BASELINE REPORT

END-OF-LIFE MANAGEMENT OF LAMPS CONTAINING MERCURY IN CANADA

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Environment and Climate Change Canada
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Environment and Climate Change Canada
Public Inquiries Centre
12th Floor, Fontaine Building
200 Sacré-Coeur Boulevard
Gatineau QC K1A 0H3
Telephone: 819-938-3860
Toll Free: 1-800-668-6767 (in Canada only)
Email: ec.enviroinfo.ec@canada.ca

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1. INTRODUCTION

The *National Strategy for Safe and Environmentally Sound Disposal of Lamps Containing Mercury Act* (the Act)[1] requires the Minister of Environment and Climate Change to develop a national strategy for lamps containing mercury in cooperation with the provinces, territories and other interested governments in Canada responsible for the environment, and in consultation with other interested persons or organizations. The Minister must submit the national strategy to Parliament in June 2019 and report on its effectiveness every 5 years.

This baseline report describes the current state of end-of-life management for lamps containing mercury in Canada. It provides key evidence and analyses used to develop the national strategy. Data in this report will be used as the baseline for measuring the effectiveness of the national strategy over time.

The report examines: sales trends for lamps containing mercury; existing programs and approaches to diverting them from landfills; factors that influence diversion rates; potential releases of mercury throughout the lifecycle of lamps; existing guidance and "best practices" resources for environmentally sound management of end-of-life lamps, and their current levels of implementation. The report also identifies barriers to increasing diversion of lamps containing mercury and key gaps in available data.

Information was collected from federal regulatory reporting programs and statistical surveys, provincial governments, lamp manufacturers, lamp processors, stewardship organizations, and recycling councils. Data was publicly available, reported voluntarily, or purchased. Data analysis was conducted in-house by Environment and Climate Change Canada unless stated otherwise.

2. OVERVIEW OF LAMPS CONTAINING MERCURY

2.1 LAMP TYPES

Figure 1 presents some of the common types of lamps that contain mercury. Linear fluorescent lamps (LFLs), also known as straight fluorescent lamps, are typically used in industrial, commercial, and institutional (ICI)buildings. Starting in the early 2000's, compact fluorescent lamps (CFLs) became widely used as replacements for incandescent lightbulbs in residential lighting, as they are significantly more energy-efficient and have a longer lifetime. High-intensity discharge (HID) lamps are used for street and stadium lighting. Specialty lamps containing mercury include lamps that emit ultraviolet (UV) light for water or air purification, tanning, or medical treatment; some automobile headlamps; "neon" lights used for signage; and lamps in some electronic displays.

Figure 1: Common types of lamps containing mercury

2.2 TRENDS IN LAMP SALES

Sales of lamps containing mercury peaked in the mid-to-late 2000's as incandescent lamps were being phased out. In recent years, there has been a significant shift in sales to light emitting diode (LED) lighting across all sectors in Canada (Figure 2). Prices for LEDs have declined an average of 20% per year since 2011, making them cost-competitive with CFLs.[2] In 2017, 50% of Canadian households reported using at least one LED, compared to 30% in 2015, while the percentage of households using at least one CFL declined from 68% to 55% over the same period.[3] LEDs are mercury-free, generally more energy-efficient, and have longer lifetimes than lamps containing mercury.

Linear LEDs and other LED replacements for LFLs remain more costly. Maximum energy savings are achieved by replacing the entire linear fluorescent light fixture, removing the ballasts, and installing smart lighting controls. However, there are also LEDs that plug directly into existing fixtures to replace an individual lamp. Despite their up-front costs, the energy efficiency benefits of LED lamps are resulting in the ICI sector shifting towards their use instead of LFLs.

Outdoor lighting (HID lamps) is one of the fastest transitioning sectors. Approximately 44% of the 2.7 million streetlights in Canada have been or are planned to be replaced by LEDs.[4] For other types of lamps containing mercury, mercury-free alternatives are also becoming cost-effective. However, for some specialty uses (for example, medical treatment), alternatives do not exist yet or their costs are still significantly higher.

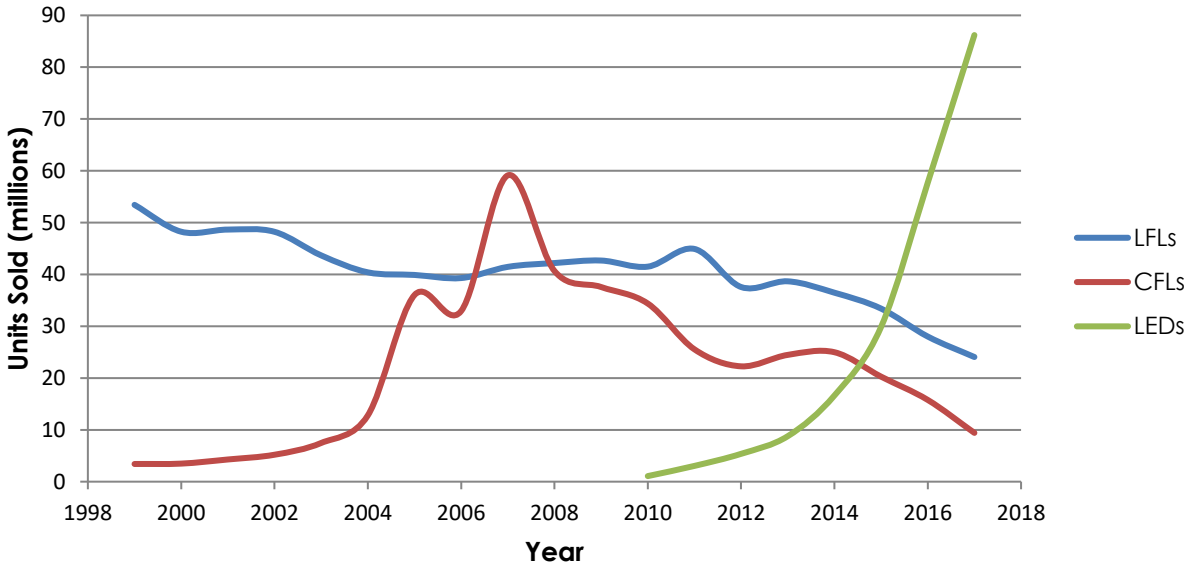


Figure 2: Sales of LFLs, CFLs, and LED lighting in Canada, 1999-2017[5,6]

3. MANAGEMENT OF LAMPS CONTAINING MERCURY IN CANADA

Mercury is released when lamps are broken or improperly disposed of (landfilled or incinerated). Mercury enters the environment as vapour, and from the liquid that drains from a landfill. Federal, provincial, territorial, and municipal governments have taken some actions to reduce mercury releases from lamps into the environment.

3.1 FEDERAL ACTIONS

Canada is Party to the Minamata Convention on Mercury, which aims to protect human health and the environment from anthropogenic (human caused) emissions and releases of mercury. It addresses all aspects of the mercury lifecycle, including the phasing-out of its use in certain products, and management of mercury waste to control emissions and releases.[7] In April 2017, Canada ratified the Minamata Convention, helping bring the treaty into force on August 16, 2017.

The federal *Products Containing Mercury Regulations* prohibit the import and manufacture of products containing mercury or any of its compounds, with some exemptions for products that have no technically or economically viable alternatives, such as lamps.[8] The regulations limit the amount of mercury in fluorescent and certain other types of lamps, and require reporting on import and manufacturing of mercury-containing products every 3 years. Most of these products must be labelled to inform consumers about the presence of mercury, safe handling procedures, and options for end-of-life management. Environment and Climate Change Canada (ECCC) plans to amend the regulations to further limit mercury in some products and to introduce prohibitions on the import and manufacture of certain lamps containing mercury (such as CFLs and LFLs).[9]

In February 2017, ECCC published the *Code of Practice for the Environmentally Sound Management of End-of-Life Lamps Containing Mercury* (Code of Practice).[10] It outlines best practices for the collection, storage, transport, processing, and disposal of lamps containing mercury, as well as guidance for northern and remote areas where access to proper disposal is limited.

3.2 LAMP DIVERSION PROGRAMS

In Canada, a number of mandatory and voluntary diversion programs have been implemented to manage lamps containing mercury. As shown in Table 1, some provinces have extended producer responsibility (EPR) regulations, while others have voluntary province-wide programs. Some municipalities, retailers, lamp manufacturers and distributers, and non-governmental organizations have also implemented voluntary programs.

Table 1: Overview of province-wide lamp diversion programs in Canada

Province	Type	Year	Sector	Program collection sites	LFL	CFL	HID	LED
British Columbia	EPR	2010	Residential ICI	333	X	X	X	X
Manitoba	EPR	2012	Residential only	100	X	X		
Ontario	Voluntary, directed by a non-profit	2008	ICI only	N/A	X	X	X	X
Quebec	EPR	2012	Residential ICI	890	X	X	X	
Nova Scotia	Voluntary, utility-funded, includes all mercury products	2015	Residential ICI	41	X	X	X	
Prince Edward Island	EPR	2015	Residential ICI	8	X	X	X	X

EXTENDED PRODUCER RESPONSIBILITY

Extended Producer Responsibility requires producers (manufacturers, first importers, or brand owners, as applicable) to be physically and financially responsible for post-consumer management of their products. Provincial regulations enable an EPR program, and specific EPR requirements are determined by the producer responsibility organization and the provincial government.[11] In practice, funding for EPR programs for lamps is generated through point-of-sale fees on applicable products. The producer responsibility organization is responsible for managing all aspects of the program including setting point-of-sale fees, tracking lamp sales, collection, program promotion, and ensuring program participants comply with all requirements and regulations. Product Care Association is currently the producer responsibility organization for Canada's existing programs in British Columbia, Quebec, Manitoba, and Prince Edward Island. Ontario has announced plans to introduce EPR regulations for lamps containing mercury within the next few years.[12] Saskatchewan recently consulted on the development of household hazardous waste regulations that would include lamps containing mercury.

The EPR programs in British Columbia and Prince Edward Island cover the most comprehensive range of lamps, including both lamps containing mercury and mercury-free lamps. The program in Quebec covers only lamps containing mercury. The program in Manitoba currently limits coverage to LFLs and CFLs from residential sources but will expand to include LFLs and CFLs from the ICI sector starting in 2020.[13]

VOLUNTARY PROGRAMS

Nova Scotia has a mercury collection program that covers both the residential and the ICI sectors. It provides funding to collection sites and offers free pick-ups for large volume generators of CFLs, LFLs, HID lamps, and other mercury-containing products. The program is funded by Nova Scotia Power and administered by EfficiencyOne in partnership with Scout Environmental. Nova Scotia Power funds the program as the collection of mercury earns emission credits under the provincial *Air Quality Regulations*.[14] These regulations currently set an end date for the program in 2024. Unlike EPR programs, the costs of lamp diversion are not paid at point-of-sale but by the utility and its ratepayers.

Take Back the Light is a voluntary program, run by the Recycling Council of Ontario, that brings together non-residential lamp purchasers with lamp distributors. The program requires distributors to collect the lamps at end-of-life from the purchaser and send them to lamp processors. The service is free for lamp purchasers, while lamp distributors contribute a small fee to the program based on gross sales.

RETAIL TAKE BACK PROGRAMS

Some retailers offer take back programs for lamps at all or most of their stores in Canada (such as IKEA, London Drugs and Lowe's). Other retailers offer take back in select stores (by decision of the franchise owners) and/or participate where there are EPR or voluntary programs in place, which reduces the cost of the program.

COURIER SERVICES

Some lamp processors and hazardous waste companies offer courier services where sturdy boxes are sent out to be filled with lamps, and the costs for shipping and processing are pre-paid. These services are typically offered for clients with smaller or intermittent volumes of lamps and/or where costs for dedicated transportation are high.

EXCHANGE PROGRAMS

Exchange programs are designed to accelerate the transition to more energy-efficient lighting through low or no cost exchanges of lamps containing mercury for energy-efficient mercury-free alternatives (such as LEDs). For example, an exchange program was conducted in Northwest Territories between 2015 and 2017. Under that program, residential lamps were collected in 25 communities, and more than 50 large buildings were retrofitted in 11 communities.

RESIDENTIAL CURBSIDE PICKUP SERVICES

A few municipalities in Canada have implemented curbside collection programs for household hazardous waste (including lamps containing mercury). For example, in Toronto and Sudbury, a curbside collection program called the Toxic Taxi allows residents to arrange a pick-up of household hazardous waste for free or for a nominal fee. In Dunnottar, Manitoba, there are a few curbside collection days every year for residents.

4. LAMP DIVERSION IN CANADA

4.1 MEASURING DIVERSION PERFORMANCE

A common metric for measuring lamp diversion is diversion rate (also commonly called capture rate), which is defined as the number of lamps collected and processed in an environmentally sound manner divided by the number of lamps expected to be available for collection. Diversion rate is used by all lamp EPR programs in Canada, though each program uses different methods to calculate the number of lamps available for collection.

There are challenges in using diversion rate as a performance indicator for products with long lifetimes, such as lamps and electronics. A variety of factors contribute to the amount of time between purchase and end-of-life, including storage before and after use, type of usage, and the quality of the product. Despite these challenges, it will be difficult to gauge effectiveness of the national strategy without an estimate of the number of lamps expected to be available for collection. The baseline report uses estimated sales of CFLs, LFLs, and HID lamps in 2012 to estimate a 2017 diversion rate for Canada.

4.2 DIVERSION RESULTS

It is estimated that approximately 22 million lamps containing mercury were diverted in Canada in 2017 (Table 2). In total, 65 million lamps containing mercury were assumed to be available for collection based on 2012 sales, resulting in an overall national diversion rate of 34%. Based on available data from existing programs, retailers, and processors, lamp diversion has been increasing steadily for at least the past 3 years. Despite progress on this issue, in 2017, an estimated 43 million lamps were disposed of in landfills.

In many cases, sales are reported based on larger geographic regions (such as Atlantic Canada); therefore sales in some provinces have been estimated based on provincial population within those regions. No information is available on sales in the territories. Specialty lamps sales data are incomplete and are not included in the calculation. The amount of mercury going to landfills was estimated based on the average mercury content reported by manufacturers, assuming a mixture of older lamps (which contain more mercury) and newer lamps (with lower amounts of mercury).[15]

Generally, provinces with diversion programs (mandatory and voluntary) that dedicate funding to collection and advertising have more collection sites and are more successful (with higher diversion rates) than provinces without. Most of the collection sites and events in Canada (1,300 out of 1,800) operate under EPR programs.

Table 2: Diversion rates of lamps containing mercury across Canada in 2017

Jurisdiction	Lamps containing mercury diverted 2017	CFLs, LFLs, and HID sales in 2012	Diversion rate	Mercury entering landfills (kg)
British Columbia	4,257,880	9,200,000	46%	34
Alberta	1,800,000	7,900,000	23%	42
Saskatchewan	450,000	2,200,000	20%	12
Manitoba	2,100,000	2,600,000	81%	3.4
Ontario	8,600,000	25,300,000	34%	115
Quebec	4,010,000	14,400,000	28%	71
New Brunswick	~20,000	1,200,000	2%	8.0
Nova Scotia	960,000	1,500,000	64%	3.7
Prince Edward Island	81,834	240,000	34%	1.1
Newfoundland and Labrador	~15,000	840,000	2%	5.6
The Territories	Unknown	Unknown	N/A	N/A
Canada	**22,000,000**	**65,000,000**	**34%**	**~300**

The EPR program in British Columbia, which has been in place the longest and covers all types of lamps, has the highest diversion rate among provinces with EPR programs. The diversion rates in Quebec and Prince Edward Island are approximately in line with the national average. Manitoba's high diversion rate is attributed to voluntary diversion from the ICI sector rather than the EPR program, which is for the residential sector and accounted for less than 10% of total lamps diverted. These data indicate that there is scope for provinces with EPR programs to divert more lamps containing mercury.

The Nova Scotia mercury collection program, in its third year of operation, has significantly increased lamp diversion numbers every year. As a result, in 2017, Nova Scotia had one of the highest diversion rates in Canada. Ontario's diversion rate is comparable to provinces with EPR. This can likely be attributed to the province's Take Back the Light program for the ICI sector, retail take back programs, and the presence of three lamp processors (the most among provinces).

Recycling data for New Brunswick and Newfoundland and Labrador are incomplete, and diversion rates may not be accurate. No data is available for the territories. No lamp processors are present in these five jurisdictions, which may create barriers for diversion due to transportation costs. Lamp crushing devices are commonly used in these jurisdictions to reduce the volume of lamps for transportation.

In provinces without programs, lamp diversion is often measured by weight rather than by unit, and data is often not available on the types of lamps collected or whether they come from the residential or ICI sectors. Collecting data consistently across Canada would help better estimate diversion rates and identify where improvements are needed most.

Limited data is available for lamps sold and collected in northern, remote, and Indigenous communities. These areas face unique challenges in end-of-life management of lamps containing mercury such as population size and distribution and lack of access to services and facilities. However, there can be opportunities to improve diversion in these communities by collecting and temporarily storing lamps at drop-off points, such as at the local waste management facility, a retail store, or a community centre.

The federal government owns or leases more than 20,000 properties and generates a significant number of lamps containing mercury. It is not currently known how many buildings used for federal government operations have a management plan in place for lamps containing mercury. LED retrofits have been carried out in many buildings and there are plans to do so in many more; however, a government-wide record of retrofits completed, planned, or in progress is not available.

4.3 EXPECTED TRENDS IN LAMP DISPOSAL

As evidenced by the trends in lamp sales and the increasing popularity of LEDs, lamps containing mercury are increasingly being replaced with LEDs before the end of their useful life. It is expected that there will soon be a peak in volumes of lamps containing mercury requiring disposal and that the numbers will begin to decline within about 5 years, as fewer lamps are available to be collected. Therefore, there is a need to improve diversion in the short term to prevent the improper disposal of a large number of lamps. These programs will also still be needed for the next 15-20 years to collect and divert lamps that are still widely in use, such as LFLs in commercial buildings and smaller volumes of HIDs, speciality lamps and CFLs.

5. KEY FACTORS THAT INFLUENCE LAMP DIVERSION RESULTS

A number of key factors have been identified that influence lamp diversion rates in Canada, including public awareness, accessibility, convenience, and costs. These factors are also measured by other provincial and territorial EPR programs, such as those for electronics. Based on consultations and data gathered from stakeholders and other sources, an analysis has been conducted on these factors to determine their potential impact and barriers to improving lamp diversion in Canada.

5.1 PUBLIC AWARENESS

The Act recommends that the national strategy include a plan to promote public awareness of safe and environmentally sound disposal. Throughout consultations on the national strategy, raising awareness was highlighted as key to increasing participation in lamp diversion programs for all sectors and ensuring that lamps are managed in an environmentally sound manner at end-of-life.

Data is limited on the level of public awareness of the presence of mercury in lamps. Under the *Products Containing Mercury Regulations*, importers and manufacturers of lamps containing mercury are required to include information on the lamp or on the packaging, indicating the presence of mercury in the lamp and the options available for diversion. A website may also be provided to help locate regional diversion options. The regulations also require that most lamps containing mercury be labelled with "Hg", the atomic symbol for mercury. Packaging may be discarded soon after purchase, so the logo on the lamp is a practical indication to users that it contains mercury. As the regulations came into force in 2015, lamps manufactured or imported before this date may not have any labels or information on the packaging indicating the presence of mercury.

There has been no comprehensive study of the current level of awareness of the need to divert lamps containing mercury in Canada. Some studies show low, but improving, awareness of the issue. Statistics Canada's Household and the Environment Survey measures the environmental practices and behaviours of Canadian households.[16] In 2009, this survey started collecting information on Canadian disposal habits for lamps containing mercury, and continues to collect data every 2 years (2017 data was not yet available).

From 2009 to 2015, there was an increase in awareness of lamp EPR programs in every province (Table 3). This increase in awareness was associated with a decrease in improper lamp disposal. In 2015, 44% of Canadian households reported throwing CFLs in the garbage, compared to 56% in 2009 (Figure 3). The number of households that reported throwing LFLs in the garbage in 2015 was much lower at 27%. The difference in disposal rates between CFLs and LFLs could be due to a variety of factors such as the size of CFLs, which makes them easier to throw out, or more awareness around the need to divert LFLs.

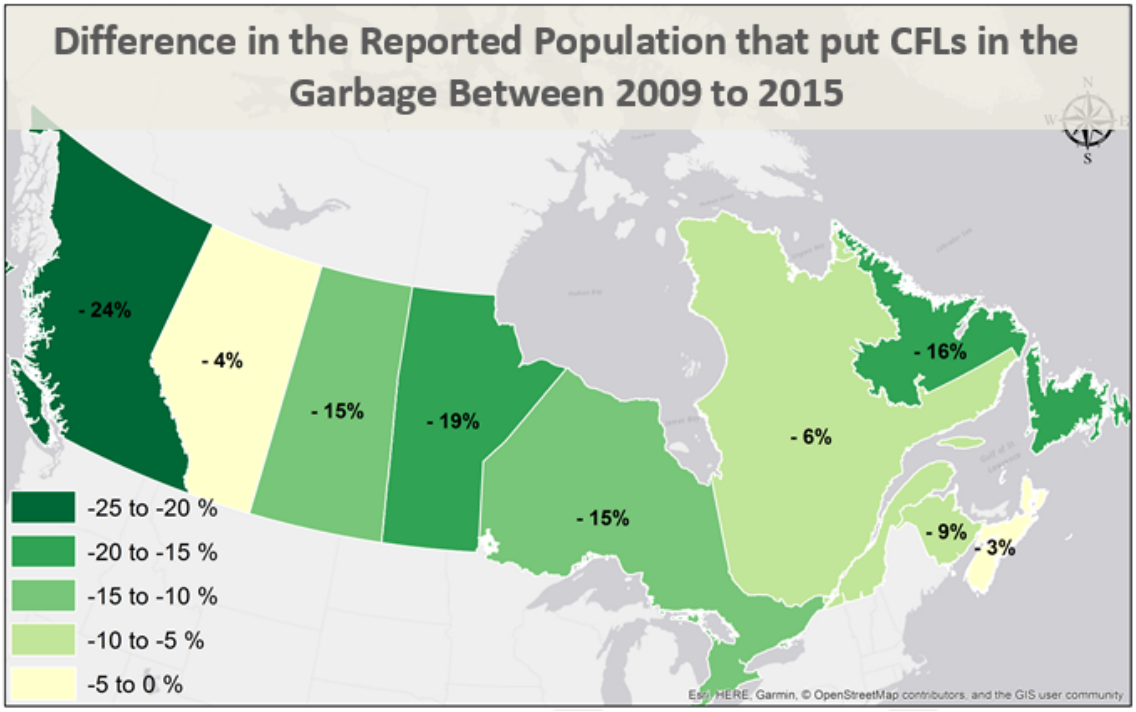


Figure 3: Difference in population that reported throwing CFLs in garbage in 2015 compared to 2009

The 2015 survey results showed improvements in diversion behavior in some EPR provinces (British Columbia and Manitoba); however Quebec residents reported diversion behaviour that were similar to provinces without EPR programs. Some provinces made significant improvements in the absence of an EPR program (Newfoundland and Labrador and Saskatchewan), while others made limited improvements (Alberta, New Brunswick, and Nova Scotia). In 2015, it was reported that 18% of households still had at least one end-of-life lamp, which represents a potentially large store of lamps containing mercury across Canada. Awareness of the need to divert lamps within the ICI sector has not been studied.

In EPR programs, there are dedicated resources to increase program awareness, including advertising on television and in public spaces such as transit, community events, displays at point of sale and point of return, hotlines, and webpages. Product Care Association conducts periodic surveys in provinces with EPR programs (Table 3),[17] and results show that program awareness is 55% or less.

Table 3: Public awareness of lamp EPR programs

Province	Public Awareness	Program initiation
British Columbia	55% (2017)	2010
Manitoba	48% (2017)	2012
Quebec	51% (2015)	2012
Prince Edward Island	32% (2015)	2015

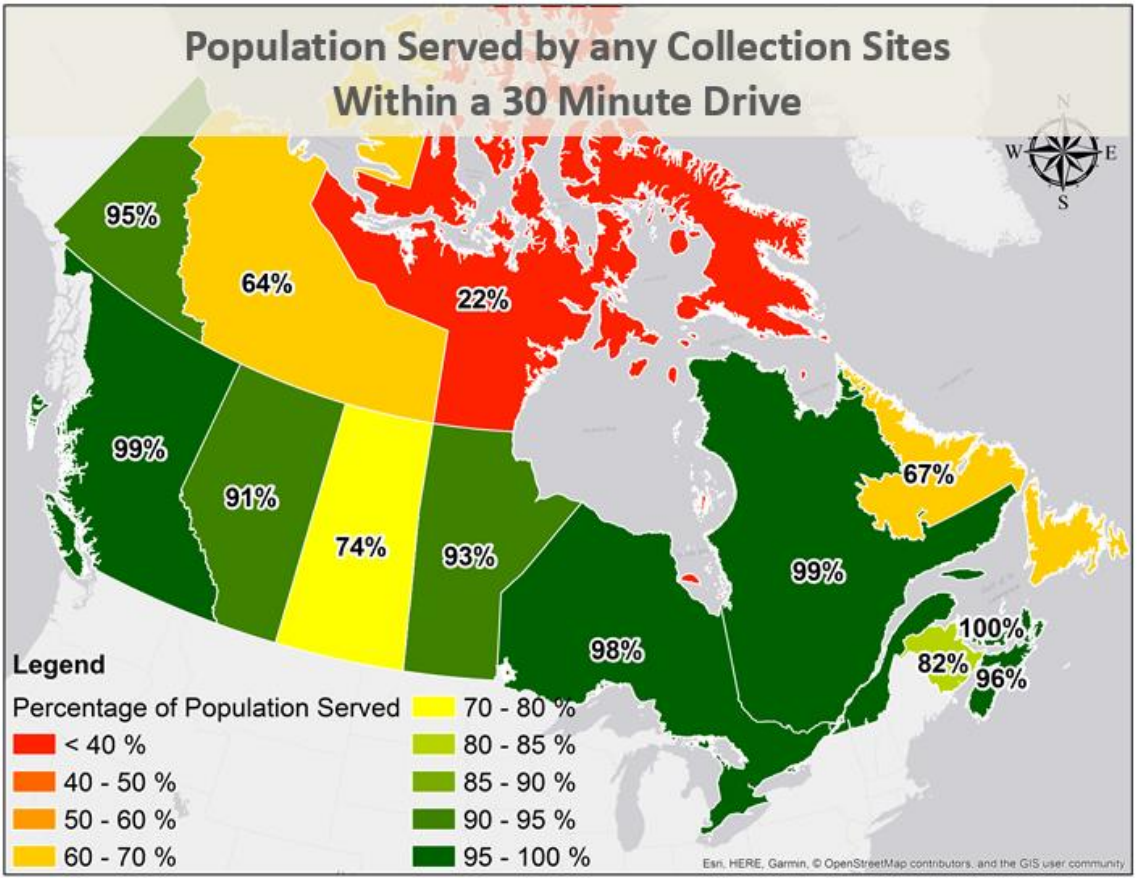
In British Columbia, surveys over multiple years show improving public awareness from 48% in 2014 to 55% in 2017. A 2015 survey commissioned by the British Columbia government, however, found that lighting products were the second most likely product to be thrown in the garbage, with the main reasons being that consumers did not know lighting products should be diverted (30%), or did not know where to take them (33%).[18] There is no data on awareness of the need to divert lamps containing mercury in provinces without EPR, but awareness levels are likely lower.

5.2 ACCESSIBILITY AND CONVENIENCE OF COLLECTION SITES AND EVENTS

Most Canadians must travel to a collection site or event to drop off spent lamps from their homes. Small businesses often do the same, as pickup services are too costly. The accessibility and convenience of these collection sites are potentially key factors for a resident or small business in considering whether to divert their spent lamps or to dispose of them improperly.

Two provinces with EPR programs (Quebec and British Columbia) have an accessibility standard with which the producer responsibility organization must comply. Quebec requires a minimum number of collection sites or events within a community, based on population. [19] British Columbia's standard is based on drive time (within 30 minutes for urban and 45 minutes for rural), and applies to communities of more than 4,000 people.[20] Collection sites may be present (but are not required) in communities of less than 4,000 people, and collection events are held to reach those without permanent collection sites. EPR programs for some other products, such as electronics, also have standards for accessibility and use drive times as the metric to determine accessibility.

There are about 1,800 collection sites and events in Canada for residents to divert lamps containing mercury. These include municipal depots, municipal household hazardous waste collection events, some retailers, and private depots. To determine accessibility to lamp collection sites, an analysis of drive time was conducted. Figure 4 shows the percentage of Canadians (by province and territory) that live within a 30 minute and 10 minute drive of the nearest residential collection site or event. Collection site and event location information for this analysis was obtained from a variety of sources (EPR programs, municipalities, retailers, and websites). For urban and suburban residents, a 10 minute drive may be similar to the average distance traveled to do routine shopping, while a 30 minute drive is likely more relevant for rural residents. Travel times would clearly be different for residents who walk, cycle or use mass transit.



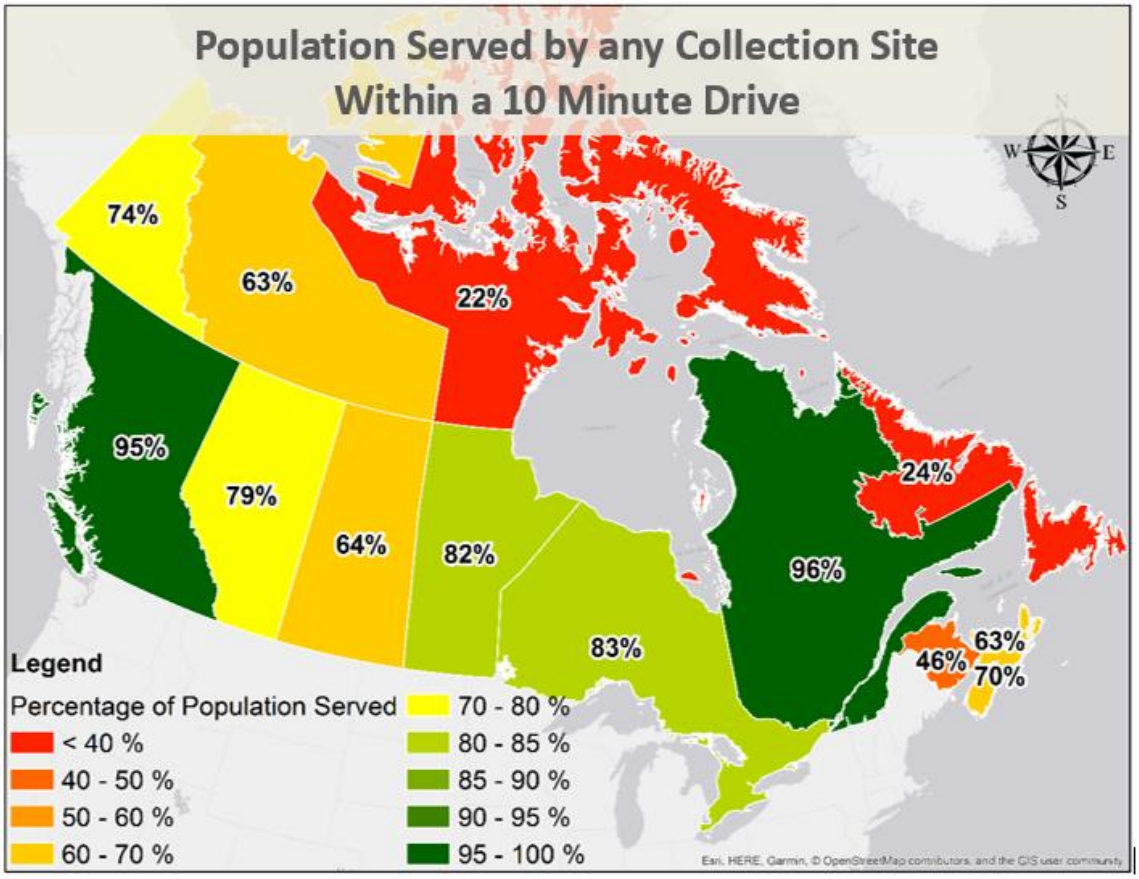


Figure 4: Percentage of population within a 30 minute or 10 minute drive of a residential collection site or event

This analysis shows that most Canadians (96%) are within a 30 minute drive of a collection site or event. While a majority of Canadians (84%) are also within a 10 minute drive, accessibility is much lower in jurisdictions where more of the population lives in rural areas, such as New Brunswick, Newfoundland and Labrador and the Northwest Territories. Residents of provinces with EPR programs generally have better accessibility.

Rural residents are rarely within a 10 minute drive to a collection site, and many are not within a 30 minute drive. Driving time is also not a useful metric for most northern and remote areas. For example, many communities in the Northwest Territories do not have year-round road access, and no communities in Nunavut are linked by road. Similar issues are faced in northern and remote regions of the provinces, and by many Indigenous communities across Canada.[21,22]

Accessibility analyses can be done on a smaller scale where more granular data is available, such as for the Golden Horseshoe area of Ontario shown in Figure 5. This analysis shows that even in areas of high population (more than 9 million people)[23] where there are no EPR programs in place, accessibility to collection sites is variable (between 95% to less than 30%).

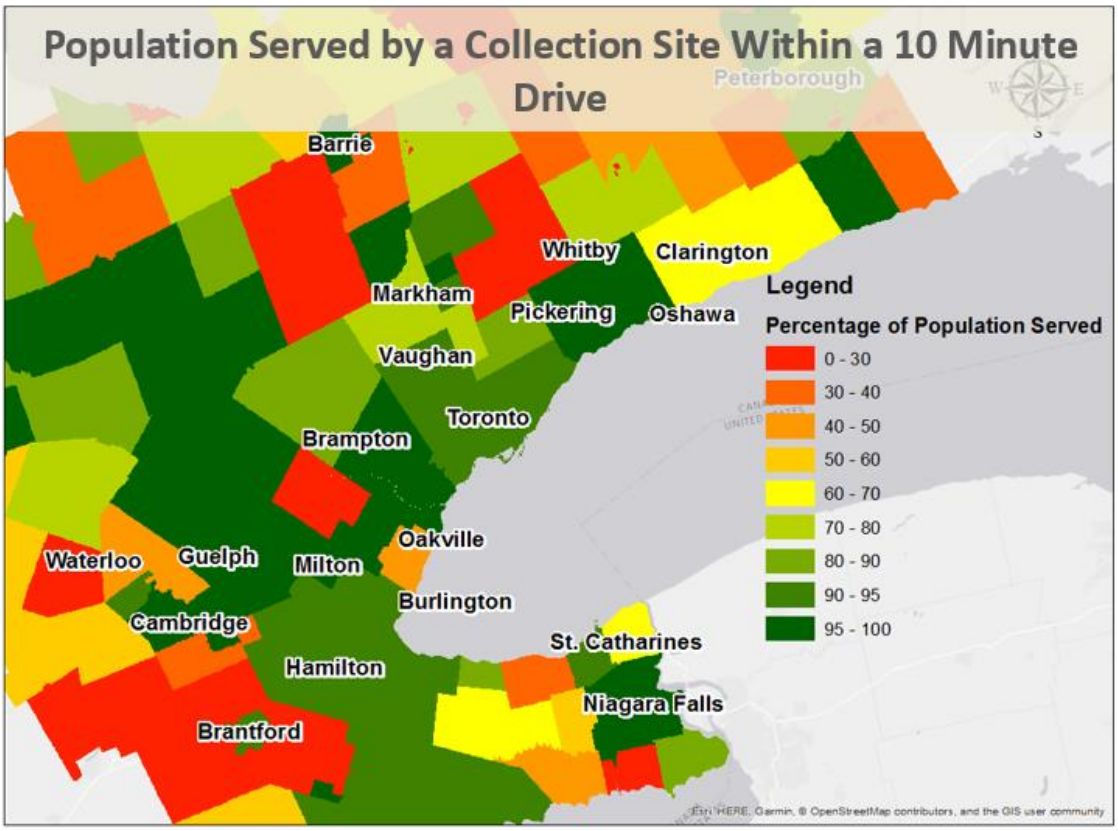


Figure 5: Percentage of population in Golden Horseshoe within a 10 minute drive of a residential collection site

This type of analysis can be used to determine where additional collection sites or events could be located to increase accessibility. Data on lamps diverted at individual collection sites/events or at the municipal scale could be compared to better assess the relationship between accessibility and diversion rates. Participation in diversion programs is also affected by a collection site's or event's convenience factors such as its hours of operation and its location relative to other places habitually visited by residents (such as retail stores). Retailers may be some of the most convenient collection sites, due to their hours of operations, their strategic placement to maximize consumer traffic, and the opportunity to combine shopping with lamp diversion.

5.3 IMPACT OF RETAIL TAKE BACK ON ACCESSIBILITY AND CONVENIENCE

Several national retailers (IKEA, London Drugs, Lowe's/Rona) facilitate diversion through take back programs across Canada, and play an important role in ensuring collection sites are accessible and convenient. If these retailers were to stop their existing programs, national accessibility to collection sites would decrease by about 20%. Small losses of accessibility would occur where an existing network of municipal or private depots exists (British Columbia and Prince Edward Island) or where there is already a lack of participating retailers (New Brunswick, Newfoundland and Labrador, and the territories). High losses of accessibility would occur in some provinces with EPR programs (Quebec and Manitoba) or in others with no EPR program (Alberta, Saskatchewan, Ontario, and Nova Scotia).

If more retailers offered take back programs, there would be a significant increase in accessibility across the country, particularly if those retailers are present in rural and remote communities. The largest increases in accessibility would occur in jurisdictions without EPR programs and those with a lower number of collection sites. For example, in Newfoundland and Labrador, accessibility within a 10 minute drive time would increase from 24% to 76% if one additional national retailer were to offer a take back program. Nationally, accessibility to permanent collection sites using a 10 minute drive time would increase from 82% to 95%.

5.4 COSTS FOR COLLECTION AND ENVIRONMENTALLY SOUND MANAGEMENT

There is currently no economic incentive to manage lamps containing mercury in an environmentally sound manner. These lamps are inconvenient to store and transport as they are fragile, may be hazardous if broken, and are highly distributed across the country. The cost to divert these lamps is also high relative to their value at purchase, and the value of their components is negligible. Diversion costs vary significantly by location and tend to increase with distance from lamp processors, all of which are located in southern Canada in or near major cities.

In EPR programs, environmental handling fees (EHFs) are intended to cover the costs of collection, transportation, processing, administration, and advertising. Current EPR programs are designed to be revenue-neutral and have been slightly revenue-positive every year, which has created reserve funds. As sales of lamps containing mercury decline, reserve funds will be used to ensure the programs continue for years to come to manage lamps already in use. However, the current fees are not sufficient to manage significantly higher volumes of lamps than what is currently collected, because the cost to divert the lamps is much higher than the fees charged at point-of-sale. Table 4 shows the fees charged for CFLs and LFLs compared to the average cost to manage end-of-life lamps, which is calculated as the 2017 budget for the EPR program divided by the number of lamps diverted in 2017.

Table 4: Comparison of environmental handling fees (EHF) to costs of running EPR programs in Canada

Province	EHF of a CFL	EHF of a 4-foot LFL	Cost of EPR program per lamp recycled, 2017	Surplus of revenues over expenses, 2017	Number of additional lamps that could be diverted with surplus	Number of lamps available for collection that were not diverted, 2017
British Columbia	$0.15	$0.40	$0.68	$771,702	1,140,000	4,900,000
Quebec	$0.20	$0.50	$1.04	$542,128	520,000	10,400,000
Prince Edward Island	$0.20	$0.50	$0.71	$28,000	40,000	160,000

Taking this average cost, an additional 1.7 million lamps could have been diverted in 2017 using the surplus allocated for the reserve fund. However, this would only have increased the national diversion rate from 34% to 36%.

To meaningfully increase diversion in Canada, EPR programs need to significantly increase revenues to improve public awareness and to collect, transport, and process significantly more lamps. This could be done by increasing the fees at point-of-sale, by expanding the programs to include more sectors and lamp types, or through other mechanisms such as direct funding by producers. For example, the programs in British Columbia and Prince Edward Island cover and generate fee revenue from all lamps (mercury and non-mercury), including LEDs.

In provinces without EPR programs, diversion costs are generally higher and have been identified by municipalities and other organizations as a significant barrier to increasing the number of lamps diverted. A detailed analysis of costs across Canada is not currently available, but municipalities that have provided information to ECCC generally pay around $0.60 to $1.00 per lamp for processing alone. Costs can exceed $1.00 per lamp including collection, containers for shipping, storage, and transportation. Given these high costs, municipalities and other organizations often do not encourage increased participation in diversion programs.

6. ENSURING ENVIRONMENTALLY SOUND MANAGEMENT

Environmentally sound management (ESM) means taking all practicable steps to ensure wastes are managed in a manner which will protect human health and the environment against the adverse effects that may result from such wastes.[24] For lamps containing mercury, ESM means ensuring that lamps are collected separately from the general waste stream, stored, handled, transported, and processed in a manner that prevent releases of mercury into the environment. It applies to all phases of the lifecycle of a lamp (Figure 6), but is most critical at end-of-life. This section describes potential releases of mercury during key phases in the lifecycle of a lamp; existing best practices, guidelines, guidance, and standards to ensure ESM. It also provides an analysis of existing guidance.

6.1 POTENTIAL RELEASES OF MERCURY DURING THE LIFECYCLE OF A LAMP

When broken, mercury in lamps is slowly released as vapour, which can build up in air within enclosed spaces to reach unsafe levels if not collected in a sealed container. Breaking a lamp could occur at any phase of the lifecycle of a lamp.

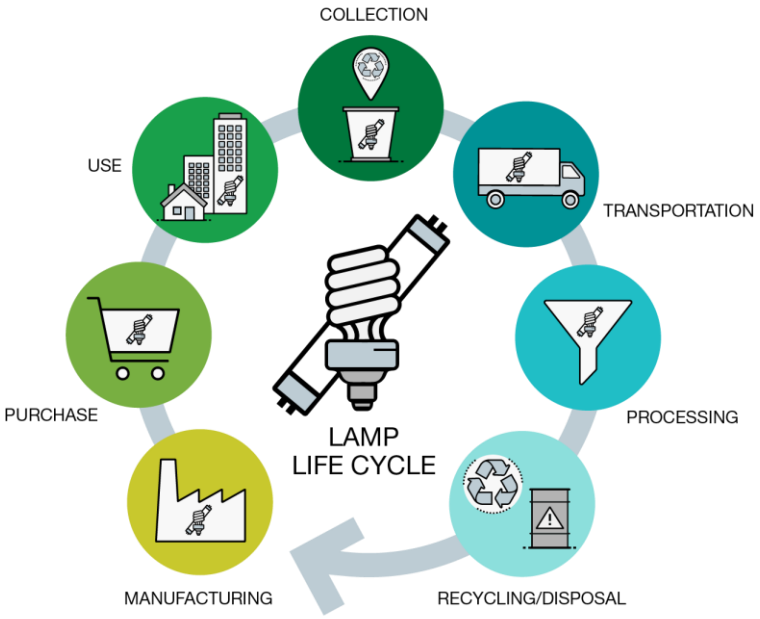


Figure 6: Lifecycle phases of a lamp

COLLECTION

A variety of public, private, and not-for-profit organizations collect lamps for the purposes of diversion. Release of mercury could occur if lamps break due to improper storage or handling procedures, or if broken lamps are received that are not in sealed containers.

LAMP CRUSHING

To facilitate storage and transport, lamps are sometimes crushed. Lamp crushing is most often done with a drum-top crusher, a device that fits on the rim of a standard 205 L steel drum. They are designed to capture mercury in the drum with the crushed lamps or in a filter, although release of mercury to air have been reported during operation.[25] Mercury can also be released when the device is removed from the drum to change a consumable part (such as a filter) or to seal a filled drum. Lamp crushers require careful use, maintenance (replacement of parts), and training for operators to ensure they are not exposed to mercury. Information is not available to estimate the extent of their usage in Canada, but they are known to be used by large institutions, private companies, and municipalities.

TRANSPORTATION

If they are not packaged properly, lamps are easily broken during transportation, which may cause mercury to be released. Lamps should be transported in durable, sealed containers to minimize releases and these containers should be properly secured during transportation.

LAMP PROCESSING

Lamp processing facilities use specially-designed machines that crush lamps and separate them into their component parts while minimizing releases of mercury. The components of lamps include glass, metal (end caps), minor components such as plastic or ceramic, and phosphor powder. Most of the mercury in a spent fluorescent lamp resides in the phosphor powder, which is separated by processing for further treatment or disposal. Mercury vapour is also captured by carbon filters, which should be treated as hazardous waste once they are replaced.

There are nine lamp processing facilities in Canada. They are provincially licensed and subject to periodic inspections to ensure safe operations. Processors have not reported treating the lamp components to remove any potential remaining mercury contamination after processing. This contamination may be minor, but not insignificant for human or environmental exposure depending on how these components are later processed, used or disposed.

RECYCLING AND DISPOSAL

Mercury captured by lamp processing is sent for disposal or long-term storage, according to ESM practices, to prevent mercury from being released into the environment. The Basel Convention, to which Canada is a Party, outlines the following as accepted methods for the ESM of mercury wastes: reclamation of mercury; chemical stabilization followed by disposal in a specially engineered landfill; and permanent storage.[26] Canada has two facilities for mercury disposal, however most mercury-rich phosphor powder from lamp processing is sent to facilities in the United States that recover the mercury in a pure form.

Other lamp components may be recycled or disposed. Metals are the easiest components to recycle as they have intrinsic value. The glass from lamps has limited uses and is often landfilled. No glass from processors is known to be recycled into new lamps or any other glass material due to technical challenges and cost. Reported uses of glass from processors includes sandblasting, as a medium for septic beds, as a decorative component in specialty concrete artistic products, or for mixing into asphalt for roads (which requires the glass to be milled). Disposal or diversion of non-hazardous components after processing is not known to be consistently tracked.

6.2 EXISTING GUIDELINES AND BEST PRACTICES

There are existing guidelines, standards, and best practices for the management of lamps at end-of-life. This section provides an overview of key guidance documents and standards noting where they are used within the lamp lifecycle and their target audience. While private organizations may have internal guidance and standards, ECCC only examined publicly available documents.

CODE OF PRACTICE FOR THE ENVIRONMENTALLY SOUND MANAGEMENT OF END-OF-LIFE LAMPS CONTAINING MERCURY

ECCC's Code of Practice is a voluntary tool developed to complement public and private lamp diversion initiatives by providing best practices for organizations that manage lamps, such as collection sites, transportation companies, and lamp processors. It provides best practices for all end-of-life phases, from collection to final disposal, and for the use of drum-top crushers. It also provides best practices for diversion program managers, such as promoting public awareness, and options and considerations for diversion in northern and remote areas.

PROGRAM-SPECIFIC GUIDANCE

Product Care Association has published guidelines for lamp collection sites operating under EPR programs,[27] and standards for transporters[28] and processing facilities.[29] Collection site guidelines are targeted at managers of collection sites and include best practices for site setup, handling lamps, arranging pickups, record keeping, health and safety, and training for employees. The transportation and processor standards are targeted at managers of these organizations and represent the minimum requirements to participate in the EPR programs. The standards focus on administrative requirements and ensuring occupational health and safety of workers and contain few best practices related to operations.

There are minimum requirements for lamp processing facilities to be able to participate in the Take Back the Light program run by the Recycling Council of Ontario.[30] The requirements document is targeted at managers (administration and operations) of lamp processing facilities and includes best practices for areas such as health and safety, handling and storage, transportation, and management of lamp components after processing.

PROVINCIAL AND TERRITORIAL GUIDANCE

Several provinces and territories have guidance on ESM of lamps such as Alberta,[31] Northwest Territories,[32] and Nunavut.[33] These documents target the ICI sector and provide an overview of applicable laws around mercury waste management (some specific to lamps) in the jurisdictions, as well as their disposal options. The Alberta and Nunavut documents cover all mercury-containing products, and contain limited best practices for their management. The Northwest Territories document is specific to lamps and contains a variety of ESM best practices for all phases of end-of-life, from collection to final disposal.

INTERNATIONAL GUIDANCE

There are a number of international guidance documents for the management of mercury wastes and mercury-containing products such as lamps. These are mainly targeted towards national governments so that they can meet international obligations. The Conference of Parties to the Basel Convention has adopted technical guidelines for ESM of mercury and mercury wastes, which includes specific guidance for managing end-of-life lamps.[34]

6.3 ANALYSIS OF EXISTING GUIDELINES AND BEST PRACTICES

A brief analysis of the various guidelines, guidance, best practices and standards is presented below. A detailed comparative analysis, with the aim of harmonization of these documents with the Code of Practice and/or improvements to the Code of Practice, would be beneficial to help ensure that management of lamps containing mercury is environmentally sound across the country.

The most comprehensive ESM best practices for all phases of end-of-life for lamps containing mercury are found in ECCC's Code of Practice. It was developed through consultation with all relevant stakeholders and was preceded with both a discussion paper[35] and a proposed Code of Practice,[36] which were open for public comment.

While the Code of Practice is comprehensive, it is a lengthy document containing technical language, which is not ideally formatted for those who work in end-of-life lamp management. For example, some best practices for the collection of lamps are targeted to site managers (such as the layout of the site and implementation of training), while other best practices are the responsibility of site workers (such as packaging lamps for transport). Collection site workers may be better served by short fact sheets or checklists that could be placed in a visible location around the working area. Plain language, local language, and pictorial materials representing best practices at different end-of-life phases would also be helpful, as was noted in consultations on the national strategy.

The Product Care Association collection site guidelines include most of the best practices for collection and storage that are found in the Code of Practice. However, these guidelines are not as comprehensive or detailed. The guidelines are meant to provide more practical, step-by-step instructions for collection site operations rather than focusing on ESM. They include pictures for activities such as setting up collection containers and preparing them for shipment. The Product Care Association's processor and transportation standards are focused on liability and worker safety, and do not overlap with many of the best practices found in the Code of Practice for transportation or processing. However, this does not preclude transporters or processing facilities from implementing best practices from the Code of Practice or other sources, in addition to those provided in Product Care Association's standards.

The Take Back the Light processor requirements document is written in the same style as the Code of Practice and covers essentially the same ESM best practices for lamp processing. It also includes additional best practices for ensuring ESM of lamp components after processing, by requiring tracking of these components and listing specific diversion options for each. Processors must divert at least 90% of lamp components and packaging material from landfill annually, though glass may be landfilled when no other options are available.

Provincial and territorial governments' guidance documents vary in structure. The Alberta guidance covers few best practices, but provides practical information on the legal requirements for lamp diversion, a list of local processors, and other sources of information. The Nunavut document provides information on the types of mercury-containing products (with pictures), some legal requirements, and some general best practices for handling and storage. The Northwest Territories guidance provides many best practices found in the Code of Practice, as well as step-by-step instructions, flowcharts, and pictures, and is generally the most user-friendly and comprehensive of the provincial or territorial government documents.

Other than the Code of Practice, guidance for drum-top crusher operations is only found in user manuals and the Northwest Territories guidance. However, given the potential releases of mercury from these devices, more detailed guidance and/or requirements may be required to prevent releases of mercury into the environment and to ensure worker safety. Some users may believe the mercury is completely captured in the filters and that the material in the drum can be disposed in landfill, but in reality only a small amount of the mercury is captured.

IMPLEMENTATION OF GUIDELINES AND BEST PRACTICES

In a 2018 survey conducted by ECCC, lamp collection site operators were asked which, if any, guidance documents they used, and whether they had implemented eight of the best practices related to lamp collection in the Code of Practice.[37] Out of 48 respondents, the average reported awareness of the Code of Practice was 4.7 out of 10. 65% of respondents reported a score of 5 out of 10 or less, and 20% reported a level of awareness of 8 out of 10 or higher. Although awareness of the Code of Practice was low, collection site operators generally reported following a guidance document of some kind and reported following most of the best practices listed in the survey. ECCC may conduct follow-up studies to measure awareness and implementation of the Code of Practice over time.

There are currently two processors registered with Take Back the Light, both located in Ontario. These processors must commission a third-party auditor to ensure compliance with program requirements. Transporters and processors operating under lamp EPR programs must adhere to their respective standards and are subject to inspections by Product Care Association and third-party auditing. There are currently three processors registered with Product Care Association and an unknown number of transporters.

Provincial and territorial guidance documents are voluntary and there is a lack of information on their implementation. There is also a lack of information on awareness and implementation of best practices for drum-top crushers by their operators in Canada.

Given that awareness and implementation of the Code of Practice is low, and requirements for following ESM best practices are limited, it is not known to what extent organizations involved in end-of-life lamp management are following ESM best practices. Four processors in Canada are not registered either with Take Back the Light or Product Care Association and their implementation of best practices is not known. Beyond legal requirements, collection sites across Canada and transporters of lamps are not required to comply with all relevant best practices, and there is a lack of information on their implementation.

7. PERFORMANCE MEASUREMENT AND REPORTING

The significance of the diversion results presented in this report is limited by the fact that, for most jurisdictions, diversion data is only available for 2017 and past diversion rates are unknown. To assess the effectiveness of the national strategy, consistent performance measurement and reporting by key stakeholders on end-of-life management is needed.

The national strategy will include a measurement framework to ensure consistent reporting using clear data requirements and performance metrics. A national database will consolidate the data.

The measurement framework will outline the data required to evaluate lamp diversion in each province and territory using data from key areas of the lamp lifecycle. Comparing diversion numbers between jurisdictions will identify which programs are most successful. Comparing diversion volumes by sector and by lamp type can also help identify where further efforts (such as promotion of programs) are needed. The measurement framework may include data requirements needed to evaluate other performance metrics such as accessibility, public awareness, diversion costs, and use of ESM best practices by industry. These factors will help identify the keys to creating a successful program in each jurisdiction.

8. CONCLUSION

In 2017, approximately 22 million lamps containing mercury were diverted from landfills, accounting for about 34% of lamps estimated to be available for diversion (based on 2012 sales data). In the same year, about 300 kg of mercury is estimated to have entered the environment from the improper disposal of approximately 43 million lamps in landfills.

The main barriers to increasing lamp diversion are low awareness and the high cost of diversion relative to the value of a lamp. Access to collection sites is an issue in some provinces, as well as in rural, remote, and northern areas. Public awareness of the presence of mercury in lamps and diversion options is generally below 55%, and access to collection facilities and the cost of recycling lamps vary widely across Canada. Furthermore, additional funding is required to significantly improve lamp diversion in Canada, even in EPR programs.

Jurisdictions with EPR programs generally divert more lamps than those without, although voluntary programs have had comparable success in some areas such as Nova Scotia. Retailers with take back programs provide the residential sector with accessible and convenient collection sites. Some lamp processors have proactively engaged the ICI sector to divert more lamps. Northern, remote, and Indigenous communities need additional options for lamp diversion due to broader solid waste management challenges in these areas.

Although a number of guidelines, best practices, guidance documents and standards for environmentally sound management of end-of-life lamps exist, there is a lack of information on the implementation of best practices by organizations involved in end-of-life management. In many cases, these documents do not cover all applicable best practices, and implementation may be impeded by information that is not presented in a user-friendly format.

There are a number of key data gaps in the state of lamp management in Canada. ECCC has established a measurement framework to collect consistent data, fill data gaps, and measure the performance of lamp diversion across Canada. ECCC will use the framework to issue a report on the effectiveness of the national strategy within 5 years.

The priorities and actions of the national strategy are based on feedback received during consultations, and the information and analysis presented in this baseline report. The priorities of the national strategy include: prohibit the import and manufacture of the most common types of lamps containing mercury; increase awareness; increase participation in diversion programs by strengthening regulations and reducing barriers; improve government operations; increase the accessibility and implementation of guidelines and best practices; and, performance measurement and reporting.

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