



Government  
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# Risk Management Strategy *for* **MERCURY**



Canada 



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Environment Canada

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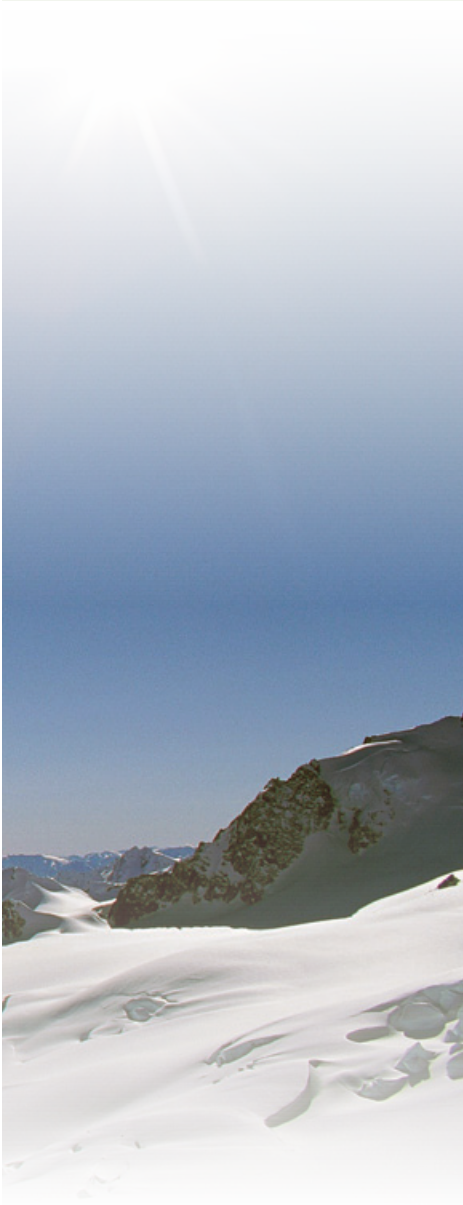
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## EXECUTIVE SUMMARY

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**M**ercury is a heavy metal naturally present in the environment. It can be released due to natural processes or human activities. In the environment, mercury can be converted to methyl mercury, the form of mercury to which humans are most often exposed, primarily through consumption of fish. Mercury releases pose significant risks to Canada's environment and the health of its citizens.

Since the 1970s, Canada has made significant progress in reducing domestic sources of anthropogenic mercury by approximately 90%. However, transboundary flows of mercury emissions are rising and now account for over 95% of mercury deposits in Canada. Accelerated global efforts will therefore be critical to meeting Canadian environmental and human health goals.

Accordingly, the Government of Canada is committed to taking further actions at home and internationally to minimize and, where feasible, eliminate anthropogenic mercury releases.

This risk management strategy provides a comprehensive description of the Government of Canada's progress to date in managing mercury. In addition, it outlines current and anticipated mercury-management activities.

# TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION</b> .....	<b>1</b>
<b>2</b>	<b>BACKGROUND</b> .....	<b>1</b>
2.1	What is Mercury? .....	1
2.2	Risks to Canadians. ....	2
	Environmental Risks. ....	2
	Human Health Risks. ....	3
2.3	Key Sources of Mercury .....	5
2.4	Canada’s Current Emissions Profile .....	6
<b>3</b>	<b>RESPONSES TO DATE</b> .....	<b>10</b>
3.1	Domestic Actions .....	10
	Emissions from Industrial Sources .....	12
	Mercury-containing Products. ....	13
	Guidelines .....	14
	Research, Monitoring and Assessment .....	16
	Reporting .....	16
	Accelerated Reduction and Elimination of Toxics (ARET) Program. ....	16
3.2	International Initiatives .....	17
3.3	Actions by the European Union and United States. ....	18
	European Union .....	18
	United States .....	18
<b>4</b>	<b>THE GROWING GLOBAL CONTEXT FOR ACTION ON MERCURY</b> .....	<b>19</b>
<b>5</b>	<b>MOVING FORWARD – ELEMENTS OF A CANADIAN APPROACH.</b> .....	<b>20</b>
5.1	Domestic Actions .....	20
	Emissions from Industrial Sources .....	21
	Mercury-containing Products. ....	21
	Waste Management. ....	22
	Science in Support of Decision Making. ....	23
5.2	International Actions .....	24
	Participation in Negotiations Towards a Global Mercury Agreement .....	24
	Enhanced Regional and Sectoral Engagement .....	25
	Bilateral Efforts .....	25
5.3	Expected Outcomes. ....	26
<b>6</b>	<b>MEASURING PROGRESS</b> .....	<b>27</b>
<b>7</b>	<b>REFERENCES</b> .....	<b>28</b>
<b>8</b>	<b>BIBLIOGRAPHY</b> .....	<b>31</b>
	Annex A – Existing Risk Management Initiatives. ....	35
	Annex B – List of Programs/Actions under the Four Complementary Activities of Research, Monitoring, Modelling and Assessment .....	40
	Annex C – Health Canada Guidelines .....	44



## 1 INTRODUCTION

Mercury<sup>1</sup> has been identified as a toxic substance under the *Canadian Environmental Protection Act, 1999*. Releases of mercury pose significant risks to Canada's environment and the health of its citizens, particularly in the Arctic, and are associated with a range of socio-economic impacts.

This risk management strategy for mercury provides a comprehensive and consolidated description of the Government of Canada's progress to date in managing the risks associated with this toxic substance. It also outlines objectives, priorities, actions under way or planned, and monitoring programs in place to address the ongoing risks associated with mercury.

The risk management objective of this strategy is to protect the health of Canadians and their environment from the risks associated with mercury, by minimizing and, where feasible, eliminating anthropogenic mercury releases.

## 2 BACKGROUND

### 2.1 What is Mercury?

Mercury is a heavy metal that can be present in the environment in many different forms. Elemental mercury is naturally present in the Earth's crust, in raw materials such as coal, crude oil and other fossil fuels, and in minerals such as limestone, soils and metal ores (including zinc, copper and gold). Mercury also enters into the environment as a result of natural processes such as volcanic activity and forest fires.

Mercury can also be released into the environment as a result of human activity, such as the combustion of coal and refined petroleum products, the extraction of metals from ore, and the use and disposal of consumer products containing mercury (e.g., batteries and light bulbs).

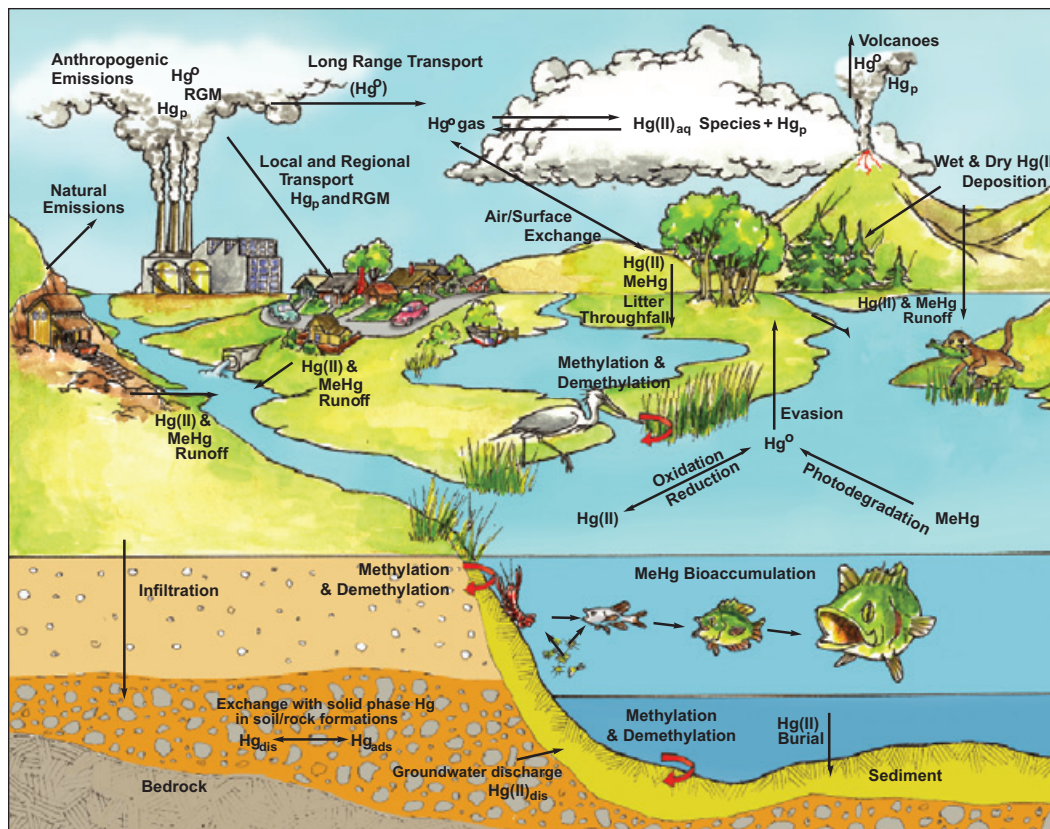
Once in the environment, mercury can be converted to various forms. For example, mercury can be transformed into a highly toxic compound called methyl mercury, which can accumulate in living organisms and biomagnify (i.e., increase in concentration) as it moves up the food chain. This is the form of mercury to which humans are most often exposed, primarily through consumption of fish and other seafood.

Elemental mercury does not break down in the environment. Once released, it persists and can cycle between air, water, soil, plants and animals for extended periods (see Figure 1). For example, mercury emitted into the atmosphere can be deposited on land and surface waters through precipitation, and can also enter water bodies as runoff from soil or through groundwater.

Because elemental mercury evaporates relatively easily, mercury emissions can also be transported on wind currents, either as vapour or bound to particles. These emissions can circulate in the atmosphere for a year or more, travelling long distances before being deposited far from their original source. It is this property of mercury that results in deposition of mercury in the Arctic, a site that is far from industrial sources of mercury emissions.

<sup>1</sup> Throughout this document, the term "mercury" refers to mercury and its compounds.





Source: Tetra Tech, Inc. 2010

Figure 1 The mercury cycle

## 2.2 Risks to Canadians

### Environmental Risks

As noted above, methyl mercury can accumulate in living organisms and biomagnify as it moves up the food chain. For example, fish-eating predators such as loons and larger fish have been observed to bioaccumulate high levels of methyl mercury. Depending on the level of exposure, effects on humans, fish and wildlife can include slower growth, reproductive failure, and the development of abnormal behaviours that can affect survival (Health Canada 2004; UNEP 2002, 2008b).

Although the impacts of mercury are evident in all regions of Canada, they are most significant in the Arctic region. Monitoring data indicate that levels of mercury in Arctic plants and wildlife have generally been increasing over the past thirty years (Health Canada 2004; UNEP 2002, 2008b).

The Arctic acts as a sink that traps many pollutants that have the ability to travel long distances. In addition, the Canadian Arctic is downwind from growing sources of mercury emissions in Asia and Eurasia. Climate change may also be enhancing and increasing the rate of methyl mercury production in the region (UNEP 2002, 2008a, 2008b).





As noted in the Great Lakes Binational Toxics Strategy Management Assessment for Mercury, levels continue to exceed risk-based criteria within the Great Lakes, most notably for methyl mercury in fish and for sediment quality (US EPA and Environment Canada 2006). In some cases, local sources are thought to account for well over half of the mercury deposition (GLRC 2009).

## Human Health Risks

Mercury poses a host of human health risks, both in its elemental form and in more toxic forms such as methyl mercury. Primary sources of exposure to methyl mercury include diet, especially fish. Currently, a large proportion of the fish consumption advisories in Canada are due to methyl mercury. As such, populations consuming large amounts of fish and marine mammals (such as northern Aboriginal communities) are particularly vulnerable to these effects. According to documents published by the United Nations Environment Programme (UNEP), levels of mercury in Inuit from Canada and Greenland are among the highest in the world however, only a small percentage of Inuit from Canada are at levels where potential health effects can occur (Health Canada 2004, 2007; INAC, 2009; UNEP 2002).

Methyl mercury is a potent neurotoxin that is readily absorbed, distributed and passed through the protective blood-brain barrier, affecting the central nervous system. In pregnant women, it can cross the placenta into the fetus, accumulating in the fetal brain and other tissues. Methyl mercury can also be passed to infants through breast milk (Health Canada 2004, 2007; UNEP 2002).

Methyl mercury is particularly damaging to the development of infants and young children, who are especially vulnerable given that their nervous systems are still developing (Health Canada 2004, 2007; UNEP 2002).

Although the level of exposure influences the severity of associated health impacts, new epidemiological findings from the past decade suggest that toxic effects may be taking place at lower concentrations than previously considered (Health Canada 2004, 2007; UNEP 2002).

Other potential health impacts being studied include links between exposure to methyl mercury from fish and increased incidence of cardiovascular disease. The International Agency for Research on Cancer has also concluded that methyl mercury may possibly be carcinogenic to humans (UNEP 2002; IARC 1993).

Those most vulnerable to mercury effects include:

- northern populations that eat fish and marine mammals as part of their traditional diet;
- women who consume greater amounts of larger species of fish throughout pregnancy and lactation, and their developing fetuses and infants;
- children, who can be exposed via a number of pathways (e.g., putting soil and other potentially contaminated objects in their mouths), and who are particularly vulnerable due to their accelerated metabolic rates. Also, their less developed organs have difficulty in eliminating mercury, and they are subject to a lower threshold for neurological effects associated with methyl mercury.

## Tracking Human Exposure

Exposure to inorganic mercury is commonly evaluated using mercury concentrations in blood and urine. Concentrations in blood and hair may be used as biomarkers of methyl mercury exposure. Blood mercury concentrations are being studied through the ongoing Canadian Health Measures Survey (CHMS) and various other regional monitoring programs such as the Northern Contaminants Program. Although full results will not be available until later in 2010, preliminary results suggest that while 90% of Canadians tested had detectable concentrations of mercury in their blood, fewer than 1% of Canadians aged 20–79 had total levels above current Health Canada guidelines of 20 µg/L for the general adult population. Nearly all blood levels of mercury were below the Health Canada guideline value, indicating that the public health risk to the general population is low and that health advisories and interventions have been generally effective.

Canadians may further be exposed to elemental mercury through inhalation of mercury vapours, which can be absorbed by lung tissues. This vapour easily penetrates the blood-brain barrier and is a well-documented neurotoxin. Neurological and behavioural disorders associated with exposure include tremors, insomnia, memory loss, neuromuscular changes, and headaches (Health Canada 2004, 2007; UNEP 2002).

Aboriginal peoples remain particularly vulnerable to higher exposures due to consumption of traditional foods that contain higher concentrations of methyl mercury. Research shows that the Inuit of northeast Canada are more often exposed to methyl mercury levels that exceed Health Canada guidelines. Biomonitoring surveys conducted among Inuit mothers in 1992 determined that blood mercury concentrations exceeded the Canadian ‘increasing risk’ guideline of 20 µg/L in as many as 36% of samples taken. However more recent studies (2005–2007) have found a maximum of 2.1% exceedance of the same guideline among Inuit mothers tested. Subtle adverse neuro-developmental effects in some infants have also been detected in these

communities though the significance as these children grow into adults is still uncertain (Van Oostdam et al. 2005; INAC 2009). Although these traditional foods may contribute to an increase in exposure to mercury it must also be noted that these foods have significant social, cultural, economic and nutritional benefits that outweigh the risks from mercury.

In addition to the direct risks described above, mercury impacts on human health can have significant socio-economic implications. For example, neurological damage resulting in impaired prenatal brain development can lead to reduced intellectual quotient (IQ) points, with associated costs for society stemming from direct and indirect loss of earnings and education (UNEP 2002). A study by the Nordic Council of Ministers estimated that the cost of IQ loss in Europe as a result of mercury pollution is in the range of C\$13,000 per 1 kg of mercury emitted to air (NMR 2008). Similarly, an American study has estimated that the collective cost of IQ loss resulting from exposure of American children to anthropogenic methyl mercury is US\$0.7–13.9 billion annually (Trasande et al. 2006).

Other studies have looked at a wider spectrum of health impacts. For example, a 2005 study estimated that the total annual human health benefits associated with mercury controls are approximately US\$4,000–110,000 per kg reduction of mercury emissions (Rice and Hammit 2005).



## 2.3 Key Sources of Mercury

UNEP has identified four types of mercury emissions: primary natural sources, primary anthropogenic sources, secondary anthropogenic sources and re-mobilization/re-emission (see Figure 2).



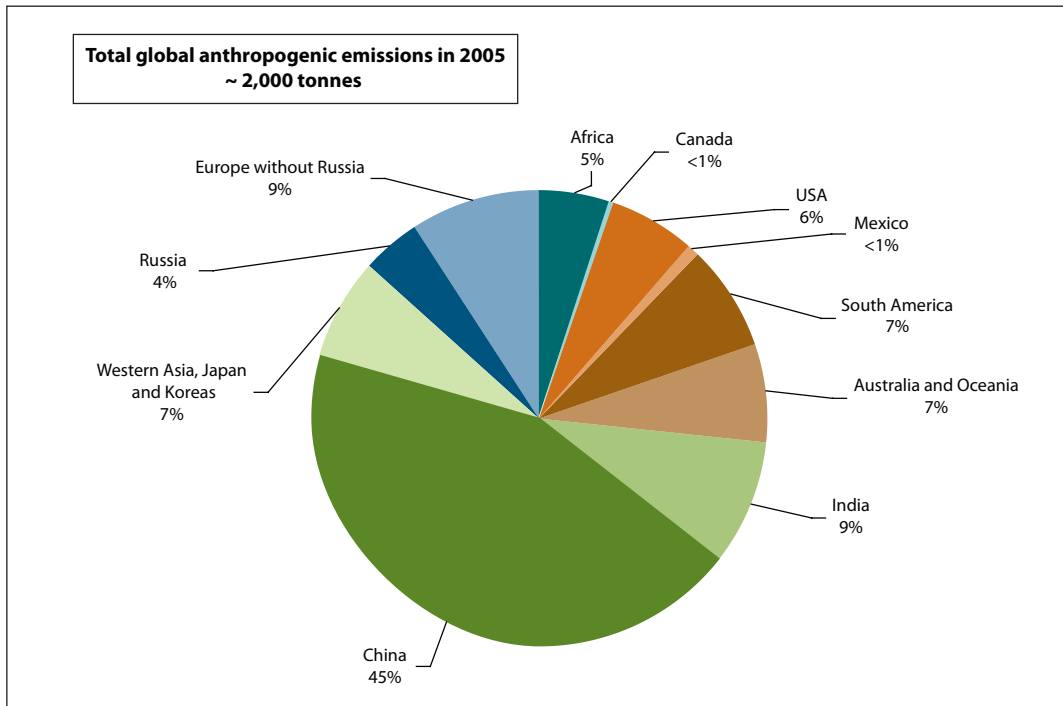
Source: UNEP 2008b

Figure 2 The four types of mercury emissions

*Primary natural sources* of mercury include volcanic activity and natural erosion of mercury-based deposits. Geothermal activity can also remove mercury from underground and release it to the atmosphere. Some recent models suggest that primary natural sources account for about one third to one half of mercury emissions to the atmosphere (UNEP 2002, 2008b).

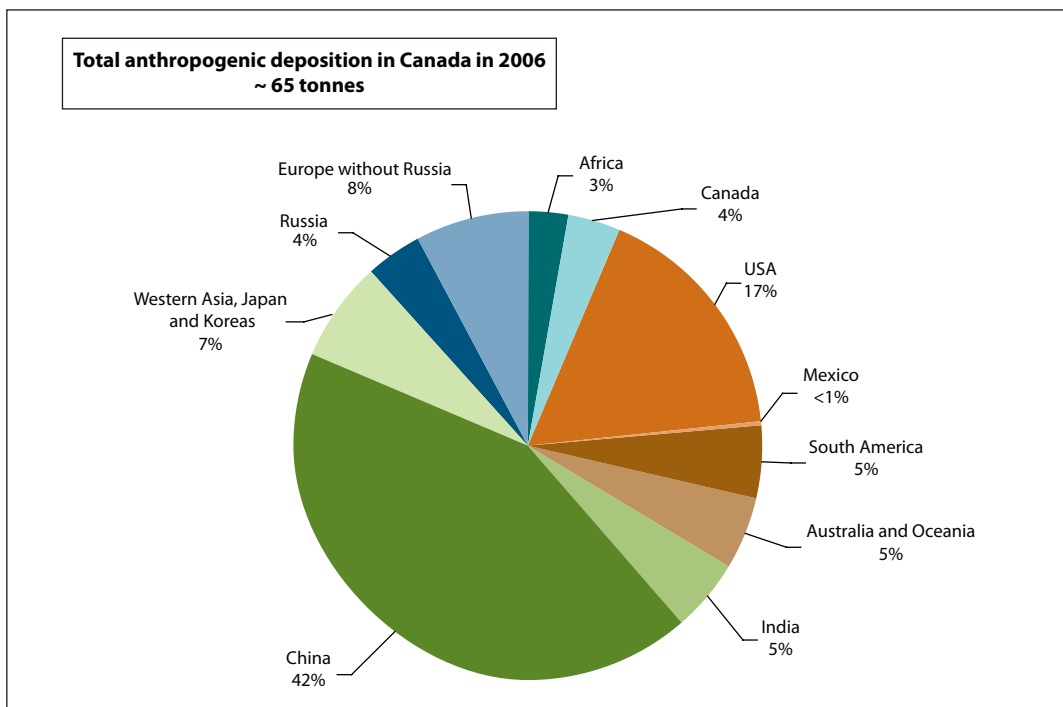






Source: Environment Canada 2009

**Figure 3** Estimated global anthropogenic emissions of mercury, 2005



Source: Environment Canada 2009

**Figure 4** Estimated anthropogenic mercury deposition in Canada, 2006





## Canadian Imports and Exports

In 2008, approximately 13 tonnes of elemental mercury were imported into Canada, and an estimated 9 tonnes were imported in finished products.

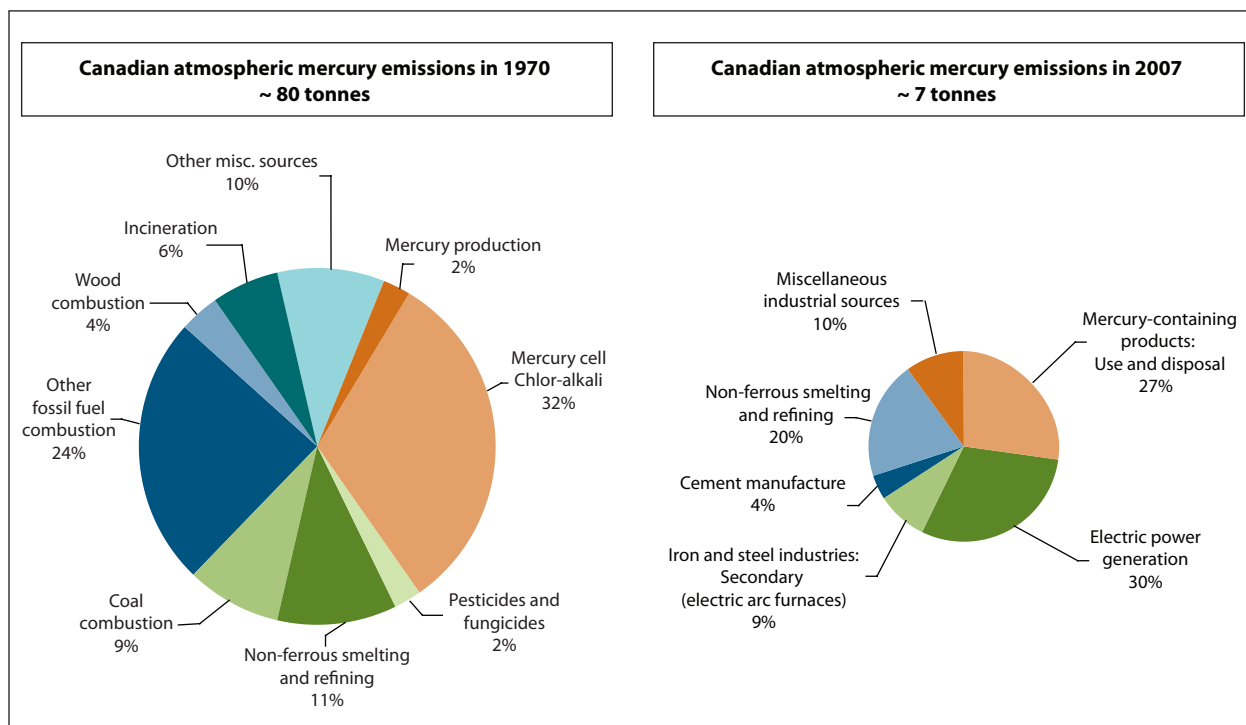
Some of these imports are used to manufacture mercury-containing products, such as lamps, which are then exported for sale.

Canada also exports mercury wastes, primarily to the United States for reclamation and/or disposal at hazardous waste facilities. In 2003 approximately 6 tonnes of mercury waste were exported to the United States for these purposes.

In addition, industrial uses of mercury in the manufacture of industrial chemicals, such as vinyl chloride monomer, pesticides, paints and pigments, have been phased out in recent years (Natural Resources Canada 2006).

Currently, major domestic sources of anthropogenic emissions are: electric power generation (utilities), non-ferrous smelting and refining, iron and steel industries, cement manufacture, and mercury-containing products (see Figure 5).

The largest anthropogenic source of mercury emissions in Canada is from electric power generation plants, which represented approximately 30% of emissions in 2007. Coal combustion, primarily in Alberta, represents 96% of mercury emissions for this sector.



Source: James F. MacLaren Ltd., 1973 and Environment Canada 2010c

**Figure 5 Comparison of Canadian anthropogenic atmospheric mercury emissions profile for 1970 and 2007**





The use and disposal of mercury-containing products, including batteries, dental amalgam, switches and relays, thermometers and lamps, is another significant source of Canadian emissions, representing 27% of atmospheric emissions in 2007. Mercury from these products can enter the environment when products are broken or when they are disposed through landfill, recycling and/or incineration.

Non-ferrous smelting and refining also makes a significant contribution, representing 20% of total domestic mercury emissions in 2007, with 90% resulting from a single facility. Canada currently has 12 primary base metals smelters in six provinces.

Another key industrial source is non-integrated steel mills (known as mini-mills), which typically recycle scrap steel in electric arc furnaces. Canada's eight facilities represent approximately 9% of mercury emissions from point sources. The majority of mercury emissions come from the recycling of automotive steel and other scrap types in which mercury switches have not been removed.

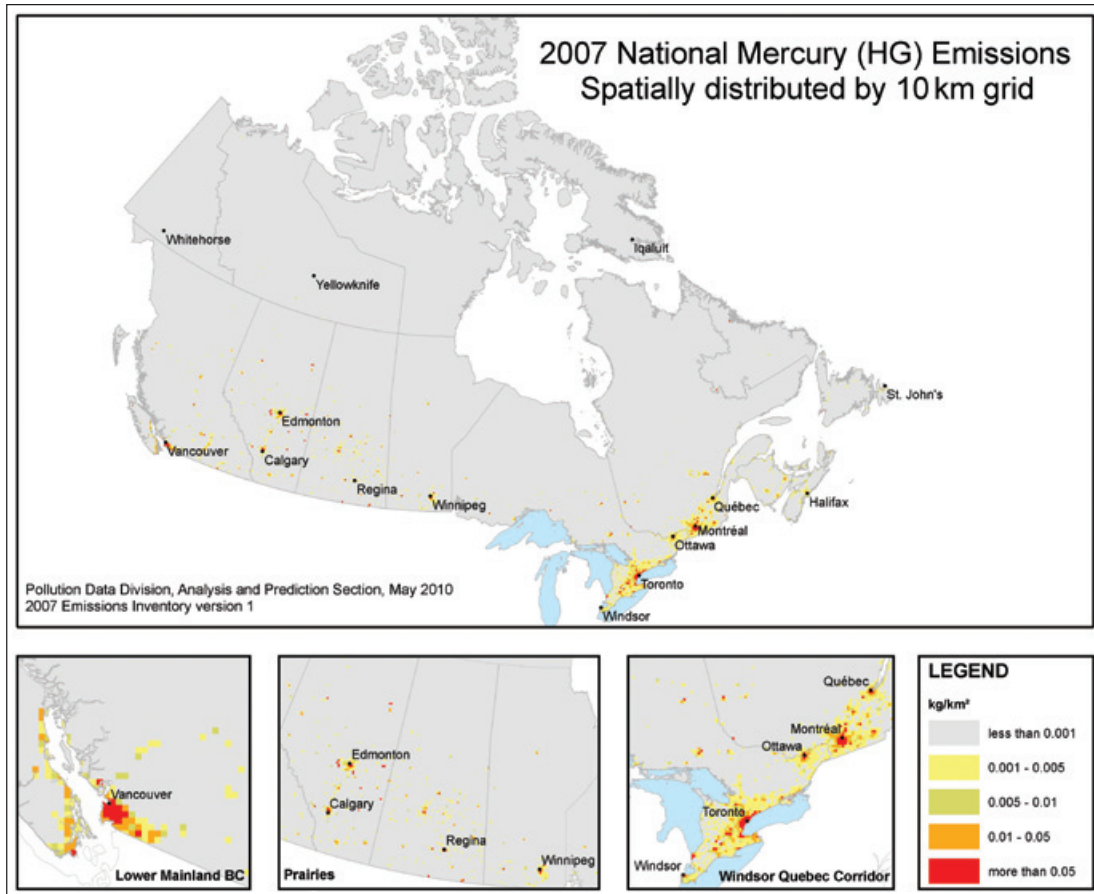
Based on data submitted to Canada's National Pollutant Release Inventory (NPRI), the United States Toxics Release Inventory and the European Pollution Emission Register cement manufacturing in Canada emits less mercury per tonne produced than do the cement industries in the United States and Europe. The sector represented approximately 4% of Canada's domestic emissions in 2007. Mercury emissions from this sector, which is based largely in Ontario, stem primarily from mercury contained in the raw materials used, such as limestone, with additional emissions arising from the combustion of fossil fuels, predominantly coal.

Figure 6 displays the spatial distribution of mercury emissions across Canada for 2007. The emissions sources are primarily industrial/commercial emissions, with additional emissions from fuel combustion and mercury use (e.g., mercury dental amalgams, automotive switches, thermometers and light bulbs).

In addition to these atmospheric emissions, a number of mercury releases into soil and water occur each year. For example, in 2008, 0.2 tonnes of mercury were reported as released to water from wastewater treatment plants and various industrial sources (including pulp and paper, non-ferrous smelting and refining, copper-zinc ore mining, and iron and steel mills).

Flooding caused by reservoir creation (hydroelectric projects) can also lead to elevated levels of mercury in the water and fish. The Center of Expertise on Hydropower Impacts on Fish and Fish Habitat (within Fisheries and Oceans Canada) conducts research on the effects of reservoir creation on mercury availability (Fisheries and Oceans Canada 2010).





Source: Environment Canada 2010c

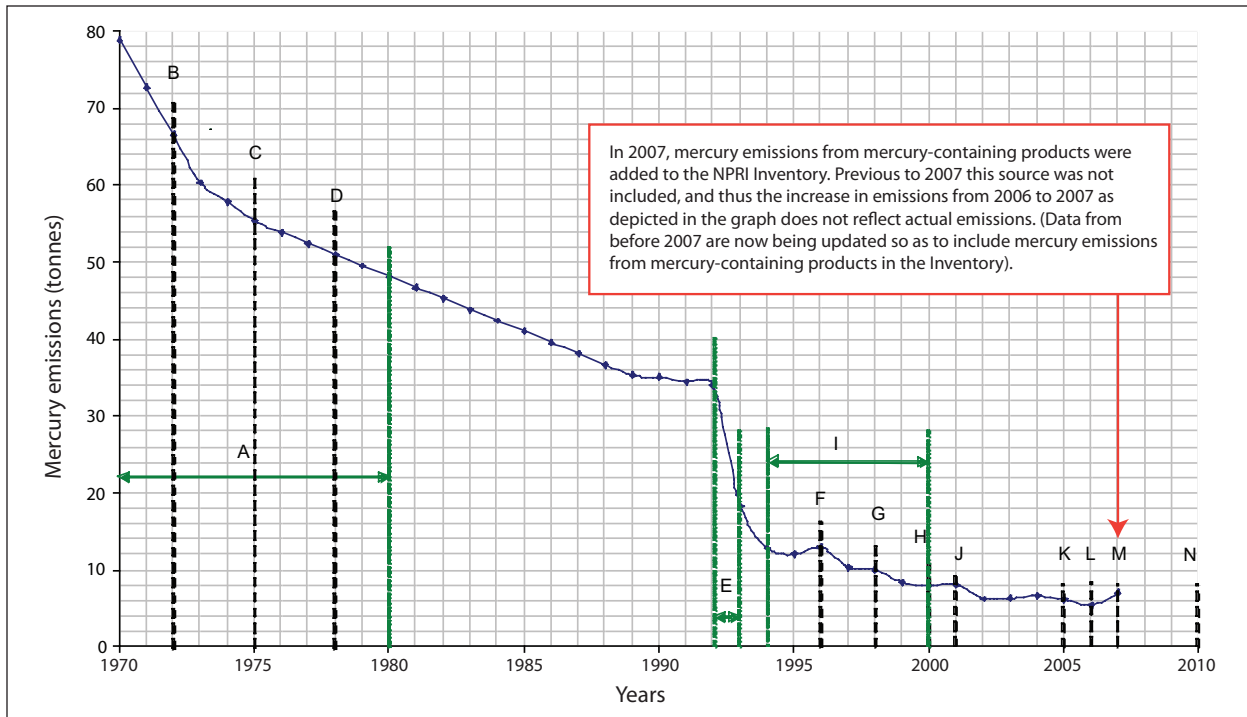
**Figure 6** Spatial distribution of Canadian anthropogenic atmospheric mercury emissions, 2007

### 3 RESPONSES TO DATE

#### 3.1 Domestic Actions

Over the past several decades, the Government of Canada has implemented a wide range of regulatory and non-regulatory initiatives in collaboration with provincial and territorial governments, industry and other stakeholders. A summary of these initiatives is included below in Figure 7, while a comprehensive list of existing risk management actions is contained in Annex A.

As a result of these actions, domestic mercury emissions have been reduced by approximately 90% since the 1970s. Preliminary results from the Canadian Health Measures Survey in 2008 indicated that less than 1% of Canadian adults have total blood mercury concentrations above the Health Canada guidance value of 20 micrograms per litre ( $\mu\text{g/L}$ ) for adults. The experience gained in achieving the reductions since the 1970s has established a strong basis for design and implementation of this risk management strategy.



<b>A</b>	1970–1980: Closure of 10 of 15 mercury cell chlor-alkali facilities
<b>B</b>	1972: <i>Alkali Mercury Liquid Effluent Regulations (Fisheries Act)</i>
<b>C</b>	1975: Closure of the Pinchi Lake primary mercury mine in 1975
<b>D</b>	1978: <i>Chlor-Alkali Mercury National Emissions Standards Regulations (Clean Air Act)</i>
<b>E</b>	1992–1993: Process change by the Hudson Bay Mining & Smelting Co. facility in Flin Flon, Manitoba
<b>F</b>	1996: <i>National Guidelines for the Use of Hazardous and Non-Hazardous Wastes as Supplementary Fuels in Cement Kilns</i>
<b>G</b>	1998: <i>National Emission Guideline for Cement Kilns</i> 1998: Mercury-based pesticide active ingredients no longer registered for use
<b>H</b>	2000: <i>Canada-wide Standards for Mercury Emissions from Incineration and Base Metal Smelting</i>
<b>I</b>	1994–2000: Accelerated Reduction/Elimination of Toxics program
<b>J</b>	2001: <i>Environmental Code of Practice for Integrated Steel Mills and Environmental Code of Practice for Non-Integrated Steel Mills</i> 2001: <i>Canada-wide Standard for Mercury-Containing Lamps</i> 2001: <i>Canada-wide Standard on Mercury for Dental Amalgam Waste</i>
<b>K</b>	2005: <i>Surface Coating Materials Regulations (Hazardous Products Act)</i>
<b>L</b>	2006: <i>Canada-wide Standards for Mercury Emissions from Coal-Fired Electric Power Generation Plants</i> 2006: <i>Environmental Code of Practice for Base Metals Smelters and Refineries</i> 2006: <i>Notice requiring the preparation and implementation of pollution prevention plans in respect of specified toxic substances released from base metals smelters and refineries and zinc plants</i> 2006: Cosmetic Ingredient Hotlist (2006) of the <i>Cosmetic Regulations</i> under the <i>Food and Drugs Act</i>
<b>M</b>	2007: <i>Notice requiring the preparation and implementation of pollution prevention plans in respect of mercury releases from mercury switches in end-of-life vehicles processed by steel mills</i>
<b>N</b>	2010: <i>Notice Requiring the Preparation and Implementation of Pollution Prevention Plans in Respect of Mercury Releases from Dental Amalgam Waste</i>

Source: Environment Canada 2010c

Figure 7 Canadian mercury emissions trend from 1970 to 2007

## **Emissions from Industrial Sources**

As indicated in Figure 7, a number of actions introduced in the 1970s and 1980s contributed to significant reductions in mercury releases from key sectors. For example, from 1986 to 1989, federal regulations targeting the mercury cell chlor-alkali industry (while it was operational in Canada) were successful in reducing aquatic and atmospheric emissions. In addition, Canada's annual mercury emissions dropped from approximately 34 tonnes in 1992 to approximately 18 tonnes in 1993, which was attributed to a process change by the Hudson Bay Mining & Smelting Co. base metals smelting facility in Manitoba, which implemented a two-stage zinc pressure leach facility to replace the former roast-leach-electrowinning.

### ***Electrical Power Generation***

The coal-fired electric power generation sector is the largest remaining human-made source of mercury emissions in Canada. In 2006, the Canadian Council of Ministers of the Environment (CCME) established the *Canada-wide Standards for Mercury Emissions from Coal-Fired Electric Power Generation Plants*, which set both provincial caps on emissions from existing plants (60% national capture of mercury from coal burned, or 70% including recognition for early action), and capture rates or emission limits for new plants based on best available technology (CCME 2006).

### ***Non-Ferrous Smelting and Refining***

In 2000, the CCME established a Canada-wide Standard for base metal smelting facilities. Environment Canada subsequently issued both an environmental code of practice and a notice requiring preparation and implementation of a pollution prevention plan (P2 notice) for the sector in 2006. This P2 notice specifies annual release reduction-targets for a number of pollutants, including mercury (CCME 2000; Canada 2006).

### ***Iron and Steel***

In 2001, Environment Canada, in collaboration with the iron and steel sector, established two environmental codes of practice: the *Environmental Code of Practice for Integrated Steel Mills* and the *Environmental Code of Practice for Non-Integrated Steel Mills*. These codes identify good environmental protection practices for various production processes and operations. Conformance with the codes was evaluated by a certified environmental auditor between 2002 and 2004, and good practices were observed (Environment Canada 2001a, 2001b).

In addition, a *Notice requiring the preparation and implementation of pollution prevention plans in respect of mercury releases from mercury switches in end-of-life vehicles processed by steel mills* was published in December 2007. This P2 notice aims to capture and divert 90% of mercury switches in end-of-life vehicles currently processed by steel mills (Canada 2007).

### ***Cement Manufacture***

In 1996, the *National Guidelines for the Use of Hazardous and Non-Hazardous Wastes as Supplementary Fuels in Cement Kilns* were published by the CCME. These guidelines provide direction on the operating and performance standards that should be met by cement kilns using wastes as supplementary fuels. Also, a *National Emission Guideline for Cement Kilns* was published in 1998; it provides a consistent national basis for restricting emissions of nitrogen



oxides and other pollutants, while encouraging greater energy efficiency in the industry. This guideline indirectly targets mercury by addressing fine particulate dust (to which mercury can be bound) (CCME 1996, 1998).

### **Waste Incineration**

The 2000 *Canada-wide Standards for Mercury Emissions* establish numeric targets for mercury emissions from municipal waste, medical waste, hazardous waste and sewage sludge incinerators. They also encourage the application of best available pollution prevention and control techniques (CCME 2000).

## **Mercury-containing Products**

### **Toys and learning materials intended for children**

To protect children from exposure to mercury, Health Canada has promulgated regulations (the *Surface Coating Materials Regulations*) under the *Hazardous Products Act* to limit the amount of mercury in coating materials used in toys and learning materials intended for children. These regulations also limit the quantity of mercury compounds in paint and other liquid coating materials. Furthermore, the *Hazardous Products Act* prohibits the sale, importation or advertisement of any toys or other children's products that have a coating containing any mercury compound.

### **Food and health products**

Mercury is controlled in a number of other products used by Canadians. For example, mercury is listed on the Cosmetic Ingredient Hotlist. The *Food and Drug Regulations* prohibit the use of mercury in most drugs (with some exceptions; see Annex A). The mercury levels in natural health products are also restricted. Annex A provides further detail on these regulations.

### **Pesticides**

Under the *Pest Control Products Act*, mercury-based pesticides are not registered for use in Canada.

### **Lamps**

Other federal actions target emissions from mercury-containing products. For example, the 2001 *Canada-wide Standard for Mercury-Containing Lamps* aimed to achieve an 80% reduction in the average content of mercury in all mercury-containing lamps sold in Canada by 2010 (CCME 2001b). According to Electro-Federation Canada, mercury content in lamps had already surpassed this reduction target in 2006.

### **Dental amalgam**

Also, the 2001 *Canada-wide Standard on Mercury for Dental Amalgam Waste* aimed to achieve a 95% reduction in releases from dental amalgam waste discharges to the environment by 2005, from a base year of 2000 (CCME 2001a). A survey of dentists estimated that in 2006, 70% of dentists were in compliance with the Standard (CCME 2007). As a result, Environment Canada published a *Notice Requiring the Preparation and Implementation of Pollution Prevention*





Plans in Respect of Mercury Releases from Dental Amalgam Waste in May 2010, targeting dental facilities that have not implemented best management practices (Canada 2010).

## Guidelines

The Government of Canada has undertaken a number of additional actions to protect Canadians from exposure to mercury. Key actions include the development of guidelines in a variety of areas (see Annex C).

### Guidelines for Mercury in Fish

Methyl mercury can accumulate in certain types of fish. To ensure that Canadians are not exposed to excessive quantities of mercury through fish consumption, Health Canada has established guidelines for levels of mercury in fish. The guideline values for methyl mercury in fish are 0.5 part per million (ppm) total mercury in general commercial fish, and 1.0 ppm total mercury in commercial predatory fish. Health Canada also provides fish consumption advice to help maximize the nutritional benefits of eating fish while minimizing the risk of exposure to mercury. Health Canada recommends that Canadians -particularly vulnerable groups such as pregnant women and children-consume only limited quantities of certain types of fish in which methyl mercury tends to accumulate (for details, see [www.hc-sc.gc.ca/fn-an/securit/chem-chim/environ/mercur/cons-adv-etud-eng.php](http://www.hc-sc.gc.ca/fn-an/securit/chem-chim/environ/mercur/cons-adv-etud-eng.php)). In addition, Health Canada recently updated its *Risk Management Strategy for Mercury in Retail Fish*, first developed in the 1960s ([www.hc-sc.gc.ca/fn-an/pubs/mercur/merc\\_fish\\_poisson-eng.php](http://www.hc-sc.gc.ca/fn-an/pubs/mercur/merc_fish_poisson-eng.php)).

To ensure that mercury levels in fish consumed by Canadians meet Health Canada standards, the Canadian Food Inspection Agency (CFIA) regularly monitors domestically produced and imported fish to determine if these products meet federal standards. Test results obtained by the CFIA are provided to Health Canada to assist in its review of guidelines. According to CFIA survey data for fish (mainly from 2002-2004), none of the species of non-predatory fish sampled had mean mercury levels above the guideline value of 0.5 ppm. However, two species of predatory fish had mean mercury levels above the guideline value of 1.0 ppm. In some of the fish species for which mean mercury levels were below guideline values, levels in some individual fish samples exceeded guidelines.

### Drinking Water Guidelines

Health Canada works with provincial and territorial governments, through the Federal-Provincial-Territorial Committee on Drinking Water, to develop guidelines that set the maximum acceptable concentrations of substances in drinking water. These drinking water guidelines are designed to protect the health of the most vulnerable members of society, especially children and the elderly. Health Canada has set the drinking water guideline for mercury at 0.001 milligrams per litre (mg/L) (0.001 ppm). Levels of mercury found in drinking water are generally well below the guideline level. All provinces and territories use the Guidelines for Canadian Drinking Water Quality as the basis for establishing their own enforceable requirements for drinking water quality. Some jurisdictions adopt all or some of the guidelines directly in their standards or regulations, while others use them as required, to issue site-specific operational licenses or permits for treatment plants.





### **Soil Quality Guidelines**

The *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health* outline numeric limits for contaminants in soil, with the purpose of protecting human health and environmental quality according to various land-use types. Health Canada develops, on behalf of the Canadian Council of Ministers of the Environment (CCME), soil quality guidelines for the protection of human health. In the case where both a health and environmental soil quality guideline are calculated, the most protective is used. The background information is presented in a supportive technical document available from Environment Canada, Health Canada and/or the CCME. Annex C contains the values for mercury in accordance with these guidelines.

### **Guidelines for Mercury Levels in Blood**

In the 1970s, Health Canada's First Nation and Inuit Health Branch (then the Medical Services Branch) established blood and hair guidance values for the general adult population. Blood levels below 20 µg/L (or 6 mg/kg in hair) are considered "acceptable", levels above 20 but below 100 are considered "at increasing risk" and levels greater than 100 µg/L in blood (or 30 mg/kg in hair) are considered "at risk". Although the developing fetus was considered as a sensitive subgroup, no specific threshold values were then proposed.

In 1998, Health Canada's Food Directorate proposed that the increased susceptibility of the developing fetus to methylmercury toxicity should be recognized and developed a provisional Tolerable Daily Intake (pTDI) for pregnant women, women of reproductive age and infants set at 0.2 µg/kg bw/day. This pTDI can also be expressed (using a widely recognised steady-state single compartment toxicokinetic model) as a blood value of 8 µg/L and used as a provisional interim blood guidance value applicable to women of childbearing age and pregnant women for the protection of the fetus.

Guidance values are provisional in nature and subject to periodic review. The pTDI harmonized blood guidance values are currently in the process of being formalized. Additional detail on the historical development of methylmercury biomonitoring guidance values is found in Legrand et al (2010).

Preliminary results from the Canadian Health Measures Survey in 2008 indicated that less than 1% of Canadian adults have total blood mercury concentrations above the Health Canada guideline value of 20 µg/L.

### **Guidelines for the Protection of Aquatic Ecosystems**

The *Canadian Water Quality Guidelines for the Protection of Aquatic Life* express nationally endorsed science-based goals for the quality of aquatic ecosystems. This includes numeric limits for mercury concentrations in freshwater and marine environments.

### **Canadian Tissue Residue Guidelines for the Protection of Wildlife Consumers of Aquatic Biota**

The tissue residue guidelines provide benchmarks to help interpret biological monitoring data, and serve as the scientific basis for determining interim management objective and performance indicators.



## Research, Monitoring and Assessment

The Government of Canada supports a range of activities aimed at both strengthening our understanding of mercury, and informing decision makers at all levels on the design and implementation of effective mercury response strategies.

Current federal research, monitoring and assessment activities aim to:

- i) monitor changes in domestic and global mercury emissions and levels;
- ii) monitor and assess exposure to mercury among the Canadian population, including among northern populations that are particularly vulnerable to mercury exposure;
- iii) monitor mercury levels in Canadian food sources such as fish;
- iv) survey samples of products (such as children's toys) to ensure they comply with regulations (e.g., those for paints and other surface coatings);
- v) assess the effectiveness of risk management actions intended to reduce exposure to mercury;
- vi) predict the influence of current and projected domestic and global mercury emissions on Canada;
- vii) define the processes governing the transport and fate of mercury; and
- viii) assess and communicate science to inform domestic and international decision making.

Specific programs that undertake the above-noted activities are outlined in Annex B.

## Reporting

The NPRI is Canada's legislated, publicly accessible inventory of pollutant releases (to air, water and land), disposals, and transfers for recycling. Releases of mercury have been reported since 1995 for the 1993 reporting year onward. For reporting to the NPRI in 2010, Environment Canada is collecting new information on mine tailings and waste rock releases for the years 2006 through 2009. This reporting will continue annually. With the new requirements, facilities must now report not only the quantities of NPRI substances released to the environment from the mine, but also the quantities of NPRI substances contained in the waste rock and tailings disposed of at the mine or transferred off-site for disposal (NPRI 2010).

## Accelerated Reduction and Elimination of Toxics (ARET) Program

Voluntary initiatives have also been undertaken with respect to mercury. The Government of Canada has recognized voluntary industry efforts such as the ARET program, a voluntary release-reduction program that ran from 1994 to 2000. The program challenged participants to reduce releases of 117 toxic substances, including mercury and was successful in reducing releases of these substances by over 72% from base year levels.



### 3.2 International Initiatives

Recognizing the adverse human health and environmental effects associated with the trans-boundary flow of mercury, the Government of Canada is actively engaged in a number of relevant regional and bilateral programs. These include the following:

- The Great Lakes Water Quality Agreement, which commits Canada and the United States to restore and maintain their shared Great Lakes ecosystem (Environment Canada 2010a). Joint initiatives related to the Agreement include the 1997 Great Lakes Binational Toxics Strategy, a multi-sectoral process working towards virtual elimination of certain persistent toxic substances, including mercury, from human activity in the region. A 90% reduction in Canadian releases of mercury and more than 50% reduction in American releases have been achieved under this program to date (Environment Canada 2010b).
- The Commission for Environmental Cooperation's (CEC's) North American Regional Action Plan on Mercury, under which Canada, the United States and Mexico aim to achieve a reduction in anthropogenic releases of mercury to the North American environment, to amounts that can be attributed to naturally occurring levels (CEC 2010).

Canada also participates in the Arctic Council, a high-level intergovernmental forum among Arctic States and communities that addresses issues such as sustainable development and environmental protection. Council working groups undertaking work on mercury include:

- the Arctic Monitoring and Assessment Programme, which includes a Mercury Expert Group that will deliver an updated assessment on mercury in the Arctic in 2011 (the Arctic Monitoring and Assessment Program's Human Health Assessment Group completed its most recent assessment in June 2009 and this included the most recent data on trends in mercury concentrations in Arctic peoples); and
- the Arctic Contaminants Action Program, which is currently undertaking a feasibility study on improved systems for management of mercury-containing waste in northwest Russia.

At the global level, Canada is party to a number of international conventions that relate directly or indirectly to mercury. These include the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, which aims to protect human health and the environment from adverse effects resulting from the generation, management, storage, transboundary movement and disposal of hazardous wastes, including mercury. Relevant initiatives under the Basel Convention include the development of *Technical Guidelines for the Environmentally Sound Management of Wastes Consisting of, Containing or Contaminated with Mercury* (Secretariat of the Basel Convention 2010). Canada will work closely and be engaged with other parties to the Basel Convention, in order to finalize the drafting of these guidelines.

Canada is also party to the Protocol on Heavy Metals to the United Nations Economic Commission for Europe's Convention on Long-range Transboundary Air Pollution, which aims to reduce emissions of mercury, lead and cadmium from industrial sources, combustion processes and waste incineration. The Protocol also introduces measures to lower emissions of mercury from products such as batteries.

In addition, Canada participates in the UNEP Global Mercury Programme and its Global Mercury Partnership, which aim to initiate early actions in a number of key sectors, such as coal combustion and artisanal and small-scale gold mining. In January 2010, Canada formally joined two Global Mercury Partnerships (Coal Combustion, and Mercury Fate and Transport).

### 3.3 Actions by the European Union and United States

#### European Union

Other countries are active in responding to the challenges and risks that mercury emissions pose to human health and the environment. For example, the European Union launched a comprehensive mercury strategy in 2005. This strategy outlines measures to reduce emissions, cut mercury supply and demand, and protect against human exposure, especially to methyl mercury found in fish.

Measures to protect the environment and human health include a directive restricting the sale of measuring devices containing mercury, as well as a 2008 regulation banning mercury exports as of 2011. The strategy also includes new mercury-storage requirements. These efforts complement existing regulatory initiatives such as restrictions on the use of mercury in batteries, electrical and electronic equipment, and switches in vehicles. The European Union is also engaged in action directly targeted at mitigating human exposure to mercury. The European limits for allowable levels of mercury in fish are 0.5 ppm for fish in general, but 1.0 ppm for certain large predatory fish (Commission of the European Communities 2005). Furthermore, some European Union member states have introduced additional controls, such as measures to restrict the use of mercury in dental amalgam. For example, in Sweden the use of dental amalgam for children and youth, and in ordinary dental care for adults, has been prohibited since June 2009.

#### United States

The United States has introduced a series of control measures to address mercury emissions. Mercury is managed primarily under the Clean Air Act, which regulates hazardous air pollutants through a series of regulations and standards, including National Emission Standards for Hazardous Air Pollutants (NESHAP) Rules for iron and steel foundries, electric arc furnace steelmaking facilities, and chlor-alkali plants. A NESHAP Rule is proposed for the Portland cement manufacturing industry, which would significantly reduce mercury emissions from that sector (US EPA 2010).

In addition, in October 2009 the U.S. Environmental Protection Agency (EPA) signed a consent decree committing the Agency to develop a final mercury emissions rule for coal- and oil-fired power plants by 2011. The EPA is currently gathering information from plant operators to assist in the development of this national rule (US EPA 2010).

Other Acts support the effective management of mercury in the United States. Under the Clean Water Act, water quality standards are developed for key pollutants. Under the Toxic Substances Control Act, the EPA is proposing a Significant New Use Rule for the use of elemental mercury in certain products and is considering management actions on mercury-containing products,



including switches/relays, button-cell batteries and measuring devices. In addition, the 1996 *Mercury-Containing and Rechargeable Battery Management Act* phases out the use of mercury in batteries, and provides for the efficient and cost-effective disposal of regulated batteries. Furthermore, on September 29, 2008, the United States Congress passed the *Mercury Export Ban Act*, which will ban the export of elemental mercury from the United States effective January 1, 2013 (US EPA 2010).

To minimize direct human exposure to mercury, the U.S. Food and Drug Administration (FDA) has established controls on mercury in fish and on dental amalgam. In 2009 the FDA reclassified dental amalgam under a new regulation (CFR 872.2070) that includes guidance for industry (US FDA 2009). As well, the FDA has set an action level for mercury in fish, shellfish and crustaceans of 1 ppm methyl mercury in an edible portion. The FDA will take legal action to remove, from the marketplace, products that are above this level (US FDA 2005).

The EPA's 2006 *Roadmap for Mercury* outlines further U.S. actions in six areas: addressing mercury releases to the environment; addressing mercury uses in products and industrial processes; managing commodity-grade mercury supplies; communicating risks to the public; addressing international mercury sources; and conducting mercury research and monitoring (US EPA 2009).

Other recent initiatives are under way under the auspices of the Great Lakes Regional Collaboration, including a 2008 Mercury in Products Phase-Down Strategy, and a 2009 Great Lakes Mercury Emission Reduction Strategy to reduce mercury emissions within the Great Lakes states and to develop mercury reduction approaches that could serve as an example in other jurisdictions (GLRC 2008, 2009).

## 4 THE GROWING GLOBAL CONTEXT FOR ACTION ON MERCURY

In recognition of the significance of mercury as a global pollutant, the UNEP Governing Council decided in 2001 to undertake a global assessment of mercury. The resulting *Global Mercury Assessment*, published in 2002, provided clear evidence of the significant adverse global impacts of mercury (UNEP 2002).

In response, UNEP established the Global Mercury Programme in 2003 to foster international action on mercury. To date, the Programme has focused on: i) technical assistance and capacity building for developing nations; ii) analysis of global mercury supply, trade and demand; iii) establishment of voluntary partnerships between governments and other interested parties (UNEP Global Mercury Partnership) in areas such as coal combustion, the chlor-alkali sector, and artisanal and small-scale gold mining; and iv) mobilizing technical and financial resources to support national, regional and international efforts.

In 2007, the UNEP Governing Council recognized that existing voluntary efforts were not sufficient and called for a review and assessment of options for enhanced voluntary measures and new or existing international legal agreements. An ad hoc Open-Ended Working Group was established to review and assess options, and to report back with its recommendations to the Governing Council in February 2009.



Based on the Working Group's report, the UNEP Governing Council agreed in February 2009 to launch negotiations on a global, legally binding agreement that could include both binding and voluntary approaches. The UNEP Executive Director was asked to convene an Intergovernmental Negotiating Committee for five negotiation meetings, with a goal of completing an agreement prior to the 27th Session of the Governing Council in 2013. The first meeting of the Committee took place in early June 2010. These negotiations form an important backdrop to Canada's management strategy.

## **5 MOVING FORWARD – ELEMENTS OF A CANADIAN APPROACH**

Recognizing the progress that the Government of Canada has made in reducing domestic mercury emissions, and the critical need for accelerated global action to reduce transboundary flows into Canada, particularly into the Arctic, the Government is committed to taking further actions to ensure it makes an ongoing and meaningful contribution to mercury emission reductions at home and internationally. This risk management strategy reflects that commitment, and outlines further actions currently under consideration by the Government of Canada. A summary of these actions is presented in subsection 5.3.

In identifying and designing these proposals, a variety of factors have been considered, including the effectiveness of proposed measures in reducing environmental risks, the effects of proposed measures on the health of vulnerable populations, and socio-economic considerations. These socio-economic factors include potential loss of income for some communities due to fish consumption advisories and associated reductions in commercial fisheries, as well as the economic costs for some industrial sectors and manufacturers of phasing out the use of mercury and identifying other, potentially more costly, substitutes. These considerations must be balanced against the societal costs of the impacts of mercury, such as loss of education and earnings for those experiencing neurological damage, particularly in the pre-natal phase.

The impacts of mercury emissions and the chemical processes they undergo are influenced by other environmental pressures, such as climate change (UNEP 2008a, 2008b). Although there is uncertainty regarding the overall implications for mercury of a changing climate, it will be important to adopt an adaptive management approach to ensure that further actions can respond to the changing context for mercury management over time.

### **5.1 Domestic Actions**

Additional domestic mercury-related actions under consideration by the Government of Canada fall into four categories:

- Emissions from industrial sources
- Mercury-containing products
- Mercury waste management
- Science in support of decision making





## Emissions from Industrial Sources

As noted in Figure 5, electrical power generation, non-ferrous smelting and refining and cement manufacture account for 54% atmospheric mercury emissions in Canada.

The Government of Canada is moving forward with the development of regulations to reduce greenhouse gas (GHG) emissions from the coal-fired electricity generation in Canada, to take effect July 1st, 2015. The objective of the proposed approach is to ensure a transition toward low- or non-emitting generation such as renewable energy, high-efficiency natural gas, or thermal power with carbon capture and storage. The proposed approach is expected to result not only in significant reduction of GHGs, but also of air pollutants such as mercury. These regulations are expected to reduce mercury emissions from electrical power generation by about 40% by 2020 and 65% by 2030 compared with 2005 levels, and could reduce mercury emissions by up to 96% by 2050.

Studies are under way by Environment Canada to determine the potential for additional control measures for the coal-fired electricity generation sector in Canada. These include the following:

- An assessment on currently available technologies to control mercury emissions from this sector and their efficiency.
- Reviewing the evolution of monitoring technologies.
- Reviewing unintended implications of release reduction control technologies.

Additional actions may be considered in the base metals smelter and iron and steel sectors. The *Notice requiring the preparation and implementation of pollution prevention plans in respect of specified toxic substances released from base metals smelters and refineries and zinc plants* must be fully implemented by the end of 2015. The notice states the intention of the Minister of the Environment and Minister of Health to recommend that release regulations be made for base metals smelters and refineries and zinc plants, effective 2015. In addition, a study on mercury abatement methods in integrated steel mills is being undertaken by Environment Canada to determine if further mercury emission reductions can be achieved by these facilities.

With respect to the cement sector, the Government of Canada will continue to monitor emissions, sources and control technologies to ensure that the Canadian sector's performance is consistent with international best practices.

As well, additional information on substances of concern (including mercury) in mine tailings and waste rock will be collected by Environment Canada through the NPRI. Based on this data, the Government of Canada will determine if further actions are required in this sector.

## Mercury-containing Products

As noted in section 2, mercury-containing products account for 27% of atmospheric mercury emissions in Canada (Environment Canada 2010c). The Government of Canada is working to reduce releases from new and existing products through several measures, including the proposed *Products Containing Certain Toxic Substances Regulations*, which will prevent the





use of mercury in new products entering the Canadian marketplace. Once they enter into force, these regulations will enable Environment Canada to:

- prohibit the manufacture, import and sale of most mercury-containing products (e.g., switches and relays, measurement and control devices and thermostats);
- target products that are manufactured or imported after 2012 (when the regulations come into effect);
- grant permits, specific exemptions and/or establish content limits for certain products that play an important role in protecting human health or the environment, and that have no viable alternatives (e.g., lamps and dental amalgam); and
- require product labelling and annual reporting of mercury used in products.

Environment Canada anticipates that the proposed regulations will come into force in 2012. An estimated annual reduction of approximately 4 tonnes of mercury used in products is expected.

The proposed regulations complement actions by Health Canada to control mercury in health products, pesticides, paints and cosmetics. In addition, the proposed regulations' mercury content limits and labelling requirements for lamps also complement Natural Resources Canada's proposed *Energy Efficiency Regulations* that will phase out inefficient incandescent light bulbs by 2012. The market for mercury lamps is currently estimated to be growing at a rate of 25% per year, which is expected to continue through 2013; the growth rate is expected to remain high beyond 2019.

The Government of Canada published a *Final Notice Requiring the Preparation and Implementation of Pollution Prevention Plans in Respect of Mercury Releases from Dental Amalgam Waste* in May 2010. The notice requires dental facilities that had not yet implemented best management practices for dental amalgam waste prior to publication of the notice to prepare and implement a pollution prevention plan within six months.

## **Waste Management**

The Government of Canada will examine how releases of mercury to the environment can be further reduced through environmentally sound end-of-life management of mercury and mercury-containing wastes. The provinces have been consulted with the *Technical Guidelines for the Environmentally Sound Management of Waste Consisting of, Containing or Contaminated with Mercury*. The Government of Canada will continue to look for opportunities, working with provinces and territories, to improve environmentally sound management of mercury-containing wastes.

The Government of Canada will also review Canada's capacity to provide mercury recovery and recycling, and review the impacts of possible import and export bans imposed by other nations, taking into consideration the future Canadian supply and demand of mercury for industries that will be permitted continued use.



## Science in Support of Decision Making

Ongoing monitoring, research, modelling and assessment are critical to our ability to both understand mercury issues and to design effective control measures. These activities support informed decision making by governments, industry and consumers.

As resources permit, actions moving forward include the following:

**1) Monitoring changes in the levels of mercury in the environment:** Northern populations are particularly vulnerable to exposure to mercury, as mercury is transported to the Arctic via air, is then deposited, and accumulates in biota such as fish, which are then consumed by northern residents. Therefore, future actions will include support for key ongoing monitoring activities for air, water and biota as well as human biomonitoring. These initiatives include the Canadian Air and Precipitation Monitoring Network, which measures levels of mercury in air and precipitation across Canada; the Canadian Northern Contaminants Program, which monitors contaminant levels in biological and physical environments, and assesses exposure through human biomonitoring and dietary exposure research in the Arctic; and the Canadian Health Measures Survey, which collects nationally representative human biomonitoring data, including assessment of mercury exposure. Other ongoing monitoring activities include Canada's participation in the North American Soil Geochemical Landscapes Project, a tri-national soil program between Canada, the United States and Mexico.

Because mercury from sources around the globe is transported to the Canadian environment, the Government of Canada will consider expanding the existing Canadian mercury-monitoring network to more effectively monitor changes in global mercury emissions, including domestic and foreign sources. Monitoring activities at existing sites could be expanded to measure different forms of mercury in order to more accurately assess risks for humans and wildlife.

**2) Research to improve understanding of the processes governing the transformation and transport of mercury in the environment:** The Government of Canada will support research to define the processes governing the transformation and transport of mercury in atmospheric, terrestrial and aquatic environments. These activities are a prerequisite to our ability to model, predict and assess the evolving risks to humans and the environment associated with mercury (see #3 below).

**3) Improvements to mercury transport and fate models:** This involves expanding support for the development and verification of atmospheric and terrestrial/aquatic models capable of predicting levels and effects of mercury in the environment, based on current and future levels of anthropogenic emissions.

**4) Assessment and communication of scientific information to inform the development of Canadian positions on domestic and global mercury emissions:** This area of action involves supporting the regular assessment of our state of knowledge on the impact of domestic versus international mercury sources on Canada, and communicating this information in a variety of domestic and international forums. Activities of the Government of Canada include the collaborative development of a comprehensive scientific assessment of mercury in Canada, and scientific activities with other nations through such initiatives as the UNEP Global Partnership for Mercury Air Transport and Fate Research under the Global Mercury Programme.

Furthermore, the Government of Canada is developing a Canadian Mercury Science Assessment. This will be the first comprehensive national evaluation of mercury in the Canadian environment. The Assessment is intended to inform decision making by policy makers and research managers, and establish a baseline against which future changes in mercury levels in the environment can be attributed to changes in mercury emissions and climate. It will provide the scientific foundation on which the effectiveness of domestic and international policy making can be assessed.

In addition, the Government of Canada will continue to implement the Canadian Health Measures Survey. The data collected through the 2007–2009 first CHMS cycle will comprise the first-ever comprehensive set of biomonitoring data on the Canadian population's exposure to environmental chemicals, including mercury. As part of this nationally representative survey, blood and urine mercury levels will be measured, enabling the Government of Canada to assess exposure to mercury among the Canadian population.

## 5.2 International Actions

Enhanced international action is a key priority for Canada, given that transboundary flows of mercury emissions from foreign sources account for over 95% of mercury deposits in Canada. The goal of these efforts is to protect the health of Canadians and their environment from risks arising from foreign sources.

Canada's international efforts will centre on the negotiation of a global, legally binding agreement on mercury under the auspices of UNEP. Given its global reach, such an agreement offers the greatest potential for securing the significant mercury reductions required to meet Canadian interests. At the same time, Canada continues its participation in regional bilateral initiatives.

These efforts will help maximize global environmental gains with respect to mercury, while ensuring a level playing field internationally.

### Participation in Negotiations Towards a Global Mercury Agreement

As noted in Section 4, negotiations commenced in June 2010 towards a global mercury agreement. Preparatory meetings have identified potential elements of a framework for addressing mercury. These include:

- reduce the supply of, international trade in, and demand for mercury globally;
- reduce or eliminate atmospheric emissions of mercury;
- find environmentally sound solutions for the management of mercury-containing wastes;
- find environmentally sound storage solutions for mercury;
- reduce the demand for mercury in products and processes; and
- increase and share knowledge and advance the science surrounding mercury.

Key issues under consideration include the following: sectoral approaches and whether transition periods and/or phase implementation will be required; arrangements for capacity building,



and technical and financial assistance; compliance; coordination with other relevant agreements, to avoid unnecessary duplication; and co-benefits of conventional pollutant control measures.

Complementary to the negotiations, Canada will continue its support for the UNEP Global Mercury Partnership through its participation in key areas such as coal combustion and mercury fate and transport.

## Enhanced Regional and Sectoral Engagement

As outlined in section 3, Canada participates in a series of regional and international efforts related to mercury. The Government of Canada will continue to participate in these initiatives. Anticipated actions moving forward include the following:

- ongoing engagement in existing fora (e.g., the CEC and Arctic Council Working Groups [Arctic Contaminants Action Program, Arctic Monitoring and Assessment Programme]) at the technical level, in order to identify and engage in relevant activities;
- advocating for and promoting continued consideration of mercury issues in policy levels of fora such as the CEC and Arctic Council;
- participating in negotiations to modify annexes of the Heavy Metals Protocol to the Convention on Long-Range Transboundary Air Pollution;
- engaging with other jurisdictions during Convention on Long-Range Transboundary Air Pollution negotiations, to exchange views and expectations for the global agreement; and
- continue working with parties to the Basel Convention to complete and approve the *Technical Guidelines for the Environmentally Sound Management of Wastes Consisting of, Containing or Contaminated with Mercury*.

## Bilateral Efforts

As part of this strategy, the Government of Canada will continue its bilateral efforts to build support for accelerated action. Approaches will vary, given the significant diversity that exists among countries with respect to the volume and sources of their emissions as well as their differing socio-economic and regulatory contexts and capacities.

According to information outlined in Figure 3, the largest global mercury emitters are China, the United States and India. As indicated in Figure 4, these countries are also key contributors to transboundary flows of mercury into Canada (Environment Canada 2009).

For China and India, as well as other developing countries and economies in transition, Canada will continue working through existing mechanisms, with a goal of supporting and providing momentum to the negotiations on a global mercury agreement.

In recognition of the flow of mercury emissions back and forth across the Canada–United States border, Canada will continue its dialogue with the United States regarding that nation’s existing and proposed domestic actions on mercury, and how our two countries can work together both bilaterally and within the context of the global negotiations.

## 5.3 Expected Outcomes

**Table 1 Summary of domestic and international actions**

Sectors	Actions	Expected outcomes
Industrial sources	Regulations to reduce GHG emissions from the electricity sector.	These regulations are expected to reduce mercury emissions from electrical power generation by about 40% by 2020 and 65% by 2030 compared with 2005 levels, and could reduce mercury emissions by up to 96% by 2050.
	Studies related to the coal-fired electricity generation.	Improved knowledge to determine the potential for additional control measures for the coal-fired electricity generation sector in Canada
	P2 plans in respect to specified toxic substances released from base metals smelters and refineries and zinc plants must be fully implemented by the end of 2015.	As described in the P2 Notice, “the intention of the Minister of the Environment and Minister of Health to recommend to the Governor in Council that release regulations be made for base metals smelters and refineries and zinc plants, effective 2015, with possible Equivalency Agreements with provinces.”
	Gather and analyze new information on mine tailings and waste rock.	Determine whether further actions are required in the mine tailings and waste rock sector as part of the risk management strategy for mercury.
	Continued monitoring of emissions from the cement sector.	Ensure that the Canadian cement sector’s performance is consistent with international best practices.
Mercury-containing products	Proposed Products Containing Certain Toxic Substances Regulations are anticipated to come into force by 2012 and will prohibit the import, manufacture and sale of mercury-containing products.	Potential estimated reduction of approximately 90 tonnes of mercury used in products is expected over the first 20 years of implementation.
Science	Monitoring of changes in the levels of mercury in the environment.	More informed decision making by governments, industry and consumers.
	Research into processes governing the transformation and transport of mercury in the environment..	Information required to model, predict and assess evolving human and environmental risks associated with mercury
	Assessment and communication of scientific information	Ability to evaluate effectiveness of domestic and international actions.
International actions	Participate in negotiations (UNEP) towards a global, legally binding instrument on mercury.	Potential decreases of Canadian mercury depositions from foreign sources.
	Enhance Canada’s participation in regional, sectoral and bilateral initiatives.	





## 6 MEASURING PROGRESS

The components of the strategy are being implemented by Environment Canada and Health Canada, who will report regularly on activities through existing accountability mechanisms. In addition to the individual actions described below a report consolidating the progress made will be published regularly.

For example, progress made pursuant to Canada-wide Standards (including *Canada-wide Standards for Mercury Emissions from Coal-Fired Electric Power Generation Plants and Canada-wide Standards for Mercury Emissions*) will be made publicly available through reports posted on the CCME website. These reports will typically include an overall evaluation of compliance and any recommendations for revisions to the standards.

Similarly, progress reports are required as part of federal P2 plans. Interim reports from industry and Environment Canada Progress Reports related to P2 plans for specified toxic substances released from base metals smelters and refineries and zinc plants are posted on the P2 website ([www.ec.gc.ca/planp2-p2plan/default.asp?lang=En&n=EF79BA93-1](http://www.ec.gc.ca/planp2-p2plan/default.asp?lang=En&n=EF79BA93-1)). Declarations and Interim Progress Reports regarding the *Notice requiring the preparation and implementation of pollution prevention plans in respect of mercury releases from mercury switches in end-of-life vehicles processed by steel mills* are posted on the P2 Plan website, via [www.ec.gc.ca/cepap2/r001/s001.cfm?uL=E&sm=1](http://www.ec.gc.ca/cepap2/r001/s001.cfm?uL=E&sm=1).

Once the *Products Containing Certain Toxic Substances Regulations* enter into force in 2012, the use of mercury in products in Canada will be monitored through mandatory reporting requirements under these regulations, as well as Canada Border Services Agency data on the import of mercury into Canada.

Other reports that will help departments assess progress towards meeting their mercury-related goals include the third *Canadian Arctic Contaminants and Health Assessment Report: Human Health 2009* volume released in June 2009 by the Northern Contaminants Program, and Environmental/Sources/Pathways/Biota volumes expected to be published by 2011; and the Canadian Health Measures Survey, the first cycle of which is expected to be released in August 2010. This first set of national data on the levels of mercury in Canadians will provide an important baseline, i.e., starting point, for future monitoring and research. The information will aid in the assessment of exposure to mercury and the development of policies to protect the health of Canadians. Also, the Canadian Mercury Science Assessment is expected to be published in 2013.

In addition to these reporting mechanisms, Treasury Board policy requires the development of performance measurement strategies for all federal programs. The purpose of these strategies is to support program planning, monitoring and reporting through the identification of performance indicators that can inform decision making and support evaluation activities over the next five years. Consistent with these directives, the Government of Canada will develop a performance measurement strategy to support the implementation of this risk management strategy for mercury during this period. The performance measurement strategy will include a commitment to review and update this risk management strategy by 2014.

Collectively, these efforts will help the Government of Canada effectively measure its progress in protecting the health and environment of Canadians from the impacts of anthropogenic emissions of mercury, now and in the future.

## 7 REFERENCES

Canada. 2006. *Notice requiring the preparation and implementation of pollution prevention plans in respect of specified toxic substances released from base metals smelters and refineries and zinc plants*. *Canada Gazette*. Part I, vol. 140, no. 17, p. 877–915. Available from: [www.ec.gc.ca/planp2-p2plan/C7D8F7C9-98BE-49C1-B422-9FE4DEDE544D/g1-14017.pdf](http://www.ec.gc.ca/planp2-p2plan/C7D8F7C9-98BE-49C1-B422-9FE4DEDE544D/g1-14017.pdf)

[Canada], Dept. of the Environment. 2007. *Notice requiring the preparation and implementation of pollution prevention plans in respect of mercury releases from mercury switches in end-of-life vehicles processed by steel mills*. *Canada Gazette*. Part I, vol. 141, no. 52, p. 3556–3586. Available from: [www.ec.gc.ca/planp2-p2plan/E8AFAE92-98F2-4860-8791-1B1D548BAC95/g1-14152.pdf](http://www.ec.gc.ca/planp2-p2plan/E8AFAE92-98F2-4860-8791-1B1D548BAC95/g1-14152.pdf)

[Canada], Dept. of the Environment. 2010. *Notice Requiring the Preparation and Implementation of Pollution Prevention Plans in Respect of Mercury Releases from Dental Amalgam Waste*. *Canada Gazette*. Part I, vol. 144, no. 19, p. 1101–1125. Available from: [www.gazette.gc.ca/rp-pr/p1/2010/2010-05-08/pdf/g1-14419.pdf](http://www.gazette.gc.ca/rp-pr/p1/2010/2010-05-08/pdf/g1-14419.pdf)

[CCME] Canadian Council of Ministers of the Environment. 1996. *National Guidelines for the Use of Hazardous and Non-hazardous Wastes as Supplementary Fuels in Cement Kilns*. Winnipeg (MB): CCME. Available from: [www.ccme.ca/assets/pdf/pn\\_1201\\_e.pdf](http://www.ccme.ca/assets/pdf/pn_1201_e.pdf)

[CCME] Canadian Council of Ministers of the Environment. 1998. *National Emission Guideline for Cement Kilns*. Winnipeg (MB): CCME. Available from: [www.ccme.ca/assets/pdf/pn\\_1284\\_e.pdf](http://www.ccme.ca/assets/pdf/pn_1284_e.pdf)

[CCME] Canadian Council of Ministers of the Environment. 1999. Canadian soil quality guidelines for the protection of environmental and human health: Mercury (inorganic) (1999). In: *Canadian environmental quality guidelines, 1999*, Canadian Council of Ministers of the Environment, Winnipeg.

[CCME] Canadian Council of Ministers of the Environment. 2000. *Canada-wide Standards for Mercury Emissions*. Available from: [www.ccme.ca/assets/pdf/mercury\\_emis\\_std\\_e1.pdf](http://www.ccme.ca/assets/pdf/mercury_emis_std_e1.pdf)

[CCME] Canadian Council of Ministers of the Environment. 2001a. *Canada-wide Standard on Mercury for Dental Amalgam Waste*. Available from: [www.ccme.ca/assets/pdf/cws\\_merc\\_amalgam\\_e.pdf](http://www.ccme.ca/assets/pdf/cws_merc_amalgam_e.pdf)

[CCME] Canadian Council of Ministers of the Environment. 2001b. *Canada-wide Standard for Mercury-Containing Lamps*. Available from: [www.ccme.ca/assets/pdf/merc\\_lamp\\_standard\\_e.pdf](http://www.ccme.ca/assets/pdf/merc_lamp_standard_e.pdf)

[CCME] Canadian Council of Ministers of the Environment. 2006. *Canada-wide Standards for Mercury Emissions from Coal-Fired Electric Power Generation Plants*. Available from: [www.ccme.ca/assets/pdf/hg\\_epg\\_cws\\_w\\_annex.pdf](http://www.ccme.ca/assets/pdf/hg_epg_cws_w_annex.pdf)

[CCME] Canadian Council of Ministers of the Environment. 2007. *Canada-wide Standards for Mercury: A Report on Compliance and Evaluation for Mercury from Dental Amalgam Waste and A Report On Progress for Mercury Emissions and Mercury-Containing Lamps*. Winnipeg (MB): CCME. Available from: [www.ccme.ca/assets/pdf/2007\\_joint\\_hg\\_rpt\\_1.0\\_e.pdf](http://www.ccme.ca/assets/pdf/2007_joint_hg_rpt_1.0_e.pdf)



[CEC] Commission for Environmental Cooperation. 2010. CEC website. [www.cec.org/Page.asp?PageID=924&SiteNodeID=310](http://www.cec.org/Page.asp?PageID=924&SiteNodeID=310)

Commission of the European Communities. 2005. *Community Strategy Concerning Mercury*. LU: Commission of the European Communities. Available from: [http://eur-lex.europa.eu/LexUriServ/site/en/com/2005/com2005\\_0020en01.pdf](http://eur-lex.europa.eu/LexUriServ/site/en/com/2005/com2005_0020en01.pdf)

Environment Canada. 2001a. *Environmental Code of Practice for Non-Integrated Steel Mills*. Gatineau (QC): Environment Canada, Minerals and Metals Division. Available from: [www.ec.gc.ca/CEPARRegistry/documents/code/1mm8/1mm8e.pdf](http://www.ec.gc.ca/CEPARRegistry/documents/code/1mm8/1mm8e.pdf)

Environment Canada. 2001b. *Environmental Code of Practice for Integrated Steel Mills*. Gatineau (QC): Environment Canada, Minerals and Metals Division. Available from: [www.ec.gc.ca/CEPARRegistry/documents/code/1mm7/1mm7e.pdf](http://www.ec.gc.ca/CEPARRegistry/documents/code/1mm7/1mm7e.pdf)

Environment Canada. 2009. Internal document. Air Quality Research Division.

Environment Canada. 2010a. *Canada–U.S. Great Lakes Water Quality Agreement*. Available from: [www.ec.gc.ca/grandslacs-greatlakes/default.asp?lang=En&n=88A2F0E3-1](http://www.ec.gc.ca/grandslacs-greatlakes/default.asp?lang=En&n=88A2F0E3-1)

Environment Canada. 2010b. *Great Lakes Binational Toxics Strategy*. Available from: [www.ec.gc.ca/grandslacs-greatlakes/default.asp?lang=En&n=941BAF79-1](http://www.ec.gc.ca/grandslacs-greatlakes/default.asp?lang=En&n=941BAF79-1)

Environment Canada. 2010c. Internal document. Pollution Data Division.

Fisheries and Oceans Canada. 2010. *Center of Expertise on Hydropower Impacts on Fish and Fish Habitat*. Available from: [www.dfo-mpo.gc.ca/science/coe-cde/chip-chif/index-eng.asp](http://www.dfo-mpo.gc.ca/science/coe-cde/chip-chif/index-eng.asp)

[GLRC] Great Lakes Regional Collaboration. 2008. *Mercury in Products Phase-Down Strategy*. Available from: [www.glrcc.us/documents/MercuryPhaseDownStrategy06-19-2008.pdf](http://www.glrcc.us/documents/MercuryPhaseDownStrategy06-19-2008.pdf)

[GLRC] Great Lakes Regional Collaboration. 2009. *Great Lakes Mercury Emission Reduction Strategy*. Available from: [www.glrppr.org/glmst/Mercury-Emissions-Reduction-Strategy.pdf](http://www.glrppr.org/glmst/Mercury-Emissions-Reduction-Strategy.pdf)

Health Canada. 2004. *Mercury – Your Health and the Environment – A Resource Tool*. Ottawa (ON): Health Canada, Mercury Issues Task Group. Available from: [www.hc-sc.gc.ca/ewh-semt/alt\\_formats/hecs-sesc/pdf/pubs/contaminants/mercury/mercur-eng.pdf](http://www.hc-sc.gc.ca/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/contaminants/mercury/mercur-eng.pdf)

Health Canada. 2007. *Mercury and Human Health*. Ottawa (ON): Health Canada. Available from: [www.hc-sc.gc.ca/hl-vs/iyh-vsv/environ/merc-eng.php](http://www.hc-sc.gc.ca/hl-vs/iyh-vsv/environ/merc-eng.php)

[IARC] International Agency for Research on Cancer. 1993. *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Volume 58: Beryllium, Cadmium, Mercury, and Exposures in the Glass Manufacturing Industry*. Lyon (FR): IARC. Available from: <http://monographs.iarc.fr/ENG/Monographs/vol58/volume58.pdf>

[INAC] Indian and Northern Affairs Canada (Northern Contaminants Program), 2009. *Canadian Arctic Contaminants and Health Assessment Report: Human Health 2009*. Published under the authority of the Minister of Indian Affairs and Northern Development and Federal Interlocutor for Métis and Non-Status Indians. Report available from [www.ainc-inac.gc.ca](http://www.ainc-inac.gc.ca)

James F. MacLaren Ltd. 1973. *National Inventory of Sources and Emissions of Mercury (1970)*. Ottawa (ON): Environment Canada Internal Report APCD 73-6, Air Pollution Control Directorate.

Legrand M., Feeley M., Tikhonov C., Schoen D., Li-Muller A. 2010. Methylmercury blood guidance values for Canada. *Canadian Journal of Public Health* 101(1): 28–31

Natural Health Products Directorate. 2007. *Evidence for Quality of Finished Natural Health Products Guidance Document, Version 2*. Available from: <http://www.hc-sc.gc.ca/dhp-mps/prodnatur/legislation/docs/eq-paq-eng.php>

[NPRI] National Pollutant Release Inventory. 2010. NPRI website. [www.ec.gc.ca/inrp-npri/default.asp?lang=En&n=4A577BB9-1](http://www.ec.gc.ca/inrp-npri/default.asp?lang=En&n=4A577BB9-1)

Natural Resources Canada. 2006. *Canadian Minerals Yearbook, 2006, Mercury*. Ottawa (ON): Natural Resources Canada, Minerals and Metals Sector. Available from: [www.nrcan.gc.ca/smm-mms/busi-indu/cmy-amc/content/2006/38.pdf](http://www.nrcan.gc.ca/smm-mms/busi-indu/cmy-amc/content/2006/38.pdf)

[NMR] Nordiska Ministerrådet (Nordic Council of Ministers). 2008. *Socio-economic costs of continuing the status-quo of mercury pollution*, TemaNord 2008:580. Copenhagen (DK): Nordic Council of Ministers. Available from: [www.norden.org/pub/sk/showpub.asp?pubnr=2008:580](http://www.norden.org/pub/sk/showpub.asp?pubnr=2008:580)

Richardson M, G., Brecher, R.W., Scobie, H., Hamblen, J., Samuelian, J. and Smith, C. 2009. Mercury vapour (Hg<sup>0</sup>): Continuing toxicological uncertainties, and establishing a Canadian reference exposure level. *Regulatory Toxicology and Pharmacology* 53(1): 32–38.

Rice G, Hammit J. 2005. *Economic Valuation of Human Health Benefits of Controlling Mercury Emissions from U.S. Coal-Fired Power Plants*. Boston (MA): Northeast States for Coordinated Air Use Management. Available from: [www.earthjustice.org/library/reports/harvard-report-controlling-mercury-emissions.pdf](http://www.earthjustice.org/library/reports/harvard-report-controlling-mercury-emissions.pdf)

Secretariat of the Basel Convention. 2010. *Technical Guidelines for the Environmentally Sound Management of Wastes Consisting of, Containing or Contaminated with Mercury – 5th draft*. Available from: [www.basel.int/techmatters/mercury/guidelines/010110.doc](http://www.basel.int/techmatters/mercury/guidelines/010110.doc)

Tetra Tech, Inc. 2010. Tetra Tech, Inc. website. [www.tetratech.com](http://www.tetratech.com)

Trasande L, Schechter C, Haynes KA, Landrigan PJ. 2006. Applying cost analyses to drive policy that protects children. *Ann. NY Acad. Sci.* 1076: 911–923.

UNEP [United Nations Environment Programme]. 2002. *Global Mercury Assessment*. Geneva (CH): UNEP Chemicals. Available from: [www.chem.unep.ch/mercury/Report/Final%20report/final-assessment-report-25nov02.pdf](http://www.chem.unep.ch/mercury/Report/Final%20report/final-assessment-report-25nov02.pdf)

UNEP [United Nations Environment Programme]. 2008a. *Mercury Fate and Transport in the Global Atmosphere: Measurements, Models and Policy Implications*. Available from: [www.chem.unep.ch/mercury/Sector-Specific-Information/Full\\_Report.pdf](http://www.chem.unep.ch/mercury/Sector-Specific-Information/Full_Report.pdf)

UNEP [United Nations Environment Programme]. 2008b. *The Global Atmospheric Mercury Assessment: Sources, Emissions and Transport*. Geneva (CH): UNEP Chemicals. Available from: [www.chem.unep.ch/MERCURY/Atmospheric\\_Emissions/UNEP%20SUMMARY%20REPORT%20-%20CORRECTED%20May09%20%20final%20for%20WEB%202008.pdf](http://www.chem.unep.ch/MERCURY/Atmospheric_Emissions/UNEP%20SUMMARY%20REPORT%20-%20CORRECTED%20May09%20%20final%20for%20WEB%202008.pdf)





[US EPA] United States Environmental Protection Agency. 2009. *EPA's Roadmap for Mercury*. Available from: [www.epa.gov/mercury/roadmap.htm](http://www.epa.gov/mercury/roadmap.htm)

[US EPA] United States Environmental Protection Agency. 2010. *Mercury*. Available from: [www.epa.gov/hg/index.html](http://www.epa.gov/hg/index.html)

[US EPA] United States Environmental Protection Agency, and Environment Canada. 2006. *Great Lakes Binational Toxics Strategy Management Assessment for Mercury*. Available from: [www.epa.gov/reg5oair/mercury/mercury\\_reassessment\\_final\\_feb%2006.pdf](http://www.epa.gov/reg5oair/mercury/mercury_reassessment_final_feb%2006.pdf)

[US FDA] U.S. Food and Drug Administration. 2005. *Guidance for Industry and FDA Staff. Class II Special Controls Guidance Document: Dental Amalgam, Mercury, and Amalgam Alloy*. Available from: [www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm073330.pdf](http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm073330.pdf)

[US FDA] U.S. Food and Drug Administration. 2009. CPG Sec. 540.600 *Fish, Shellfish, Crustaceans and other Aquatic Animals – Fresh, Frozen or Processed – Methyl Mercury*. Regulatory Action Guidance. Available from: [www.fda.gov/ICECI/ComplianceManuals/CompliancePolicyGuidanceManual/ucm074510.htm](http://www.fda.gov/ICECI/ComplianceManuals/CompliancePolicyGuidanceManual/ucm074510.htm)

Van Oostdam, J., A. Gilman, E. Dewailly, P. Usher, B. Wheatley, H. Kuhnlein, S. Neve, J. Walker, B. Tracy, M. Feeley. 1999. Human health implications of environmental contaminants in Arctic Canada: a review. *Sci. Total Environ.* 230: 1–82.

Van Oostdam, J., S.G. Donaldson, M. Feeley, D. Arnold, P. Ayotte, G. Bondy, L. Chan, E. Dewailly, C.M. Furgal, H. Kuhnlein. 2005. Human health implications of environmental contaminants in Arctic Canada: A review. *Sci. Total Environ.* 351–352: 165–246.

## 8 BIBLIOGRAPHY

Arctic Council. [date unknown]. *About Arctic Council*. Available from: <http://arctic-council.org/article/about>

Arctic Council. [date unknown]. *Arctic Contaminants Action Program*. Available from: [http://arctic-council.org/working\\_group/acap](http://arctic-council.org/working_group/acap)

Arctic Council. [date unknown]. *Arctic Contaminants Action Program – Work Plan for 2009–2013 for approval by SAO's*. Available from: [http://arctic-council.org/filearchive/acap\\_final\\_work\\_plan\\_2009-2011.doc](http://arctic-council.org/filearchive/acap_final_work_plan_2009-2011.doc)

Arctic Council. [date unknown]. *Arctic Monitoring and Assessment Programme*. Available from: [http://arctic-council.org/working\\_group/amap](http://arctic-council.org/working_group/amap)

Arctic Council. [date unknown]. *Arctic Monitoring and Assessment Programme – Work plan for 2009-2011 and tentative list of deliverables for 2009-2013*. Available from: [http://arctic-council.org/filearchive/amap\\_draft\\_work\\_plan\\_2009\\_-\\_2011.pdf](http://arctic-council.org/filearchive/amap_draft_work_plan_2009_-_2011.pdf)

Canada. 2002. *Metal Mining Effluent Regulations*, SOR/2002-222. Available from: <http://laws.justice.gc.ca/PDF/Regulation/S/SOR-2002-222.pdf>

Canada. 2007. *Mercury*. Available from: [www.chemicalsubstanceschimiques.gc.ca/fact-fait/mercury-mercure-eng.php](http://www.chemicalsubstanceschimiques.gc.ca/fact-fait/mercury-mercure-eng.php)

[Canada], Dept. of the Environment. 2009. *Proposed notice regarding pollution prevention planning in respect of mercury releases from dental amalgam waste*. *Canada Gazette*. Part I, vol. 143, no. 16, p. 1053–1077. Available from: [www.ec.gc.ca/planp2-p2plan/956B3E8C-4612-4A65-92AF-0506964DE100/g1-14316.pdf](http://www.ec.gc.ca/planp2-p2plan/956B3E8C-4612-4A65-92AF-0506964DE100/g1-14316.pdf)

Canada. 2010. *Canadian Health Measures Survey Preliminary Release – Biomonitoring Results of Lead, Mercury, and Cadmium*. Available from: [www.chemicalsubstanceschimiques.gc.ca/media/chms-eng.php](http://www.chemicalsubstanceschimiques.gc.ca/media/chms-eng.php)

Canada/[US EPA] United States Environmental Protection Agency. 2008. *Great Lakes Binational Toxics Strategy – December 2008 Status Report*. Available from: [http://binational.net/bns/2008/2008GLBTS\\_en.pdf](http://binational.net/bns/2008/2008GLBTS_en.pdf)

[CCME] Canadian Council of Ministers of the Environment. *Canadian Environmental Quality Guidelines*. CCME. Available from: <http://ceqg-rcqe.ccme.ca>

Clark, N.A., K. Teschke, K. Rideout, R. Copes. 2007. Trace element levels in adults from the west coast of Canada and associations with age, gender, diet, activities, and levels of other trace elements. *Chemosphere* 70(1): 155–164.

Committee on the Environment of the Conference of New England Governors and Eastern Canadian Premiers. 1998. *Mercury Action Plan 1998*. Available from: [www.dem.ri.gov/topics/pdf/hgap98.pdf](http://www.dem.ri.gov/topics/pdf/hgap98.pdf)

Environment Canada. 2000. *The Status of Mercury in Canada, Report No. 2*. Gatineau (QC): Environment Canada, Transboundary Air Issues Branch. Available from: [www.cec.org/files/PDF/POLLUTANTS/Hgcan-e3.pdf](http://www.cec.org/files/PDF/POLLUTANTS/Hgcan-e3.pdf)

Environment Canada. 2006. *Environmental Code of Practice – Base Metals Smelters and Refineries*. Gatineau (QC): Environment Canada, Natural Resource Sectors. Available from: [www.ec.gc.ca/CEPARRegistry/documents/code/smelters/BMS\\_CP\\_E.pdf](http://www.ec.gc.ca/CEPARRegistry/documents/code/smelters/BMS_CP_E.pdf)

Environment Canada. 2006. *Risk Management Strategy for Mercury-Containing Products*. Available from: [www.ec.gc.ca/ceparegistry/documents/part/Merc\\_RMS/Merc\\_RMS.cfm](http://www.ec.gc.ca/ceparegistry/documents/part/Merc_RMS/Merc_RMS.cfm)

Environment Canada. 2007. *Proposed Risk Management Instruments for Mercury-Containing Products*. Available from: [www.ec.gc.ca/CEPARRegistry/documents/part/wmd-dgd/pro-ris.cfm](http://www.ec.gc.ca/CEPARRegistry/documents/part/wmd-dgd/pro-ris.cfm)

Environment Canada. 2008. *Progress Report – Pollution Prevention Planning from Base Metals Smelters and Refineries and Zinc Plants*. Available from: [www.ec.gc.ca/planp2-p2plan/default.asp?lang=En&n=F02C15C9-1](http://www.ec.gc.ca/planp2-p2plan/default.asp?lang=En&n=F02C15C9-1)

Environment Canada. 2010. *Canada–Ontario Agreement Respecting the Great Lakes Basin Ecosystem*. Available from: [www.ec.gc.ca/grandslacs-greatlakes/default.asp?lang=En&n=B903EE0D-1](http://www.ec.gc.ca/grandslacs-greatlakes/default.asp?lang=En&n=B903EE0D-1)

Environment Canada. 2010. *Progress Report: Pollution Prevention Planning and Mercury Switches*. Available from: [www.ec.gc.ca/planp2-p2plan/00206F8A-299E-46CF-96E0-EBB5B65AD03C/Progress\\_Report\\_Pollution\\_Prevention\\_Planning\\_and\\_Mercury\\_Switches\\_February2010.pdf](http://www.ec.gc.ca/planp2-p2plan/00206F8A-299E-46CF-96E0-EBB5B65AD03C/Progress_Report_Pollution_Prevention_Planning_and_Mercury_Switches_February2010.pdf)





Fisheries and Oceans Canada. 2008. Fact Sheet – *Metal Mining Effluent Regulations*. Available from: [www.dfo-mpo.gc.ca/habitat/role/141/1415/14156-eng.htm](http://www.dfo-mpo.gc.ca/habitat/role/141/1415/14156-eng.htm)

Foreign Affairs and International Trade Canada. 2008. *Barrow Declaration on the occasion of the Second Ministerial Meeting of the Arctic Council*. Available from: [www.international.gc.ca/polar-polaire/barrow.aspx?lang=en](http://www.international.gc.ca/polar-polaire/barrow.aspx?lang=en)

Govtrack.us. [date unknown]. Text of S. 906 [110th]: *Mercury Export Ban Act of 2008*. Available from: [www.govtrack.us/congress/billtext.xpd?bill=s110-906](http://www.govtrack.us/congress/billtext.xpd?bill=s110-906)

Health Canada. 2007. *Updating the Existing Risk Management Strategy for Mercury in Retail Fish*. Ottawa (ON): Health Canada, Bureau of Chemical Safety. Available from: [www.hc-sc.gc.ca/fn-an/alt\\_formats/hpfb-dgpsa/pdf/nutrition/risk-risque\\_strat-eng.pdf](http://www.hc-sc.gc.ca/fn-an/alt_formats/hpfb-dgpsa/pdf/nutrition/risk-risque_strat-eng.pdf)

Institut national de santé publique du Québec. 2004. *Étude sur l'établissement de valeurs de référence d'éléments traces et de métaux dans le sang, le sérum et l'urine de la population de la grande région de Québec*. Cote: INSPQ-2004-030. Québec: Institut national de santé publique du Québec.

Legrand, M., M. Feeley, C. Tikhonov, D. Schoen, A. Li-Muller. 2010. Methylmercury blood guidance values for Canada. *Can. J. Public Health* 101(1): 28–31.

Meek, M.E., V.C. Armstrong. 2007. The assessment and management of industrial chemicals in Canada. In: C.J. van Leeuwen, T.G. Vermeire, editors. *Risk Assessment of Chemicals: An Introduction*. 2nd ed. Dordrecht (NL): Springer. p. 591–621. Available from: [www.springerlink.com/content/k7q72272u1q21w65/?p=a1a427b6a7ff40f898e117389c021bfb&pi=14](http://www.springerlink.com/content/k7q72272u1q21w65/?p=a1a427b6a7ff40f898e117389c021bfb&pi=14)

Paine, P.J. 1994. *Compliance with Chlor-Alkali Mercury Regulations, 1986–1989: Status Report*. Environment Canada. Available from: [www.ec.gc.ca/CEPARRegistry/documents/pubs/eps-1-ha-2/toc.cfm](http://www.ec.gc.ca/CEPARRegistry/documents/pubs/eps-1-ha-2/toc.cfm)

*Regulation (EC) No. 1102/2008 of the European Parliament and of the Council of 22 October 2008 on the banning of exports of metallic mercury and certain mercury compounds and mixtures and the safe storage of metallic mercury*. Available from: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:304:0075:01:EN:HTML>

UNECE [United Nations Economic Commission for Europe]. *Protocol on Heavy Metals*. Available from: [www.unece.org/env/lrtap/hm\\_h1.htm](http://www.unece.org/env/lrtap/hm_h1.htm)

[UNECE TFHM] United Nations Economic Commission for Europe Task Force on Heavy Metals. 2006. *Best Available Scientific Information on the Effects of Deposition of Heavy Metals from Long-Range Atmospheric Transport*. Available from: <http://unece.org/env/lrtap/TaskForce/tfhm/third%20meetingdocs/PostOttawa/effects%20of%20deposition%20of%20HMs%20final%20June%202016.pdf>

[UNECE TFHM] United Nations Economic Commission for Europe Task Force on Heavy Metals. 2009. *Draft Track B Review Report*. Available from: [www.unece.org/env/lrtap/TaskForce/tfhm/6th%20Meeting%2027-29%20May%20Stockholm/Draft%20track%20B.pdf](http://www.unece.org/env/lrtap/TaskForce/tfhm/6th%20Meeting%2027-29%20May%20Stockholm/Draft%20track%20B.pdf)

UNEP [United Nations Environment Programme]. 2009. *GC decision 25/5 III Chemicals management, including mercury*. Available from: [www.chem.unep.ch/mercury/GC25/GC25Report\\_English\\_25\\_5.pdf](http://www.chem.unep.ch/mercury/GC25/GC25Report_English_25_5.pdf)

UNEP [United Nations Environment Programme]. 2010. UNEP Mercury Programme website. [www.chem.unep.ch/mercury/default.htm](http://www.chem.unep.ch/mercury/default.htm)

US EPA [United States Environmental Protection Agency]. 2009. *Elemental Mercury Used in Flow Meters, Natural Gas Manometers, and Pyrometers; Proposed Significant New Use Rule*. Federal Register. Vol. 74, no. 175. Available from: [www.epa.gov/fedrgstr/EPA-TOX/2009/September/Day-11/t21894.pdf](http://www.epa.gov/fedrgstr/EPA-TOX/2009/September/Day-11/t21894.pdf)

Van Oostdam, J., S. Donaldson, M. Feeley, C. Tikhonov, B. Armstrong, P. Ayotte, W. Bowers, O. Boucher, L. Chan, F. Dallaire. 2009. *Canadian Arctic Contaminants and Health Assessment Report: Human Health 2009*. Ottawa (ON): Indian and Northern Affairs Canada, Northern Contaminants Program.

Wong, S., E. Lye. 2008. Lead, mercury and cadmium levels in Canadians. *Health Reports* 19(4): 31–36. Available from: [www.statcan.gc.ca/pub/82-003-x/2008004/article/6500106-eng.htm](http://www.statcan.gc.ca/pub/82-003-x/2008004/article/6500106-eng.htm)



## ANNEX A

### Existing Risk Management Initiatives

#### Government of Canada Actions on Mercury under the *Canadian Environmental Protection Act, 1999* (CEPA 1999)

Regulatory Action	Objective
<p><b><i>Chlor-Alkali Mercury Release Regulations</i></b>  <a href="http://laws.justice.gc.ca/PDF/Regulation/S/SOR-90-130.pdf">http://laws.justice.gc.ca/PDF/Regulation/S/SOR-90-130.pdf</a></p>	<p>These regulations limit the release of mercury into ambient air from mercury cell chlor-alkali plants. The Regulations also include provisions with respect to reporting releases, malfunctions and breakdowns. Note: the last mercury cell plant in Canada closed in July 2008, but the Regulations are still in effect.</p>
<p><b><i>Disposal at Sea Regulations</i></b>  <a href="http://laws.justice.gc.ca/PDF/Regulation/S/SOR-2001-275.pdf">http://laws.justice.gc.ca/PDF/Regulation/S/SOR-2001-275.pdf</a></p>	<p>CEPA 1999, Part 7, Division 3, deals with disposal at sea. This part specifies that “substances” cannot be disposed of in the sea without a permit. Permits are only considered for a small list of waste or other matter that has been assessed according to an internationally required framework. Most of the quantity allowed under permit is dredged material from clearing navigation channels. Mercury and other contaminants can be present in the dredged material and thus its analysis is part of the minimum information requirements in a permit application. The <i>Disposal at Sea Regulations</i> also set a lower action level (level below which there is no concern for disposal at sea) of 0.75 milligrams per kilogram dry weight for mercury. Trace levels are often found naturally in the sediment. At no time would a pure chemical contaminant like mercury be permitted for ocean disposal.</p> <p>After permits are issued, Environment Canada conducts representative disposal site monitoring, and mercury levels can also be assessed to ensure they remain below action levels as the sites are used over time.</p>
<p><b><i>Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations</i></b>  <a href="http://laws.justice.gc.ca/PDF/Regulation/S/SOR-2005-149.pdf">http://laws.justice.gc.ca/PDF/Regulation/S/SOR-2005-149.pdf</a></p>	<p>These regulations exempt the transboundary movement of liquid elemental mercury in quantities below a 50 millilitre threshold. Also, mercury and mercury compounds are covered under requirements for substances with specific physical characteristics, such as corrosiveness or leachate toxicity. In addition, several mercury compounds are explicitly covered in schedules when those substances are being disposed of or recycled.</p>
<p><b><i>Export Control List Notification Regulations</i></b>  <a href="http://canadagazette.gc.ca/archives/p2/2000/2000-03-29/pdf/g2-13407.pdf#page=109">http://canadagazette.gc.ca/archives/p2/2000/2000-03-29/pdf/g2-13407.pdf#page=109</a></p>	<p>These regulations require exporters to provide notice to the Minister of Environment of the proposed exports of substances on the Export Control List, Schedule 3 of CEPA 1999, and to submit annual reports.</p>
<p><b><i>Export of Substances Under the Rotterdam Convention Regulations</i></b>  <a href="http://laws.justice.gc.ca/PDF/Regulation/S/SOR-2002-317.pdf">http://laws.justice.gc.ca/PDF/Regulation/S/SOR-2002-317.pdf</a></p>	<p>These regulations will permit Canada to implement the Rotterdam Convention on the Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals and Pesticides in International Trade. The main purpose of the Regulations is to ensure that chemicals and pesticides subject to the PIC procedure are not exported to parties to the Convention, unless the importing party has provided its PIC for the shipment.</p>
<p><b><i>Environmental Emergency Regulations</i></b>  <a href="http://laws.justice.gc.ca/PDF/Regulation/S/SOR-2003-307.pdf">http://laws.justice.gc.ca/PDF/Regulation/S/SOR-2003-307.pdf</a></p>	<p>These regulations aim to enhance protection of the environment and human health in environmental emergency situations, by promoting prevention and ensuring preparedness, response and recovery. These regulations mandate persons who own or manage specified toxic and hazardous substances at or above the specified thresholds to provide required information on the substance(s) and their quantities, and to prepare and implement environmental emergency plans.</p>

Environmental Codes of Practice / Guidelines	Objective
<p><i>Environmental Code of Practice for Integrated Steel Mills</i>  <a href="http://www.ec.gc.ca/CEPARRegistry/documents/code/1mm7/1mm7e.pdf">www.ec.gc.ca/CEPARRegistry/documents/code/1mm7/1mm7e.pdf</a></p> <p><i>Environmental Code of Practice for Non-integrated Steel Mills</i>  <a href="http://www.ec.gc.ca/CEPARRegistry/documents/code/1mm8/1mm8e.pdf">www.ec.gc.ca/CEPARRegistry/documents/code/1mm8/1mm8e.pdf</a></p>	<p>These instruments identify recommended good environmental protection practices for the prevention and control of atmospheric emissions, and wastewater effluents and wastes, from iron and steelmaking operations.</p>
<p><i>Environmental Code of Practice for Base Metals Smelters and Refineries</i>  <a href="http://www.ec.gc.ca/CEPARRegistry/documents/code/smelters/BMS_CP_E.pdf">www.ec.gc.ca/CEPARRegistry/documents/code/smelters/BMS_CP_E.pdf</a></p>	<p>This code identifies recommended environmental protection practices for the prevention and control of atmospheric emissions, and wastewater effluents and wastes, from base metals smelting and refining operations. It includes mercury emission guidelines for existing and new facilities.</p>
<p><i>National Guidelines for the Use of Hazardous and Non-hazardous Wastes as Supplementary Fuels in Cement Kilns</i>  <a href="http://www.ccme.ca/assets/pdf/pn_1201_e.pdf">www.ccme.ca/assets/pdf/pn_1201_e.pdf</a></p>	<p>These guidelines provide direction on the operating and performance standards that should be met by cement kilns using wastes as supplementary fuels. Accordingly, this document provides guidance on: criteria for the selection of wastes; handling and storage of wastes; emission limits; testing and monitoring requirements; solid residue management; and reporting requirements. These guidelines were subsequently withdrawn from active circulation, and are now available only through the CCME archives for reference and historical purposes.</p>
<p><i>National Emission Guideline for Cement Kilns</i>  <a href="http://www.ccme.ca/assets/pdf/pn_1284_e.pdf">www.ccme.ca/assets/pdf/pn_1284_e.pdf</a></p>	<p>This guideline provides a consistent national basis for restricting emissions of nitrogen oxides and other pollutants, while encouraging greater energy efficiency in the industry. The Guideline indirectly targets mercury by addressing fine particulate dust (to which mercury can be bound).</p>
<p><i>Environmental Code of Practice for Metal Mines</i>  <a href="http://www.ec.gc.ca/CEPARRegistry/documents/code/metal/ECP_eng.pdf">www.ec.gc.ca/CEPARRegistry/documents/code/metal/ECP_eng.pdf</a></p>	<p>This code describes operational activities and associated environmental concerns of this industrial sector. The document applies to the complete life cycle of mining, from exploration to mine closure, and environmental management practices are recommended to mitigate the identified environmental concerns. The recommended practices in the Code include the development and implementation of environmental management tools, the management of wastewater and mining wastes, and the prevention and control of environmental releases to air, water and land.</p>
Pollution Prevention Plans	Objective
<p><i>Notice requiring the preparation and implementation of pollution prevention plans in respect of specified toxic substances released from base metals smelters and refineries and zinc plants</i>  <a href="http://www.ec.gc.ca/planp2-p2plan/C7D8F7C9-98BE-49C1-B422-9FE4DEDE544D/g1-14017.pdf">www.ec.gc.ca/planp2-p2plan/C7D8F7C9-98BE-49C1-B422-9FE4DEDE544D/g1-14017.pdf</a></p>	<p>This notice outlines the requirements to prepare and implement pollution prevention plans in respect of specified toxic substances released from base metals smelters and refineries and zinc plants, and includes forms to be completed by persons subject to the notice. The notice specifies reduction targets in annual releases of mercury to 373 kg by 2008 for the largest emitter of mercury in Canada (Hudson Bay Mining &amp; Smelting Co. in Flin Flon, Manitoba).</p>



<p><b>Notice Requiring the Preparation and Implementation of Pollution Prevention Plans in Respect of Mercury Releases from Mercury Switches in End-of-life Vehicles Processed by Steel Mills</b></p> <p><a href="http://www.ec.gc.ca/planp2-p2plan/E8AFAE92-98F2-4860-8791-1B1D548BAC95/g1-14152.pdf">www.ec.gc.ca/planp2-p2plan/E8AFAE92-98F2-4860-8791-1B1D548BAC95/g1-14152.pdf</a></p>	<p>This notice applies to manufacturers of vehicles that contain mercury switches and to steel mills that process end-of-life vehicles or scrap from end-of-life vehicles. The notice identifies the following considerations to take into account in preparing and implementing pollution prevention plans: participation in a mercury switch management plan with a goal to capture and divert 90% of mercury switches in end of life vehicles currently processed by steel mills; establishment of a purchasing policy of mercury-free steel scrap; distribution of educational material to vehicle recyclers; and establishment and maintenance of funding for the mercury switch program.</p>
<p><b>Notice Requiring the Preparation and Implementation of Pollution Prevention Plans in Respect of Mercury Releases from Dental Amalgam Waste</b></p> <p><a href="http://www.gazette.gc.ca/rp-pr/p1/2010/2010-05-08/html/notice-avis-eng.html#d104">www.gazette.gc.ca/rp-pr/p1/2010/2010-05-08/html/notice-avis-eng.html#d104</a></p>	<p>This notice targets dental facilities and/or owners of a building where a dental facility is located where dental amalgam is being handled and that have not implemented best management practices. The notice requires dental facilities that have not implemented best management practices for dental amalgam waste to prepare and implement a pollution prevention plan. Best practices include but are not limited to the installation of a certified amalgam separator and sending the mercury waste for recycling or proper disposal.</p>
<p><b>Canada-wide Standards Published by the Canadian Council of Ministers of the Environment</b></p>	<p><b>Objective</b></p>
<p><b>Canada-wide Standards for Mercury Emissions</b></p> <p><a href="http://www.ccme.ca/assets/pdf/mercury_emis_std_e1.pdf">www.ccme.ca/assets/pdf/mercury_emis_std_e1.pdf</a></p>	<p>These standards address both existing and new facilities in the waste incineration and base metals smelting sectors. The waste incineration sector includes hazardous waste, sewage sludge, municipal waste, and medical waste incinerators. For base metals smelters, the Standards set a limit of mercury released to air per tonne of metal produced.</p>
<p><b>Canada-wide Standards for Mercury Emissions from Coal-fired Electric Power Generation Plants</b></p> <p><a href="http://www.ccme.ca/assets/pdf/hg_epg_cws_w_annex.pdf">www.ccme.ca/assets/pdf/hg_epg_cws_w_annex.pdf</a></p>	<p>Endorsed in 2006, these standards include: a) relative to a 2002–2004 emissions baseline, the equivalent to a 60% national capture of mercury from coal burned by facilities existing in 2006 where the capture is achieved via province-specific caps applicable from 2010 onwards; and b) for new facilities, target capture or emissions rates that are coal rank specific and were based on best available control technology, economically achievable during the Standards’ development.</p>
<p><b>Canada-wide Standard for Mercury-containing Lamps</b></p> <p><a href="http://www.ccme.ca/assets/pdf/merc_lamp_standard_e.pdf">www.ccme.ca/assets/pdf/merc_lamp_standard_e.pdf</a></p>	<p>The intent of this standard is to reduce releases of mercury to the environment from mercury-containing lamps. The target is a 70% reduction by 2005 and an 80% reduction by 2010 in the average content of mercury in all mercury-containing lamps sold in Canada, from a 1990 baseline.</p>
<p><b>Canada-wide Standard on Mercury for Dental Amalgam Waste</b></p> <p><a href="http://www.ccme.ca/assets/pdf/cws_merc_amalgam_e.pdf">www.ccme.ca/assets/pdf/cws_merc_amalgam_e.pdf</a></p>	<p>This standard led to the signing of a Memorandum of Understanding by Environment Canada and the Canadian Dental Association, committing each to actions towards the voluntary implementation of this standard. The objective is to apply “best management practices” to achieve a 95% national reduction in mercury releases from dental amalgam waste discharges to the environment by 2005, from a base year of 2000.</p>
<p><b>Canadian Environmental Quality Guidelines</b></p> <p><a href="http://ceqg-rcqe.ccme.ca">http://ceqg-rcqe.ccme.ca</a></p>	<p>Nationally endorsed science-based goals for the quality of atmospheric, aquatic and terrestrial ecosystems. They are defined as numerical concentrations or narrative statements that are recommended as levels that should result in negligible risk to biota, their functions, or any interactions that are integral to sustaining the health of ecosystems and the designated resource uses they support.</p>





## Mercury Management Activities Under Other Acts of Parliament

Regulatory Action	Objective
<p><b>Chlor-Alkali Mercury Liquid Effluent Regulations</b>  <a href="http://laws.justice.gc.ca/PDF/Regulation/C/C.R.C., c. 811.pdf">http://laws.justice.gc.ca/PDF/Regulation/C/C.R.C., c. 811.pdf</a></p>	<p>Under the authority of the <i>Fisheries Act</i>, these regulations require all chlor-alkali plants to limit the amount of mercury in liquid effluents on any day to 2.5 grams of mercury per tonne of chlorine produced multiplied by the reference production rate (RPR). The RPR is defined for each facility in question. Note: the last mercury cell plant in Canada closed in July 2008, but the regulations are still in effect.</p>
<p><b>Metal Mining Effluent Regulations</b>  <a href="http://laws.justice.gc.ca/PDF/Regulation/S/SOR-2002-222.pdf">http://laws.justice.gc.ca/PDF/Regulation/S/SOR-2002-222.pdf</a></p>	<p>Under the authority of the <i>Fisheries Act</i>, these regulations set limits for the discharge of deleterious substances (arsenic, copper, lead, nickel, zinc, total suspended matter, radium 226 and hydrogen potential [pH]) in liquid effluents from base metals, uranium and iron ore mines. While there is no regulated limit for mercury in effluent under the Regulations, metal mines are required to monitor and report mercury concentrations in effluent and in water bodies into which effluent is discharged as part of federal Environmental Effects Monitoring requirements. Data reported under the Regulations indicate that metal mines do not appear to be a source of concern regarding mercury.</p>
<p><b>Surface Coating Materials Regulations</b>  <a href="http://laws.justice.gc.ca/PDF/Regulation/S/SOR-2005-109.pdf">http://laws.justice.gc.ca/PDF/Regulation/S/SOR-2005-109.pdf</a></p>	<p>Under the authority of the <i>Hazardous Products Act</i>, these regulations limit the amount of mercury in coating materials used in toys and learning materials intended for children. Also, they limit the quantity of mercury compounds in paint and other liquid coating materials. These regulations introduced a limit of 10 mg/kg total mercury on all consumer paints imported, advertised or sold in Canada, with a phase-in period for recycled paints which ended on June 30, 2010.</p>
<p><b>Prohibition in children's toys – Paragraph 9(d) of Part I of Schedule I to the Hazardous Products Act</b>  <a href="http://laws.justice.gc.ca/PDF/Statute/H/H-3.pdf">http://laws.justice.gc.ca/PDF/Statute/H/H-3.pdf</a></p>	<p>Prohibits the sale, import or advertisement in Canada of toys, equipment and other products for use by a child in learning or play that have applied to them a decorative or protective coating that contains any compound of mercury introduced as such.</p>
<p><b>Cosmetic Ingredient Hotlist (2010) of the Cosmetic Regulations under the Food and Drugs Act</b>  <a href="http://www.hc-sc.gc.ca/cps-spc/alt_formats/hecs-sesc/pdf/person/cosmet/info-ind-prof/hot-list-critique/hotlist-liste_2010-eng.pdf">http://www.hc-sc.gc.ca/cps-spc/alt_formats/hecs-sesc/pdf/person/cosmet/info-ind-prof/hot-list-critique/hotlist-liste_2010-eng.pdf</a></p>	<p>The Cosmetic Ingredient Hotlist prohibits the use of mercury and its compounds in cosmetics.</p>
<p><b>Prohibition in pharmaceuticals – Section C.01.036, paragraph (1) (c), of the Food and Drug Regulations</b>  <a href="http://laws.justice.gc.ca/PDF/Regulation/C/C.R.C., c. 870.pdf">http://laws.justice.gc.ca/PDF/Regulation/C/C.R.C., c. 870.pdf</a></p>	<p>Prohibits the use of mercury or any of its salts or derivatives unless the drug is an ophthalmic drug or other drug used in the area of the eye, is a drug for nasal administration, is a drug for optic administration, or is a drug for parenteral administration that is packaged in a multi-dose container in which the mercury or the salt or the derivative thereof is present as a preservative and the manufacturer or importer has submitted evidence demonstrating that the only satisfactory way to maintain the sterility or stability of the drug is to use that preservative.</p>





<p><b><i>Pest Control Products Act</i></b>  <a href="http://laws.justice.gc.ca/PDF/Statute/P/P-9.pdf">http://laws.justice.gc.ca/PDF/Statute/P/P-9.pdf</a></p>	<p>Mercury-based pesticides are no longer registered under the <i>Pest Control Products Act</i>.</p>
<p><b><i>Guidance Document Evidence for Quality of Finished Natural Health Products (June 2007, Version 2)</i></b>  <a href="http://www.hc-sc.gc.ca/dhp-mps/alt_formats/hpfb-dgpsa/pdf/prodnatur/eq-paq-eng.pdf">www.hc-sc.gc.ca/dhp-mps/alt_formats/hpfb-dgpsa/pdf/prodnatur/eq-paq-eng.pdf</a></p>	<p>Sets a tolerance limit for total mercury in finished natural health products (NHPs). All finished NHPs are required to comply with the established tolerance limit for mercury. Health Canada monitors compliance for NHPs and other marketed health products.</p>
<p><b><i>Risk Management Strategy for Mercury in Retail Fish</i></b>  <a href="http://www.hc-sc.gc.ca/fn-an/alt_formats/hpfb-dgpsa/pdf/nutrition/risk-risque_strat-eng.pdf">www.hc-sc.gc.ca/fn-an/alt_formats/hpfb-dgpsa/pdf/nutrition/risk-risque_strat-eng.pdf</a></p>	<p>Sets the maximum level of mercury in retail fish and provides consumer consumption advice.</p>



## ANNEX B

### List of Programs/Actions under the Four Complementary Activities of Research, Monitoring, Modelling and Assessment

#### 1. MONITORING CHANGES IN DOMESTIC AND GLOBAL MERCURY EMISSIONS AND LEVELS, AND EFFECTS OF MERCURY IN HUMANS AND THE CANADIAN ENVIRONMENT

Programs/Actions	Descriptions
<b>Atmosphere</b>	
<b>The Canadian Air and Precipitation Monitoring Network</b> <a href="http://www.msc.ec.gc.ca/capmon/index_e.cfm">www.msc.ec.gc.ca/capmon/index_e.cfm</a>	Supports the long-term monitoring of mercury in the atmosphere and deposition at sites across Canada. This network is designed to provide answers to a number of key questions related to emissions origin, spatial and temporal distribution, atmospheric transformation and fate, and the relationships between mercury and other atmospheric pollutants.
<b>The Integrated Atmospheric Deposition Network</b> <a href="http://www.msc-smc.ec.gc.ca/iadn/index_e.html">www.msc-smc.ec.gc.ca/iadn/index_e.html</a>	In operation since 1990 under the guidance of an implementation plan signed in that year, the Network measures levels of mercury in the atmosphere and deposition at two sites in the Great Lakes Basin.
<b>International Polar Year activities</b>	Environment Canada supported short-term (2007–2009) projects to measure trans Pacific transport and fate of mercury in the Arctic.
<b>Aquatic Ecosystems</b>	
<b>The Water Quality Monitoring and Surveillance Program</b> <b>The Great Lakes Fish Contaminants Surveillance Program</b>	Measure mercury in water, sediment and fish in the Great Lakes Basin and other transboundary watersheds across Canada.
<b>Environment Canada’s Seabird Egg Monitoring programs</b>	Track the concentration of mercury in seabird colonies located along Canada’s east, west and arctic coasts, and the Great Lakes.
<b>Environment Canada’s Wildlife Toxicology Program</b>	Monitors levels of mercury in, and studies its effects on, selected predatory aquatic wildlife (e.g., loons, mink) and their prey, at high-risk sites across Canada.
<b>The Northern Contaminants Program</b> <a href="http://www.ainc-inac.gc.ca/nth/ct/ncp/index-eng.asp">www.ainc-inac.gc.ca/nth/ct/ncp/index-eng.asp</a>	Tracks mercury’s levels in and effects on fish and wildlife commonly consumed by humans.
<b>Environment Canada’s Wildlife and Landscape Science Directorate and Water Science and Technology Directorate</b>	Study mercury deposition in lake sediments, emission sources, and biological effects in relation to acid deposition.
<b>Environment Canada</b>	In support of specific studies, measures—across Canada—mercury in selected reservoirs, downstream of pulp and paper mills, at mining sites, and in lakes.



Humans	
<p><b>The Northern Contaminants Program</b>  <a href="http://www.ainc-inac.gc.ca/nth/ct/ncp/index-eng.asp">www.ainc-inac.gc.ca/nth/ct/ncp/index-eng.asp</a></p>	<p>Supports human risk assessment of mercury in the North via the monitoring of: trend data for environmental contaminants, including mercury, in human tissues; food consumption patterns of people in the North; and the levels of mercury found in commonly consumed fish and wildlife.</p>
<p><b>Canadian Health Measures Survey</b>  <a href="http://www.statcan.gc.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&amp;SDDS=5071&amp;lang=en&amp;db=imdb&amp;adm=8&amp;dis=2">www.statcan.gc.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&amp;SDDS=5071&amp;lang=en&amp;db=imdb&amp;adm=8&amp;dis=2</a></p>	<p>An ongoing nationally representative survey that is collecting important health information through household interviews and direct physical measures at a Mobile Examination Clinic. The Survey is tracking levels of mercury in the blood of Canadians.</p>
<p><b>Health Canada's chemical surveillance program</b></p>	<ul style="list-style-type: none"> <li>• Monitors the concentrations in foods of various chemicals, including mercury, through its ongoing Total Diet Study surveys.</li> <li>• Undertook a survey on fish and seafood. Farmed and wild caught fish and seafood products sold at the retail level were sampled in Vancouver, Toronto and Halifax during March 2002. Data are also generated by the Canadian Food Inspection Agency as part of its compliance monitoring program.</li> </ul>
<p><b>Maternal-Infant Research on Environmental Chemicals (the MIREC study)</b></p>	<p>A national five-year research study that is recruiting approximately 2000 women from Canadian cities. Women will be recruited during the first trimester of pregnancy, and followed through pregnancy and up to eight weeks after birth. The main goals of this study are to:</p> <ul style="list-style-type: none"> <li>• measure the extent to which pregnant women and their babies are exposed to environmental chemicals, as well as tobacco smoke;</li> <li>• assess which pregnancy health risks, if any, are associated with exposure to heavy metals (lead, mercury, cadmium, arsenic and manganese); and</li> <li>• measure the levels of environmental chemicals and some of the beneficial components (nutritional and immune constituents) of breast milk.</li> </ul>
<p><b>Health Canada</b></p>	<ul style="list-style-type: none"> <li>• Surveys and testing to assess if samples taken from the marketplace comply with the mercury requirements for paints and other surface coating materials, and for surface coating materials applied to children's toys.</li> <li>• Committed to reviewing the data that is routinely generated by the Canadian Food Inspection Agency (as part of its compliance monitoring program) and by Health Canada food science laboratories (as part of its chemical surveillance program).</li> <li>• A federal food inspection program is in place, under the Canadian Food Inspection Agency, which ensures compliance of retail fish with the federal standards (maximum levels) for mercury in fish.</li> </ul>



## 2. PREDICTING THE INFLUENCE OF CURRENT AND PROJECTED DOMESTIC AND GLOBAL EMISSIONS ON CANADA

Programs	Descriptions
Global/Regional Atmospheric Heavy Metals Model (GRAHM)	Provides estimates of the contribution of domestic and foreign sources of mercury emissions to the Canadian atmosphere, global simulations of the atmospheric transport of mercury, and levels of deposition of mercury in the Canadian environment.
The Clean Air Regulatory Agenda Mercury Science Program (2007–2011)	Supports development of the GRAHM model, and integration of the model with two non-governmental modelling activities: <ul style="list-style-type: none"> <li>• Terrestrial model: predicts the concentration of mercury in lakes and rivers from atmospheric deposition on the watershed.</li> <li>• Aquatic models: predict the levels of mercury in fish based on levels of mercury in lakes and rivers.</li> </ul>

## 3. DEFINING THE PROCESSES GOVERNING MERCURY TRANSPORT AND FATE

Programs	Descriptions
The Clean Air Regulatory Agenda Mercury Science Program (2007–2011)	Environment Canada is funding research into the processes governing the transport and fate of mercury emissions in the atmosphere.
The Mercury Experiment to Assess Atmospheric Loading in Canada and the United States	A multi-agency, binational study producing new knowledge on the processes governing the transport and fate of atmospheric mercury deposited on terrestrial and aquatic ecosystems.
Environment Canada's Wildlife Toxicology Program	Supports research on the mechanisms governing the toxicity of mercury to fish and wildlife.
The Northern Contaminants Program <a href="http://www.ainc-inac.gc.ca/nth/ct/ncp/index-eng.asp">www.ainc-inac.gc.ca/nth/ct/ncp/index-eng.asp</a>	Supports research on the fate of mercury in arctic ecosystems.



#### 4. ASSESSING AND COMMUNICATING SCIENCE TO INFORM DOMESTIC AND INTERNATIONAL DECISION MAKING

Programs/Projects/ Assessments	Descriptions
<i>The Global Atmospheric Mercury Assessment: Sources, Emissions and Transport</i> (UNEP 2008)	This assessment describes the best available data on atmospheric emissions of mercury and our current understanding of the transport and fate of these emissions around the globe.
Arctic Monitoring and Assessment Program–AMAP Assessment 2011: Mercury in the Arctic (in progress)	This assessment will describe the transport, fate and effects of mercury in the Arctic.
Canadian Mercury Science Assessment	This will be the first comprehensive national description of mercury in the Canadian environment. The Assessment is intended to inform decision making by policy makers and research managers, and establish a baseline against which future changes in mercury levels in the environment can be attributed to changes in mercury emissions and climate. The Assessment will not only provide the scientific foundation on which the effectiveness of domestic policy making can be assessed, but will also be Canada’s contribution the Effectiveness Evaluation that will be prepared by UNEP following the successful negotiation of a global, legally binding agreement on mercury emissions in 2013.
Collaborative projects	The Government of Canada is active in collaborative projects, such as: <ul style="list-style-type: none"> <li>• Mercury Air Transport and Fate Research Partnership under UNEP’s Global Mercury Programme</li> <li>• Pan-Pacific Transport of Mercury Project under the International Polar Year</li> <li>• Environmental Monitoring and Assessment Program under the Commission for Environmental Cooperation’s Sound Management of Chemicals initiative</li> </ul>
Conferences and meetings	Canadian researchers participate in international mercury conferences and meetings, which are forums for the dissemination of scientific information and established science-policy links in the decision-making processes in Canada, the United States, the United Nations and the Arctic Council.

## ANNEX C

### Health Canada Guidelines

Health Canada, as a federal regulatory body, sets health standards and issues health advisories, when necessary, to help reduce mercury exposure. The department maintains a number of guidelines/recommendations on mercury, as indicated below.

#### Health Canada Guidelines/Recommendations for Mercury Exposure

Guideline	Maximum Acceptable Concentration
<b>Drinking Water</b>	
<i>Guidelines for Canadian Drinking Water Quality</i>	0.001 mg total mercury per litre
<b>Contaminated Sites</b>	
Soil Quality Guidelines for the protection of human health for Mercury (inorganic) [CCME, 1999]	
- Agricultural	6.6 mg/kg
- Residential/Parkland	6.6 mg/kg
- Commercial	24 mg/kg
- Industrial	99 mg/kg <sup>2</sup>
Provisional Mercury Vapour (tolerable concentration) [Richardson et al., 2009]	0.0006 mg/m <sup>3</sup>
<b>Food</b>	
Commercial Fish (General)	0.5 part per million total mercury <sup>1</sup>
Commercial Predatory Fish	1.0 part per million total mercury <sup>1</sup>
Provisional Tolerable Daily Intake (pTDI)	
- Adults	0.47 micrograms (µg) monomethyl mercury (MeHg) per kilogram of body weight per day (kg-bw/day)
Provisional Tolerable Daily Intake (pTDI)	
- Children, and women of child-bearing age	0.2 µg MeHg per kg-bw/day
<b>Blood</b>	
Blood (methyl mercury) for adults	
- Normal Acceptable Range	<20 µg/L
- Increasing Risk	20–100 µg /L
- At Risk	>100 µg/L
Proposed provisional blood (methylmercury) harmonized with the pTDI for children and women of child-bearing age [LeGrand et al., 2010]	
- Normal Acceptable Range	<8 µg/L

<sup>1</sup> This guideline applies to commercial fish only and not to fish caught for such non-commercial purposes as sport, recreation or subsistence. See Health Canada's website at [www.hc-sc.gc.ca/fn-an/pubs/mercur/risk-risque\\_strat-eng.php](http://www.hc-sc.gc.ca/fn-an/pubs/mercur/risk-risque_strat-eng.php) for derivation.





**[www.ec.gc.ca](http://www.ec.gc.ca)**

Additional information can be obtained at:

Environment Canada  
Inquiry Centre  
351 St. Joseph Boulevard  
Place Vincent Massey, 8th Floor  
Gatineau, Quebec K1A 0H3  
Telephone: 1-800-668-6767 (in Canada only) or 819-997-2800  
Fax: 819-994-1412  
TTY: 819-994-0736  
Email: [enviroinfo@ec.gc.ca](mailto:enviroinfo@ec.gc.ca)

Chemical Substances Website Inquiries  
c/o Health Canada  
A.L. 4905B  
Ottawa, Ontario K1A 0K9  
Telephone: 613-954-9807  
Fax: 613-952-8857  
Email: [info@chemicalsubstanceschimiques.gc.ca](mailto:info@chemicalsubstanceschimiques.gc.ca)  
Government of Canada

