



Background Study on Increasing Recycling of End-of-life Mercury-containing Lamps from Residential and Commercial Sources in Canada

Prepared by:

Christopher Hilkene, Hilkene International Policy
and
Krista Friesen, Pollution Probe

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Natural Resources Canada, Office of Energy Efficiency (OEE) — Established in April 1998 as part of Natural Resources Canada, the OEE's mandate is to renew, strengthen and expand Canada's commitment to energy efficiency. The OEE originated out of Canada's commitment to reduce GHG emissions by six percent below 1990 levels by the period between 2008 and 2012, as agreed to in the Kyoto Protocol.

Environment Canada, National Office of Pollution Prevention (NOPP) — The NOPP is Environment Canada's focal point for the management of toxic substances, implementation of federal pollution prevention policy and legislation and the development of new concepts and policy instruments that facilitate the transition to pollution prevention in Canada.

Executive Summary

Pollution Probe is pleased to release this background study on the state of recycling of mercury-containing lamps in Canada. The benefits of developing an efficient recovery and recycling infrastructure for mercury-containing lamps are three-fold:

1. protecting the environment from releases of mercury;
2. displacing virgin materials required for production of new lamps; and,
3. increasing the sustainability associated with the use of these energy efficient products.

The objectives of this study were to summarize international experience with respect to recovery and recycling of mercury-containing lamps; inventory Canadian fluorescent lamp recycling and recovery initiatives; estimate quantities of end-of-life bulbs and tubes being disposed of in Canada; estimate quantities of metals and other materials recovered through lamp recycling, and conversely, estimate the tonnage of metals and other materials being lost to disposal systems; estimate energy savings and associated greenhouse gas emission reductions from substitution of recycled fluorescent lamp materials for virgin materials in manufacturing operations; identify other environmental benefits accruing from current or potential recycling and recovery initiatives; identify recovery opportunities and barriers to fluorescent lamp recovery and recycling initiatives; examine options for stimulating greater recovery and recycling of mercury-containing lamps; and, identify critical factors for a meaningful cost-benefit analysis on enhanced recovery.

Because mercury is a potent neurotoxin that is bioaccumulative and persists in the environment, it is extremely important to properly handle and dispose of mercury-containing lamps. Moreover, the responsible use and end-of-life management of mercury-containing lamps (i.e., recycling them rather than landfilling them) can actually help to reduce the overall amount of mercury entering the environment. Because of the energy efficiency benefits they offer compared to incandescent lamps, mercury-containing lamps, such as fluorescent tubes, compact fluorescent lamps and high intensity discharge lamps, reduce the demand for energy from mercury-emitting coal-fired power plants.

By examining the steps other countries are taking to recover and recycle mercury-containing lamps, Pollution Probe learned that Canada, which has a current recovery rate of seven percent, is lagging by comparison.

The European Union has set a target recovery rate of 80 percent by 2006 for lighting products under the Directive on Waste Electrical and Electronic Equipment (WEEE). The United States has set a goal to raise its national recycling rate for mercury-containing lamps from the current 24 percent level to 80 percent by 2009. Taiwan implemented a compulsory fluorescent lamp recycling program in 2002, and as of 2003 its collection rate is approximately 87 percent. Korea introduced legislation in 2003 that expands and improves its

extended producer responsibility system, which comes into effect in 2006, to include all mercury-containing lamps.

During the course of this study, Pollution Probe conducted two surveys to examine current Canadian mercury-containing lamp recovery and recycling initiatives — one was sent to Canadian municipalities and the other was sent to Canadian lamp recyclers.

One of the most common challenges of initiating or running mercury-containing lamp recycling programs articulated by all 40 reporting municipalities is a lack of public knowledge about the environmental and health impacts related to the landfilling of mercury-containing lamps. Other challenges identified by the municipalities include shipping, handling and storage issues, additional costs, geographic issues, lack of expertise and lack of enforcement.

Municipalities identified education about the proper disposal of mercury-containing lamps as one of the principal tools the federal government could provide to them. Other potential tools identified include legislation banning the landfilling of mercury-containing products, funding to improve the recycling infrastructure for mercury-containing lamps, and incentives to encourage the industrial, commercial and institutional sectors to increase their recycling of mercury-containing lamps.

Each year approximately 60 million mercury-containing lamps reach the end of their life in Canada, according to the Canadian Council of Ministers of the Environment (CCME). The 1.2-metre (4 foot) fluorescent tube is the highest volume lamp sold and accounts for roughly 75 percent of the Canadian market. The typical 1.2-metre fluorescent lamp contains approximately 0.26 kg of glass, 0.02 kg of combined metals, 0.01 kg of phosphor powder and 11.6 mg of mercury.

The five Canadian lamp recyclers surveyed received roughly 4,279,300 end-of-life mercury-containing lamps in 2004, or seven percent of the total estimated end-of-life mercury-containing lamps entering the waste stream. The total approximate weight of these lamps was 1,261 metric tonnes. Of this, approximately, 1,240 metric tonnes of glass, metals, phosphor powder and mercury were recovered.

Besides reducing waste that ends up in landfill, recycling products and materials rather than manufacturing them from raw materials often results in reduced emissions of greenhouse gases (GHGs) through reduction of energy demands for material acquisition and manufacture, and avoidance of primary production process emissions. Numerical “GHG factors” that represent the net impact on GHG emissions of various waste management strategies applied to different materials in Canada (recently developed by Natural Resources Canada, Environment Canada and ICF Consulting) were used to calculate the savings in carbon dioxide equivalent (CO₂e) per year resulting from the recycling of end-of-

life lamps (rather than landfilling them). At the current diversion rate of seven percent the savings is 175 tonnes CO₂e per year. If all the mercury-containing lamps were recycled (100 percent diversion) the GHG savings would be about 2,300 tonnes CO₂e per year. Considering that Canada has made a commitment to reduce annual GHG emissions by about 270 million tonnes of CO₂e by the Kyoto Protocol commitment period, one can see that the principal benefit of recovering and recycling spent mercury-containing lamps is to prevent harm to the environment and human health through exposure to mercury.

In reaction to the information collected throughout this study, Pollution Probe proposes the following seven options the federal government could use to increase the recycling of mercury-containing lamps in Canada:

1. *Status Quo* — This option requires no increase in activity and carries no additional cost. It relies on market forces to stimulate recycling and provides the federal government and stakeholders more time to assess the best avenues for future action. However, the gap between Canada and that of other leading jurisdictions would continue to increase.
2. *Universal Waste Rule* — This option emulates the US approach by developing rules similar to the Universal Waste Designation to remove some of the barriers associated with the handling, storage and transportation of mercury-containing lamps.
3. *National Education and Outreach Program* — This option provides the federal government with an opportunity to demonstrate initiative through the provision of information and tools, while promoting voluntary action. Education and Outreach can be delivered as a stand alone program or as a program supporting Option 2. It could be undertaken at relatively low cost. This option integrates mercury-containing lamp recovery within existing and evolving provincial waste management programs. The program could be integrated with existing non-governmental sector recycling programs and/or established industry stewardship organizations.
4. *Federal Procurement Policy* — This option would see the federal government incorporating measures into its procurement policy that would restrict the purchasing of new mercury-containing lamps to suppliers that offer take-back programs for recycling purposes. It would demonstrate leadership by the federal government and would have a measurable increase in the national recycling rates for mercury-containing lamps. It is something that the federal government can do directly. Provincial governments may follow the federal example, but there is no guarantee.
5. *National Mercury-containing Lamp Recovery Challenge* — This option would see the federal government establishing a recovery target for end-of-life mercury-containing lamps from federal facilities and issuing challenges to provincial governments, the Federation of Canadian Municipalities and the

private sector to match federal performance. In this option, the federal government could demonstrate leadership via direct action and encourage action from other levels of government and the private sector.

6. *Disposal Bans* — This option would see the federal government working to establish legislation that would ban the landfilling of mercury-containing lamps in Canada. This is the preferred option of Canadian lamp recyclers and a number of the municipalities surveyed during this study. This approach is consistent with the efforts of some European countries and a number of US states, where recycling rates for mercury-containing lamps are significantly higher than in Canada.
7. *Extended Producer Responsibility* — This option is essentially an adaptation of the European model. It involves mandating manufacturers and retailers to take shared or full responsibility for managing the wastes that result from the products they produce and/or sell. This option would significantly increase the recycling rates of mercury-containing lamps. It could also result in a disposal charge being added to the price of mercury-containing lamps.

Pollution Probe recommends the Canadian federal government take the following four actions to increase the recycling of mercury-containing lamps in Canada:

1. The federal government should work with various sectors, but particularly the mercury-containing lamp manufacturers and recyclers, to develop appropriate counting systems and reporting protocols to ensure more accurate, sales and recovery data is available. Sales and recovery rates should be tracked on a regular basis (annually or bi-annually).
2. Environment Canada and Natural Resources Canada should advocate, through the Canadian Council of Ministers of the Environment (CCME), to establish interim and long-term Canadian recycling targets for mercury-containing lamps, consistent with targets in the United States and the European Union.
3. A multi-stakeholder workshop should be held (including manufacturers, retailers, recyclers, federal and provincial governments, municipalities, utilities and non-governmental organizations) to build a consensus position on a Canadian approach to increased recycling of mercury-containing lamps. A key outcome of this workshop should be the development of pilot projects and federal and provincial initiatives to regulate and manage the recycling of mercury from lamps.
4. Environment Canada should develop a national education and outreach program, similar to the US EPA's, to increase awareness of the proper disposal methods of mercury-containing products.

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1. Introduction

Pollution Probe is a non-profit environmental organization that works in partnership with all sectors of society to protect health by promoting clean air and clean water. Since 1996, Pollution Probe has been a national leader in actions and policies aimed at reducing mercury pollution in Canada and North America. Pollution Probe has developed a comprehensive, multi-faceted approach to achieving this goal, through advocating the reduction of mercury use and release.

This report is an extension of Pollution Probe's previous work on mercury and is specifically aimed at identifying the state of recycling infrastructure for mercury-containing lamps, including the opportunities and challenges involved in enhancing recycling of these products in Canada.

This report was funded jointly by Environment Canada's National Office of Pollution Prevention (NOPP), Natural Resources Canada's Office of Energy Efficiency (OEE) and the Enhanced Recycling Program of the *Government of Canada Action Plan 2000 on Climate Change* (also a Natural Resources Canada initiative). The benefits of elucidating the state of recycling of mercury-containing lamps are three-fold and relate to the aims of each funding partner respectively, as follows:

- Protecting the environment and human health from releases of mercury;
- Increasing the sustainability associated with the use of these energy efficient products; and,
- Strengthening the opportunities for recycling lamps, thereby displacing virgin materials required for production of new lamps — resulting in energy and greenhouse gas emission savings.

The use of fluorescent and high intensity discharge (HID)¹ lamps is increasing in Canada, driven largely by the energy efficiency benefits associated with these mercury-containing lamps relative to incandescent lamps (for example, mercury-containing lamps tend to be four to five times more energy efficient than incandescent lamps). As many as 60 million mercury-containing bulbs and fluorescent tubes are sold in Canada annually.² Their production utilizes valuable resources, including brass, copper, glass, mercury, phosphor powder and aluminum. Each of these components can be recovered through the recycling process for reuse, reducing the demand for virgin resources. Using recycled materials — especially in the case of metals — to manufacture new products

¹ "HID" is a general term used to designate four different types of lamps. They include mercury vapor, metal halide, high pressure sodium and low pressure sodium and all are used mainly outdoors (please see www.bchydro.com/business/investigate/investigate763.html for more information).

² CCME. 2001. *Mercury-Containing Lamps — Canada-wide Standards, Backgrounder*. www.ccme.ca/assets/pdf/merc_lamp_bground_e.pdf.

also reduces the energy burden and greenhouse gas emissions associated with mining, smelting and refining raw metals.

Despite a high recycling potential, the infrastructure for recycling of mercury-containing lamps in Canada is limited. The Canada-wide Standards for mercury call for the promotion and development of lamp recycling infrastructure for recovering the mercury in lamps.³

This study:

- Summarizes international experience with respect to recovery and recycling of mercury-containing lamps;
- Summarizes material composition of these lamps;
- Inventories Canadian fluorescent lamp recycling and recovery initiatives;
- Estimates quantities of end-of-life bulbs and tubes being disposed of (including tonnages of specific metals and materials);
- Estimates quantities of metals and other materials recovered through lamp recycling, and conversely, estimate the tonnage of metals and other materials being lost to disposal systems;
- Estimates energy savings and associated greenhouse gas emission reductions from substitution of recycled fluorescent lamp materials for virgin materials in manufacturing operations;
- Identifies other environmental benefits accruing from current or potential recycling and recovery initiatives;
- Identifies recovery opportunities and barriers (i.e., collection, handling challenges, municipal roles and responsibilities, distance to markets, etc.) to fluorescent lamp recovery and recycling initiatives;
- Examines options for stimulating greater recovery and recycling of mercury-containing lamps (including regulatory, public policy, voluntary, extended producer responsibility options); and,
- Identifies critical factors for a cost-benefit analysis of enhanced recovery.

Originally, it was intended that this study would also include:

- A summary of the quantities of mercury-containing lamps sold annually in Canada, distinguishing between quantities produced domestically versus imported and determining the brands/models sold in the highest volumes; and,
- An analysis by the CANMET research facility of high volume (domestic and imported) for their mercury content.

Neither the Electro-Federation Canada nor the Retail Council of Canada were able to provide sales data for mercury-containing lamps, and it was not intended that this study would involve conducting new market research. As a result, we were unable to use sales data to determine the number of waste units entering

³ CCME. 2001. *Initial set of Actions for the Canada-wide Standard for Mercury-Containing Lamps*. www.ccme.ca/assets/pdf/merc_lampinitacts_e.pdf.

the Canadian waste stream. Canadian figures have been estimated using available American waste/recycling data.⁴

The analysis of a sample of lamps that contain high volumes of mercury by CANMET was not performed because of insufficient funding. As well, it was felt that the data on the mercury content of lamps given in Section 6 of this report could be applied to mercury-containing lamps in general, especially since the typical 1.2-metre fluorescent tubes account for 75 percent of the market. Finally, because there are more than 5,000 different mercury-containing lamp types available, it was not thought that a composition study of any one lamp would provide any further insight into how much mercury is contained in these products overall.

⁴ Data were obtained from the Association of Lamp and Mercury Recyclers (ALMR) and the National Electrical Manufacturers Association (NEMA).

2. Environmental and Health Considerations for Recycling Mercury-containing Products

In 2003, Pollution Probe published *Mercury in the Environment: A Primer* to provide an overview of the presence and effects of mercury in the environment and its effects on human health. The primer identifies where mercury is being used and released, the risks associated with exposure to mercury and ways to help prevent mercury pollution. This publication can be downloaded from Pollution Probe's website at www.pollutionprobe.org/Publications/Primers.htm.

2.1 Sources of Mercury

The four principle pathways that result in mercury being released to the environment are:

1. Natural processes, such as volcanic eruptions;
2. Incidental to some other activity, such as production of electricity from the burning of coal;
3. Certain industrial processes, such as chlor-alkali plants; and,
4. From breakage, disposal or incineration of mercury-containing products, such as mercury-containing lamps.

According to a Canadian study published in 2004⁵, approximately 20 tonnes of mercury are released to air, land and water from mercury-containing products, with approximately four tonnes coming from fluorescent lamps. This value is greater than that reported by the *Canada-wide Standard for Mercury-Containing Lamps* (2001), which states that mercury-containing lamps “emit 180 kg per year of mercury vapour to the atmosphere during their life-cycle — 40 kg per year is emitted during lamp manufacturing, transport, landfilling and incineration; while 140 kg per year is emitted indirectly from power plants.” In addition, the CWS states that “waste lamps, whether broken or intact, contribute about 1,150 kg per year of mercury to landfill bound to the phosphor in the glass.”

2.2 Mercury as a Pollutant of Concern

Because mercury is a potent neurotoxin that is bioaccumulative and persists in the environment, the use and end-of-life management of mercury-containing products must be undertaken with extreme care.

The Vermont Department of Environmental Conservation's Mercury Education and Reduction Campaign⁶ provides the following description for mercury as a pollutant of concern: “Almost all mercury compounds are toxic and can be dangerous at very low levels in both aquatic and terrestrial ecosystems. Because

⁵ Hageen, LA and BA Lourie. Canadian Mercury Inventories: The Missing Pieces. *Environmental Research*, Vol. 95, Issue 3, March 2004, pp. 272–281.

⁶ Vermont Department of Environment Conservation Mercury Education and Reduction Campaign. www.anr.state.vt.us/dec/ead/mercury/environ/index.htm, accessed May 11, 2005.

mercury is a persistent substance, it can build up, or bioaccumulate, in living organisms, inflicting increasing levels of harm on higher order species such as predatory fish and fish-eating birds and mammals through a process known as “biomagnification”.

The nervous system is very sensitive to all forms of mercury. Exposure to high levels of mercury can cause permanent brain damage, central nervous system disorders, memory loss, heart disease, kidney failure, liver damage, loss of vision, loss of sensation and tremors.⁷ Mercury is also a suspected endocrine disruptor, which means it damages the reproductive and hormonal development and growth of fetuses and infants. Even low-level exposure to mercury has serious health effects that include neurological damage, reproductive system damage, behavioural problems and learning disabilities.⁸

Environment Canada’s *Mercury in the Environment* website provides information about the adverse environmental and health effects of mercury. The website can be accessed at www.ec.gc.ca/mercury.

2.3 Mercury Use in Lighting Products

Fluorescent lamps and high intensity discharge (HID) lamps are the two most common types of lamps that utilize mercury. A typical fluorescent lamp is composed of a phosphor-coated glass tube with electrodes located at either end. The tube contains mercury, of which only a very small amount is in vapor form. When a voltage is applied, the electrodes energize the mercury vapor, causing it to emit ultraviolet (UV) energy. The phosphor coating absorbs the UV energy, causing the phosphor to fluoresce and emit visible light. Without the mercury vapor to produce UV energy, there would be no light. The amount of mercury required is very small, typically measured in milligrams, and varies by lamp type, date of manufacture, manufacturing plant and manufacturer.⁹

Generally, mercury-free electric lamps cannot be substituted for mercury-containing lamps because of incompatibilities of light output, shape, color, life, electrical characteristics and excessive heat, or because their increased energy consumption may violate energy codes and overload electrical circuits.¹⁰

Over the past two decades, the mercury content in fluorescent bulbs has steadily decreased. The average four-foot lamp today contains over 75 percent less mercury than the same lamp would have contained in 1985. In 1989, the average mercury content in a fluorescent bulb manufactured in the US was 48.2 mg

⁷ Pollution Probe. 2003. *Mercury in the Environment: A Primer*.

⁸ Ibid.

⁹ North Carolina Department of Environment and Natural Resources. Mercury website. www.p2pays.org/mercury/lights.asp#lights1.

¹⁰ NEMA. 2001. *Alternatives to Mercury Containing Light Sources*. www.nema.org/gov/ehs/committees/lamps/upload/alt-mercury-lightsourcespdf.pdf.

(USEPA 1999a); this number decreased to 11.6 mg in 1999 for a typical four-foot lamp (NEMA 2000). In 1995, Philips Lighting introduced a low-mercury fluorescent lamp containing only 4.4 mg of mercury (USEPA 1999a).¹¹

Table 6-2 (page 22) shows the typical mercury content of various types of mercury-containing lamps.

2.4 Energy Efficiency of Mercury-containing Lamps

According to the Office of Energy Efficiency (OEE), compact fluorescent lamps (CFLs) use about 75 percent less energy than incandescent bulbs and can last for up to five years (based on three hours of use per day). Generally, fluorescent lamps are four to five times more efficient than incandescent bulbs.¹² Because mercury-containing lighting is energy efficient, less energy is needed for power than is needed for conventional lighting, thus translating to reduced mercury emissions from coal-burning power generating plants. According to the US EPA,¹³ over five years, the electricity production required to power an incandescent bulb would produce 10 mg of mercury, whereas powering a compact fluorescent light (CFL) for the same amount of time would only produce 2.4 mg of mercury.

Coal-fired electricity generation accounts for 27 percent of atmospheric mercury emissions to the Canadian environment¹⁴ — this is the largest single source in Canada. Therefore, the use of fluorescent lamps in place of incandescent bulbs can reduce energy consumption and may, as a result, decrease overall mercury emissions.

¹¹ US EPA. 2002. *Use and Release of Mercury in the United States*, Chapter 3: Manufacturing Processes Involving Mercury.

www.epa.gov/ORD/NRMRL/pubs/600r02104/600r02104chap3.pdf.

¹² US EPA. *Fact Sheet: Mercury in Compact Fluorescent Lamps (CFLs)*.

www.nema.org/lamprecycle/epafactsheet-cfl.pdf, accessed December 14, 2004.

¹³ *Ibid*, accessed May 12, 2005.

¹⁴ National Pollutant Release Inventory. 2001. www.ec.gc.ca/pbd/npri/npri_home_e.cfm.

3. Methodology

An initial literature review and Internet scan was conducted to identify Canadian and international mercury-containing lamp recovery and diversion programs.

To examine current Canadian mercury-containing lamp recycling and recovery initiatives, national surveys were conducted via email and fax involving the following sectors:

- Canadian municipalities, and,
- Lamp recyclers.

Copies of the surveys are included in Appendices 1 and 2.

To address the issue of varied data tracking and reporting formats, a set of assumptions was developed to assist in the normalization and standardization of data sets. Performance assumptions were also made regarding municipal programs that did not participate in the surveys. Assumptions are stated throughout the report.

The survey data were analyzed to estimate material generation, composition, recovery flows and program costs according to geography, population and type of program. Variable factors affecting recovery were identified and recommendations were developed.

The estimated waste diversion flows in Canada and the greenhouse gas emission reductions associated with mercury-containing lamp recycling were calculated. Information on the environmental considerations associated with the sound management of mercury from end-of-life lamps was identified through a comprehensive review of literature. Various options for stimulating greater recovery and recycling of mercury-containing lamps (including regulatory, public policy, voluntary and extended producer responsibility options) were examined. The critical factors for a cost-benefit analysis on enhanced recovery were identified.

Summary recommendations for optimizing mercury-containing lamp diversion are presented based on the information gathered during this study.

3.1 *Municipal Survey*

Municipalities across Canada were sent copies of the municipal survey by email. Municipalities in the three Northern Territories were not included in the distribution due to their comparatively sparse populations.

Contact information for municipal waste management officials was obtained from the Recycling Council of British Columbia (www.rcbc.bc.ca), the Recycling Council of Alberta (www.recycle.ab.ca), the Saskatchewan Waste Reduction

Council (www.saskwastereduction.ca), Resource Conservation Manitoba (www.resourceconservation.mb.ca), Waste Diversion Ontario (www.wdo.ca), l'Association des organismes municipaux de gestion des matières résiduelles (www.aomgmr.com), and various provincial and municipal government websites in the Atlantic Provinces.

The questions in the survey were designed to determine:

- the types of lamp collection programs run by municipalities;
- the levels of service available to the public;
- the quantities of mercury-containing lamps managed;
- the end markets;
- the costs and revenues associated with operating lamp collection programs; and,
- the challenges and opportunities of operating lamp collection programs.

The survey was sent to 318 municipalities; 40 surveys were returned.

3.2 *Lamp Recyclers Survey*

Lamp recycling companies from British Columbia, Alberta, Ontario and Quebec were surveyed as part of the study. The companies were drawn from the National Electrical Manufacturers Association (NEMA) website, as well as information obtained from the Fluorescent Lamp Recyclers Inc. The five Canadian companies identified were the only recyclers operating in Canada at the time the survey was initiated. A new company is establishing a base in Winnipeg, Manitoba, but had not yet commenced operations at the time this report was prepared.

Each company received the survey by fax or e-mail, accompanied by a letter of introduction from Pollution Probe that highlighted how the data would be used and ensured the confidentiality of company specific information.

The survey posed 14 questions focusing on the quantities of lamps and materials recovered, the origin of the lamps, market factors influencing the quantity of lamps recovered and the ultimate fate of the lamps.

All of the companies approached participated in the survey.

4. International Experience

The following section examines measures taken by countries other than Canada to collect and recycle mercury-containing lamps.

4.1 The United States

In the United States, used lamps are regulated as hazardous waste and are subject to *Resource Conservation and Recovery Act* requirements. In 1999, the US EPA added mercury-containing lamps to the federal list of universal wastes to remove some of the barriers associated with handling fluorescent bulbs as hazardous waste.¹⁵

A 1997 study by the US EPA of mercury emissions from discarded lamps showed that emissions of mercury from fluorescent lamps would be reduced under the universal waste approach.¹⁶ Handlers of universal wastes are subject to less stringent standards for storing, transporting and collecting these wastes than are handlers of other hazardous wastes.¹⁷

A handful of states (most notably Minnesota, California, Wisconsin and Florida) have policies that complement the federal regulations — they have

Universal Waste Regulations

In the United States, universal waste regulations have been implemented to streamline hazardous waste management standards for federal universal wastes. The regulations govern the collection and management of wastes, such as batteries, pesticides, thermostats and mercury-containing lamps, and are meant to increase the proper recycling or treatment.

These regulations, which are set forth in 40 CFR part 273, can be modified by individual states and additional categories of universal waste may be added.

The universal waste regulations apply to:

1. Handlers of universal waste (i.e., businesses that generate universal waste, take-back programs or collection programs);
2. Transporters that transport universal waste from handlers to other handlers, destination facilities or foreign destinations.
3. Destination facilities that recycle, treat or dispose of universal wastes as hazardous waste.

There are two types of handlers of universal waste — small quantity (those that accumulate less than 5,000 kg of universal waste at any one time) and large quantity handlers (those that accumulate more than 5,000 kg of universal waste at any one time). Both types of handlers must manage mercury-containing lamps in a way that prevents releases of any universal waste or component of a universal waste to the environment.

For more information, see www.epa.gov/epaoswer/hazwaste/id/univwast.htm.

¹⁵ US EPA. Universal Waste website. www.epa.gov/epaoswer/hazwaste/id/univwast.htm, accessed December 14, 2004.

¹⁶ Ibid.

¹⁷ Ibid.

banned mercury-containing lamps from their landfills.¹⁸

In 2002, the US EPA initiated an education and outreach program to promote recycling of mercury-containing lamps by commercial and industrial users.¹⁹ This program raises awareness of the proper disposal methods for these lamps to ensure compliance with federal and state universal waste rules. This outreach effort aims to increase the amount of lamps recycled in the short-term, as well as to have a lasting impact over the long-term. **The US EPA's goal is to raise the national recycling rate for mercury-containing lamps from the current 20 percent level to 40 percent by 2005, and to 80 percent by 2009.**

The US EPA has 10 cooperative agreements for the development and implementation of a coordinated nationwide mercury-containing lamp recycling outreach program, which is currently being implemented in two phases. Recipients of phase one cooperative agreements are developing outreach materials, such as fact sheets, databases, websites and public service announcements. Phase one recipients include the Association of Lighting and Mercury Recyclers (ALMR) (in collaboration with National Electrical Manufacturers Association (NEMA) and Solid Waste Association of North America (SWANA)), Hawaii Department of Health and Northeast Waste Management Officials' Association (NEWMOA).

Recipients of phase two contribution agreements will focus on program implementation. They will conduct education and outreach to segments of the lamp-disposing population by using and adapting the materials developed in phase one. Phase two recipients include Tennessee Department of Environment and Conservation, California Department of Toxic Substances Control, Center for Ecological Technology, Pacific Northwest Pollution Prevention Resource Center, St. Regis Mohawk Tribe, University of South Carolina and Vermont Department of Environmental Conservation.

In the US, the recycling rate for mercury-containing lamps has increased from two percent in 1990 to approximately 24 percent in 2004.²⁰ This increase is in part due to outreach efforts undertaken by the US EPA, ALMR and NEMA. In 2004, this percentage roughly equates to 144 million mercury-containing lamps being recycled and 456 million lamps going to landfills or incinerators.

¹⁸ University of Nebraska. *Handling Wastes: Household Fluorescent Lighting and PCB Ballasts*. <http://ianrpubs.unl.edu/wastemgt/nf190.htm>, accessed March 17, 2005.

¹⁹ US EPA. Outreach Effort to Increase Recycling of Mercury-Containing Lamps website. www.epa.gov/epaoswer/hazwaste/id/univwast/lamp.htm, accessed December 14, 2004.

²⁰ Association of Lighting and Mercury Recyclers website. www.almr.org/messageforall.htm.

4.2 Europe

Because solid waste is usually incinerated in Europe, rather than landfilled, European governments have confronted the problem of mercury from discarded lamps for some time. Historically, in European countries, such as Sweden, Denmark, Finland, Norway, Germany, Netherlands, Switzerland, and Belgium, the collection and recycling of mercury-containing lamps has either been recommended or legislated.²¹ These countries have declared mercury-containing lamps hazardous waste, and most have programs in place to deal with the problem.²²

The European Union passed the Directive on Waste Electrical and Electronic Equipment (WEEE) in 2003, which addresses the takeback of waste electrical and electronic equipment. The Restriction on Hazardous Substances Directive (RoHS), which accompanies the WEEE directive, “bans the use of heavy metals and brominated fire retardants in the manufacture of electrical and electronic equipment.”²³

The WEEE and RoHS directives were to be implemented in European member states by August 2004, with the collection, treatment and financing systems for WEEE in place by September 2005, and the first collection and treatment targets attained by December 2006.²⁴ Under the WEEE directive, the definition of electronic waste is broad, and includes just about any product used by consumers or businesses with a plug or a battery — including fluorescent lamps, high intensity discharge lamps and low pressure sodium lamps.²⁵

The WEEE directive requires producers to set up collection systems for electrical and electronic waste from households and other end users, and it requires member states to collect four kilograms per person by the end of 2006, although targets will not be compulsory until more data are available.²⁶ **The 2006 target recovery rate for lighting products under the WEEE directive is 80 percent.**²⁷

Specific examples of initiatives that some European countries have taken to manage mercury-containing lamps include Sweden’s Environmental Protection Agency’s (Naturvårdsverket) “cradle-to-grave” policy and Netherlands’ trash separation program.

²¹ University of Nebraska. *Handling Wastes: Household Fluorescent Lighting and PCB Ballasts*. <http://ianrpubs.unl.edu/wastemgt/nf190.htm>, accessed March 17, 2005.

²² *Ibid.*

²³ Letsrecycle.com. Waste Electrical and Electronic Equipment (WEEE) webpage. www.letsrecycle.com/legislation/weeefridge.jsp.

²⁴ *Ibid.*

²⁵ Raymond Communications. 2002. *Electronics Takeback Laws: A Summary*.

²⁶ *Ibid.*

²⁷ *Ibid.*

Sweden's Environmental Protection Agency's (Natursvårdsverket) "cradle-to-grave" policy places the economic liability for mercury management on lamp manufacturers. The agency intervenes if it finds that the manufacturers have not made sufficient progress towards reducing the amount of mercury in lamps. One manufacturer — Lumalampan AB — voluntarily collects discarded lamps from its customers and pays for mercury recovery. Lumalampan uses the recovered materials to manufacture new lamps. In addition, a company called Kviksilveråtervinning AB (Mercury Recycling, Inc.) claims to be recovering 14 percent of the country's domestic fluorescent lamp waste.²⁸

After just two years, a mercury-containing lamp recycling program in the **Netherlands** had already far exceeded a 50 percent lamp collection rate through a new trash separation program for household hazardous waste.²⁹

Germany also has a program in place, which has the largest lamp collection infrastructure in the world. There are about 220 locations where consumers can deposit old lamps, which are then transported to one of the country's 20 mercury-containing lamp recovery plants. In 1994, 70 to 80 percent of all used German mercury-containing lamps were expected to be taken to recovery plants, representing about 50–60 million lamps.³⁰

Two more examples of recovery rates of mercury-containing lamps include **Switzerland**, which has a collection rate of 60–70 percent (representing about five million lamps per year) and **Austria**, which has a collection rate of over 50 percent (representing approximately 2.5 million lamps annually).³¹ Austria subsidizes its lamp recycling program through a system in which customers pay two deposits of 15 ATS (about \$1.70 CDN) — one refundable and one not — when they buy their lamps.³²

4.3 Asia

In addition to the nine European countries that currently have "mandatory" electronics recovery laws, there are two Asian countries — Taiwan and Japan — that have electronics recovery laws. As well, Korea's Environment Ministry has published new takeback rules, and China plans to crack down on recycling in its electronics sector.³³

The Environmental Protection Administration (EPA) of **Taiwan** implemented a compulsory fluorescent lamp recycling program in 2002. According to the EPA's Bureau of Solid Waste Management, the principles laid out in Taiwan's *Waste*

²⁸ Ibid.

²⁹ Ibid.

³⁰ Ibid.

³¹ Ibid.

³² Ibid.

³³ Ibid.

Disposal Act show that the recycling of light sources, such as fluorescent bulbs, is mandatory.³⁴ Beginning November 1, 2004, citizens of Taiwan are able to recycle used fluorescent tubes in any of 2,000 shops island-wide that sell the lamps. Shop owners who fail to cooperate with the EPA on the recycling project will be fined between NT\$60,000 and NT\$300,000 (\$2,000–\$11,000 CDN).³⁵

The Taiwan EPA reported that 7,800 tonnes of fluorescent tubes were recycled in 2003 — this represents a collection rate of approximately 87 percent. All of the collected tubes were treated by four factories that have adopted advanced technologies that not only separate hazardous fluorescent powders, but also refine mercury.³⁶

Japan has recently introduced environmental legislation that has made it a world leader in recycling. The recovery of earth metals, such as mercury, that are used in fluorescent light bulbs is part of this recycling initiative. In 1997, the German company, Trienekens AG, joined in a 50/50 venture with Yashiki Kankyo Hozen Co., Ltd. to create a Nagasaki-based company that recycles used fluorescent lights and used batteries.³⁷

In May 2003, the **Korean** Ministry of Environment amended the *Act on the Promotion of Saving and Recycling of Resources* in an effort to expand and improve the Extended Producers Responsibility (EPR) System, which will come into effect in 2006.³⁸ The EPR system includes a total of 15 items, one of which is fluorescent light bulbs. Under the Korean EPR system, producers of the included items receive mandatory recycling obligations for their specific EPR item.

4.4 Australia

Many Australian government agencies are beginning to include mercury-containing lamp recycling as an environmental management system (EMS) activity. The Department of the Environment and Heritage (DEH) has committed to the ongoing recycling of fluorescent tubes from its operations.³⁹ The DEH recycled all fluorescent tubes removed from the recent demolition of the old Communications Centre, now the home of the Australian Greenhouse Office.

³⁴ Environmental Policy Monthly. June 2000. *Recycling of Fluorescent Light Tubes to Begin July 2001*. Volume III, Issue 12. http://ivy2.epa.gov.tw/out_web/english/EPM/issue0006.htm, accessed March 17, 2005.

³⁵ Taipei Times. October 30, 2004. *Tube recycling system launched*. www.taipaitimes.com/News/taiwan/archives/2004/10/30/2003208949.

³⁶ Ibid.

³⁷ Japanese External Trade Organization. www.jetro.go.jp/australia/sydney/info/publi/other/senviro.pdf%20, accessed March 17, 2005.

³⁸ Ministry of Environment, Republic of Korea. 2004. *Act on the Promotion of Saving and Recycling of Resources*. http://eng.me.go.kr/user/envnews/envnews_view.html?seq=275&page=1, accessed March 17, 2005.

³⁹ Australian Government, Department of the Environment and Heritage. www.deh.gov.au/industry/agency-performance/tubes.html, accessed December 14, 2004.

5. Mercury-containing Lamp Recovery in Canada

There are a variety of sectors that have the opportunity to play a role in the recovery and recycling of mercury-containing lamps in Canada. These sectors include the federal government, the provincial and territorial governments, municipalities, lamp recyclers, lamp manufacturers and retailers.

5.1 Federal and Provincial/Territorial Government Actions

In June 2001, the Canadian Council of Ministers of the Environment (CCME) implemented a Canada-wide standard (CWS) for mercury-containing lamps that takes “a pollution prevention approach by calling for a reduction in the average mercury content of lamps sold in Canada.”⁴⁰ The numeric target of the CWS is a 70 percent reduction by 2005 (from a 1990 baseline) and a total reduction of 80 percent by 2010.⁴¹ The CWS also includes a commitment to assess the feasibility of recycling and recovering mercury-containing lamps and to implement initiatives to encourage these types of activities. The implementation plans for the federal government and each Canadian province that has submitted a plan are described in Table 5.1.

Table 5.1: Implementation Measures for the Canada-wide Standard for Mercury-containing Lamps

Jurisdiction	Current Actions and Commitments to Manage Mercury Emissions from Fluorescent Lamps	Potential Future Actions
Federal Government	Monitors industry compliance with the reductions stipulated in the CWS — 80 percent reduction in the mercury content of lamps by 2010 (from a 1990 baseline). Works with industry and provincial/territorial jurisdictions where lamps are manufactured to reduce mercury emissions from operations. Environment Canada works with other federal departments to encourage further mercury reductions and energy conservation purchasing considerations for lighting of federal buildings (including the replacement of high mercury content lamps and utilization of low mercury, high efficiency lamps under programs such as the Federal Buildings Initiative). ⁴²	Initiate partnership agreements with other concerned agencies and stakeholder groups in Canada to develop economies of scale and on-site recycling facilities during building renovations and modernization.

⁴⁰ Environment Canada. Mercury and the Environment website. www.ec.gc.ca/mercury, accessed December 15, 2004.

⁴¹ Information on historic and current mercury content in lamps is provided in section 2.3.

⁴² Environment Canada. Mercury and the Environment website. www.ec.gc.ca/mercury, accessed December 15, 2004.

Jurisdiction	Current Actions and Commitments to Manage Mercury Emissions from Fluorescent Lamps	Potential Future Actions
Alberta	Operates the "Partners in Recycling" program, which started in February 2001. ⁴³ This program, which promotes the recycling of fluorescent lamps, is a joint initiative between Alberta Environment and Northern CARE (Coordinated Action for Recycling), City of Calgary, Recycling Council of Alberta and Alberta Plastics Recycling Association. The recycling rate for fluorescent bulbs in 2002 for this phase of the program was 23 percent. Reporting is done voluntarily through recyclers of fluorescent lamps and the results are posted by the government of Alberta. ⁴⁴	
Manitoba	Promotes lamps that contain lower levels of mercury in government buildings as part of its procurement policy. Assesses and promotes programs to recycle and recover mercury-containing lamps from government buildings. ⁴⁵ In 2001, Manitoba Conservation released a discussion paper that contained a proposed regulation on product stewardship requirements for the sellers and manufacturers of mercury-containing lamps. Although Manitoba Conservation reviewed comments from the public consultation and continues to meet with interested and affected stakeholders to hear views on various program options, the final decision on this program is still pending.	
New Brunswick	Uses low mercury/energy efficient fluorescent lights in government buildings, wherever possible, and encourages large property owners to use such lamps. ⁴⁶	Will explore the potential for the recycling of fluorescent light bulbs and mercury separation units. ⁴⁷

⁴³ Alberta Environment. Focus on Waste Reduction website. www.gov.ab.ca/env/waste/aow/flcr, accessed December 15, 2004.

⁴⁴ Ibid.

⁴⁵ Manitoba Conservation. Canada-wide Standards. www.gov.mb.ca/conservation/cwsmb/#mercury, accessed December 15, 2004.

⁴⁶ New Brunswick Environment and Local Government. Mercury website. www.gnb.ca/0009/0355/0009/index.htm, accessed December 15, 2004.

⁴⁷ Ibid.

Jurisdiction	Current Actions and Commitments to Manage Mercury Emissions from Fluorescent Lamps	Potential Future Actions
Newfoundland and Labrador	Does not intend to provide a public record of either recycling rates or mercury content of fluorescent lamps (as tracking will be done at the federal level).	Intends to examine the possibility of recycling fluorescent lamps, and if it is not cost prohibitive, the government may encourage and promote the recycling of mercury-containing lamps. May encourage building owners to use low mercury content fluorescent tubes.
Ontario	Waste Diversion Ontario ⁴⁸ tracks municipal waste collection and reports on actions associated with lamp recycling.	Will post any progress reports supplied by the federal government on the tracking and collection of fluorescent lamps on the Ministry of the Environment website. ⁴⁹
Saskatchewan		Intends to promote the recycling of fluorescent lamps where the infrastructure and capacity are sufficient to make it cost effective. ⁵⁰ Will evaluate lamp recycling and will partner with SaskPower, where appropriate, to bring into place collection and recycling initiatives.

⁴⁸ Waste Diversion Ontario. www.wdo.ca, access December 16, 2004.

⁴⁹ Ontario Ministry of the Environment. Canada-wide Standards in Ontario. www.ene.gov.on.ca/envision/cws/index.htm#mercury, accessed December 15, 2004.

⁵⁰ Saskatchewan Environment. Canada-Wide Environmental Standards Sub-agreement. www.se.gov.sk.ca/environment/protection/standards, accessed December 15, 2004.

5.2 Municipalities

In Canada, municipalities are responsible for the collection and management of municipal residential waste. Many Canadian municipalities have existing curbside collection/recycling programs in place; however, very few of these programs include mercury-containing lamps. As well, many municipalities operate depots for the collection of household hazardous wastes, which in theory include mercury-containing lamps.

5.3 Canadian Recyclers

Five companies currently recycle spent mercury-containing lamps in Canada. These five companies are Environmental Lamp Disposal Ltd., Fluorescent Lamp Recyclers Inc. (FLR), Nu-Life Industries Inc., PROECO Corporation and Recyclage de lampes fluorescent AAZ Inc (RLF).

Environmental Lamp Disposal Ltd.⁵¹ is a fluorescent lamp recycler whose mission is to recycle any component possible in the fluorescent lamp recycling process, thereby reducing the amount of dangerous chemicals and heavy metals that are directed to landfills each day. The company endeavors to inform the public and private sectors of the dangers associated with the practice of dumping lamps and strives to provide a service that will assist with the elimination of this practice. Environmental Lamp Disposal Ltd.'s recycling process differs from most of its competitors in that it does not pre-break lamps prior to feeding them into its machine. This eliminates the possibility of airborne contaminants during the process. The company utilizes a cold-water and vacuum process to collect contaminants during the recycling process. This process has been independently monitored and emission levels have been documented to be well below the maximum allowable levels for water and air quality set by local governmental regulations. Environmental Lamp Disposal Ltd. is located in the city of Edmonton and offers a pickup program within the province of Alberta. It also accepts delivered lamps from anywhere in Canada.

Fluorescent Lamp Recyclers Inc. (FLR)⁵² offers a full-service mercury-containing lamp recycling option. FLR is an approved recycler with the Ontario Ministry of the Environment, and has three Certificates of Approval to transport and recycle lamp waste. FLR is a member of the Ontario Waste Management Association and Emery Creek Environmental Association. FLR is committed to providing a safe, cost effective and environmentally friendly option to dealing with mercury and mercury-containing lamp waste. FLR will transport, process and document lamp waste it receives. FLR also provides annual recycling certificates, detailing volumes and weights of each element recycled and diverted from

⁵¹ Environmental Lamp Disposal Ltd. website. www.environmentallamp.com, accessed December 10, 2004.

⁵² ConTech website. www.contech.ca, accessed December 10, 2004.

landfill. FLR is located in Ayr, Ontario, and is considered to be one of Canada's leading lamp recycling facilities. It services clients from across the country.

Nu-Life Industries Inc.⁵³ offers environmentally sound management of fluorescent and other mercury-containing lights and all types of batteries. Using its specially designed fluorescent lamp machine, lamps are disassembled into their components — glass, which is used in the manufacture of fibreglass; end caps, which are used by smelters; and, mercury-containing phosphor powder, which is sent for removal of mercury through a distillation process. The mercury is then re-used. Nu-Life Industries is located in Aldergrove, British Columbia.

PROECO Corporation⁵⁴ is a fully licensed and approved recycling and disposal facility that has run a fluorescent tube recycling program for more than 10 years. On receipt, the fluorescent lamp tubes are transferred to a processing area for recycling. Once the lamps are inserted into a self-contained lamp crushing unit, emissions are controlled by a “High Efficiency Particle Air” (HEPA) and carbon filtration system. The components are then separated and the residuals are sent for recovery and recycling. PROECO Corporation has partnered with the Alberta Environment's “Action on Waste” program. PROECO Corporation provides access to the largest network of disposal and recycling facilities throughout North America. Their facility, located in Edmonton, Alberta, is capable of assisting with the disposal and/or recycling of all waste classes, with the exception of explosives and radioactive material.

Recyclage de lampes fluorescent AAZ Inc. (RLF) is a fully licensed and approved lamp recycling subsidiary of ChemTECH Environment Inc. RLF was established in 1996 in Coteau-du-Lac, Quebec, and offers a complete lamp recycling service to clients in Quebec, Ontario and the North Eastern United States.

5.4 Lamp Manufacturers

In Canada the lamp manufacturers are represented by the Electro-Federation Canada.⁵⁵ Members include GE Lighting, OSRAM Sylvania Ltd., Panasonic Canada Inc. and Philips Lighting. These members produce over 90 percent of the fluorescent and high intensity discharge (HID) lamps sold in Canada.

The Canadian lighting industry has been reducing the use of mercury on a per lamp basis through production and lamp design changes over the past 15 years. In 2000, the lamp manufacturers committed to activities as part of the Canada-Wide Standard for mercury including:

⁵³ Nu-Life Industries Inc. website. www.nulife-ind.com, accessed December 10, 2004.

⁵⁴ PROECO Corporation website. www.proeco.com, accessed December 10, 2004.

⁵⁵ Electro-Federation Canada website. www.electrofed.com, accessed October 25, 2005.

- Reduction of average mercury content per lamp for all fluorescent and HID lamps sold in Canada of at least 60 percent by 2005 and 80 percent by 2010 (from the 1990 base line average).
- Provide a report to the CCME with the final 1990 baseline information (by October 31, 2000). And in 2004, 2007 and 2012 report on progress towards accomplishing the reduction targets in Canada to representatives of CCME. The reports for 2000 and 2004 have been provided.

Electro-Federation Canada reported that the lighting industry expects to continue to reduce the average mercury content per lamp sold in Canada. Canadian lamp manufacturers exceeded the 2005 goal in 2003. In 1990 average mercury use per lamp was 43 mg and in 2003 average mercury use per lamp was 11.4 mg, or a reduction of 73.5 percent (versus the target of 70 percent in 2005).

Most industry members have also begun to mark mercury-containing lamps with a circle-HG on the monogram to indicate which lamps contain mercury for easy user identification. As well, most mercury containing lamp packaging now includes the lamprecycle.org website, which lists lamp recyclers in the US and Canada.

5.5 Retailers

Some major retailers in Canada have implemented take-back programs for the mercury-containing lamps that they sell. For example, IKEA encourages its customers to return certain types of waste, such as compact fluorescent light bulbs, batteries and packaging. The store then ensures that the waste is taken care of in the proper way, by recycling for example.⁵⁶

5.6 Other Efforts

An example of another mercury-containing lamp recovery effort in Canada is the one operated by a non-governmental organization, EcoSuperior. Its Merc-Divert fluorescent light recycling program recycles spent lamps from major industries in Thunder Bay and communities along the North Shore of Lake Superior.

EcoSuperior's website⁵⁷ reports that "this project is aimed at diverting mercury from the waste stream and the environment. The process provides 100 percent diversion from landfill. The program has now been streamlined to increase volume. Participating industries and organizations have identified efficiencies leading to:

- Central consolidation of spent fluorescent lights from all participating facilities;
- The opportunity to ship larger volumes of spent lights for recycling in a single load;

⁵⁶ IKEA Group Corporate website. www.ikea-group.ikea.com, accessed October 25, 2005.

⁵⁷ EcoSuperior Environmental Programs. MERC Divert webpage. www.ecosuperior.com/fluoro.html, accessed October 17, 2005.

- Full package recycling with a single phone call (807-345-2378) including pickup, transportation and recycling;
- Reliable pickup and transportation with a reputable firm;
- A single bill for all aspects of the program;
- A storage option for those facilities with space constraints; and,
- An optional reduced package for those facilities which would like to deliver their spent lamps to the central consolidation point.”

6. Generation and Material Composition

6.1 Sources and Assumptions

There are approximately 5,000 different fluorescent lamp products currently on the market in North America. Material composition and life span vary according to type of lamp, manufacturer and manufacturing date. Due to the large number of products and their diversity, no direct attempt was made in this study to determine the generation of waste based on sales figures. Life span and composition figures are provided for information purposes only and have not been used to calculate waste generation. Generation data were obtained through a scan of available literature.

Life Span

A review of product information on the General Electric, Osram Sylvania and Philips websites was conducted to determine the average life spans of mercury-containing lamps. There is a great amount of variance in the life spans of these products.

The average life span ranges for mercury-containing lamps are:

- Compact florescent lights — 5,000–10,000 hours;
- T8 (1" diameter) and T12 (1.5" diameter) fluorescent tubes — 10,000–20,000 hours; and,
- HID lamps — 20,000–27,000 hours.⁵⁸

Material Composition

The approximate weights of the various mercury-containing lamps are shown in Table 6.1.

Table 6.1: Approximate Weights of Various Lamp Types*

Lamp Type	Weight Data from Environment Canada**	Weight Data from Electro-Federation Canada***
4-foot fluorescent	0.3125 kg	0.245 kg
8-foot fluorescent	0.625 kg	0.530 kg
HID	0.220 kg	0.220 kg
High Pressure Sodium	0.220 kg	0.150 kg

* the weight of individual lamps may vary

** Source: Environment Canada, Pollution Prevention Fact Sheet #21 — Federal Programs Division, www.on.ec.gc.ca/pollution/fpd/fsheets/4021-e.html.

*** Source: Electro-Federation Canada, communications September 2005.

⁵⁸ Data from the manufacturers' websites — www.sylvania.com, www.gelighting.com, www.lighting.philips.com.

As shown in Table 6-1, there is discrepancy in the weights of the different types of mercury-containing lamps. In particular, during the course of this project, three different weights were supplied for 4-foot fluorescent tubes. Environment Canada uses an average weight of 0.3125 kg, the Electro-Federation Canada uses an average weight of 0.245 kg and the Fluorescent Lamp Recyclers (FLR) use an average weight of 0.29 kg. For this study, we used the weight provided by FLR (0.29 kg) because it is from current data and was supplied early in the research. These discrepancies demonstrate that further work is needed to reconcile existing data.

The 1.2-metre (4-foot) fluorescent lamps are the highest-volume lamps sold, accounting for approximately 75 percent of the market.⁵⁹ The typical 1.2-metre fluorescent lamps contain approximately 0.26 kg of glass, 0.02 kg of combined metals and 0.01 kg of phosphor powder.⁶⁰ The filament and cardboard insert found in the end caps are not recycled, but are burned off during recycling. According to Environment Canada, the typical 1.2-metre fluorescent lamps contain about 11.6 milligrams (mg) of mercury.⁶¹

Table 6.2 shows the typical mercury content of various types of mercury-containing lamps.

Table 6.2: Mercury Content of Specific Mercury-containing Lamps

Lamp type	Hg content (mg)
Compact Fluorescent Lamps	1 – 25
Fluorescent U-tubes	3 – 12
Fluomeric Lamps	~ 2
Linear Fluorescent Lamps: Mercury reduced	3 – 12
Non-mercury reduced	10 – 50
Mercury Vapour Lamps: 75-watt	25
1500-watt	225
Metal Halide Lamps: 75-watt	25
1500-watt	225
Sodium Vapour Lamps: 35-watt	20
1000-watt	145

Source: Environment Canada's Mercury and the Environment Program.

⁵⁹ Environment Canada. Federal Facilities Mercury Info-Guide — Federal Programs Division. www.on.ec.gc.ca/pollution/fpd/merc/merc-1000-e.html.

⁶⁰ Interview with Tom Maxwell, Fluorescent Lamp Recyclers, February 2005.

⁶¹ Environment Canada. Federal Facilities Mercury Info-Guide — Federal Programs Division. www.on.ec.gc.ca/pollution/fpd/merc/merc-1000-e.html.

Number of Waste Units Available in 2004

Attempts to obtain sales and life-expectancy data for the Canadian market from lamp manufacturers, manufacturing and retail associations, and market research companies were unsuccessful. Canadian figures have been estimated using available American waste/recycling data.

According to the Association of Lamp and Mercury Recyclers (ALMR), approximately 600 million mercury-containing lamps entered the United States' waste stream in 2004.⁶² Given that Canada has approximately one-tenth the population of the US, we estimate that approximately 60 million mercury-containing lamps entered the Canadian waste stream in 2004. This number is consistent with CCME projections,⁶³ as well as estimates used by Canada's fluorescent lamp recyclers.

In the absence of available Canadian sales data, a mandatory national deposit system in Canada would enable "counting" how many units are sold per year. A national landfill ban would ensure that no end-of-life units end up anywhere other than a recycler, enabling counting of recycled units.

⁶² Association of Lighting and Mercury Recyclers website. www.almr.org.

⁶³ CCME. 2001, *Mercury-Containing Lamps — Canada-wide Standards, Backgrounder*. www.ccme.ca/assets/pdf/merc_lamp_bground_e.pdf.

7. Municipal Recovery Programs

The information in this section reflects data collected via a national municipal survey. Appendix 1 lists the survey questions and Appendix 3 reports the survey responses. The survey was designed to determine:

- the types of lamp collection programs run by municipalities;
- the levels of service available to the public;
- the quantities of mercury-containing lamps managed;
- the end markets;
- the costs and revenues associated with operating lamp collection programs; and,
- the challenges and opportunities of operating lamp collection programs.

7.1 Survey Participation Rates

The survey was sent via email to 318 municipalities in the 10 Canadian provinces (the survey was not sent to municipalities in the three northern territories). Appendix 4 lists the municipalities that received the survey.

Forty Canadian municipalities responded to the survey. The participating municipalities were from six of the 10 provinces to which the surveys were sent. Responses were not received from any municipalities in Prince Edward Island, New Brunswick, Quebec or British Columbia.

As indicated in the following table, survey participation rates varied considerably in the six participating provinces.

Table 7.1: Municipal Survey Participation Rates by Province

Province	Number of Surveys Submitted	Population in Participating Communities	Provincial Population ⁶⁴	Percent Participation (by population)
Newfoundland	2	119,009	512,930	23.2
Nova Scotia	7	198,438	908,007	21.9
Ontario	18	1,838,505	11,410,046	16.1
Manitoba	2	630,200	1,119,583	56.3
Saskatchewan	2	16,400	978,933	1.7
Alberta	9	248,105	2,974,807	8.3
Total	40	3,050,657	17,904,306	17.0

The surveys were submitted by municipalities of varying sizes. The following is a breakdown by population size of the municipal surveys received:

- two municipalities with 500,000–1,000,000 residents;
- five municipalities with 100,000–500,000 residents;
- eight municipalities with 50,000–100,000 residents;

⁶⁴ Statistics Canada. 2001 Population Data.

- five municipalities with 25,000–50,000 residents; and,
- 20 municipalities with less than 25,000 residents.

7.2 Municipal Program Design — Survey Results

The detailed responses from the 40 submitted surveys can be found in Appendix 3. The survey began with basic questions of the municipalities' overall recycling programs. Twenty-five of the 40 responding municipalities have an existing curbside recycling program, and one municipality will be starting a program in June 2005. The details of these recycling programs (i.e., days and hours of operation, location, etc.) can be found in Appendix 3. Thirty-two of the 40 responding municipalities have an existing depot recycling program.

Mercury-containing Lamp Collection Programs

In terms of the collection of mercury-containing lamps, seven of the 40 responding municipalities collect lamps for the purpose of reuse or recycling. A number of other municipalities indicated that they collect mercury-containing lamps, but send them to landfill, rather than recycling them. The existing municipal lamp collection programs began between 2001 and 2002.

The remainder of this section deals exclusively with the responses from the seven municipalities that collect lamps for the purpose of reuse or recycling.

The seven municipalities that collect lamps for recycling indicated that they accept the following types of mercury-containing lamps:

- All seven municipalities accept fluorescent tubes;
- Four municipalities accept compact fluorescent lamps;
- Three municipalities accept high intensity discharge/mercury vapour lamps; and,
- One of the seven municipalities accepts high pressure sodium/low pressure sodium lamps.

The following mechanisms are used by the seven municipalities to collect the mercury-containing lamps (two of the municipalities use multiple mechanisms):

- Five municipalities have the lamps dropped off at a permanent recycling site and/or hazardous waste depot;
- Two municipalities have the lamps dropped at a temporary recycling site and/or hazardous waste depot;
- One municipality has the lamps dropped off at a waste transfer site;
- One municipality partners with a fluorescent lamp recycler for collection of the lamps;
- One municipality has the lamps dropped off at a local environmental non-profit office.

The municipalities were asked what restrictions, if any, are applied to the lamps that they collected. The following are their responses:

- One municipality said they have no restrictions;
- Two municipalities said that the tubes have to be intact to be collected;
- One municipality mentioned a limit on the quantities that could be collected;
- One municipality said the tubes they collect could not be taped together; and,
- One municipality requires that the tubes be dropped off while the depot is manned.

Six of the seven municipalities that collect lamps for recycling indicated that they pay a recycler to take the lamps they collect, and the seventh municipality indicated the lamps they collect are crushed in a bulb-eater, then the spent filters are collected by a household hazardous waste firm at cost and the glass is disposed of, or recycled if an option is found.

Data Collection

Six of the seven municipalities that collect lamps for recycling have kept records of the amounts collected. The seventh municipality was able to estimate the quantity of lamps collected. The most recent data for these municipalities were collected in 2003 to 2004.

From the data provided by these seven municipalities, it is estimated that they collected a total of 191,000 mercury-containing tubes. This equates to the collection of 49,660 kg of glass, 3,820 kg of metals, 1,910 kg of phosphorus powder and 2.2 kg of mercury (based on the assumption that each tube contains 0.26 kg of glass, 0.02 kg of metals, 0.01 kg of phosphorus powder and 11.6 mg of mercury).

Another source of data for the collection of mercury-containing lamps is Waste Diversion Ontario (WDO).⁶⁵ WDO compiles data from Ontario municipalities on the types and amounts of household special waste that it collects. The 2003 data from WDO show that 17 Ontario municipalities reported collecting 13,664 kilograms of fluorescent lamps, which converts to 44,077 tubes (based on the assumption that each 1.2-metre tube weighs 0.31 kg). The collection of 44,077 tubes means that 11,460 kg of glass, 880 kg of metals, 440 kg of phosphorus powder and 0.44 kg of mercury were collected in Ontario in 2003 (based on the assumption that each tube contains 0.26 kg of glass, 0.02 kg of metals, 0.01 kg of phosphorus powder and 11.6 mg of mercury).

Financial

None of the seven municipalities that collect lamps for recycling charge a fee for collection, disposal or recycling of residential mercury-containing lamps. One said there was a charge if residents brought their lamps to a local private

⁶⁵ Waste Diversion Ontario website. www.wdo.ca, accessed February 21, 2005.

company. Another municipality indicated there was a charge for the commercial sector to have their lamps collected.

Municipalities were asked to determine the costs of a number of aspects of their lamp collection programs, including the cost of collection, the cost of promotion and education, the cost of coordinating the program and the cost of depot/special collection day staffing. Many municipalities indicated little to no extra cost for their lamp collection programs. In most cases this was because they lumped a number of their recycling and household hazard waste costs together.

The specific costs were identified by the municipalities were:

- The cost of collection for lamp collection programs ranged from \$210 per year to \$9,000 per year (average value: \$3,250).
- The cost of promotion and education for lamp collection programs ranged from \$50 per year to \$500 per year (average value: \$250).
- The cost of coordination for lamp collection programs ranged from \$50 per year to \$500 per year (average value: \$275).
- Only one value was reported for the cost of depot/special day staffing for lamp collection programs, which was \$1,200 per year.

Challenges and Opportunities

This section contains responses from all 40 municipalities that submitted surveys. The municipalities were asked to identify any particular challenges they face in running, or initiating, collection programs for mercury-containing lamps. The following are general themes of **challenges** that emerged.

Education and outreach — The most common challenge identified by municipalities was the promotion of lamp recycling programs to their residents. It is important for the public to understand the environmental and health benefits of reducing or eliminating the practice of “landfilling” mercury-containing products. At this point, many people don’t realize that fluorescent lamps and other lights contain mercury and should be handled as household hazardous waste. In some cases, residents may find it easier to include mercury-containing lamps in their garbage than to deliver to them to hazardous waste depots or other drop-off locations. It was suggested that public participation in this type of program may be a challenge, as the public is often indifferent to such programs.

Shipping, handling and storage issues — Municipalities identified that shipping and handling of mercury-containing lamps is difficult and dangerous, and that they must ensure the lamps arrive at the recycler unbroken. Municipalities need to find companies that can collect the lamps and then transport them to the appropriate recycling operation. Municipalities store the lamps on-site until quantities warrant processing and delivery to a recycler. This can mean the lamps sit around for a long time if there is low volume, or, on the

other hand, lack of space can be an issue for municipalities that collect high volumes of lamps.

Additional costs — Many municipalities identified additional costs as a challenge for operating lamp collection programs. Specific costs that were identified included the costs of proper disposal, hiring a licensed hauler, secondary storage, amending CofA (if possible) and program promotion.

Local/geographic issues — A number of municipalities identified rural settings as a particular challenge for lamp collection programs. In many rural areas, there is no collection of garbage or recycling, it is all done by resident drop-off at landfill sites. There was an opinion that a curbside lamp collection program would be most effective because many ratepayers will not drive their spent light bulbs to a specific hazardous waste depot, as they do not understand the benefit.

Lack of staff and expertise — Some municipalities mentioned that they do not have the staff available to run a lamp collection program. As well, there was concern that municipalities currently lack expertise to run collection programs.

Lack of enforcement — Municipalities felt that it is difficult to keep hazardous items, such as mercury-containing lamps, from being deposited with regular garbage. Enforcement to keep these lamps out of landfills will be difficult unless the items are banned.

Non-residential sources of lamps — Most municipalities do not currently accept fluorescent tubes from private businesses. This is because the municipality is charged a disposal fee for the lamps, but the private businesses do not financially support the municipal recycling programs or depots.

When asked to identify any **tools or support** that would help them run, or initiate, a collection program for mercury-containing lamps, the municipalities identified the following general themes:

Education and access to information — One of the most common forms of support that was identified by municipalities was education — both for the public, as well as for the municipal employees that would be involved in the lamp collection programs. It was felt that a collection program would be most successful if residents had information and education materials about mercury-containing lamps, specifically which ones to look for, so that the lamps could be removed from the waste stream and set aside for recycling. Another idea to educate the public was to have information printed on the boxes the lamps come in describing the proper disposal methods or to have information for the consumers at the point of purchase. In terms of material and information that would assist the municipal employees involved in the lamp collection programs, the following were identified:

- An up-to-date list of available recyclers by region;
- Case studies and contact information for successful Canadian mercury recycling programs;
- Sample agreements where the service is contracted by other Canadian municipalities;
- Promotional awareness-raising materials on the benefits of recycling or capturing mercury;
- Information on the technologies associated with lamp recycling (i.e., “Bulb Eater” type units);
- An assessment of the financial and environmental implications associated with lamp recycling programs; and,
- Baseline data showing public attitudes and profiles of who uses the lamps, where the lamps come from, and quantities produced per household.

Funding — Many of the municipalities felt that funding intended specifically for this waste type would be a useful tool. This funding could be supplemented by a cost-effective recycling company within close proximity to keep transportation costs down and/or by contracted service providers.

Upgrades to collection systems — Many municipalities considered their current collection systems to be insufficient to handle mercury-containing lamps. Changes would need to be made to ensure that the lamps would not be broken during collection. Specific suggestions included lamps being returned in their original packaging, as well as the idea of weather proof containers. One other aspect of residential collection that was identified was the potential need for specialized commercial haulers to deal with the mercury.

Legislation — One municipality stated that unless there was a law that forced it to collect and recycle mercury-containing lamps, its council would be unlikely to increase budget spending for such a program. Other municipalities said that disposal bans would motivate change in the collection and recycling of mercury-containing products.

Producer responsibility — One municipality suggested that the public taxpayer should not be responsible for funding the management of mercury-containing lamps. Rather, any product sold to a consumer that requires such special end-of-life handling (i.e., storage, transport and disposal) due to the serious toxicological effects of the contents, must be given additional consideration by the producers.

Finally, the municipalities provided the following thoughts on how the federal government could stimulate the recovery of mercury-containing lamps:

Legislation — Some municipalities said that the federal government should introduce and pass legislation banning all mercury-containing products from landfills. If a ban was put in place, it would be important for the federal

government to assist in setting up a network for recycling mercury-containing lamps.

Funding — Many municipalities said the federal government should provide funding to implement and support municipal mercury-containing lamp collection programs. Funding would help to set up the infrastructure for the collection and recycling, as well as being applied to awareness-raising programs for residents.

Information and outreach — It was thought that the federal government could develop an advertising campaign for lamp collection programs that would provide municipalities with information on which lamps contain mercury and how to recover those lamps. The federal government could also develop and provide municipalities with information and material on public education, community based social marketing, public awareness and access to recycling opportunities.

Incentives — One municipality said the federal government should launch an incentives program to encourage industrial, commercial and institutional facilities to collect and recycle mercury-containing lamps. Another municipality said that applying a specific tax to mercury-containing items that would then be used to support collection programs would reduce the financial burden to municipalities.

Producer responsibility — One municipality said the federal government should require manufacturers to disclose, via labelling, that their products contain mercury, and the manufacturers should be obliged to establish and fully finance consumer education, convenient product take-back facilities and end-of-life management.

7.3 Overview of Municipal Recovery Programs

Forty Canadian municipalities (representing a combined population of 3,050,657 people, or 9.5 percent of the Canadian population) responded to the survey concerning recycling of mercury-containing lamps. Seven of the 40 municipalities (with a combined population of 367,352 people, or 1.1 percent of the Canadian population) that returned the municipal surveys collected end-of-life mercury-containing lamps for recycling. A number of the other municipalities collected spent lamps, but sent them to landfill.

All seven municipalities that had mercury-containing lamp recycling programs accepted fluorescent tubes, four accepted compact fluorescent lamps, three accepted high intensity discharge/mercury vapour lamps and one accepted high pressure sodium/low pressure sodium lamps.

The most common type of service used by the municipalities that recycle mercury-containing lamps is drop-off at a recycling site or hazardous waste depot (permanent or temporary). None of the responding municipalities offered

curbside collection as an option for mercury-containing lamps intended for recycling.

Six of the seven of municipalities surveyed reported that they track quantities of the lamps collected. The seventh municipality was able to estimate the quantity of lamps collected. **It is estimated that municipalities participating in the study collected 191,000 mercury-containing lamps in 2004, resulting in the recovery of 49,660 kg of glass, 3,820 kg of metals, 1,910 kg of phosphor powder and 2.2 kilograms of mercury.**

The collected mercury-containing lamps translate into an average of 0.5 lamps recycled per person in the communities that have mercury-containing lamp recycling programs and 0.06 lamps per person for all 40 of the reporting municipalities.

None of the municipalities surveyed indicated that they derived revenue from the recycling of mercury-containing lamps. However, six of the seven municipalities pay a recycler to take the mercury-containing lamps they collect. Many municipalities indicated little to no extra cost for coordinating and running their lamp collection programs. In most cases, this was due to the lumping together of their recycling and household hazardous waste costs.

One of the most common challenges of initiating or running mercury-containing lamp recycling programs articulated by all 40 reporting municipalities is a lack of public knowledge about the environmental and health impacts related to the landfilling of mercury-containing lamps. Most people do not realize that fluorescent lamps contain mercury and should be handled as hazardous waste. Other challenges identified by the municipalities include shipping, handling and storage issues, additional costs, geographic issues, lack of expertise and lack of enforcement.

Municipalities identified education about the proper disposal of mercury-containing lamps as one of the principal tools that the federal government could provide them with. Other potential tools identified include legislation banning the landfilling of mercury-containing products, funding to improve the recycling infrastructure for mercury-containing lamps, and incentives to encourage the industrial, commercial and institutional sectors to increase their recycling of mercury-containing lamps.

8. Canadian Recycling Rates

In 2004, Canadian fluorescent lamp recyclers reported processing an estimated 4,279,266 units (combined fluorescent tubes, compact fluorescent lamps, high intensity discharge lamps, mercury vapour lamps, high pressure sodium lamps and low pressure sodium lamps) weighing approximately 1,261 metric tonnes.

8.1 Recycling Rates by Weight and Lamp Type

The percentage of mercury-containing lamps being recovered was derived by dividing the number of units recycled by the total number of units entering the waste stream. **Table 8.1 indicates that the percentage of mercury-containing lamps recycled in 2004 was roughly seven percent of all mercury-containing lamps disposed of. Consequently, 93 percent of end-of-life mercury-containing lamps in Canada were not recycled and were disposed of by other means, the majority likely sent to landfills.**

Table 8.1: Estimated Percentage of Canadian Mercury-containing Lamps Recycled 2004 (per unit)

Estimated Waste Generated	60,000,000
Units Recycled	4,279,266
Percent Recycled	7%

Tables 8.2 through 8.5 calculate the relative weights (in kilograms) of the different mercury-containing lamp types recycled in Canada during 2004.

Table 8.2: Fluorescent Tubes Recovered in 2004 (by weight)

	Company A	Company B	Company C	Company D	Company E	Total
Weight of Lamps Recovered	125,000	770,030	28,600	22,680	315,076	1,261,386
Percentage Fluorescents	0.65	0.93	0.96	0.79	0.92	
Weight of Fluorescents	81,250	716,128	27,456	17,917	289,870	1,132,621

Approximately 1,133 metric tonnes of fluorescent tubes were recycled in 2004 (by weight).

Table 8.3: Compact Fluorescent Lamps (CFL) Recovered in 2004 (by weight)

	Company A	Company B	Company C	Company D	Company E	Total
Weight of Lamps Recovered	125,000	770,030	28,600	22,680	315,076	1,261,386
Percentage CFLs	0.15	0.01	0.01	0.12	0.03	
Weight of CFLs	18,750	7,700	286	2,722	9,452	38,910

Almost 40 metric tonnes of compact fluorescent lamps were recycled in 2004 (by weight).

Table 8.4: High Intensity Discharge (HID)/Mercury Vapour (MV)/High Pressure Sodium (HPS)/Low Pressure Sodium (LPS) Lamps Recovered in 2004 (by weight)

	Company A	Company B	Company C	Company D	Company E	Total
Weight of Lamps Recovered	125,000	770,030	28,600	22,680	315,076	1,261,386
Percentage HID/MV/HPS/LPS	0.2	0.06	0.03	0.09	0.05	
Weight of HID/MV/HPS/LPS	25,000	46,202	858	2,041	15,754	89,855

Roughly 90 metric tonnes of high intensity discharge, mercury vapour, high pressure sodium and low pressure sodium lamps were recycled in 2004 (by weight).

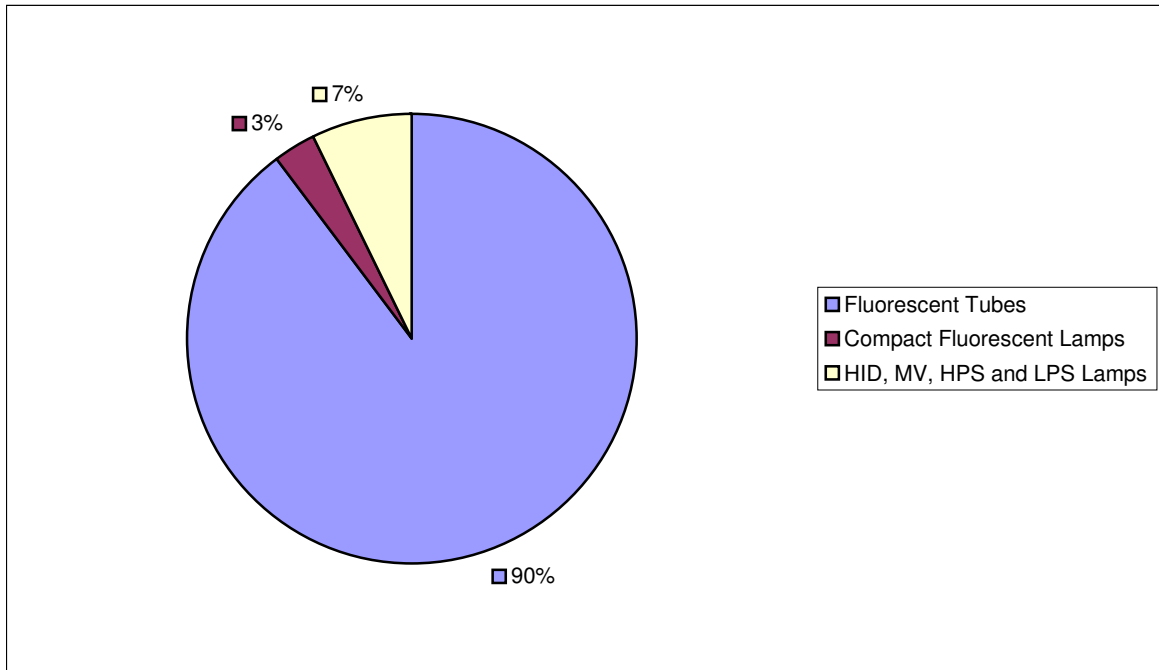
Table 8.5 and Figure 8.1 provide summaries of the relative breakdown of lamp types recycled in Canada in 2004. Relative contribution (percentage) was calculated based on the weight of the lamp types recycled relative to the total of all lamps recycled.

Table 8.5: Total Weight of Recycled Mercury-containing Lamps in 2004

	Fluorescent Tubes	Compact Fluorescent Lamps	HID, MV, HPS and LPS Lamps	Total
Weight by Lamp Type (kg)	1,132,621	38,910	89,855	1,261,386
Relative Percentage	90%	3%	7%	100%

Figure 8.1 demonstrates that fluorescent tubes account for approximately 90 percent of all lamps recycled in Canada during 2004. CFLs (three percent), HID, mercury vapour and HPS/LPS lamps (seven percent) account for the remaining 10 percent.

Figure 8.1: Total Weight of Recycled Mercury-containing Lamps in 2004



As mentioned earlier, fluorescent tubes comprise roughly 75 percent of sales of mercury-containing lamps. Yet they account for 90 percent of the mercury-containing lamps being recycled by weight in Canada.

8.2 Materials Recovered

Survey responses for amounts of glass, phosphor powder, mercury and combined metals recycled were used to determine the total weight of materials recovered through recycling.

Table 8.6 indicates that approximately 1,240 metric tonnes of combined materials from mercury-containing lamps were recycled in 2004. Materials not accounted for represent recyclable materials not included in the survey and/or non-recyclable materials.

Table 8.6: Materials Recovered by Weight in 2004 (kg)

	Company A	Company B	Company C	Company D	Company E	Totals
Glass	100,000	749,433	8,580	12,246	286,000	1,156,259
Phosphor Powder	5,670	10,881	286	285	21,362	38,484
Mercury	500	120	286	306	238	1,450
Combined Metals	2,000	9,595	20,020	7,092	7,476	44,183
Total Weight	108,170	770,029	29,172	19,929	315,076	1,240,376

Table 8.7 and Figure 8.2 illustrate that glass accounts for approximately 93 percent percent of materials (by weight) recycled from mercury-containing lamps in 2004. Phosphor powder, mercury and metals make up the remaining seven percent.

The 1,450 kg of mercury reported seems high in relation to the total mercury releases in Canada. Upon further inquiry it was discovered that three of the five companies surveyed provided figures for total mercury recovered from all products (e.g., switches, etc.).

The two companies that do track mercury from lamps separately from mercury reclaimed from other products suggested that all mercury recovered from lamps comprised roughly 0.016 percent of the weight of all lamps combined.

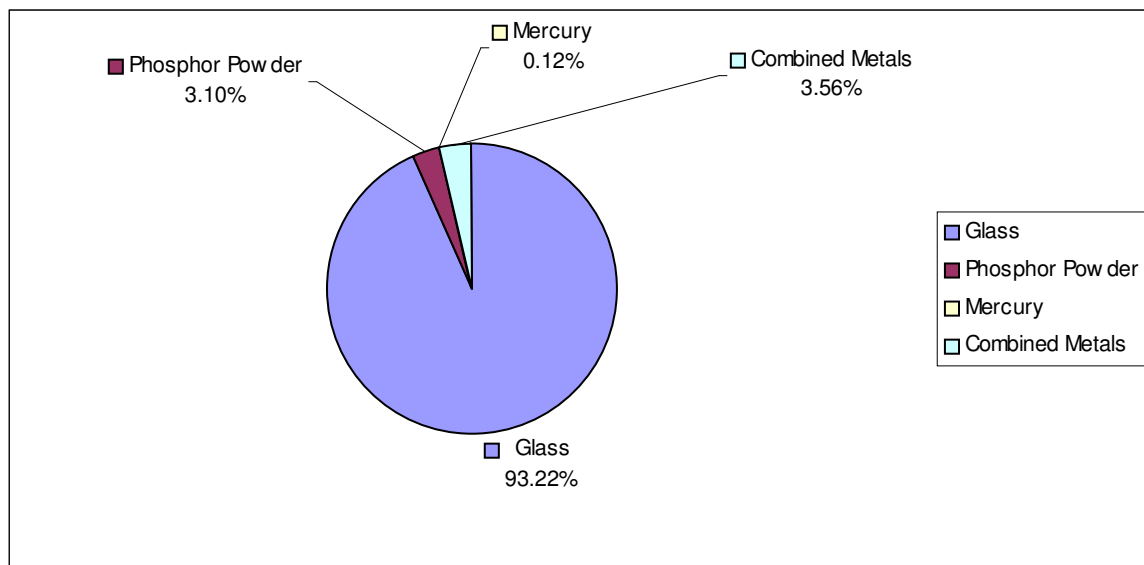
Given that the companies that track mercury recycled from lamps separately from other sources are the two largest recyclers of mercury-containing lamps in Canada, we feel this percentage produces a more realistic figure for mercury recovered from lamp recyclers. It will, however, produce a conservative estimate, because two of the other companies surveyed process higher percentages of HID lamps, which contain 20 to 30 times more mercury per unit.

Based on this percentage we expect **the amount of mercury recovered from mercury-containing lamp recycling was roughly 198.5 kg in 2004.**

Table 8.7: Relative Percentage of Materials Recovered in 2004

Material	Weight Recovered (kg)	Relative Percentage (%)
Glass	1,156,259	93.22
Phosphor Powder	38,484	3.10
Mercury	1,450	0.12
Combined Metals	44,183	3.56
Total Weight	1,240,376	100.00

Figure 8.2: Relative Percentage of Materials Recovered in 2004



8.3 Sources of Recycled Mercury-containing Lamps

The survey responses from the recyclers identified a range of suppliers for the end-of-life mercury-containing lamps. The relative contribution per source was provided as a percentage of total mercury-containing lamps recycled. Each company seems to have developed unique relationships with different types of sources. There were also regional differences in the sources. Given the high degree of variability, a summary of the ranges has also been reported.

Utilities: Average of 11 percent. (Contributions ranged from five to 20 percent. All recyclers obtained some of their lamps from utilities.)

Municipal Governments: Average of 41 percent. (Contributions ranged from five to 90 percent. All recyclers obtained some of their lamps from municipal governments. For two of the four companies surveyed, municipalities contributed more than 50 percent of their supply.)

Provincial Governments: Average of four percent. (Contributions ranged from two to five percent. All recyclers received some lamps from provincial governments, though it was a very small contribution.)

Federal Government: Average of three percent. (Contributions ranged from zero to five percent. Only two of the four recyclers obtained lamps from the federal government; in both cases, it represented five percent of the total supply.)

Retailers: Average of eight percent. (Contributions ranged from one to 20 percent. All recyclers received some lamps from retailers.)

Commercial/Industrial: Average of 33 percent. (Contributions ranged from five to 72 percent. All recyclers obtained some of their lamps from commercial/industrial sources).

8.4 Catchment Areas

Survey responses indicated that the principal catchment areas of the companies recycling mercury-containing lamps are the provinces in which those facilities are located. There is currently one facility operating in British Columbia, two in Alberta, one in Ontario and one in Quebec. A sixth facility (not included in the survey) is being set up in Manitoba.

Each company indicated that it receives some of its supply of mercury-containing lamps from out-of-province. The total catchment area appears to be Canada west of Montreal, Quebec. The Atlantic provinces do not appear to be serviced.

8.5 Fate of Recovered Mercury

According to the recyclers surveyed, all recycled mercury is sold to third party companies, which in turn sell the recycled mercury on the open market. Recycled mercury is used in the manufacture of new lamps, mercury switches, thermometers, etc.

9. Estimated Waste Diversion Flows in Canada

As mentioned earlier in the report, approximately 60 million mercury-containing lamps entered the Canadian waste stream in 2004.⁶⁶ According to the five Canadian fluorescent lamp recyclers that participated in the survey, of the 60 million mercury-containing lamps that are disposed of annually, roughly four and a quarter million (4,279,266 lamps) are recycled. This means that more than 55 million mercury-containing lamps (55,720,734 lamps) end up in Canadian landfills each year.

Using these numbers and the composition data for fluorescent lamps found in Appendix 6, it is estimated that in Canada in 2004 the following was sent to landfill:

- 12,816 tonnes of glass
- 111 tonnes of aluminum
- 28 tonnes of steel
- 557 tonnes of phosphor powder
- 0.64 tonnes of mercury

It is not possible, from the survey results, to determine accurately the relative contributions of the industrial, commercial and institutional (IC&I) sector and residential sector. Follow-up queries were made with the recyclers to determine these contributions. Responses from Canada's two largest lamp recyclers suggest that more than 90 percent of the lamps recycled come from the IC&I sector.

This is a function of the IC&I sector being the largest user of fluorescent and HID lamps and the existence of infrastructure in most of Canada to recover lamps from the IC&I sector. Very little infrastructure exists to collect lamps from the residential sector.

Efforts to recycle mercury-containing lamps have focused on the IC&I sector because they have traditionally been the predominant users of mercury-containing lamps. However, governments have begun promoting the use of the CFLs for residential applications because of their energy-efficient characteristics. CFLs are also becoming less expensive to manufacture and are increasing in popularity among homeowners. Given the lack of infrastructure for recycling of mercury-containing lamps from the residential sectors, almost all CFLs will be landfilled at their end-of-life.

⁶⁶ Data estimated from Association of Lighting and Mercury Recyclers (www.almr.org) and CCME. 2001. *Mercury-Containing Lamps — Canada Wide Standards, Backgrounder*. www.ccme.ca/assets/pdf/merc_lamp_bground_e.pdf.

10. Greenhouse Gas Emission Reductions from Mercury-containing Lamp Recycling

The build-up of greenhouse gases (GHGs) in the Earth's atmosphere can cause gradual warming of the atmosphere and result in changes in average weather patterns around the globe. This phenomenon — known as climate change — “could have far-reaching and/or unpredictable environmental, social and economic consequences.”⁶⁷ National inventories of emissions of GHGs, like that compiled by Environment Canada's Greenhouse Gas Division, express emissions in terms of carbon dioxide equivalencies (CO₂e).

Canada's Kyoto Protocol commitment to reduce emissions by six percent below the 1990 level of 596 Mt means that substantial reductions are needed. Recycling can contribute to these reductions as recycling products often requires less energy than manufacturing products from virgin resources as the acquisition of materials (e.g., mining) and primary processing steps (e.g., smelting and refining) are eliminated. When recycled materials are used in the place of raw materials, the transportation emissions (e.g., from vehicles transporting materials from the mine to the smelter to the refinery) are also eliminated.

However, one must consider many variables when determining the *net GHG impact* of recycling particular materials. For example, savings in emissions during recycling may be outweighed by the emissions from trucks transporting post-consumer or post-industrial materials from point of generation (e.g., curbside bin, factory, etc.) to a material recovery facility to scrap material markets to a manufacturing facility. One must also consider the energy it takes to separate mixed recyclable materials into specific streams.

Natural Resources Canada, Environment Canada and ICF Consulting have collaborated on a project⁶⁸ to develop GHG emissions factors that can be used to compare the net GHG emissions impact of applying different management strategies to various kinds of end-of-life materials in Canada. The emissions factors listed in Table 10-1 represent the net GHG emissions of the waste management practice.

⁶⁷ www.climatechange.gc.ca

⁶⁸ ICF Consulting. October, 2005. *Determination of the Impact of Waste Management Activities on Greenhouse Gas Emissions: 2005 Update Final Report*,

Table 10-1: Emissions Factors⁶⁹

Material	Net impact of recycling vs. landfilling (tonnes CO ₂ e)
Glass	-0.12
Aluminum	-6.51
Steel	-1.20
Mercury	-1.27

For the purposes of this report, the values of net emissions for mercury are estimates derived internally by Natural Resources Canada, however these values should be considered extremely tentative. Natural Resources Canada does not plan to conduct a life-cycle analysis of mercury at this time.

In order to calculate an estimate of the GHG emissions that could be saved if various percentages of the fluorescent lamps in Canada that end up in landfills were recycled, the following assumptions were made:

- There are 60 million fluorescent lamps disposed of in Canada each year and only 4.25 million of these lamps are recycled.
- Approximately 2/3 of disposed four-foot fluorescent tubes are T12 (1-1/2" diameter, 0.275 kg) and 1/3 are T8 (1" diameter, 0.185 kg), based on data from Electro-Federation Canada.
- The composition of the lamps is based on this averaging of T8 and T12 four-foot lamps (the specific composition data are found in Appendix 6).
- The most recent emissions factors (shown in Table 10.1) provided by the Government of Canada were used.

At the current recycling rate of seven percent, the GHG emissions saved by recycling mercury-containing lamps, rather than sending them to landfill totals 175 tonnes (as shown in Table 10.2).

Table 10.2: Current Greenhouse Gas Emissions Reductions (at seven percent recycling rate)

Material	Average Amount in a 1.2-metre fluorescent tube (kg)*	Amount recycled each year (tonnes)	GHG emissions saved by recycling instead of landfilling (tonnes)
Glass	0.23	977.50	117.30
Aluminum	0.002	8.50	55.30
Steel	0.0005	2.10	2.50
Mercury	0.0000114	0.05	0.06
Total		988.20	175.16

* Data supplied by Electro-Federation Canada (September 2005).

If Canada were to attain a recycling rate of 24 percent, as with the current US recycling rate, Canada would then be recycling 14.4 million mercury-containing lamps per year. The GHG emissions saved by recycling mercury-containing lamps, rather than sending them to landfill, would be an additional 419 tonnes

⁶⁹ Data provided by Natural Resources Canada, October 2005.

over the current amount, for a total reduction of 593.7 tonnes (as shown in Table 10.3).

Table 10.3: Potential Greenhouse Gas Emissions Reductions at 24 percent Recycling Rate

Material	Average Amount in a 1.2-metre fluorescent tube (kg)*	Amount recycled each year (tonnes)	GHG emissions saved by recycling instead of landfilling (tonnes)
Glass	0.23	3,312.00	397.4
Aluminum	0.002	28.80	187.5
Steel	0.0005	7.20	8.6
Mercury	0.0000114	0.16	0.2
Total		3,348.20	593.7

* Data supplied by Electro-Federation Canada (September 2005).

If Canada were to attain a recycling rate of 80 percent, as with the European Union target for 2006 and the US target for 2009, Canada would then be recycling 48 million mercury-containing lamps per year. The GHG emissions saved by recycling mercury-containing lamps, rather than sending them to landfill, would be an additional 1,804 tonnes over the current amount, for a total reduction of 1,979 tonnes (as shown in Table 10.4).

Table 10.4: Potential Greenhouse Gas Emissions Reductions at 80 percent Recycling Rate

Material	Average Amount in a 1.2-metre fluorescent tube (kg)*	Amount recycled each year (tonnes)	GHG emissions saved by recycling instead of landfilling (tonnes)
Glass	0.23	11,040.00	1,324.8
Aluminum	0.002	96.00	625.0
Steel	0.0005	24.00	28.8
Mercury	0.0000114	0.55	0.70
Total		11,160.60	1,979.3

* Data supplied by Electro-Federation Canada (September 2005).

If Canada were to attain a recycling rate of 100 percent, Canada would then be recycling 60 million mercury-containing lamps per year. The GHG emissions saved by recycling mercury-containing lamps, rather than sending them to landfill, would be an additional 2,124 tonnes over the current amount, for a total reduction of 2,299.2 tonnes (as shown in Table 10.5).

Table 10.5: Potential Greenhouse Gas Emissions Reductions at 100 percent Recycling Rate

Material	Average Amount in a 1.2-metre fluorescent tube (kg)*	Amount send to landfill each year (tonnes)	GHG emissions that could be saved by recycling instead of landfilling (tonnes)
Glass	0.23	12,822.50	1,539.00
Aluminum	0.002	111.50	725.90
Steel	0.0005	27.9	33.50
Mercury	0.0000114	0.64	0.81
Total		12,962.50	2,299.20

** Data supplied by Electro-Federation Canada (September 2005).*

11. Options for Increasing the Recycling of Mercury-containing Lamps

This section outlines six possible options to address the recycling of mercury-containing lamps.

1. Status Quo

As the title implies, Status Quo suggests not doing anything beyond current activities. This option requires no increase in activity and carries no additional cost. It relies on market forces to stimulate recycling and provides the federal government and stakeholders more time to assess the best avenues for future action.

However, the gap between Canadian performance and that of other leading jurisdictions would continue to increase. Canada already has much lower performance levels than the United States and countries within the European Union. If this was the option chosen, Canada would be correctly perceived as a laggard.

2. Universal Waste Designation

A second option would be to follow the US lead and create something similar to a Universal Waste Designation to remove some of the barriers associated with the handling of mercury-containing lamps.

US experience demonstrates that easing the restrictions on the storage, handling, and transportation for mercury-containing lamps leads to increased recycling.

3. National Education and Outreach Program

A complimentary option is to implement a national outreach and education program on mercury-containing lamp recovery (similar to the US EPA's outreach program). It could be designed for different target audiences. In the first instance, the program might focus on the industrial, commercial and institutional (IC&I) sector (the largest user of mercury-containing lamps) and then later roll out to other sectors of society. Components of an education and outreach program could include:

- a searchable website that provides information on local alternative recovery options;
- integration of mercury-containing lamp management related information into existing or planned broader waste management education and outreach programs at local and provincial levels;
- point-of-sale, and on-product and packaging information about recycling options for end-of-life products;

- promotion of the recovery of used lamps through voluntary action (potential industry and municipally sponsored programs); and,
- recognition of leadership through an awards program.

This option provides the federal government with an opportunity to demonstrate initiative through the provision of information and tools, while promoting voluntary action. It could be undertaken at relatively low cost.

This option integrates mercury-containing lamp recovery within existing and evolving provincial waste management programs. The program could be integrated with existing non-governmental sector recycling programs and/or established industry stewardship organizations.

The willingness of target audiences to absorb the recovery costs, however, is unknown. There are also significant transport and shipping issues for regions of the country where recycling facilities do not exist (specifically Eastern Canada). Voluntary action would likely be higher in areas near mercury-containing lamp recycling facilities. However, if government outreach on its own is expected to significantly increase the demand for recycling, there will be a need for private sector investment in recycling infrastructure in under-serviced regions of the country.

4. Federal Procurement Policy

This option would see the federal government incorporating measures into its procurement policy that would restrict the purchasing of new mercury-containing lamps to suppliers that offer take-back programs for recycling purposes.

Incorporating take-back and recycling of end-of-life mercury-containing lamps would help to deliver on Throne Speech commitments to develop procurement policies that support the federal government's sustainable development objectives. It would demonstrate leadership by the federal government and would have a measurable increase in the national recycling rates for mercury-containing lamps. It is something that the federal government can do directly. Provincial governments may follow the federal example, but there is no guarantee.

This option is something that the federal government can do in isolation or in combination with a national education and outreach program (Option 2).

On its own, the procurement policy could increase the federal government's recycling rate for mercury-containing lamps to 100 percent; however, it may have no effect on other levels of government or other segments of Canadian society.

There would be a cost associated with increased recycling rates⁷⁰. However, suppliers may absorb some of these costs in order to remain competitive.

This option could also limit the number of eligible suppliers, at least initially. Suppliers would likely make arrangements with mercury-containing lamp recyclers in short order to remain eligible for federal contracts.

5. National Mercury-containing Lamp Recovery Challenge

This option would see the federal government establishing a recovery target for end-of-life mercury-containing lamps from federal facilities and issuing challenges to provincial governments, the Federation of Canadian Municipalities and the private sector to match federal performance.

In this option, the federal government could demonstrate leadership via direct action and encourage action from other levels of government and the private sector. It builds on existing efforts within the federal government to encourage the recycling of end-of-life mercury-containing lamps. It would require Environment Canada in cooperation with Public Works and Government Services to enhance the federal government's existing mercury-containing lamp recovery activities or to adopt a procurement policy similar to that outlined in Option 3. It could be implemented as a stand-alone program, or could be done in conjunction with Option 2.

The challenges associated with this type of program are that waste management costs would be born by program participants. The higher the recovery rate, the higher the total cost for the program participant.

While the federal government has the ability to increase its own recycling rates directly, participation by other levels of government and the private sector are not guaranteed. The current lack of infrastructure in some provinces/regions may hamper participation. It may be necessary to create incentives to encourage participation, particularly at the municipal level, as well as to provide infrastructure development support.

6. Disposal Bans

This option would see the federal government working to establish legislation that would ban the landfilling of mercury-containing lamps in Canada. This is the preferred option of Canadian lamp recyclers and a number of the municipalities surveyed during this study.

⁷⁰ According to the recyclers surveyed, the recycling cost can range between 8 cents and 15 cents per unit, with an average cost of 12 cents per unit. According to Jim Bailey of EcoSuperior, when factoring the collection, transportation etc., the cost to the IC&I sector is approximately 50 cents per unit.

This approach is consistent with the efforts of some European countries and a number of US states, where recycling rates for mercury-containing lamps are significantly higher than in Canada.

This is an activity the federal government could not undertake on its own. It would have to be adopted by the CCME and, for the most part, implemented at the provincial level.

A national landfill ban on mercury-containing lamps would have a significant impact on recycling rates in Canada. Extensive outreach and enforcement would be required to ensure compliance. In addition, the federal government may need to assist in the development of recycling infrastructure to ensure compliance across the country.

7. Extended Producer Responsibility

This option is essentially an adaptation of the European model. It involves mandating manufacturers and retailers to take shared or full responsibility for managing the wastes that result from the products they produce and/or sell.

This option would significantly increase the recycling rates of mercury-containing lamps. It could also result in a disposal charge being added to the price of mercury-containing lamps. The degree to which the extended producer responsibility model would increase the price of these types of lamps in Canada is not currently known, however, we do know that in Austria, consumers pay a charge of approximately \$1.70 CDN for recycling of mercury-containing lamps. It is not currently known what impact this option would have on the use of energy efficient lamps, but given recent and expected increases in energy costs, it would appear these types of products would continue to be cost-effective lighting options for consumers.

Under CEPA, the federal government can require companies to develop pollution prevention plans. It is, however, unclear whether this enables the federal government to impose extended producer responsibility on a particular sector or whether there is the political will to do so. Provinces, on the other hand, do have the authority to legislate extended producer responsibility. The federal government may wish to work with the provinces through the CCME to advance this type of approach.

We have learned through communication with Electro-Federation Canada that this option would receive strong opposition from the manufacturers of mercury-containing lamps (see Appendix 6).

12. Identifying Critical Factors for a Cost-Benefit Analysis

A cost-benefit analysis (CBA) estimates and totals the equivalent money value of the costs and benefits of a project to establish whether it is economically worthwhile. One of the problems with a CBA is that while the computation of many benefits and costs is intuitive, there are others that are more difficult to estimate and measure. For example, problems persist in applying monetary valuation to environmental and human health issues.⁷¹

Another important consideration of a CBA is that all costs and benefits of a project should be measured in one common unit — the most convenient unit is money. The equivalent monetary value of costs and benefits is based on information derived from consumer and producer market choices. One of the most challenging parts of a CBA is finding past examples that reveal tradeoffs and the equivalent costs of preference. Care must also be taken to properly allow for fluctuating factors, such as inflation.⁷²

While a formal CBA for mercury-containing lamp recycling programs goes beyond the scope of the project, it is possible to identify some of the key costs and benefits associated with such a program.

12.1 Costs

The costs of establishing and running a recycling program for mercury-containing lamps include:

- Administration/coordination
- Education and outreach to the public
- Collection (either setting up a pick-up program or staffing a drop-off depot)
- Transportation and handling
- Processing of the mercury-containing lamps (by an existing lamp recycler)
- Establishing a recycling facility (in an area that does not have an existing lamp recycler)
- Purchase of portable crushing units (if a municipality or private company wishes to run their own recycling program, rather than shipping the mercury-containing lamps to a lamp recycler)

To get an idea of what the range of costs might be, it is possible to look at the results of the municipal surveys from this report and a report produced by Alberta Environment.

⁷¹ N. Hanley. *Environmental Cost-Benefit Analysis: Making It More Useful*. www.sussex.ac.uk/units/gec/fellsumm/hanley.htm, accessed March 29, 2005

⁷² T. Watkins. *Introduction to Cost Benefit Analysis*. www2.sjsu.edu/faculty/watkins/cba.htm, accessed March 29, 2005.

The results gathered from the municipal surveys showed the following estimates of annual costs accrued by the municipalities that currently run recycling programs for mercury-containing lamps:

- The average cost of coordination for lamp collection programs was \$275 (values ranged from \$50 per year to \$500 per year).
- The average cost of promotion and education for lamp collection programs was \$250 (values ranged from \$50 per year to \$500 per year).
- The average cost of collection for lamp collection programs was \$3,250 (values ranged from \$210 per year to \$9,000 per year).
- Only one value was reported for the cost of depot/special day staffing for lamp collection programs — \$1,200 per year.

Data from Alberta Environment, derived from their mercury-containing lamp recycling program and presented in a report published in 2000, provide estimates of values for the other costs identified.⁷³ The cost to transport mercury-containing lamps from Edmonton to Aldergrove, BC (as per the City of Edmonton contract at that time) was approximately \$0.08 per lamp. The average cost to process a typical 2.1-metre fluorescent lamp was \$0.40 (based on volumes of 500 or more tubes). Therefore, it is estimated that a typical shipment of 50,000 mercury-containing lamps costs approximately \$24,000 to recycle at an out-of-province facility (approximately \$0.48 per lamp).

Additionally, Alberta Environment estimated the cost to establish a permanent mercury-containing lamp recycling facility in the order of \$700,000. Assuming a five-year return on investment and a labour cost of \$0.30 per bulb, a new recycler would have to handle approximately 700,000 lamps per year or 3.5 million lamps over five years.

Portable crushing units can be purchased for a little as \$5,000 per unit. The estimated cost to run a crushing unit (i.e., operational costs plus labour costs) is \$0.42 per lamp. Assuming a five-year return on investment, a municipality or private company operating a portable crushing unit would have to handle approximately 12,000 lamps per year or 62,500 lamps over five years.⁷⁴

12.2 Benefits

The benefits that would result from establishing and running recycling programs for mercury-containing lamps include:

Improved human health, resulting in reduced healthcare costs for treatment of illnesses arising from mercury exposure including:

- Neurological disorders
- Heart disease

⁷³ Alberta Environment. 2000. *Fluorescent Lamp Stewardship Initiative*.

⁷⁴ Ibid.

- Liver failure
- Vision impairment
- Reproductive system damage

Improved human health, resulting in reduced social costs related to the treatment of behavioral problems and learning disorders resulting from mercury exposure.

Improved ecosystem health including:

- Fewer fish eating advisories
- Improved wildlife population health

As mentioned at the beginning of this section, it is difficult to determine a monetary valuation for environmental and human health benefits. However, there would be definite benefits to society if the recycling of mercury-containing lamps results in an overall reduction of mercury emissions and lower exposure levels.

It is known that both environmental and human health are adversely impacted by mercury in the environment (through contamination of drinking water,⁷⁵ bioaccumulation in the food chain and permanent damage to the brain, kidneys and developing fetus⁷⁶), and mercury-containing lamps that end up in landfills result in atmospheric emissions of mercury, as well as leachate to the soil.

⁷⁵ Environment Canada. January 1999. *Toxic Chemicals*.

⁷⁶ Environmental Lamp Disposal Ltd. website.

www.environmentallamp.com/effects_of_mercury.htm, accessed December 14, 2004.

13. Conclusions

In this section, a summary of the major findings is presented, along with some of the broader conclusions and recommendations that can be derived from the findings.

13.1 Summary of Findings

Environmental and Health Considerations

Fluorescent tubes, CFLs and HID lamps tend to be four to five times more energy efficient than incandescent lamps and their use tends to decrease overall mercury emissions by reducing mercury emissions from coal-fired power plants. Mercury-containing lamps help to reduce the overall amount of mercury entering the air and subsequently depositing in aquatic environments.

However, mercury is a potent neurotoxin that can cause brain damage, especially in infants and small children when they are exposed to even a small amount. Consequently, there are strong arguments to be made for enhanced management of end-of-life mercury-containing lamps.

International Experience

The approaches taken to recycling mercury-containing lamps in all the countries examined are similar in that they encourage and/or require reductions in the amount of mercury contained in energy efficient lamps and they encourage and/or require the recycling of mercury-containing lamps as the preferred disposal option.

The European Union, through its Directive on Waste Electrical and Electronic (WEEE), has elected to address end-of-life electrical and electronic wastes (including mercury-containing lamps) using an extended producer responsibility approach. As a result, manufacturers are fully responsible for managing the wastes associated with their products.

Under the WEEE Directive, the European recycling target for mercury-containing lamps is 80 percent recovery by the end of 2006. Germany had already attained this level of recycling prior to the introduction of the WEEE Directive. Countries such as Netherlands and Austria already have recycling rates greater than 50 percent and are well on their way to meeting the 2006 targets.

The United States has established a similar 80 percent diversion target for mercury-containing lamps by 2009. The US EPA has tried to facilitate recycling of spent mercury-containing lamps by classifying them as universal wastes and by working on education and outreach with manufacturers and recyclers. The US

government's work has been supported by independent activities in several states.

The current US recovery rate of 24 percent is well below the 80 percent target, but it is a significant increase from the four percent that was being attained in 1990. Most of the increase has taken place since 1999, when serious efforts to increase recycling were started.

Generation and Material Composition

There are approximately 5,000 different mercury-containing lamp products on the market in Canada. The estimated life spans of mercury-containing lamps range from eight to 5,000 to 27,000, hours depending on the type of lamp.

The 1.2-metre (4 foot) fluorescent tube is the highest volume lamp sold and accounts for roughly 75 percent of the Canadian market. The typical 1.2-metre fluorescent lamp contains approximately 0.26 kg of glass, 0.02 kg of combined metals, 0.01 kg of phosphor powder and 11.6 mg of mercury.

In 2004, approximately 60 million mercury-containing lamps reached the end of their useful life in Canada. This represents approximately two lamps per Canadian citizen.

The single largest material in mercury-containing lamps is glass, which accounts for about 90 percent by weight (this percentage is an average and could vary considerably by lamp type). Metals, phosphor powder and mercury account for the remaining 10 percent.

Municipal Mercury-containing Lamp Recovery Programs

Seven of the 40 municipalities (with a combined population of 367,352 people, or 1.1 percent of the Canadian population) that returned the municipal surveys collected end-of-life mercury-containing lamps for recycling. A number of the other municipalities collected spent lamps, but sent them to landfill.

The most common type of service used by the municipalities that recycle mercury-containing lamps is drop-off at a recycling site or hazardous waste depot (permanent or temporary). None of the responding municipalities offered curbside collection as an option for mercury-containing lamps intended for recycling.

Six of the seven of municipalities surveyed reported that they track quantities of the lamps collected. The seventh municipality was able to estimate the quantity of lamps collected. It is estimated that municipalities participating in the study collected 191,000 mercury-containing lamps in 2004, resulting in the recovery of

49,660 kg of glass, 3,820 kg of metals, 1,910 kg of phosphor powder and 2.2 kilograms of mercury.

This translates into an average of 0.5 lamps recycled per person in communities that have mercury-containing lamp recycling programs and 0.06 lamps per person for all of the reporting municipalities (the total combined population of the 40 municipalities that submitted surveys is 3,050,657 people).

None of the municipalities surveyed indicated that they derived revenue from the recycling of mercury-containing lamps. Many municipalities indicated little to no extra cost for coordinating their lamp collection programs. In most cases, this was due to the lumping together of some of their recycling and household hazardous waste costs.

One of the most common challenges articulated by municipalities is a lack of public knowledge about the environmental and health impacts related to the landfilling of mercury-containing lamps. Most people do not realize that fluorescent lamps contain mercury and should be handled as hazardous waste.

Municipalities identified the provision of education about the disposal of mercury-containing lamps as one of the principal tools that the federal government could provide them with. Other potential tools identified include legislation banning the landfilling of mercury-containing products, funding to improve the recycling infrastructure for mercury-containing lamps, and incentives to encourage the industrial, commercial and institutional sectors to increase their recycling of mercury-containing lamps.

Recyclers: Total Estimated Waste Diversion Flows in Canada

Fluorescent lamp recyclers in Canada received 4,279,266 end-of-life mercury-containing lamps, or seven percent of the total estimated end-of-life mercury-containing lamps entering the waste stream. The total approximate weight of these lamps is 1,261 metric tonnes. Of this, approximately, 1,240 metric tonnes of glass, metals, phosphor powder and mercury were recovered.

Municipalities are estimated to collect approximately 45 percent of the lamps (1,920,000 lamps) received by Canadian fluorescent lamp recyclers, which equates to approximately three percent of all end-of-life lamps in Canada, or 475 metric tonnes. The remaining 55 percent of end-of-life lamps collected by Canadian fluorescent lamp recyclers is attributed to non-municipal sources.

Energy and Greenhouse Gas Emission Savings Attributable to Recycling Mercury-containing Lamps

Considerable work has been conducted in Canada and internationally to develop conversion factors for estimating the energy savings and greenhouse gas (GHG)

reductions associated with the reduction, reuse, recycling, composting and disposal of a variety of materials commonly found in the waste stream.

Using the conversion factors available at the time of writing this report, it was estimated that at the current recycling rate of seven percent, the GHG emissions saved by recycling mercury-containing lamps, rather than sending them to landfill, is 175 tonnes of CO₂e.

Even if Canada were to obtain a 100 percent recycling rate for mercury-containing lamps, GHG savings (of recycling over landfilling), would only be about 2,300 tonnes of CO₂e. Considering that Canada's Kyoto Protocol commitment is to achieve annual reductions of approximately 270 million tonnes of CO₂e by 2010, it can be seen that the energy efficiency and health benefits of recycling mercury-containing lamps are far more important than the climate change mitigation impacts.

13.2 Broader Observations

Concern about the disposal of mercury-containing lamps is an issue that is international in scope. All of the non-Canadian jurisdictions examined either have or are developing mechanisms to increase recovery and recycling rates for these products.

There appears to be a significant lack of knowledge among the Canadian public that many energy efficient lamps contain mercury and a lack understanding about the potential environmental and health implications associated with the improper disposal of mercury-containing lamps.

European countries and the United States have established aggressive targets of up to 80 percent diversion for end-of-life mercury-containing lamps. Canada, to date, has not established a recycling target.

Canada's current estimated recovery rate of seven percent of mercury-containing lamps stands out in stark contrast to what is being done in the United States and European countries where current recycling rates range from 24 percent to 80 percent.

At present, Alberta is the only Canadian province that has a program in place to encourage the recycling of mercury-containing lamps. Recovery rates in Alberta were estimated to be 23 percent in 2002 — this is approximately three times higher than the national recovery rate.

13.3 Recommendations

1. The federal government should work with various sectors, but particularly the mercury-containing lamp manufacturers and recyclers, to develop appropriate

counting systems and reporting protocols to ensure more accurate, sales and recovery data are available. Sales and recovery rates should be tracked on a regular basis (annually or bi-annually).

2. Environment Canada and Natural Resources Canada should advocate, through the CCME, to establish interim and long-term Canadian recycling targets for mercury-containing lamps, consistent with targets in the United States and the European Union.
3. A multi-stakeholder workshop should be held (including manufacturers, retailers, recyclers, federal and provincial governments, municipalities, utilities and non-governmental organizations) to build a consensus position on a Canadian approach to increased recycling of mercury-containing lamps. A key outcome of this workshop should be the development of pilot projects and federal and provincial initiatives to regulate and manage the recycling of mercury from lamps.
4. Environment Canada should develop a national education and outreach program, similar to the US EPA's, to increase awareness of proper disposal methods for mercury-containing lamps.

Appendix 1 — Municipal Survey

Pollution Probe, with funding from Natural Resources Canada (NRCan), is conducting a “Background Study on Increasing Recycling of End-of-life Mercury-containing Lamps from Residential and Commercial Sources in Canada.”

One of the objectives of this study is to develop baseline figures for the number and types of mercury-containing lamps being disposed of each year in Canada.

We are requesting your municipality’s cooperation in helping establish this important baseline information. The final report, to be completed by April 2005 will be publicly available on the Pollution Probe website and will include information on public and private sector infrastructure for end-of-life lamp management, as well as estimated regional recovery rates and identification of environmental issues.

Please complete the accompanying survey by February 1, 2005. If you have any questions, please contact Krista Friesen, Senior Project Manager, Pollution Probe at 416-926-1907 x242 or kfriesen@pollutionprobe.org.

Please note, for the purposes of this study “mercury lamps” are defined to include Fluorescent Tubes, Compact Fluorescent Lamps, High Intensity Discharge Lamps/Mercury Vapor Lamps and High Pressure Sodium/Low Pressure Sodium Lamps

Thank you in advance for participating in this survey.

Contact Information

Name:

Title:

Municipality:

Population:

Number of Households:

Province:

Phone Number:

Email Address:

Recycling Specifics

1. Does your municipality have a curbside recycling program?
2. Does your municipality have depot recycling?
3. Does your municipality collect mercury-containing lamps for reuse or recycling?
4. Does your municipality collect mercury-containing lamps for disposal only?
5. In what year did your municipality start collecting mercury-containing lamps?
6. Indicate the types of mercury-containing lamps accepted by your municipality.
 - Fluorescent Tubes
 - Compact Fluorescent Lamps
 - High Intensity Discharge Lamps/Mercury Vapor Lamps
 - High Pressure Sodium/Low Pressure Sodium Lamps
 - Other (please specify)
7. What collection mechanisms are used to collect mercury-containing lamps?
 - Curbside pick-up with regular garbage collection
 - Curbside pick-up on special collection day(s)
 - Curbside pick-up by special arrangement
 - Drop off at waste transfer site
 - Drop off at landfill site
 - Drop off at permanent recycling site and/or hazardous waste depot
 - Drop off at temporary recycling site and/or hazardous waste depot
 - Sorted from mixed waste stream
 - Partnering with fluorescent lamp recycler
 - Other (please specify)
8. Please describe your collection system (e.g., days and hours of operation, retail location, etc.).
9. What, if any, restrictions apply to the lamps that are collected?

10. Are you aware of private sector companies that collect mercury-containing lamps in your municipality?
11. If you answered yes to Question 10, please specify who those companies are.
12. How does your municipality manage the mercury-containing lamps it collects?
 - Sell to a recycler
 - Give to a recycler
 - Pay a recycler
 - Send to landfill
 - Other (please specify)
13. If the mercury-containing lamps you collect end up with a recycler, please provide contact information for that recycler.

Data Collection

1. Do you keep records of the amounts of mercury-containing lamps collected?
2. If you answered yes to Question 1, please specify the amount collected (please specify if your answer is in units, kilograms or pounds).
3. If you answered no to Question 1, please estimate the amount collected (please specify if your answer is in units, kilograms or pounds).
4. For what year is your most recent data available?

Financial Aspects

1. Does your municipality charge a fee for collection, disposal or recycling of mercury-containing lamps? If so, how much?
2. Please estimate the cost of collection for your lamp collection program.

3. Please estimate the cost of promotion and education for your lamp collection program.
4. Please estimate the cost of coordination for your lamp collection program.
5. Please estimate the cost of depot/special day staffing for your lamp collection program.
6. Please specify and estimate any other costs associated with your lamp collection program.

Challenges and Opportunities

1. Please identify any particular challenges you face in running, or initiating, a collection program for mercury-containing lamps.
2. Please identify any tools or support that would help you in running, or initiating, a collection program for mercury-containing lamps.
3. Do you have any thoughts on how the federal government could stimulate the recovery of mercury-containing lamps, or any other opportunities for increasing recovery?

Thank you for taking the time to answer these questions, your assistance is greatly appreciated.

For your information, you will be notified when the final report is available on the Pollution Probe website.

Appendix 2 — Lamp Recycler Survey

Pollution Probe, with funding from Natural Resources Canada (NRCan), is conducting a "Background Study on Increasing Recycling of End-of-life Mercury-containing Lamps from Residential and Commercial Sources in Canada." One of the objectives of this study is to develop baseline figures for the number and types of mercury-containing lamps being disposed of each year in Canada. Hilkene International Policy has been retained to assist in the development of the study and conduct this survey of the lamp recycling industry to identify local infrastructure and estimated quantities recovered.

We are requesting your cooperation in helping establish this important baseline information. The final report, to be completed by April 2005 will be publicly available on the Pollution Probe website and will include information on public and private sector infrastructure for end-of-life lamp management as well as estimated regional recovery rates, and identification of environmental issues.

All information provided will be kept strictly confidential. Only the consultants analyzing data will see individual responses. In the final report, data will be presented in aggregate form only. No individual responses will be cited.

Please complete the sections below and return by email to chilkene@hilkene.com or by fax to 416-425-6667 by January 18, 2005.

Thank you in advance for participating in this survey. If you have any questions please contact Christopher Hilkene at chilkene@hilkene.com or by phone at 416-425-1313.

Name:
Company:
Address:
Municipality:
Province:
Phone #:
Fax #:
Email:

1. Is your business a final end user of mercury-containing lamps? Or do you collect/process and ship to an end-user?
2. What is the approximate total weight of mercury-containing lamps you process per year?
3. What percentage by weight of these lamps would you estimate are:
 - a. Fluorescent Tubes
 - b. Compact Fluorescent Lamps
 - c. High Intensity Discharge Lamps/Mercury Vapor Lamps
 - d. High Pressure Sodium/Low Pressure Sodium Lamps
4. What are the approximate total weights of the individual recyclable materials processed per year?
Glass:
Phosphor Powder:
Mercury:
Steel:
Aluminum:
Brass:
Copper:
5. What materials cannot be recovered? What percentage of a lamps weight does the non-recyclable component represent?
6. Approximately how many individual units do you receive per year?
7. Can you provide an approximate break down (by unit) of the types of lamps you receive?
8. From whom do you get most of your supply by percentage (please provide organization and program names as well as contact information where possible).
Utilities:
Municipal governments:
Provincial programs:
Federal programs:
Retailers:
Commercial/Industrial facilities:

Manufacturers:

9. Does the price of the recyclable materials, impact the quantity of lamps you process? Please explain.

10. Do you travel to pick up lamps?
 - a. If so what is the maximum distance you will travel?
 - b. What would be your minimum requirements?

11. Do you have a sense of the size of the catchment area your company serves (in terms of population and/or geographic size)?

12. How are mercury and any other regulated materials managed throughout the recycling process?

13. What are the main markets for the recyclable materials recovered from lamps?

14. Do you have any thoughts on how the federal government might stimulate the recovery of mercury-containing or any other opportunities for increasing recovery?

Appendix 3 — Responses to the Municipal Survey

Participating Municipalities

Newfoundland	City of St. John's City of Corner Brook
Nova Scotia	Annapolis, Kings, Kentville, Wolfville, Berwick Region 6 Solid Waste Management Municipality of West Hants Region of Queens Municipality Town of Port Hawkesbury Victoria County of Colchester
Ontario	City of Ottawa Town of Blind River Township of Russell Ashfield-Colborne-Wawanosh City of North Bay City of Cornwall Municipality of West Perth Calvin City of Orillia Bluewater Recycling Association Chatham-Kent Corporation of Haldimand County City of Sarnia Town of The Blue Mountains Thunder Bay Centre & South Hastings Waste Services Board County of Wellington City of Greater Sudbury
Manitoba	Winnipeg
Saskatchewan	City of Steinbach Town of Bengough
Alberta	City of Swift Current Town of Cochrane Jasper Town of Stony Plain City of Lloydminster City of Lethbridge City of Red Deer Town of Taber Camrose City of Airdrie

Recycling Specifics

1. Does your municipality have a curbside recycling program?

Yes — 25

No — 11

Other — 1 (one to start June 1, 2005)

2. Does your municipality have depot recycling?

Yes — 28

No — 4

Other — 5 (hazardous waste only; Landfills; shipped to Sydney, NS; 4 private recycling depots; private depot)

3. Does your municipality collect mercury-containing lamps for reuse or recycling?

Yes — 7

No — 29

Other — 1 (product stewardship offered thru 'Take it Back' program)

(Question 4 is missing)

The next 19 questions focus on answers submitted by the seven municipalities that collect mercury-containing lamps for the purpose of reuse or recycling. The municipalities are:

Annapolis, Kings, Kentville, Wolfville, Berwick, NS

Town of Cochrane, AB

City of Orillia, ON

Corporation of Haldimand County, ON

Thunder Bay, ON

Centre & South Hastings Waste Services Board, ON

Camrose, AB

The total population of these seven municipalities is 367,352.

5. In what year did your municipality start collecting mercury-containing lamps?

2 in 2001

4 in 2002

1 no response

6. Indicate the types of mercury-containing lamps accepted by your municipality.

Fluorescent Tubes — 7

Compact Fluorescent Lamps — 4

High Intensity Discharge Lamps/Mercury Vapor Lamps — 3

High Pressure Sodium/Low Pressure Sodium Lamps — 1

7. What collection mechanisms are used to collect mercury-containing lamps?

Curbside pick-up with regular garbage collection — 0

Curbside pick-up on special collection day(s) — 0

Curbside pick-up by special arrangement — 0

Drop off at waste transfer site — 1

Drop off at landfill site — 0

Drop off at permanent recycling site and/or hazardous waste depot — 5

Drop off at temporary recycling site and/or hazardous waste depot — 2

Sorted from mixed waste stream — 0

Partnering with fluorescent lamp recycler — 1

Other (please specify) — 1 (residents drop off at local environmental programs

non-profit office (EcoSuperior))

8. Please describe your collection system (e.g., days and hours of operation, retail location, etc.).

Municipality	Mercury-containing lamp collection system
Annapolis, Kings, Kentville, Wolfville, Berwick, NS	5.5 days per week (Mon.–Fri. 8:00am–4:00pm, Sat. 8:00am–noon). Two centrally located transfer stations.
Town of Cochrane, AB	Drop off depot Mondays 10:00am–5:00pm, Thursdays 9:00am–9:00pm, Fridays 7:00am–6:00pm, Saturdays 9:00am–4:00pm
City of Orillia, ON	We collect fluorescent tubes at our permanent HHW Depot, which is located at our landfill site in Orillia. The depot is open year round, Monday to Saturday from 8:30am to 12:30pm.
Corporation of Haldimand County, ON	Household Hazardous Waste Days — Saturdays 9:00am–1:00pm, four times per year, held at Public Works Yards and two privately owned facilities.
Thunder Bay, ON	Drop off lights at HHW facility at our landfill site. Same days as landfill site (Monday–Saturday 8:00am–4:30pm). City of Thunder Bay office bulbs are brought to a local electrical store (MGM electric) who partners with a lamp recycler. Residents can also bring their bulbs to our local non-profit environmental group office to be shipped, office hours (Mon.–Fri. 8:30am–4:30pm)
Centre & South Hastings Waste Services Board, ON	Permanent HHW Depot — 43 days per year. Event Days — 19 events per year. Hours of operation vary 9:00am–2:00pm and 8:00am–noon.
Camrose, AB	Recycling depot is manned six days per week, Monday to Saturday, and open for drop off 24 hours per day, 364 days per year.

9. What, if any, restrictions apply to the lamps that are collected?

No restrictions — residential and commercial

Limit of 30 per visit

Cannot be taped together, cannot be broken

Must be intact

We request that they be dropped off while the depot is manned and a small fee is charged to cover the cost of recycling

10. Are you aware of private sector companies that collect mercury-containing lamps in your municipality?

Yes — 3

No — 4

11. If you answered yes to Question 10, please specify who those companies are.

Enviro Sort, Red Deer, AB — 403-342-7823

MGM Electric

Fluorescent Lamp Recyclers Inc.

12. How does your municipality manage the mercury-containing lamps it collects?

Sell to a recycler — 0

Give to a recycler — 0

Pay a recycler — 6

Send to landfill — 0

Other (please specify) — 1 (Lamps crushed in bulb-eater. Spent filters collected by HHW firm at cost. Glass disposed of or recycled if option found)

13. If the mercury-containing lamps you collect end up with a recycler, please provide contact information for that recycler.

Enviro Sort — 403-342-7823

Fluorescent Lamp Recyclers (FLR) Technologies Inc. Contact Martin

Fluorescent Lamp Recyclers, Cambridge

Miller Environmental (Winnipeg, MB — 1-204-925-9600) handles most household hazardous material from the landfill. They do take away some of the bulb, but most go to MGM Electric.

Fluorescent Lamp Recyclers Inc. — 75 Wanless Court, Ayr, Ontario N0B 1E0

Contact: Dan Powers, Account Manager — 519-740-3334, email: dan@flr.ca

Environmental Lamp Disposal, Edmonton, Alberta

Data Collection

1. Do you keep records of the amounts of mercury-containing lamps collected?

Yes — 6

No — 1

2. If you answered yes to Question 1, please specify the amount collected (please specify if your answer is in units, kilograms or pounds).
 - 1500 feet
 - In 2003, we collected 2,189 tubes or 679 kg
 - 100 kg in 2004
 - 4305 kg glass, 52 kg metal, 49 kg phosphor, 1.53 kg mercury
 - 34,302 feet
 - approx. 16000 tubes
3. If you answered no to Question 1, please estimate the amount collected (please specify if your answer is in units, kilograms or pounds).
 - 7,000–8,000 tubes per year
4. For what year is your most recent data available?
 - 2003–2004
 - 2002–2004
 - 2003
 - 2004
 - 2004
 - 2004
 - 2003

Financial Aspects

1. Does your municipality charge a fee for collection, disposal or recycling of mercury-containing lamps? If so, how much?
 No — 7
 Comments:
 If brought to the HHW depot then free. If residents bring lamps to EcoSuperior it is also free. Charged at MGM electric.
 No fee for residential source. IC&I source — \$0.20/foot
2. Please estimate the cost of collection for your lamp collection program.
 - Approximately \$1500 — primarily processing costs and filter disposal costs (processing includes labour).
 - \$210.00
 - \$560/year
 - \$9000
 - \$5,000.00
3. Please estimate the cost of promotion and education for your lamp collection program.
 - Approximately \$500 — included in general written literature and on website.
 - \$50.00
 - \$200–\$500/year
 - included in promotion of entire program; not a specific cost

- 0
 - 250
 - \$100.00/year
4. Please estimate the cost of coordination for your lamp collection program.
 - Included in overall supervision and operations manager duties — cannot estimate.
 - \$50.00
 - Cost not separated out from other HHW coordination at this time.
 - Not broken out separately
 - Cannot break out specific costs
 - \$500.00/yr
 5. Please estimate the cost of depot/special day staffing for your lamp collection program.
 - \$0.00
 - Staff wages not separated out from other HHW operations.
 - Not broken out separately.
 - Cannot break out specific costs.
 - \$1200.00/yr
 6. Please specify and estimate any other costs associated with your lamp collection program.
 - None
 - Recycling — about \$3,500
 - None

Challenges and Opportunities

This section includes responses from all 40 municipalities that submitted a survey.

1. Please identify any particular **challenges** you face in running, or initiating, a collection program for mercury-containing lamps.
 - Ensuring lamps arrive unbroken. Generator must deliver tubes — inconvenient. Storage on-site until quantities warrant processing.
 - Funding.
 - Trying to keep hazardous items from being deposited with regular garbage.
 - Not enough volume. Municipality is mostly residential.
 - Cost for proper disposal.
 - Rural area, no collection of garbage or recycling, it is all done at the landfill site. No available staff to run a program. Currently all hazardous waste is dropped off by individuals at the Hazardous waste disposal site in North Bay Ont. Our municipality pays \$530 per year to allow our residents access to this facility.
 - Space is sometimes a problem.

- Storage is an issue, non-residential sources of lamps is an issue, paying for disposal is an issue.
 - Promoting it to residents; finding a recycling market.
 - If the City was collecting them, we would need company who could collect them from us and transport to the appropriate recycling operation.
 - Education and associated costs are concerns we have.
 - Shipping and handling is difficult and dangerous.
 - Education — this is the first formal communication I have seen that suggests recycling these materials. We understand the benefit to the environment, of reducing/eliminating the 'landfilling' of mercury.
 - Enforcement would be difficult if the items were banned. For residents it may be easier to break the tubes and hide it in their garbage than to deliver to our hazardous waste depot or other drop off.
 - Public participation in this type of program is a challenge — the public is often indifferent to such programs. Budget justification for: the expense of hiring a licensed hauler, secondary storage, amending COA (if possible), and program promotion is a challenge for a small municipality. The Town is a geographically large municipality — unless the program is curbside, many ratepayers will not drive their old light bulbs to a depot, the benefit is not understood.
 - Residents bringing the bulbs to our local recycling depots which do not accept these items.
 - Storage of lamps prior to disposal.
 - Many people don't realize that fluorescents and other lights contain mercury and should be handled as HHW.
 - Funding, this would be provincial jurisdiction. Lack of expertise — we have never done this before.
 - We do not accept private business tubes due to the fact that we are charged disposal fee. Private businesses do not support the recycling depot financially.
 - Storage, handling, transportation, disposal and recycling.
 - Commercial/industrial wanting to take part in the program.
2. Please identify any **tools or support** that would help you in running, or initiating, a collection program for mercury-containing lamps.
- Collection is complicated by danger of breakage. Curbside collection seems unfeasible, without significant changes in collection methods. Most tubes are in IC&I sector. Commercial haulers would need to be paid. Tubes should be returned in original cardboard box to prevent breakage. Disposal bans would motivate change in collections made and increased costs.
 - Funding specifically identifying this waste type.
 - Please identify any tools or support that would help you in running, or initiating, a collection program for mercury-containing lamps.
 - Education to the public. Collections and storage of these items until HHWD.

- Funds. A cost effective recycling company within close proximity to keep transportation costs down. Legislation-unless a law, Council is less likely to increase budget spending.
 - Would divert the waste if a known source of recycling was available.
 - More education materials.
 - Weather proof containers for collection. A collection system. No cost.
 - Having an up-to-date list of recycling markets for this material.
 - More information about recycling these lamps. Which ones to look for, so that they can be removed from the waste stream, and set aside for recycling.
 - Educational information, list of available recyclers and financial/environmental implications would be useful. Funding for this activity would be useful in order to pay for the diversion of these lamps.
 - Case studies and contact information of successful Canadian mercury recycling programs. Sample agreements where this service is 'contracted' by other Canadian municipalities. Funding to assist municipalities or contracted service providers with establishing a program.
 - Promotional awareness materials on the hazards of not recycling/capturing and Information on recyclers and “Bulb Eater” type units.
 - The general taxpayer should not be responsible for funding the management of mercury-containing lamps. Any product sold to a consumer that requires such special end-of-life handling (storage, transport, disposal) due to the serious toxicological effects of the contents, must be given additional consideration by the producers.
 - A ban on such items from our landfill.
 - Information and education on what lamps contain mercury.
 - Information printed on boxes on proper disposal methods and/or flyers indicating same at point of purchase.
 - Base line data — public attitudes and profiles/segmentation, who uses them, where do they come from, quantities per house hold, what are the barriers to participate in a recycling program, what are the benefits.
 - Economical program for recycling. An infrastructure or system for the recycling of the lamps.
3. Do you have any thoughts on how the **federal government** could stimulate the recovery of mercury-containing lamps, or any other opportunities for increasing recovery?
- Banning disposal. But receiving landfills or transfer stations need to be prepared.
 - Widely advertised and funded program.
 - Funding.
 - Introduce and pass legislation stating that all mercury filled products cannot be landfilled. Once this happens, more companies will start accepting mercury waste goods.
 - Issue has not raised itself as a major concern, to this date.
 - Education and partnership.
 - Landfill bans.

- Advertising campaign to the municipalities. Providing information on how to recover.
- Launch incentive programs for industrial, commercial, and institutional facilities to get on board. Don't overlook all the street lamps that are out there — they contain 10 times more mercury than fluorescent lamps. Provide green funding to municipalities.
- Provide funding to implement and support a collection program.
- Ban these items from disposal and assist in setting up a network for recycling.
- Program elements should include: Phase out mercury in products; require manufacturers or brand owners to disclose (via labelling) that their products contain mercury; and, oblige manufacturers or brand owners to establish and fully finance consumer education, convenient product take-back facilities and end-of-life management.
- Include in Waste Diversion Ontario's list of materials we presently receive funding for (possible include along with other designated HHW).
- Grants.
- They should be encouraging further reduction of use in products rather than trying to find ways to manage it so that eventually there will not be a problem with mercury-containing lamps.
- Funding, public education, community based social marketing, public awareness, convenient access to recycling opportunities.
- Put an environmental fee on buying these items therefore municipalities do not have to carry the financial burden.
- Regulatory action.

Appendix 4 — Recipients of the Municipal Survey

Alberta (44)

Airdrie
Banff
Calgary
Calmar
Camrose
Canmore
Cochrane
Cold Lake
Drayton Valley
Edmonton
Fort MacLeod
Fort Saskatchewan
Grand Prairie, County of
Hinton
Innisfail
Jasper, Municipality of
Leduc
Lethbridge
Lloydminster
Mackenzie, Municipal District of
Medicine Hat
Okotoks
Olds
Ponoka
Provost
Red Deer
Rimbey
Rocky View, Municipal District of
Spruce Grove
St. Albert
Stony Plain
Strathcona County
Strathmore
Sturgeon County
Sylvan Lake
Taber
Three Hills
Turner Valley
Valleyview
Wetaskiwin
Willow Creek, Municipal District of
Wood Buffalo, Municipality of
Vermilion River, County of
Yellowknife

British Columbia (2)

Cowichan Valley, Regional District of
Nanaimo, Regional District of

Manitoba (8)

Brandon
Dauphin
Flin Flon
Selkirk
Steinbach
Thompson
Winkler
Winnipeg

New Brunswick (8)

Bathurst
Campbellton
Dieppe
Edmunston
Fredericton
Miramichi
Moncton
Saint John

Newfoundland (4)

Corner Brook
Gander
St. Anthony
St. John's

Nova Scotia (8)

Eastern Sub-Region A (Town and County of Antigonish, Mulgrave, Canso, St. Mary's and Guysborough)
Eastern Sub-Region B (Town and County of Pictou, New Glasgow, Trenton, Stellarton and Westville)
Halifax Regional Municipality
Northern Region (Colchester, Truro, Stewiacke, East Hants, Cumberland, Amherst, Parrsboro, Oxford and Springhill)
Region of Cape Breton (Cape Breton Regional Municipality, Inverness, Victoria, Richmond and Port Hawkesbury)
South Shore/West Hants (Town and District of Lunenburg, Chester, Bridgewater, Mahone Bay, Region of Queens, Town and District of Shelburne, District of West Hants, Windsor, Hantsport and Lockport)
Valley Region (Annapolis, Kings, Kentville, Wolfville, Berwick, Middleton, Bridgetown and Annapolis Royal)
Western Region (Town and County of Digby, Clare, Argyle, District of Yarmouth, Barrington and Clark's Harbour)

Ontario (194)

Addington Highlands Township

Admaston/Bromley Township
Alberton Township
Alfred and Plantagenet Township
Algonquin Highlands Township
Almaguin Recycling Initiative
Amaranth Township
Armour Township
Arnprior
Ashfield-Colborne-Wawanosh Township
Athens Township
Atikokan Township
Augusta Township
Aylmer
Baldwin Township
Barrie
Bayham, Municipality of
Beckwith Township
Black River-Mason Township
Blind River
Bluewater Recycling Association
Bonfield Township
Bonnechere Valley Township
Brant County
Brantford
Brockville
Bruce Area Solid Waste Recycling
Brudenell, Lyndoch and Raglan Township
Callander, Municipality of
Calvin, Municipality of
Carleton Place
Carling Township
Carlow Mayo Township
Casey Township
Casselman
Central Elgin, Municipality of
Central Frontenac Township
Central Huron, Municipality of
Central Manitoulin Township
Chapple Township
Chatham-Kent, Municipality of
Chatsworth Township
Clarence-Rockland
Cochrane Temiskaming Waste Management Board
Cornwall
Deep River
Drummond-North Elmsley Township
Dryden
Durham, Regional Municipality of
Dutton-Dunwich, Municipality of
Dysart Et Al Township
East Ferris Township

East Garafraxa Township
East Luther Grand Valley Township
Edwardsburgh Cardinal Township
Elizabethtown-Kitley Township
Elliot Lake
Emo Township
Enniskillen Township
Espanola
Essex-Windsor Solid Waste Authority
Fort Frances
Front of Yonge Township
Frontenac Islands Township
Gananoque
Georgian Bluffs Township
Gillies Township
Gore Bay
Greater Madawaska Township
Greater Napanee Township
Greater Sudbury
Grey Highlands, Municipality of
Guelph
Haldimand County
Halton, Regional Municipality of
Hamilton
Hanover
Hastings Highlands, Municipality of
Hawkesbury Joint Recycling
Highlands East, Municipality of
Hilliard Township
Horton Township
Howick Township
Hudson Township
Huron East, Municipality of
Huron Shores, Municipality of
Johnson Township
Kawartha Lakes
Kenora
Kerns Township
Killaloe, Hagarty and Richards Township
Kingston
Kirkland Lake
La Vallee Township
Lanark Highlands Township
Laurentian Hills
Leeds and the Thousand Islands Township
London
Loyalist Township
Machin Township
Madawska Valley Township
Malahide Township
Marathon

Mattawa
Mcdougall Township
Mckellar Township
Mcnab-Braeside Township
Meaford, Municipality of
Melancthon Township
Merrickville-Wolford
Minden Hills Township
Mississippi Mills
Mono Township
Montague Township
Morris-Turnburry, Municipality of
Mulmur Township
Muskoka, District, Municipality of
Nairn and Hyman Township
Neebing, Municipality of
Newbury
Newmarket
Niagara, Regional Municipality of
Norfolk County
North Bay
North Dundas Township
North Frontenac Township
North Glengarry Township
North Grenville Township
North Huron Township
North Stormont Township
Northeastern Manitoulin and Islands
Northern Bruce Peninsula, Municipality
Northumberland County
Oconnor Township
Oliver Paipoonge, Municipality of
Orangeville
Orillia
Ottawa Valley Waste Recovery Centre
Ottawa
Owen Sound
Oxford, Restructured County of
Parry Sound
Peel, Regional Municipality of
Perry Township
Perth
Peterborough
Peterborough County
Plympton-Wyoming
Prescott
Prince Township
Quinte Waste Solutions
Renfrew
Rideau Lakes Township
Russell Township

Sables-Spanish Rivers Township
Sarnia
Sault Ste. Marie
Seguin Township
Shelburne
Simcoe County
Sioux Lookout
Sioux Narrows Nestor Falls Township
Smiths Falls
South Dundas Township
South Frontenac Township
South Glengarry Township
South Stormont Township
Southgate Township
Southwold Township
St. Clair Township
St. Thomas
Stirling-Rawdon Township
Stone Mills Township
Stratford
Tarbutt and Tarbutt Additional Township
Tay Valley Township
Thames Centre, Municipality of
The Archipelago Township
The Blue Mountains
The Nation Municipality
Thunder Bay
Timmins
Toronto
Tri-Neighbours
Tudor and Cashel Township
Waterloo, Regional Municipality of
Wellington County
West Elgin, Municipality of
West Grey, Municipality of
West Nipissing, Municipality of
West Perth Township
Whitestone, Municipality of
Whitewater Region Township
York, Regional Municipality of

Prince Edward Island (1)

Island Waste Management Corporation

Quebec (23)

Amos
Arthabaska, Regional Municipality of
Asbestos, Regional Municipality of
Assomption, Regional Municipality of
Autray, Regional Municipality of
Bellechasse, Regional Municipality of

Coaticook, Regional Municipality of
Cote de Beupre, Regional Municipality of
Erable, Regional Municipality of
Gatineau
Joliette, Regional Municipality of
Laval
Lévis
Longueuil
Lotbiniere, Regional Municipality of
Montreal
Nouvelle Beauce, Regional Municipality
Quebec City
Riviere-du-Loup
Rouyn-Noranda
Sherbrooke
St. Raymond
Victoriaville

Saskatchewan (26)

Assiniboia
Begough
Bienfait
Big River
Biggar
Birch Hills
Carnduff
Delisle
Esterhazy
Etevan
Humboldt
Langham
Lloydminster
Lumsden
Maidstone
Moose Jaw
North Battleford
Outlook
Prince Albert
Regina
Saskatoon
St. Walburg
Swift Current
Weyburn
Wilkie
Yorkton

Appendix 5 — Lamp Recyclers Survey Results

Company A	
1. Is your business a final end-user of mercury containing lamps? Or do you collect/process and ship to an end-user?	Ship to End-User
2. What is the approximate total weight of mercury containing lamps you process per year	125,000 kg
3. What percentage by weight of these lamps would you estimate are:	
a. Florescent Tubes	65%
b. Compact Fluorescent Lamps	15%
c. High Intensity Discharge Lamps/Mercury Vapour Lamps	10%
d. High Pressure Sodium/Low Pressure Sodium Lamps	10%
4. What are the approximate total weights of the individual recyclable materials processed per year?	
Glass	100,000 kg
Phosphor Powder	5,600 kg
Mercury	500 kg
Steel	
Aluminum	2,000 kg
Brass	
Copper	
5. What materials cannot be recovered? What percentage of a lamp's weight does the -non-recyclable component represent?	0%
6. Approximately how many individual units do you receive per year?	500,000
7. Can you provide an approximate breakdown (by unit) of the types of lamps you receive?	2', 4', 6', 8'
8. From whom do you get most of your supply by percentage (please organization and program names as well as contact information where possible)?	
Utilities	10%
Municipal Governments	20%
Provincial Governments	5%
Federal Programs	5%
Retailers	10%
Commercial/Industrial facilities	50%
Manufacturers	
9. Does the price of the recyclable materials impact the quantity of lamps you process?	No
10. Do you travel to pick up lamps?	
a. If so what is the maximum distance you will travel?	75 km
b. What would be your minimum requirements	n/a
11. Do you have a sense of the size of the catchment area your company serves (in terms of population and/or geographic size)?	Vancouver Lower Mainland to Chilliwach for pick-up. BC, AB, SK, MB for commercial freight
12. How are mercury and any other regulated materials managed throughout the recycling process?	See website
13. What are the main markets for the recyclable materials recovered from lamps?	Metal recyclers, roads for glass, mercury powder is returned

14. Do you have any thoughts how the federal government might stimulate the recovery of mercury containing lamps or any other opportunities for increasing recovery?	Legislate and set the example
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Company B	
1. Is your business a final end-user of mercury containing lamps? Or do you collect/process and ship to an end-user?	Process mercury containing lamps and produce clean, recyclable components from the lamps including glass, metals, mercury and phosphor powder
2. What is the approximate total weight of mercury containing lamps you process per year	770,030 kg
3. What percentage by weight of these lamps would you estimate are:	
a. Florescent Tubes	93%
b. Compact Fluorescent Lamps	< 1%
c. High Intensity Discharge Lamps/Mercury Vapour Lamps	3.10%
d. High Pressure Sodium/Low Pressure Sodium Lamps	2.90%
4. What are the approximate total weights of the individual recyclable materials processed per year?	
Glass	749,433 kg
Phosphor Powder	10,881 kg
Mercury	120 kg
Steel	9,595 kg (all metals)
Aluminum	
Brass	
Copper	
5. What materials cannot be recovered? What percentage of a lamp's weight does the -non-recyclable component represent?	Insulation cap is not recycled, but is burnt off during the smelting process to recover the metals (< 1%)
6. Approximately how many individual units do you receive per year?	2,575,341
7. Can you provide an approximate breakdown (by unit) of the types of lamps you receive?	Fluorescent - 2,330,441 (or 9,374,184 linear ft., HID, MVL - 81,683, HPS, LPS - 75,236, Incandescent Halogen, CFL - 88,011, crushed lamps - 3255 kgs
8. From whom do you get most of your supply by percentage (please organization and program names as well as contact information where possible)?	
Utilities	< 5%
Municipal Governments	<5%
Provincial Governments	<2%
Federal Programs	<5%
Retailers	< 1%
Commercial/Industrial facilities	72%
Manufacturers	0%
9. Does the price of the recyclable materials impact the quantity of lamps you process?	No. residual value of waste streams is negligible.
10. Do you travel to pick up lamps?	
a. If so what is the maximum distance you will travel?	Across Canada

b. What would be your minimum requirements	No minimum criteria. Timelines must be flexible for small quantities.
11. Do you have a sense of the size of the catchment area your company serves (in terms of population and/or geographic size)?	Typically from Windsor to Toronto, ON plus the 401 corridor to Montreal
12. How are mercury and any other regulated materials managed throughout the recycling process?	Mercury components must remain within a controlled atmosphere throughout the recycling process to mitigate any fugitive emissions. Exhaust air must be filtered through an activated carbon bed.
13. What are the main markets for the recyclable materials recovered from lamps?	Glass - fiberglass products, phosphor powder - paints and pigments, plastics, metals - various, mercury - various.
14. Do you have any thoughts how the federal government might stimulate the recovery of mercury containing lamps or any other opportunities for increasing recovery?	Regulation and enforcement

Company C	
1. Is your business a final end-user of mercury containing lamps? Or do you collect/process and ship to an end-user?	Collect and Process
2. What is the approximate total weight of mercury containing lamps you process per year	28,600 kg
3. What percentage by weight of these lamps would you estimate are:	
a. Florescent Tubes	96%
b. Compact Fluorescent Lamps	< 2%
c. High Intensity Discharge Lamps/Mercury Vapour Lamps	< 2%
d. High Pressure Sodium/Low Pressure Sodium Lamps	1%
4. What are the approximate total weights of the individual recyclable materials processed per year?	
Glass	8,580 kg
Phosphor Powder	< 286 kg
Mercury	< 286 kg
Steel	20,020 kg (all metals)
Aluminum	
Brass	
Copper	
5. What materials cannot be recovered? What percentage of a lamp's weight does the -non-recyclable component represent?	All materials recovered
6. Approximately how many individual units do you receive per year?	~ 155,000
7. Can you provide an approximate breakdown (by unit) of the types of lamps you receive?	see question 3
8. From whom do you get most of your supply by percentage (please organization and program names as well as contact information where possible)?	
Utilities	5-10%
Municipal Governments	85-90%
Provincial Governments	5%

Federal Programs	0
Retailers	<2%
Commercial/Industrial facilities	5%
Manufacturers	0
9. Does the price of the recyclable materials impact the quantity of lamps you process?	No. Not compensated for recyclables
10. Do you travel to pick up lamps?	
a. If so what is the maximum distance you will travel?	
b. What would be your minimum requirements	
11. Do you have a sense of the size of the catchment area your company serves (in terms of population and/or geographic size)?	Alberta wide
12. How are mercury and any other regulated materials managed throughout the recycling process?	Mercury/phosphor powder is send to a third party facility for retort
13. What are the main markets for the recyclable materials recovered from lamps?	Road paint crush/aluminum and metal recycling
14. Do you have any thoughts how the federal government might stimulate the recovery of mercury containing lamps or any other opportunities for increasing recovery?	Mercury and its compounds are already governed under CEPA. Attempting to force any more recovery may prove to be quite difficult.

Company D	
1. Is your business a final end-user of mercury containing lamps? Or do you collect/process and ship to an end-user?	Processor/recycler of fluorescent and HID lamps
2. What is the approximate total weight of mercury containing lamps you process per year	20,412 kg - 22,680 kg
3. What percentage by weight of these lamps would you estimate are:	
a. Florescent Tubes	79%
b. Compact Fluorescent Lamps	12%
c. High Intensity Discharge Lamps/Mercury Vapour Lamps	9%
d. High Pressure Sodium/Low Pressure Sodium Lamps	included in above
4. What are the approximate total weights of the individual recyclable materials processed per year?	
Glass	12,246 kg
Phosphor Powder	~ 285 kg
Mercury	~ 306 kg
Steel	539 kg
Aluminum	4,814 kg
Brass	349 kg
Copper	1390 kg
5. What materials cannot be recovered? What percentage of a lamp's weight does the -non-recyclable component represent?	fillament and cardboard insert (< 1/2 of 1%)
6. Approximately how many individual units do you receive per year?	~135,000
7. Can you provide an approximate breakdown (by unit) of the types of lamps you receive?	see question 3
8. From whom do you get most of your supply by percentage (please organization and program names as well as contact information where possible)?	

Utilities	20%
Municipal Governments	50%
Provincial Governments	5%
Federal Programs	0%
Retailers	20%
Commercial/Industrial facilities	5%
Manufacturers	0%
9. Does the price of the recyclable materials impact the quantity of lamps you process?	We receive very little for our raw material post recycle
10. Do you travel to pick up lamps?	
a. If so what is the maximum distance you will travel?	Across Canada
b. What would be your minimum requirements	1,500 lamps per pick-up - must be boxed and palletted
11. Do you have a sense of the size of the catchment area your company serves (in terms of population and/or geographic size)?	We deal in all parts of Canada and US, but mostly central and northern Alberta
12. How are mercury and any other regulated materials managed throughout the recycling process?	They are placed in sealed drums provided to use by a licensed handler, and are sent to approved facilities that reclaim mercury and phosphor
13. What are the main markets for the recyclable materials recovered from lamps?	Glass has several markets, India is buying large quantities of mercury. The lighting industry. Metals are sent to local smelters
14. Do you have any thoughts how the federal government might stimulate the recovery of mercury containing lamps or any other opportunities for increasing recovery?	Mercury lamps should be banned from landfills like in the US. Government could offer a recognition program for taking the lead. Tax breaks for corporations that comply.

Company E	
1. Is your business a final end-user of mercury containing lamps? Or do you collect/process and ship to an end-user?	Collects, processes and ships to 3 end users
2. What is the approximate total weight of mercury containing lamps you process per year	315,076 kg
3. What percentage by weight of these lamps would you estimate are:	
a. Florescent Tubes	92%
b. Compact Fluorescent Lamps	3%
c. High Intensity Discharge Lamps/Mercury Vapour Lamps	5%
d. High Pressure Sodium/Low Pressure Sodium Lamps	included in above
4. What are the approximate total weights of the individual recyclable materials processed per year?	
Glass	286,000kg
Phosphor Powder	21,362 kg
Mercury	238 kg
Steel	0
Aluminum	7476 kg (all metals)
Brass	
Copper	

5. What materials cannot be recovered? What percentage of a lamp's weight does the -non-recyclable component represent?	All is recovered
6. Approximately how many individual units do you receive per year?	913,925
7. Can you provide an approximate breakdown (by unit) of the types of lamps you receive?	fluorescent tubes 2,412,016 linear feet, CFLs 28,044, HID Mercury and Sodium 32,877
8. From whom do you get most of your supply by percentage (please organization and program names as well as contact information where possible)?	Industrial companies, cities, provincial and federal programs and commercial/industrial facilities in Quebec and Ontario and manufacturers in Quebec.
Utilities	
Municipal Governments	2%
Provincial Governments	
Federal Programs	
Retailers	
Commercial/Industrial facilities	98% comes from IC&I sector
Manufacturers	
9. Does the price of the recyclable materials impact the quantity of lamps you process?	Yes, because the more lamps receive the more maintenance is required. Carbon filters need to be replaced and machines need to be cleaned more often
10. Do you travel to pick up lamps?	
a. If so what is the maximum distance you will travel?	500 km
b. What would be your minimum requirements	minimum 300 lamps
11. Do you have a sense of the size of the catchment area your company serves (in terms of population and/or geographic size)?	RLF services Montreal, Quebec City, Trois-Rivieres, Sherbrooke, Hull, Gatineau. In Ontario, Ottawa, Cornwall, Toronto and Arnprior
12. How are mercury and any other regulated materials managed throughout the recycling process?	Phosphor powder/mercury
13. What are the main markets for the recyclable materials recovered from lamps?	Glass, metal, phosphor powder/mercury
14. Do you have any thoughts how the federal government might stimulate the recovery of mercury containing lamps or any other opportunities for increasing recovery?	Federal government should designate fluorescent tubes and HID lamps as hazardous waste. So they are not disposed of in municipal landfills.

Appendix 6 — Comments from Electro-Federation Canada

These comments were prepared by the Lamp Committee of the Electro-Federation as part of the review of the study on increasing recycling rates in Canada. The comments were received September 2005.

SUGGESTED ACTIONS

Industry agrees that Canada should adopt “Universal Waste-Type” rules for lamp recycling... Many other ideas listed in the report, such as further education and outreach, are also worth consideration.

The report identifies an existing third party lamp-recycling infrastructure. This independent infrastructure should be used to further increase lamp recycling in Canada.

INDUSTRY POSITION ON TAKE-BACK

Lamp manufacturers are not in the waste management business, and do not offer these services.

Manufacture Take-Back is strongly opposed by industry and is not an acceptable or viable approach in the US and Canada for the following reasons.

Manufacturer collection is bad policy for the following reasons:

- **It is not needed to ensure high rates of recycling.** The growth in recycling and the high rates of recycling in some areas, demonstrates this.
- **The current recycling system is very efficient and economical.** It is very economical for businesses and governments to directly contract with third party recyclers for lamp recycling needs. This allows them to get bids from more than one recycler (that they have qualified) assuring that they are receiving lamp recycling services at the most competitive rate. This system also takes immediate advantage of any efficiency improvements in the recycling process because competition rewards efficiency improvements and continually lowers recycling costs.
- **Lamp manufacturer take-back systems would be inefficient and duplicative.** Manufacturer collection replaces the current system with a manufacturer-funded system, which will result in significantly higher recycling costs, as many duplicative and non-competitive systems will be required. There are currently well over 100 manufacturers or importers selling mercury-containing lamps in the US and Canada, each of which would be required to individually fund a collection system of some type under a manufacturer

collection system. There are even a greater number of companies that sell products that contain lamps.

- **Government and private sector facilities will incur additional costs.** Over the years, businesses buy lamps from several different lamp manufacturers. Today, all of their lamps are recycled with one pick-up, regardless of the original manufacturer. Under a manufacturer take-back system, in addition to having to pay a high up-front fee at the time of lamp purchase, facilities will incur increased costs related to segregating and storing each manufacturer's lamps for each unique recycling system. Consequently, the new cost of an energy efficient fluorescent lamp following passage of a manufacturer collection requirement will be much higher than the combined cost of a fluorescent lamp and the cost of recycling under the current system.

- **It will reduce the use of energy efficient lighting.** Lamps are a commodity, and as such are very price-sensitive. The cost of recycling large quantities of lamps is approximately 33 percent of the cost of a commodity 4-foot lamp. Recycling costs for small quantities of lamps is typically much higher per lamp. Adding recycling costs in the selling price will increase the cost of the product by a significant amount. This will discourage the purchase of energy efficient lamps. Fluorescent lamps are typically *three to four times* more energy efficient than incandescent lamps. A recent study in California found that energy efficient lighting is responsible for over 73 percent of all energy savings in new California buildings vs. buildings constructed a few years ago. In addition, higher up-front cost is

A MANUFACTURER TAKE BACK SYSTEM WOULD BE VERY EXPENSIVE

Under a manufacturer take-back system, the manufacturer would have to include administrative overhead to the process, adding significantly to the disposal cost.

Under a manufacturer take-back system, recycling costs would be charged at the time of lamp purchase, 4 or 5 years before the lamps were actually recycled. This would produce a very expensive recycling system to both businesses and governments because:

1. Recycling costs essentially would be paid 5 years in advance, eliminating use of this money for other investments.
2. Companies and Governments that "pre-paid" for recycling services in the cost of the lamp would not be able to take advantage of any recycling efficiency improvements or pricing reductions during those 5 years.
3. There would be no ability to bid for recycling services between different lamp recyclers.
4. Manufacturers would have to maintain a significant overhead structure to manage recycling issues and would build-in a significant additional overhead charge to the cost of recycling.
5. Antitrust laws would prevent manufactures from developing a common collection system, with a common disposal fee.

already the major impediment to the use of energy efficient compact fluorescent lighting in homes. Environment Canada feels so strongly about the environmental benefits of using energy-efficient lighting that it runs a promotion to encourage the use of ENERGY STAR® mercury-containing lamps every fall — “Switch and Save.”

- **The system of distributing new products cannot be used to transport lamps back for recycling.** Laws governing the transportation of waste are different than regulations governing the transportation of new products. Trucks from distributors of new products are not typically licensed to transport waste. In addition, new product distributors and retailers are usually not licensed to store waste, nor are they familiar with waste transportation or waste disposal regulations. For these reasons, lamp recycling should be restricted to companies that are knowledgeable about disposal regulations for this waste stream.
- **Proponents of manufacturer take-back sometimes claim to model the European approach to lamp recycling.** However, the EU has not yet implemented such a plan and is now having to confront all the barriers mentioned in this white paper. The EU companies are not saddled with the same degree of anti-trust restrictions in effect in North America regarding collaborative collection arrangements. Nonetheless, it is instructive to note that our European counterparts are proposing to add one Euro (> \$1) to the cost of each lamp to cover recycling at some future date, and the additional administration and reporting that is required. On average that will DOUBLE the wholesale cost of 4ft fluorescent lamps. The equivalent cost in Canada under the current competitive system is approximately 30–50 cents per lamp.

LAMP RECYCLERS IN NORTH AMERICA DO NOT SUPPORT A MANUFACTURER TAKE BACK SYSTEM

“SB511, (a failed CA manufacturer take-back bill) as written, would undermine everything we have done and are doing with the EPA, DTSC and the lamp consumers to increase recycling. It is counterproductive to transfer responsibility for recycling to hundreds of lamp manufacturers, who are not in any way involved with collecting lamps or in the competitive market of lamp recycling. It is not appropriate to require manufacturers to do this kind of planning, and it is especially not appropriate for the DTSC (a state environmental agency) to have review and approval authority for the commerce of lamp recycling. This would be an administrative burden to DTSC and it is not within their capability to judge plans that involve thousands of entities engaged in intra- and inter-state commerce. – Paul Abernathy, Executive Director, Association of Lighting and Mercury Recyclers, Testimony before the California Senate Committee on Environment, April 28, 2003, in opposition to a proposed manufacturer take back requirement.

“Yet, we contend that the fact that the existing and expanding service infrastructure is being underutilized currently for mercury waste is no reason to set up new collection systems by manufacturers. The tools to greatly increase recycling rates are already available without new legislation.” – Barry Jordan, Superior Special Services, Testimony Before the New Hampshire House Natural Resources and Agriculture Committee, March 21, 2001.

“We feel that it would be counter-productive to require manufacturers to establish take-back programs when the system currently in place is working very well. We see a greater problem in states that have not currently adopted the Universal Waste Rule. We also feel that the issue of education and enforcement could have a much more positive effect of capture rated than mandatory take-back programs. We continue to work with state and local governments, as well as lamp generators and lamp manufacturers, to develop the infrastructure needed to make recycling easy and available to everyone.” – Raymond Graczyk, President of Northeast Lamp Recycling, Before Connecticut Joint Natural Resources Committee, Feb. 16, 2001.

CONCLUSION

The current system, where the beneficial user is responsible for lamp disposal is the most cost effective. For the user, the cost of recycling represents only one percent of the total cost of ownership of a fluorescent lamp. The majority of ownership costs are for energy, and a typical fluorescent lamp rewards its owner several hundred times its purchase price compared with what would have been spent on energy, using inefficient incandescent lamps. As the overwhelming financial beneficiary in the manufacturer-distributor-user chain, there is a strong case for lamp users/owners to continue to fund their own recycling and negotiate their own contracts with the existing infrastructure of lamp recyclers.

A manufacturer take-back system would be the most costly of all alternatives and create enormous inefficiencies and unintended consequences. Industry recommends using the existing infrastructure to recycle lamps. Provinces will need to assist in educating users about disposal requirements, enforce existing laws, and adopt universal waste type regulations to ease collection and transportation of spent lamps. Industry can assist education through lamp and package labeling and information dissemination through the www.lamprecycle.org website.