  
**Mercury Chemical Action Plan**

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June 2002 (draft)

Publication No. 02-03-016

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# **PRELIMINARY DRAFT**

## **Washington State**

### **Mercury Chemical Action Plan**

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*by*  
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## Purpose of this Document

The purpose of this document is to identify sources of mercury, outline the existing regulatory structure around mercury and existing mercury reduction efforts, and identify possible strategies for further mercury reduction. Using this information, the Departments of Ecology and Health have made initial prioritizations of mercury sources for reduction and elimination, potential strategies for accomplishing this, and have identified areas for further research.

This is a working document; not all of the information contained has been confirmed. 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.

# Mercury Chemical Action Plan Committee

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# Goals and Purpose

The Mercury Action Plan is designed to meet two, co-equal goals:

1. Virtually 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.

*to be completed:* Short-term Objectives

## Preliminary Screening Process

The Mercury Chemical Action Plan Committee, made up of Department of Ecology and Department of Health staff, has reviewed the known anthropogenic sources of mercury in Washington State and potential reduction and elimination strategies. As part of a preliminary screening process, sources were evaluated by size and potential strategies were passed through a series of yes/no “screens”:

- Does the strategy make use of an existing reduction option or regulation?
- Does the strategy focus on pollution prevention?
- Would the strategy result in a cross-media transfer that reduces or eliminates exposure?
- Would the strategy increase public education about mercury?
- Is the strategy technically feasible?
- Has the strategy worked in other locations? Is it consistent with the US EPA Working Draft of the PBT National Action Plan for Mercury?

In each case, the preferred answer was “yes.” Based on this review, a short list of sources and potential strategies for near-term action was developed. This list is still undergoing internal review through the summer of 2002, including cost analysis.

Since the initial screening, additional sources and possible strategies have been identified. These are included in the draft, but are still in the process of being evaluated.

# Potential Strategic Directions for Near-Term Action

(All strategies listed subject to further evaluation.)

## Mercury products- General

*estimated annual release in Washington:* >1,800 pounds

*possible strategies:*

- Support development and passage of legislation to require labeling, manufacturer collection and phase-out of mercury products

*reasons:*

- Products are the largest source of mercury in Washington State.
- Nearly all mercury-added products have readily available cost-effective alternatives.
- Focus on pollution prevention.
- Product legislation of varying degrees has been passed in 10 other states.

## Mercury Products- Specific Products and Sectors

### General Education Campaign/ Thermometer Exchanges

---

*estimated annual release in Washington:* 12 pounds

*estimated total amount of mercury that could be collected:* 1,152 pounds

*possible strategies:*

- Grants to counties to conduct thermometer exchanges (ongoing)
- Joint thermometer exchange and education campaign with Washington State Pharmacy Association

*reasons:*

- Public education is necessary to reduce releases of mercury from consumer products.
- Thermometer exchanges have been extremely successful public education tools in other states.
- The volume of mercury that can potentially be collected through a statewide thermometer exchange is very large.

### Fluorescent Lamps

---

*estimated annual release in Washington:* 507 pounds

*possible strategies:*

- Increase grant funding to counties for fluorescent collection
- Application of Universal Waste Rule

- Outreach and education to building managers on Universal Waste Rule

*reasons:*

- Large single source of mercury.
- Regulatory structure and collection infrastructure to prevent releases already in place.

## Thermostats

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*estimated annual release in Washington:* 430 pounds

*possible strategies:*

- Support expansion of Thermostat Recycling Corporation
- Work with Building Code Council to change state building code to prohibit use of new mercury gauges and switches
- Require that HVAC systems be checked for mercury gauges and switches before demolition
- Outreach and education to contractors

*reasons:*

- Relatively large single source of mercury
- Partial collection infrastructure (wholesalers) could be put into place at no cost to consumer
- Focus on pollution prevention- precedent for ban on installation of mercury thermostats exists in Oregon and Rhode Island.

## Dental Facilities

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*estimated annual release in Washington:* 400 pounds

*possible strategies:*

- Require use of amalgam separators and best management practices by dentists
- Outreach and education for dental staff
- Approach the Insurance Commissioner on equal coverage for amalgam and non-mercury restoratives

*reasons:*

- Relatively large single source of mercury
- Amalgam separators are available that will remove 95 percent of mercury particles in dental effluent
- Fifty percent of Washington dentists, those who practice in King County, are required to follow best management practices and will be required to install amalgam separators by June 2003.
- Insurance Commissioner- focus on pollution prevention

## Medical Facilities

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*estimated annual release in Washington:* Unknown. In other areas of the country, however, medical facilities have consistently been one of the largest sources of mercury to POTW's. The

Washington State Hospital Association is currently conducting a survey to determine the use of mercury products in hospitals.

*possible strategies:*

- Voluntary mercury reduction program by medical facilities
- Mandatory mercury reduction by medical facilities
- Outreach and education for medical staff

*reasons:*

- Potentially large point source of mercury
- Strategies focusing on purchasing practices, disposal methods, and general outreach and education to medical staff have been very effective in other areas of the country

## Auto Switches

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*estimated annual release in Washington:* 253 pounds

*possible strategies:*

- Replace switches at state inspections
- 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

*reasons:*

- Relatively large single source of mercury
- Currently, large percent of mercury from auto switches is released to the air at secondary steel smelters, which are not regulated for mercury emissions
- A number of states are focusing on this issue in a coordinated fashion

## K – 12 Schools

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*estimated annual release in Washington:* Unknown.

*possible strategies:*

- Finish Rehab the Lab project
- Work with Healthy Schools Task Force

*reasons:*

- Children are particularly vulnerable to the effects of mercury, including breathing mercury vapors released following a spill.
- Mercury spills have proven extremely costly for schools in other parts of the country.
- The Rehab the Lab project has already removed mercury, among other unnecessary chemicals, from approximately 50 percent of middle and high schools in the state.
- The Healthy Schools Task Force is an ongoing, multi-agency effort, which has expressed interest in removing mercury from K – 12 schools.

# Mining

## Lode Gold Mining

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*estimated annual release in Washington: 777 pounds*

*possible strategies:*

- 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.

*reasons:*

- Very large single source of mercury in Washington State.
- Little is currently known about the fate and potential reduction opportunities for mercury emissions.
- Consistent with EPA PBT National Action Plan for Mercury (Working Draft)

## Abandoned Mine Cleanup

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*estimated annual release in Washington: Unknown*

*possible strategies:*

- 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.

*reasons:*

- Runoff from abandoned placer gold mines has been identified as one of the sources of mercury to Lake Roosevelt.
- Estimates are there may be as many as 3500 abandoned metals mines in the 68 mining districts in Washington. Of these, it is estimated that approximately 500-600 are considered significant (more than 200 pounds of product produced during the life of the mine).
- Assessment and clean up of abandoned mines is ongoing, but presently there is no focus on mercury as a criterion for clean up.

# 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.

Washington State has only one coal-fired utility, Transalta Centralia Steam Plant. The power 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. The ESP is credited with a high degree of efficiency.

#### 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.

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.

#### Sectors Affected

Transalta Centralia steam plant, Southwest Regional Air Authority, Yakama Tribe, others who consume fish downwind of the facility

## **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.<sup>2</sup>

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.

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<sup>2</sup> <http://yosemite.epa.gov/opa/admpress.nsf/>, 3/4/02.

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.<sup>3</sup>

### Reduction Options

Develop state regulations requiring reduced emissions.

Screen	Response
Strategy uses an existing reduction option or regulation	No
Focus on pollution prevention	No
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	No
Technically feasible	Unknown
Strategy has worked in other locations/ consistent with EPA	No

## 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.<sup>4</sup>

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. The table below lists typical values for mercury in oils, which were obtained by taking the average of the mean values found in the literature. The value for distillate oil is the single data point found in the literature and may not be as representative as the values for residual and crude oils.

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<sup>3</sup> [http://fossil.energy.gov/techline/tl\\_mercurysel2.shtml](http://fossil.energy.gov/techline/tl_mercurysel2.shtml), 3/4/02.

<sup>4</sup> New Jersey Task Force, New Jersey Mercury Task Force Report: Volume III, New Jersey Department of Environmental Protection, December 2001, pp. 60, 63.

Table x: Typical Values for Mercury in Oils

Fuel Oil Type	No. of Samples	Mercury concentration, ppmwt	
		Range	Typical Value
Residual #6	--	0.002-0.006	0.004
Distillate #2	--	--	<0.12
Crude	46	0.007-30	3.5

The only substantive source of mercury emissions from fuel oil combustion operations is the combustion gas exhaust stack. Three types of information were used to develop emission factors for oil combustion.

First, the data described above on fuel oil heating value and mercury content of fuel oils were used to develop emission factors by mass balance, assuming conservatively that all mercury fired with the fuel oil is emitted through the stack. Second, the emission factors developed in "The EPA Emissions Factors Publication, AP-42," for residual and distillate oil combustion for residual oil combustion was evaluated. Third, rated emission test data were evaluated and summarized. The paragraphs below first present the results generated from each of the three sources. Then, the relative merits of the emission factors generated via each of the procedures are discussed, and the best "typical" emission factors are identified.

The literature on fuel oil combustion suggests that essentially all mercury in the fuel oil is vaporized in the combustion zone and exhausted as a vapor in the combustion gas stream.

Using the assumption that 100 percent of the mercury in fuel oil leaves the boiler or furnace in the exhaust gases, the emissions rates found in the table below were calculated.

**Table x: Calculated Mercury Emission Factors**

Fuel Oil Type	Calculated mercury emission factors					
	Kg/10 <sup>15</sup> J	Lb/10 <sup>12</sup> Btu	g/Mg fuel oil	10 <sup>-3</sup> lb/ton fuel oil	g/10 <sup>3</sup> L fuel oil	Lb/10 <sup>6</sup> gal fuel oil
Residual # 6	0.092	0.21	0.004	0.008	0.0039	0.033
Distillate #2	2.7	6.2	0.12	0.24	0.10	0.86
Crude	82	190	3.5	7.0	3.4	28

The calculated emission factors in the table above were compared to the available emission factors for fuel oil combustion from AP-42. The AP-42 presents emission factors for No. 2 and No. 6 fuel oils; no emission factors are developed for crude oil in AP-42. The AP-42 emission factor for residual oil (No. 6) combustion is based on emission tests from 15 sites conducted from April 1990 through April 1994. The average emission factor reported for mercury emissions is 1.13 E-04 lb/10 gallons (0.73 lb/10 Btu). The comparable calculated emission factor for residual oil in Table 6-12 based on the mercury content in the oil is 3.3 E-05 lb/10 gallons (0.21 lb/10 Btu). The AP-42 emission factor for distillate oil (No. 2) combustion (3.0 lb/10 Btu) is actually based on the average concentration of mercury in residual oil. It is not based on any emission test data. Additionally, the residual oil mercury concentration data used

to develop this estimate are somewhat dated. The comparable calculated emission factor for distillate oil in Table 6-12 is 6.2 lb/10 Btu and is based on the average of the mercury concentration measured in distillate oil samples at three sites as part of the California AB2588 study.

Mercury emissions from residual oil combustion are highly variable and in most cases, the measured stack emissions are higher than the inlet fuel levels. Because these data are not normally distributed and appear to be log normal, a geometric mean was calculated to better represent the range of the data. The geometric mean for these data is 0.46 lb/10 Btu. Data are not available for distillate or crude oil combustion.

In summary, 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 data base 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 x: Typical Mercury Emission Factors**

Fuel Oil Type	Typical mercury emission factors					
	Kg/10 <sup>15</sup> J	Lb/10 <sup>12</sup> Btu	g/Mg fuel oil	10 <sup>-3</sup> lb/ton fuel oil	g/10 <sup>3</sup> L fuel oil	Lb/10 <sup>6</sup> 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

*Still need estimated quantities of fuel oil consumed by type in Washington State.*

### **Sectors 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.

## **Oil Refineries**

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### **Identification and Description of Source**

According to the 1997 EPA Mercury Study Report to Congress, mercury is reported to be present in petroleum crude, with its content ranging from 0.023 to 30 ppmwt. The primary source of mercury emissions in petroleum refining is the separation process, although mercury emissions can also be expected in the petroleum conversion and petroleum treating processes.<sup>5</sup>

### **Quantity and Estimated Uncertainty**

Four refineries reported releasing a total of 125 pounds of mercury in 2000 to the Toxics Release Inventory.

### **Sectors 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)

### **Action by Other Groups**

The California Regional Water Quality Control Board, San Francisco Bay Region, examined the feasibility of establishing an interim performance-based concentration limit for mercury that could be applied to its local refineries through National Pollutant Discharger Elimination System (NPDES) permits. 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,

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<sup>5</sup> United States 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; pp. 4-74, 4-75.

monthly average effluent concentration limit for the five refineries in the Bay Area. This limit was expected to hold the refineries at current treatment plant performance.<sup>6</sup>

## **Reduction Options**

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

## **Wood 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  $3.5 \times 10 \text{ kg/Mg}$  ( $6.9 \times 10 \text{ lb/ton}$ ) of dry wood burned. The average emission factor reported for boilers with ESP's was  $1.3 \times 10 \text{ kg/Mg}$  ( $2.6 \times 10 \text{ lb/ton}$ ) 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  $2.6 \times 10 \text{ kg/Mg}$  ( $5.2 \times 10 \text{ lb/ton}$ ) of wet, as-fired wood burned.

The NCASI average emission factor reported for wood-fired boilers with ESP's of  $1.3 \times 10 \text{ kg/Mg}$  ( $2.6 \times 10 \text{ lb/ton}$ ) 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

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<sup>6</sup> Eddy So, P.E., "Staff Report on Statistical Analysis of Ultraclean Mercury Data from San Francisco Bay Area Refineries; California Regional Water Quality Control Board, San Francisco Bay Region; June 13, 2001; pp. 4, 15.

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.

## **Sectors Affected**

Households with wood stoves, industrial facilities that use wood fuel

## **Current Regulations and Policy**

Mercury emissions from wood combustion is 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.

## **Outreach and Education Options**

Support local government switch out programs (publicity).

<b>Screen</b>	<b>Response</b>
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

## 2. Mining and Manufacturing

### Mining

#### Mercury Mining

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##### 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.<sup>7</sup>

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.<sup>8</sup> 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.

##### Sectors 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

##### Ongoing Activities

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<sup>7</sup> 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.

<sup>8</sup> Ronald A. Lee, "Investigations: Mercury in Washington State;" Office of Technical Services, Department of Ecology; Olympia, Washington; July, 1971; p. 12.

The Department of Ecology Central Regional Office is in the process of prioritizing abandoned mines 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.

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

## Gold Mining

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### *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.<sup>9</sup>

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.<sup>10</sup> 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.<sup>11</sup>

#### **Quantity and Estimated Uncertainty**

<sup>9</sup> <http://pubs.usgs.gov/gip/prospect1/goldgip.html>, 4/1/02.

<sup>10</sup> J. M. West, "How to Mine and Prospect for Placer Gold," <http://imcg.wr.usgs.gov/usbmak/ic8517.html>, 3/29/02.

<sup>11</sup> 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.

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 placer gold the nation's placer gold was mined through 1969,<sup>12</sup> 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.<sup>13</sup> 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.

### **Sectors 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.

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<sup>12</sup> 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.

<sup>13</sup> <http://water.wr.usgs.gov/mercury/fs06100.html>, 4/1/02.

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

### *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 x. 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.<sup>14</sup>

It is unknown whether Washington gold mines that process ore emit mercury. Gold mines are issued air permits by Ecology or local air authorities; the permits are being reviewed to see if they include any conditions for mercury.

### **Sectors 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.

## **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

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<sup>14</sup> 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.

exploring reduction options as part of the Mercury 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 x.

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

SIC Code	Name	SIC Code	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 whether the HWTR Program's "Education Fee". Conversely, explore a fee break (incentive) if the generator were mercury/PBT free.

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

Engage existing P2 planners to include mercury in P2 plans.

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

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

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

## Manufacturing of Mercury-Added Products

### Instrument Manufacturers

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#### 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.<sup>15</sup>

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.<sup>16</sup>

### **Quantity and Estimated Uncertainty**

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

### **Sectors 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)

## **Manufacturing of Products where Mercury is a Contaminant**

### **Pulp and Paper**

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#### **Identification and Description of Source**

According to the 1997 EPA Mercury Study Report to Congress, mercury can be introduced to the pulping process through wood that is being pulped, in the process water used in the pulping process, and as a contaminant in 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).<sup>17</sup>

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<sup>15</sup> United States 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.

<sup>16</sup> <http://www.census.gov/epcd/naics/NSIC3D.HTM#S38>, 4/12/02.

<sup>17</sup> United States 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.

### **Quantity and Estimated Uncertainty**

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

### **Sectors 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)

## **Industrial Inorganic Chemicals**

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### **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.

### **Sectors 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)

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<sup>20</sup> United States 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.

## Cement Manufacturing

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### 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.<sup>20</sup>

### 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.

### Sectors 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)

## Lime Manufacturing

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### 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 combustion will occur during the calcination step and will be discharged as vapor kiln exhausts.<sup>21</sup>

### 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.

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<sup>21</sup> United States 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.

## **Sectors 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)

## Secondary Steel Smelters

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See *Steel Recyclers* section in this document.

## Primary Production of Aluminum

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### **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.

## **Sectors 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)

## 3. Use of Products Containing Mercury

### 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.

### 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.

Screen	Response
Strategy uses an existing reduction option or regulation	No
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

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. The HWTR Program 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 mis-managed.

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	No
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	No
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

### 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.

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	No
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

## Specific Products and User Groups

### Medical Facilities

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#### 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.

#### Quantity and Estimated Uncertainty

There is likely a mercury release involved, though data is lacking for Washington State. 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.

### **Sectors Affected**

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

### **Current regulations and policy**

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](http://www.h2e-online.org).

Only one hospital in Washington State, Mark Reed Hospital in McCleary, has signed up to the mercury free challenge issued by Hospitals for a Healthy Environment, a joint effort of US EPA and the National Hospital Association.

### **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 Roundtable (MIRT) was established about two years ago with funding from US EPA and the King County Department of Natural Resources Solid Waste Division. MIRT provides 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 attendance from area hospitals and other medical industry support professions. MIRT is supported through the efforts of the King County Department of Natural Resources, the Business and Industry Resource Venture, the Washington State Department of Ecology, the US EPA, the Washington Society for Healthcare Environmental Services (WSHES), and the Pacific Northwest Pollution Prevention Resource Center (PPRC). This project is currently funded by the US EPA and the King County Department of Natural Resources. MIRT organizes and presents numerous

seminars of interest to the medical industry, and organizes campaigns within the medical industry to address waste issues. In the past MIRT offered a seminar detailing the issue of Mercury in Hospitals and Biomedical Facilities and currently is in the process of developing a press release identifying those hospitals that have removed Mercury from their Neo-Natal Intensive Care Units. MIRT also has become a Hospitals for a Healthy Environment (H2E) Champion for Change so that its goals officially tie in with the H2E goals promoting the removal of Mercury in hospitals and reducing waste.

MIRT has grown to include members from across the entire state, California, Oregon, and Idaho. Because of this growth, King Co. DNR/Solid Waste has decided to reduce its commitment when the original grant funding ends on May 15, 2002. The Pacific Northwest Pollution Prevention Resource Center has agreed to act as the “mother organization” and act as acceptor for the next grant if one is awarded.

MIRT has funding for its next three seminars, including seminar in September on mercury similar to the one held in May 2001.

([http://dnr.metrokc.gov/swd/bizprog/waste\\_pre/MIRTsem8.htm](http://dnr.metrokc.gov/swd/bizprog/waste_pre/MIRTsem8.htm)) Additionally, there is thought that MIRT would be helpful to organize hospitals in any mercury thermometer collection as drop off points, or whatever is needed. Attached is the list of steering committee members and their organizations. MIRT is prepared provide assistance as an established, trusted organization to the PBT Initiative.

### 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](http://www.noharm.org).

### Reduction Options

Voluntary mercury reduction program by medical facilities

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

Mandatory mercury reduction by medical facilities

Screen	Response
Strategy uses an existing reduction option or regulation	No
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

## Outreach and Education Options

Outreach and education for medical staff.

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

## Dental Facilities

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### 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.<sup>22</sup> 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.<sup>23</sup>

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

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<sup>22</sup> 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.

<sup>23</sup> Walker, p. 51.

**Table x**  
**Estimated Mercury Discharged from Dental Offices in King County, Washington**  
**Total Pounds per Year<sup>24</sup>**

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

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.<sup>25</sup>

### **Sectors Affected**

Dentists, hazardous waste haulers, autoclaves, POTWs

### **Current Regulations and Policy**

Dangerous Waste Regulations, Dept of Ecology

### **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**

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<sup>24</sup> 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.

<sup>25</sup> Walker, pp. 9 – 10.

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.<sup>26</sup>

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. 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.

Screen	Response
Strategy uses an existing reduction option or regulation	No
Focus on pollution prevention	No
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

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

Screen	Response
Strategy uses an existing reduction option or regulation	No
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	No
Technically feasible	Unknown
Strategy has worked in other locations/ consistent with EPA	No

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.)

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<sup>26</sup> Industrial Waste Program, Water and Land Resources Division, Department of Natural Resources, King County, Washington, “Industrial Pretreatment Quarterly,” September 2001.

## **Outreach and Education Options**

Conduct state-wide dental office campaign and outreach effort.

## **Veterinarians**

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### **Identification and Description of Source**

This section to be completed.

### **Quantity and Estimated Uncertainty**

### **Sectors Affected**

### **Current Regulations and Policy**

### **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**

### **Research, Development, and Monitoring Options**

### **Outreach and Education Options**

## **Batteries**

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### **Identification and Description of Source**

This section to be completed.

### **Sectors Affected**

### **Quantity and Estimated Uncertainty**

### **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.

## **Research, Development, and Monitoring Options**

### **Outreach and Education Options**

## **HVAC systems**

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### **Identification and Description of Source**

Many heating, ventilation, and air conditioning systems contain mercury switches. These switches may break during the life of the system, requiring a clean up of spilled mercury, they 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.

### **Sectors Affected**

Facility managers, local building inspectors, waste haulers

### **Quantity and Estimated Uncertainty**

There may be a release involved; see issue summary. No data is available.

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.

### **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

### **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.<sup>27</sup>

### Reduction Options

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

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	No
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

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

Screen	Response
Strategy uses an existing reduction option or regulation	No
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

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

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	No
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

### Outreach and Education Options

Outreach and education to contractors

<sup>27</sup> [http://www.nema.org/index\\_nema.cfm/664/](http://www.nema.org/index_nema.cfm/664/), accessed 6/25/02.

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

Outreach and education to local building inspectors

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

## Fluorescent Lamps

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### Identification and Description of Source

Facility lighting lamps often contain mercury and can be designated as dangerous waste. Large quantities of spent lamps are generated yearly from homes, offices, small businesses and manufacturing plants. What impact does the disposal of mercury containing lamps have on the release of mercury to the environment, and how do we presently minimize that impact? What are some ways, through rule, policy, and education, that we can further reduce the amount of mercury released to the environment?

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

The UWR prohibits generators from crushing lamps on site. Crushing make them easier to transport since there is much less bulk and chance of breakage in transit. Ecology decided

against allowing this form of treatment, because it is difficult to prevent release of mercury vapor during the crushing process. Further, the intent of the UWR is to streamline the regulation of the recycling process, and extensive rules for controlling mercury vapor emissions from crushers would complicate the UWR regulations.

### 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.

### Reduction Options

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

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

Evaluate standards used for government purchasing of lamps and facility lighting. Strive to use the least amount of mercury in lighting of buildings.

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

Consider revising the UWR to allow on-site crushing of lamps. There would need to be a way to enforce management standards for this practice so that Mercury vapor was not released during crushing.

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

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

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

### Research, Development, and Monitoring Options

What is the state of current technology and research about mercury reduction and alternatives in lamps?

How effective are other states efforts at reducing mercury levels in lamps?

How can the state be proactive in reducing the total amount of mercury added lamps in state buildings?

What is the actual quantity of mercury that ends up in landfills from lamps?

What are the actual disposal practices of businesses? What would make recycling a better alternative, from their perspective? Would a business community survey help to find answers to these questions?

Study the economics of recycling of lamps to see if additional recycling facilities (where the actually component processing is done) can be built. Is there a way for the state to help establish more recycling facilities?

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.

Ideally, manufacturing lamps without mercury or other harmful constituents would be a wonderful solution. Until that becomes feasible, lamps need to be manufactured with the least amount of mercury as possible. It is important that the concept of recycling be most strongly emphasized, because even the land-filling of non-hazardous lamps contributes significantly to the total mercury in the environment. 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).

### **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.

<b>Screen</b>	<b>Response</b>
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	No
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

## **K – 12 Schools**

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### **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.<sup>28</sup>

### **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

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<sup>28</sup> 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.

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.

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.

### **Sectors 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.

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

[Universities](#)

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**Identification and Description of Source**

This section to be completed.

**Quantity and Estimated Uncertainty**

**Sectors Affected**

**Ongoing Activities**

**Reduction Options**

## **Research, Development, and Monitoring Options**

### **Outreach and Education Options**

## **Laboratories**

### **Identification and Description of Source**

This section to be completed.

### **Quantity and Estimated Uncertainty**

### **Sectors Affected**

### **Current Regulations and Policy**

### **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.

### **Reduction Options**

## **Research, Development, and Monitoring Options**

### **Outreach and Education Options**

## **Mercury Products in Cars**

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### **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 2003. When melted in electric arc furnaces, 6-10 tons of mercury are emitted each year, more than all manufacturing sources combined.

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 when switches corrode as cars set out in auto salvage yards.

There are approximately 340 licensed auto recyclers in the state.

### **Quantity and Estimated Uncertainty**

Ecology estimates that approximately 263 pounds of mercury are released from convenience light switches in vehicles each year. Ecology does not currently have an estimate for mercury released from other sources in vehicles.

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. According to Schnitzer, between its facility, 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.

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.

### **Sectors 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. Conversations have also begun regarding options for avoiding the purchase of mercury components in future vehicle procurement.

The Automotive Recyclers of Washington Association (AROW) will inform their membership at 6 workshops throughout the state concerning the issue of mercury switches. The workshops will be held later this spring (2002). There will be a demonstration on how to remove and properly handle the switches and a list given out of the cars the switches are most likely to be found in.

AROW plans to initiate a voluntary program this spring (2002) where auto recyclers remove and recycle used mercury switches from vehicles as they come into their yards. For vehicles already in the yards, mercury switches will be removed prior to crushing. Containers will be provided for the switches along with their collection.

### **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 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](http://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 us 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 inspections

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	No
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	No

Place bounty on switches funded by car manufacturers

Screen	Response
Strategy uses an existing reduction option or regulation	No
Focus on pollution prevention	No
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

Require auto dismantlers to make reasonable effort to remove switches

Screen	Response
Strategy uses an existing reduction option or regulation	No
Focus on pollution prevention	No
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

Support legislation to ban use of mercury in vehicles

Screen	Response
Strategy uses an existing reduction option or regulation	No
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

Voluntary exchange programs and incentives

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	No

Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

## State Purchasing

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### 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.

### Sectors 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](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.<sup>29</sup>

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.<sup>30</sup>

## **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 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.

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<sup>29</sup> <http://www.productstewardshipinstitute.org/>, 3/4/02.

<sup>30</sup> <http://www.productstewardship.net/>, 3/4/02.

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.

<b>Screen</b>	<b>Response</b>
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

## **Dairies**

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### **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 atomized-mercury to the atmosphere if milking systems are malfunctioning. 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.

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.

### **Quantity and Estimated Uncertainty**

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.

### **Sectors Affected**

Dairy farms that have operating milk parlors or moth-balled 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.

### **Current Regulations and Policy**

*to be developed*

### **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 news letters, Cooperative Extension news letters, 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.

## ***4. Products Containing Mercury at End-of-Life***

### **Disposal of Products Containing Mercury**

#### **Municipal Waste Combustors**

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##### **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 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.

##### **Sectors 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.

Screen	Response
Strategy uses an existing reduction option or regulation	No
Focus on pollution prevention	No
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

### Outreach and Education Options

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

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

## Medical Waste Incinerators

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### 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 mercury emissions for 2001 were calculated at 0.30 pounds, total. This is just mercury from the stack, of course.

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.

### **Sectors Affected**

Washington State University

### **Current Regulations and Policy**

Clean Air Act

### **Reduction Options**

Require facility to establish a source separation program.

<b>Screen</b>	<b>Response</b>
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

### **Outreach and Education Options**

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

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

## Landfills

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### Identification and Description of Source

If products containing mercury are disposed of in landfills, mercury may be released through air emissions.

Landfills are increasingly collecting and burning landfill gases for energy recovery, which results in the emission of mercuric oxides, often emitted at low stack heights.

Landfills are being encouraged to go to the reactor versus tomb design on the theory that "composting" garbage no matter how crudely is a good thing, because the waste should be stabilized before the liner wears out. Little thought has been given to what this does interim of increasing carbon releases to the atmosphere or what the implications are for increased mercury emissions.

The trend toward space-saving "daily cover" materials. Six inches of compacted soil used to be the norm. Increasingly, commercial firms have marketed much thinner and less-impervious daily cover material that may contribute to emission of elemental mercury from consumer products at the working face of a municipal landfill.

### Quantity and Estimated Uncertainty

A recent study conducted in Florida showed that methylmercury was emitted with landfill gas.<sup>31</sup> 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 Sectors

Municipalities, counties, landfill owners, and operators

### Current Regulations and Policy

To be completed.

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<sup>31</sup> Lindberg, S.E., D. Wallschläger, E.M. Prestbo, N.S. Bloom, J. Price, D. Reinhart, "Methylated mercury species in municipal waste landfill gas sampled in Florida, USA." Atmospheric Environment 35 (2001) 4011 – 4015, 24 February 2001.

## **Research, Development, and Monitoring Options**

Conduct sampling and speciation for mercury emissions at Washington landfills.

## **Medical Waste Autoclaves and Retorts**

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### **Identification and Description of Source**

There are two medical waste autoclaves in Washington State, both owned by Stericycle. One is located in Morton and the other in Ferndale.

The Ferndale facility is an autoclave, which uses steam sterilization. Steam sterilization is the thermal treatment of regulated medical waste using steam, sometimes generated within the waste through the use of microwave or radio frequency radiation. The Ferndale facility currently treats medical waste exclusively from Canada.

The Morton facility is a retort, which uses thermal inactivation. Thermal inactivation uses high temperatures to destroy infectious organisms in regulated medical waste.

Once the waste from both facilities is treated, it is then shredded and landfilled.

### **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.

### **Sectors Affected**

autoclave owners and operators, medical facilities, dentists

### **Current Regulations Policy**

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 Action 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.<sup>32</sup> 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.<sup>33</sup>

### Research and Monitoring Options

Sample air and water at the facilities for mercury.

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	No
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

### Outreach and Education Options

Work with Stericycle to conduct outreach and education to the medical and dental communities on the proper disposal of mercury waste.

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

<sup>32</sup> 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.

<sup>33</sup> Brodie, W., Industrial Hygiene Consultant, Washington Department of Labor and Industries; memo to Gail Savina, King County Hazardous Waste Dental Project, March 20, 2000.

## Publicly Operated Treatment Works (POTW's)

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### 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.<sup>34</sup>

### 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 X). These discharges are regulated through the NPDES program. Discharges to ground can be regulated using State Waste Discharge permits.

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<sup>34</sup> "Mercury Source Control and Pollution Prevention Program Evaluation;" Association of Metropolitan Sewerage Authorities; p. ES-4.

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 adequate mixing by the edge of the mixing zone are not given limits. In this case, mercury could be present in the discharge and is allowed by the NPDES permit.

**Table x. 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

**Sectors 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

## 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.<sup>35</sup>

## 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.

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

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.

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<sup>35</sup> "Mercury Source Control and Pollution Prevention Program Evaluation;" Association of Metropolitan Sewerage Authorities; pp. ES-2,3.

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

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.

Screen	Response
Strategy uses an existing reduction option or regulation	No
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Unknown

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

## Septic Systems

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### 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.

## Sectors 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.

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	No
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Unknown

## Sewage Sludge Incinerators

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### 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

**Table x. Sewage Sludge Incinerated in 2000**

Facility	Dry Tons Incinerated	
Anacortes WWTP	603.89	604
Edmonds WWTP	2674	2674
LaConner WWTP, Skagit Co SD #1	8.1	at Bellingham
Longview Fibre Company	125	125
Lynnwood WWTF	1843.3	1843
North Bend WWTP	95	at Edmonds
Post Point WWTP- Bellingham	3805.7	3806
Skagit Cnty Sewer Dist #2 WWTP	6.8	at Bellingham
Sumner WWTP	57	at Edmonds
Vancouver Westside TP	6827	6827
Whatcom Cnty Water Dist #13 TP	12.7	at Bellingham
	<b>TOTAL</b>	<b>15879</b>

### Sectors Affected

Cities with sludge incinerators. These 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](#)

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See *Mercury Products in Cars* section in this document.

### [Steel Recyclers](#)

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### 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.

## Sectors 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.

Screen	Response
Strategy uses an existing reduction option or regulation	Yes
Focus on pollution prevention	Yes
Result in cross-media transfer that reduces or eliminates exposure	Yes
Increase public education	Yes
Technically feasible	Yes
Strategy has worked in other locations/ consistent with EPA	Yes

## Crematoria

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### Identification and Description of Source

There are 66 crematories in Washington;<sup>36</sup> 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

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<sup>36</sup> <http://www.cremationassociation.org/docs/00data-projtest-new.pdf>, 3/28/02.

fillings (SOURCE?). Cremations account for approximately 11% of all mercury emissions in the 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 279 pounds of mercury are released in Washington annually through crematory stack emissions. Crematories are not regulated for mercury.

### **Sectors Affected**

Crematoria and customers

### **Research, Development, and Monitoring Options**

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

# 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.

<i>County</i>	<i>City</i>	<i>Name or Location of HHW Site</i>	<i>Address</i>
Adams	Othello	Bruce Transfer Station	Lucy Road
Adams	Ritzville	Ritzville Transfer Station	Danekas Road
Asotin	Clarkston	Asotin County Landfill	2901 6 <sup>th</sup> Avenue
Benton	Richland	Richland Landfill	Hwy 240, 3 miles NW of Richland
Clark	Vancouver	Central Transfer and Recycling Center	11034 NE 117 <sup>th</sup> Ave.
Clark	Vancouver	West Van Materials Recovery	6307 Lower River Rd
Franklin	Pasco	Household Hazardous Waste Facility	Basin Transfer Station, 1721 Dietrich Rd
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
Island	Coupeville	Coupeville Landfill/Recycle Park	630 West State Hwy 20
Island	Langley	Bayview Transfer Station	5790 S Kramer Road
Island	Oak Harbor	Oak Harbor Transfer Station	3155 N. Oak Harbor Road
Jefferson	Port Townsend	Jefferson County Moderate Risk Waste Facility	282 10 <sup>th</sup> St (across from Safeway, Port area) 360-379-6911
King	Seattle	South Transfer Station	8100 Second Avenue South
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
Klickitat	Dallesport	Dallesport Transfer Station	136 Tidyman Road
Klickitat	Goldendale	Goldendale Transfer Station	Highway 142, west of town
Klickitat	Roosevelt	Roosevelt Regional Landfill	Roosevelt Landfill
Klickitat	White Salmon	BZ Corners Transfer Station	5 Fir Tree Road
Lewis	Centralia	Hazo Hut	Across street from 1411 S. Tower Ave
Okanogan	Okanogan	Okanogan County Central Landfill Recycling	240 B&O Road North
Pend Oreille	Ione	North County Transfer Station	1712 Sullivan Lake Road

The Solid Waste Program encouraged local governments to submit proposals for mercury reduction projects as part of the CPG grant program in 2002. Eight proposals were received, requesting funding for outreach, thermometer exchanges, thermostat collection programs, and auto switch removal. The proposals are being evaluated.

## Lamp Recyclers

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To be developed.

## Hazardous Waste Contractors

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To be developed.

## **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.

### **Sectors 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.

# 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.

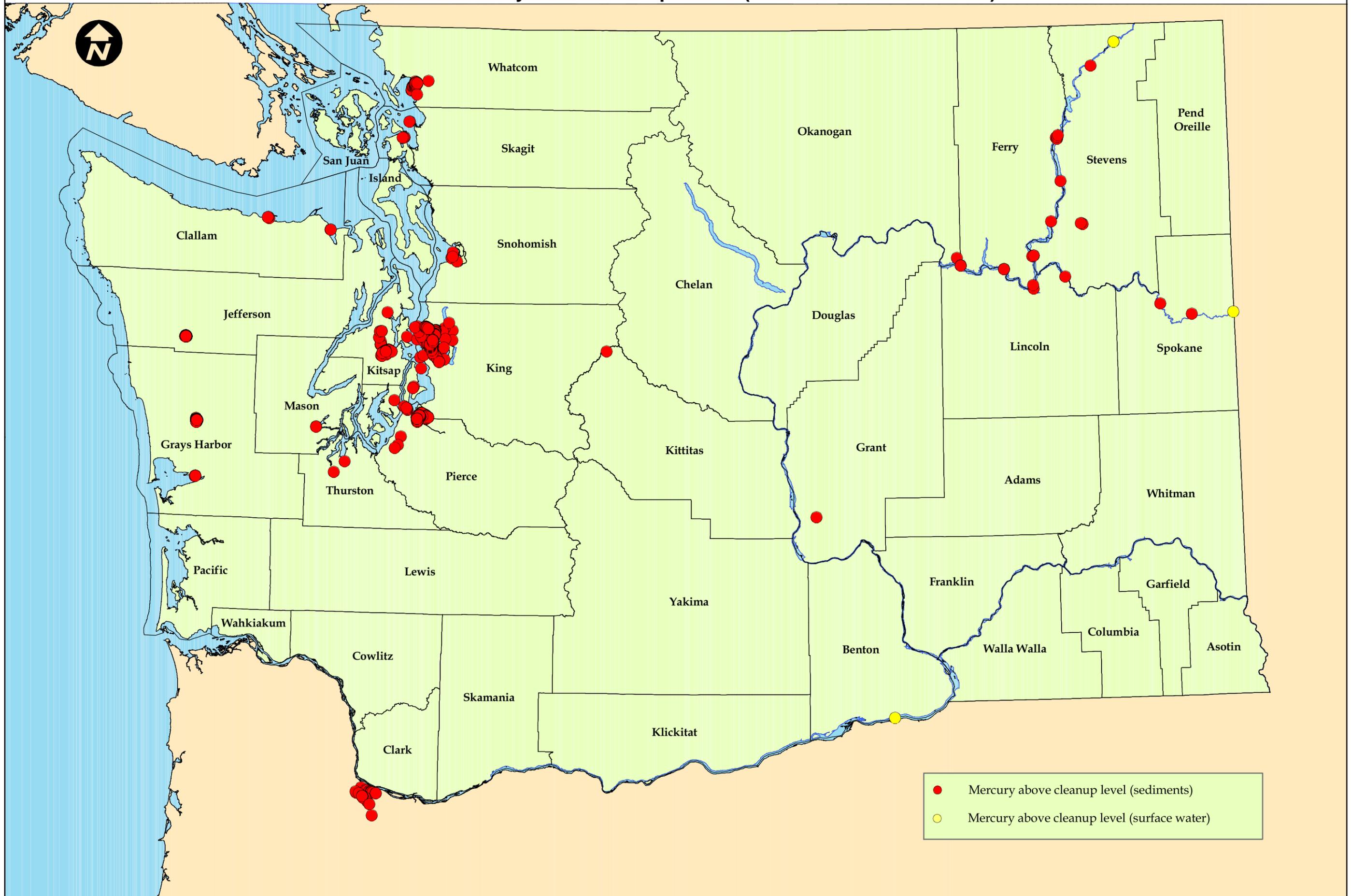
Unless a body of water is listed, or mercury is regulated from the source, it may not be found by water quality. At this point the solid waste program may find mercury and regulate it where water quality did not. Better detection limits of priority pollutants scans may be a way to find mercury more easily.

## **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:

- Procedures for cleanup of historic sediment contamination,
- Procedures for preventing future sediment contamination from discharges,
- and 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.

Until very recently, the Toxics Cleanup Program has not consistently tracked mercury as an individual contaminant at cleanup sites. In many cases, mercury was reported under the category of "metals." 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. Based on an informal survey of project coordinators in August 2000, the Toxics Cleanup Program identified a partial list of the sites in Table x as having mercury or multiple PBTs.

**Table x**  
**Partial List of Specific Sites that Have or Had Mercury at Them (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

Summary of existing Washington State research to be developed- little exists.

## Fish-eating Mammals

Summary of existing Washington State research to be developed- little exists.

## Humans

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](http://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..

# Research and Monitoring

## Ongoing Research

### [Washington State Toxics Monitoring Program](#)

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*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](#)

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*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](#)

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*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

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*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' Environmental Information Management system.

## Lake Whatcom Mercury in Sediment Project

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*Department of Ecology*

Fish tissue sampling conducted by EAP in previous studies have 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.

## Quicksilver Caucus – EPA Mercury Stewardship Initiative

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*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, U S 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

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*Department of Health*

### Potential Research Questions

How accurate is reporting for mercury on the Toxics Release Inventory?

What is the fate of mercury released in lode gold mining?

What is the fate of mercury at crematoria?

What is the impact of mercury on Washington wildlife (e.g., orcas, eagles)?

How many fluorescent lamps are being disposed of in landfills?

What is the fate of mercury in biosolids?

How much mercury is in effluent versus biosolids?

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# Preliminary Mercury Release Inventory

Sources	Estimated total mercury releases or potential releases	Data Source
Coal-fired power plants	436.3	Toxics Release Inventory, 2000
Gold Mining	776.6	Toxics Release Inventory, 2000
Manufacturing	296.3	Toxics Release Inventory, 2000
Products Containing Mercury	1,800.0	See "Product Inventory"
Municipal Waste Combustors	146.3	TRI, Spokane Solid Waste WA Dept. of Ecology Eastern Regional Office
Medical Waste Incinerators	0.3	Derived from estimate of dental amalgam in red bag waste.
Medical Waste Autoclaves	106.0	Estimate of mercury in biosolids.
POTW's	298.3	Estimate of mercury in biosolids.
Sewage Sludge Incinerators	79.2	Estimate of mercury in biosolids.

**Table x**  
**2000 Toxics Release Inventory for Mercury and Mercury Compounds**

SIC Code	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
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 x: Pounds of Mercury in Biosolids not Incinerated in 2000**

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

**(71859.7 TONS/64702.5 TONS) x 298.3 LBS = 331.3 LBS Hg IN NON-INCINERATED BIOSOLIDS**

List of 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
FERNDALE WWTP	55.00	1.80	0.002	0.20
FORT LEWIS WWTP	360.00	4.96	0.002	3.57
FRIDAY HARBOR WWTP	49.00	3.37	0.002	0.33
GIG HARBOR WWTP	154.00	2.17	0.002	0.67
GRANDVIEW WWTP	857.00	0.64	0.002	1.10
GRANITE FALLS WWTP	90.00	1.18	0.002	0.21
HARTSTENE POINTE WWTP	4.25	1.43	0.002	0.01
ILWACO WWTP	62.00	0.90	0.002	0.11
KALAMA, CITY OF, WWTP	14.50	0.02	0.002	0.00

FACILITY	Tons BIOSOLIDS	Hg PPM	FACTOR	LBS Hg
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 - BURIEN	245.00	1.17	0.002	0.57
SEDRO-WOOLLEY WWTP	165.16	2.79	0.002	0.92
SELAH WWTP	221.79	1.55	0.002	0.69
SHELTON WWTP	367.49	1.20	0.002	0.88
SOUTH TREATMENT PLANT (RENTON)	13483.00	2.73	0.002	73.48
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
WINLOCK WWTP	50.00	0.60	0.002	0.06
WOODLAND WWTP	102.53	1.14	0.002	0.23
<b><u>TONS BIOSOLIDS</u></b>	<b><u>64702.54</u></b>		<b><u>LBS Hg</u></b>	<b><u>298.30</u></b>

**Table X: 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.

<b>FACILITY</b>	<b>TONS BIOSOLIDS</b>
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
DAYTON WWTP	9.50
DES MOINES CREEK TP	449.36

<b>FACILITY</b>	<b>TONS BIOSOLIDS</b>
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
LYNDEN WWTP	626.00
MABTON WWTP	18.00
MANCHESTER WWTP	33.48
MCCLEARY WWTP	15.00

<b>FACILITY</b>	<b>TONS BIOSOLIDS</b>
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
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

<b>FACILITY</b>	<b>TONS BIOSOLIDS</b>
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
W/W PUMPING SERVICE, INC	41.26
WALLA WALLA WWTP	322.00
WARM BEACH CAMPGROUND WWTP	12.20
WASHINGTON CORRECTIONS CENTER	26.20
WASHOUGAL WWTP	100.00
WENATCHEE WWTP	511.00
WEST POINT WWTP	13283.00
WESTPORT WWTP	109.35
WHIDBEY ISLAND STP	203.00
WINLOCK WWTP	50.00
WOLLOCHET HARBOR WWTP	0.50
WOODLAND WWTP	102.53
YAKIMA REGIONAL WWTP	1152.80
YELM WWTP	10.31
ZILLAH WWTP	10.00
<b><u>TONS BIOSOLIDS</u></b>	<b><u>71859.68</u></b>

**Table x.**  
**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					<a href="http://www.remote-control.net/convert/tables/general/index.html">http://www.remote-control.net/convert/tables/general/index.html</a>
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					<a href="http://www.remote-control.net/convert/tables/general/index.html">http://www.remote-control.net/convert/tables/general/index.html</a>
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 x**  
**Estimated Annual Mercury Releases from Products Disposed in Washington State**

Mercury Products	Estimated pounds of mercury disposed with solid or medical waste or sewage annually
Fluorescent lamps	507
Thermostats	431
Dental Amalgam from Dental Facilities	404
Dental Amalgam in Cremations	263
Auto Convenience Light Switches	219
Dental Amalgam in Feces and Urine	62
Household fever thermometers	12
<b>TOTAL:</b>	<b>1,898</b>

**Table x**  
**Estimated Annual Mercury Releases from Fluorescent Lamps in Washington State**

Number of lamps manufactured in U.S. annually	600,000,000	<a href="http://www.epa.gov/glnpo/bnsdocs/milwaukeehg/chapter3.html">http://www.epa.gov/glnpo/bnsdocs/milwaukeehg/chapter3.html</a>
U.S. population (2001)	284,796,887	<a href="http://eire.census.gov/popest/data/states/populartables/table04.php">http://eire.census.gov/popest/data/states/populartables/table04.php</a>
WA State population	5,987,973	<a href="http://eire.census.gov/popest/data/states/populartables/table04.php">http://eire.census.gov/popest/data/states/populartables/table04.php</a>
% of U.S. population	0.021	
Number of new lamps annually	12,615,250	
Hg per lamp (gm)	0.0228	<a href="http://www.epa.gov/bns/mercury/MercuryReport.pdf">http://www.epa.gov/bns/mercury/MercuryReport.pdf</a>
Est. Hg in new lamps annually (gm)	287628	
Conversion factor	0.002204623	<a href="http://www.remote-control.net/convert/tables/general/index.html">http://www.remote-control.net/convert/tables/general/index.html</a>
Est Hg in new lamps annually (lbs)	634	
Lifetime of lamp (yrs)	4	<a href="http://www.epa.gov/bns/mercury/MercuryReport.pdf">http://www.epa.gov/bns/mercury/MercuryReport.pdf</a>
Est total Hg in lamps (lbs)	<b>2536</b>	
Est. Hg in lamps disposed/year	634	
Est. % of lamps recycled	0.20	Estimates of Potential Mercury Releases from Anthropogenic Sources in Oregon. Hemple and Weiss, 2001.
Est amt Hg disposed to solid waste fr lamps (lbs)	507	

**Table x**  
**Estimated Annual Mercury Releases from Thermostats in Washington State**

national tons/year in MSW	10	<a href="http://www.epa.gov/ttn/oarpg/t3/reports/volume2.pdf">http://www.epa.gov/ttn/oarpg/t3/reports/volume2.pdf</a> , p. 4-19
g of Hg per thermostat	2.5	USEPA, 1997
households in US	105,480,101	<a href="http://quickfacts.census.gov/qfd/states/53000.html">http://quickfacts.census.gov/qfd/states/53000.html</a>
households in WA	2,271,398	<a href="http://quickfacts.census.gov/qfd/states/53000.html">http://quickfacts.census.gov/qfd/states/53000.html</a>
% of US hh in WA	2%	
tons in WA	0.215339005	
conversion factor, tons to lbs	2000	
pounds in WA	431	

**Table x**  
**Estimated Annual Mercury Releases from Dental Amalgam in Urine and Feces in Washington State**

Hg released in feces and urine µg/day/person	17.2	Larry Walker Associates, "Mercury Source Control and Pollution Prevention Program Evaluation: Final Report," prepared for the Association of Metropolitan Sewerage Agencies under grant from U.S. Environmental Protection Agency, March 2002, pp. 9 - 10
days in year	365	
WA pop estimate, 2001	5,987,973	<a href="http://quickfacts.census.gov/qfd/states/53000.html">http://quickfacts.census.gov/qfd/states/53000.html</a>
WA pop estimate, % under 18	74.30%	<a href="http://quickfacts.census.gov/qfd/states/53000.html">http://quickfacts.census.gov/qfd/states/53000.html</a>
Estimated total µg released annually in feces and urine	27,931,223,409	
conversion factor, µg to g	0.000001	
conversion factor, g to lbs	0.002204623	
Estimated total lbs. released annually in feces and urine	62	

**Table x**  
**Estimated Annual Mercury Releases 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 x**  
**Estimated Annual Mercury Releases from Auto Switches in Washington State**

221,060	Number of vehicles in Washington reported wrecked, damaged or destroyed, 2001	WA State Dept. of Licensing
0.8	grams of mercury per switch	<a href="http://www.state.me.us/dep/mercury/Auto%20Releases.pdf">http://www.state.me.us/dep/mercury/Auto%20Releases.pdf</a> , p.2
0.65	est. switches per registered vehicle	<a href="http://www.state.me.us/dep/mercury/Auto%20Releases.pdf">http://www.state.me.us/dep/mercury/Auto%20Releases.pdf</a> , p. 5
0.002204623	conversion factor, grams to pounds	<a href="http://www.remote-control.net/convert/tables/general/index.html">http://www.remote-control.net/convert/tables/general/index.html</a>
253	est. pounds of mercury released from switches in WA annually	

**Table x**  
**Estimated Annual Mercury Releases from Dental Amalgam at Crematoria in Washington State**

Number of deaths in WA in 2000	43,904	<a href="http://www.doh.wa.gov/EHSPHL/CHS/CHS-Data/death/deatmain.htm">http://www.doh.wa.gov/EHSPHL/CHS/CHS-Data/death/deatmain.htm</a>
% of dead that are cremated in WA	0.59	<a href="http://www.cremation.org/">http://www.cremation.org/</a>
Number of cremations in 2000	25,903	
Grams of Hg released per cremation	4.6	Hg release data range fr. $.94 \times 10^{-3}$ gm/body to 5.6 gm/body. "Summary of references on mercury emissions from crematoria" John Reindl, Dane Co., WI March 2002 for review of data.
Grams of Hg released during cremations in 2000	119,155	
Conversion factor	0.0022046	<a href="http://www.remote-control.net/convert/tables/general/index.html">http://www.remote-control.net/convert/tables/general/index.html</a>
Hg released during cremations in 2000 (lbs)	<b>263</b>	Note: Doesn't all go to air. It's assumed that some of the Hg stays in crematoria -- on walls, etc.
Hg emitted <i>to air</i> per cremation (gms)	1 - 5.6	Canadian Emission Inventory Guidebook - 5-10 gm; UK - 2.95 gm; Norway - 2-4 gm; Norway - 4.9; Swedish EPA - 5 gm. See "Summary of references on mercury emissions from crematoria" John Reindl, Dane Co., WI March 2002 for details and references.

**Table x**  
**Estimated Annual Releases from Household Fever Thermometers in Washington State**

% of households with Hg fever thermometer	0.46	King County Hazardous Waste Sound Stats Sept 2001
Number of households	2,271,398	<a href="http://www.metrokc.gov/exec/orpp/agr/agr01/ch4-01.pdf">http://www.metrokc.gov/exec/orpp/agr/agr01/ch4-01.pdf</a> <a href="http://quickfacts.census.gov/qfd/states/53000.html">http://quickfacts.census.gov/qfd/states/53000.html</a>
Number of households with Hg fever thermometers	1,044,843	
Hg per thermometer (gms)	0.5	
Est. Hg in fever thermometers (gms)	522,422	
Conversion factor	0.0022046	<a href="http://www.remote-control.net/convert/tables/general/index.html">http://www.remote-control.net/convert/tables/general/index.html</a>
Est. Hg in fever thermometers (lbs)	<b>1152</b>	
% of households breaking a Hg thermometer/yr	0.01	King County Hazardous Waste Sound Stats Sept 2001
Est. Hg released/year from broken thermometer (lbs)	12	

# Appendices

## Appendix A

### Regulatory Overview

#### EPA Authority Relative to Mercury

Air	Water	Waste	Use Limitations	Reporting Requirements/ Spills
<p><b>Clean Air Section 112</b> provides authority to regulate hazardous air pollutants (HAPs);</p> <ul style="list-style-type: none"> <li>- Section 112(c)(6): requires promulgation of emission standards by 2000 for sources that account for 90% of aggregate mercury emissions<sup>1</sup></li> <li>- Section 112(n)(1)(C): requires a study of hazardous air pollutant emissions from electric utility plants &amp; requires a finding on the need for regulation</li> <li>- Section 112(n)(C): requires study of mercury from all sources</li> <li>- Section 112(m): requires study of HAPs to Great Waters and recommendations</li> <li>- Clean Air Act Section 129: requires regulatory actions for the solid waste combustion industry<sup>1</sup></li> </ul>	<p><b>Safe Water Drinking Act</b> provides authority for National Primary Drinking Water Regulations</p> <p><b>Clean Water Act</b> provides authority on priority pollutants for:</p> <ul style="list-style-type: none"> <li>- Ambient Water Quality Criteria<sup>2</sup></li> <li>- Effluent limitation guidelines<sup>2</sup></li> <li>- Pretreatment of discharges to publicly owned sewage treatment plants<sup>2</sup></li> </ul>	<p><b>Resource Conservation and Recovery Act</b> provides authority to:</p> <ul style="list-style-type: none"> <li>- regulate storage, treatment, transport and disposal of mercury wastes</li> </ul> <p><b>Comprehensive Environmental Response, Compensation, and Liability Act</b> provides authority clean up past waste</p> <p><b>Superfund Amendment Reauthorization Act</b></p> <ul style="list-style-type: none"> <li>- Section 110: Superfund Site Priority Contaminants</li> </ul>	<p><b>Toxic Substances Control Act</b> provides authority to regulate chemical substances and mixtures which present an unreasonable health risk to the environment<sup>2</sup></p> <p><b>Federal Insecticide, Fungicide, and Rodenticide Act</b> provides authority to regulate pesticides that cause unacceptable risk (mercury use as a fungicide in paint)</p> <p><b>Mercury-Containing and Rechargeable Battery Management Act</b> 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><b>Emergency Planning and Community Right-to-Know Act</b></p> <ul style="list-style-type: none"> <li>- Section 313: requires qualifying facilities to report amounts of toxic substances released or managed as waste. Information maintained in the Toxic Release Inventory<sup>3</sup></li> </ul> <p><b>Pollution Prevention Act</b> 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)<sup>2</sup></p> <p><b>Comprehensive Environmental Response, Compensation, and Liability Act</b></p> <ul style="list-style-type: none"> <li>- Section 103: Requires reporting of releases. Reporting requirements for spills &gt; 1 lb in organic mercury/day</li> </ul>

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

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

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

## Washington State Department of Ecology Authority Relative to Mercury

Air	Water	Waste	Use Limitations	Reporting Requirements/Spills
		<p><b>Dangerous Waste Regulations</b></p> <p><b>Ch. 70.105D RCW, Model Toxic Control Act</b> establishes 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.</p> <ul style="list-style-type: none"> <li>- provides broad powers of regulation to Ecology relating to management of hazardous wastes and releases of hazardous substances;</li> <li>- promotes waste reduction and encourages other improvements in waste management practices;</li> <li>- promotes 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;</li> <li>- provides for prevention of problems related to improper management of hazardous substances before such problems occur</li> <li>- assures that needed hazardous waste management facilities may be sited in the state, and to ensure the safe operation of the facilities</li> <li>- sediment standards?</li> </ul>	<p><b>Ch. 70.95G RCW Packages Containing Metals</b> limits the concentration levels of mercury in and package or packaging content.</p>	<p><b>Ch 70.95C RCW Pollution Prevention Plan</b> encourages voluntary efforts to redesign industrial, commercial, production, and other processes to result in the reduction or elimination of hazardous waste by-products and to maximize the in-process reuse or reclamation of valuable spent material whenever economically and technically practicable.</p> <p>Emergency Planning and Community Right to Know Act</p>

### **Washington State Department of Health Authority Relative to Mercury**

**Ch. 64.44 RCW Contaminated Properties** states that shall adopt rules for decontamination of a property used as an illegal drug laboratory, including decontamination standards for mercury.

### **Washington State Department of Agriculture Authority Relative to Mercury**

**Ch. 69.04 RCW Intrastate Commerce in Food, Drugs and Cosmetics** states that if a drug is not designated by a name recognized in an official compendium, it shall be considered misbranded unless the label bears the common name and the quantity of mercury contained, if any.

### **Washington State Department of Labor and Industries**

**Ch. 70.74 RCW Washington State Explosives Act** classifies fulminate of mercury as a Class A explosive and limits its use.

### **Local Air Agencies' Authority Relative to Mercury in Washington State**

### **Local Health Departments' Authority Relative to Mercury in Washington State**

### **Local Solid Waste Districts' Authority Relative to Mercury 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 n 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.

- **173-308 WAC**

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.

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.

### **173-400 WAC General Regulations for Air Pollution Sources**

#### **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’ve 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”.

- **70.95 RCW**

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**

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.

- **9048 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**

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

## **Appendix B**

### **Summary of Department of Ecology Data Sources**

To be developed.

## Appendix C

### 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.

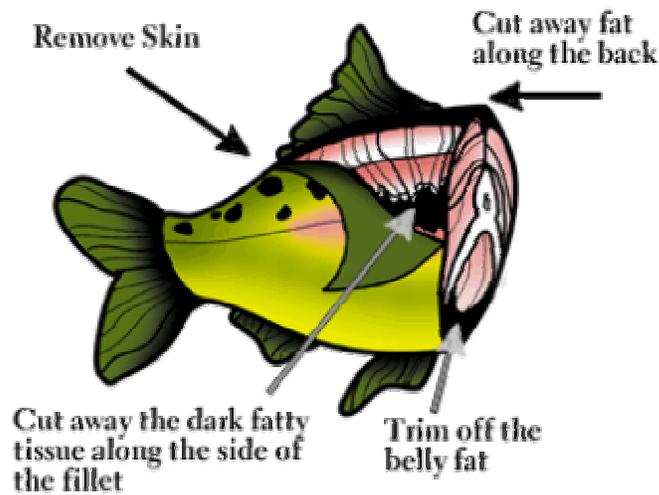
- Fish is a healthy food, and the Department of Health recommends that people eat a variety of fish as part of a balanced diet. Health benefits of eating fish are:
  - Fish is an excellent low-fat food, a great source of protein, vitamins, and minerals.
  - The oils in fish are important for unborn and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

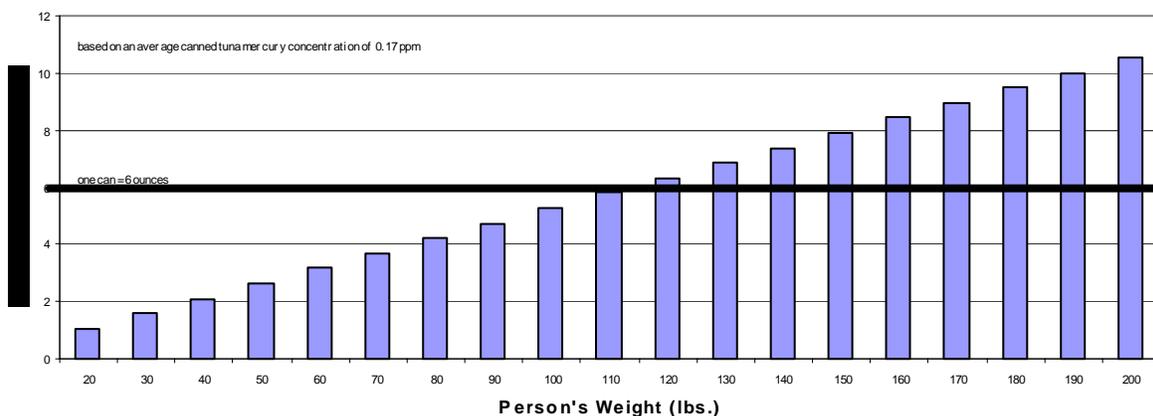
- There is not a lot of information statewide on mercury contamination on fresh water fish. We do know on a national basis that bass, pike, and walleye tend to have higher levels of mercury than other species.
- Contaminants other than mercury may be a problem for fish in certain areas of the state. 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](http://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](mailto:dave.mcbride@doh.wa.gov).

**Canned Tuna Weekly Consumption Rates**  
 Bars indicate the weekly limit of canned tuna for women of childbearing age and children under six as recommended by Washington State Department of Health 4/12/01



## Appendix D

### 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](http://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](http://www.doh.wa.gov/fish). The DOH contact for this fish consumption advisory is:

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PO Box 47846  
Olympia, WA 98504-7846  
Email: [dave.mcbride@doh.wa.gov](mailto: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/](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 E

### 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	<b>Unet</b> 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- <b>unet</b> 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 <b>sceen</b> . 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.
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 <b>carbonaire</b> mercury zinc (lead??) Batteries dumped in the lake near the channel light across from seven bays. He said they found them just at the water line when the lake was about 1230 feet.

Date Call Received	Date of Incident	Notes
6/6/2001	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		<p>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.</p> <p>They had a small mercury release there this morning (7/9/01). A manometer (?) Broke in a conex (?) Box - 1 pound release. NRC &amp; 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.</p>
7/9/2001	7/9/2001	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.
7/30/2001	7/30/2001	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.
8/24/2001	8/24/2001	Caller is calling for neighbor who spilled mercury from glass jar. Wanted to know what to do.
8/28/2001	8/28/2001	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.
10/5/2001	10/5/2001	

Date Call Received	Date of Incident	Notes
11/5/2001		<p>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</p>
11/8/2001	11/8/2001	<p>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.</p>
11/17/2001	11/17/2001	<p>Liquid mercury at the little rock fire department.</p>
12/5/2001		<p>Caller worked at the <b>vetranary</b> 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.</p>
12/7/2001	12/7/2001	<p>Cowlitz co. Health dept called. There has been about a dime size of mercury spilled onto carpet at a residence in Cowlitz County.</p>
3/2/2002	3/2/2002	<p>Homeowner broke a thermometer and has mercury on floor. Would like our help.</p>
3/18/2002		<p>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.</p>

## Appendix F

### 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