Environment and Climate Change Canada
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# Proposed Code of Practice for the Environmentally Sound Management of End-of-life Lamps Containing Mercury

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Canada

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# 1. Preface

Mercury is an essential component in some energy-efficient lamps such as fluorescent tubes and light bulbs. Mercury-containing lamps use a low-pressure mercury electrical discharge in which a fluorescing coating transforms ultraviolet energy into visible light. These lamps contain a small amount of mercury which may be released when the lamps break or are improperly disposed as regular garbage. The mercury vapour released from these broken lamps poses a potential risk to human health and the environment. Thus, it is important that mercury-containing lamps are managed properly at their end of life to prevent the release of mercury to the environment.

Mercury is a toxic, naturally occurring, chemical element that can cycle between air, water, land, plants and animals for extended periods of time, and may be carried over long distances in the atmosphere. In the environment, micro-organisms and natural processes convert mercury to more harmful forms of the metal, such as methyl mercury. Readily absorbed by organisms, methyl mercury bioaccumulates in living tissue and becomes increasingly potent as it moves up the food chain. In humans, methyl mercury can cause an array of health problems including brain damage and neurological development effects in fetuses, infants and young children. Mercury accumulates in northern regions via atmospheric circulation processes, and poses a particular risk to those who eat large amounts of fish or marine mammals such as northern Indigenous Peoples who rely on traditional foods.

Mercury and its compounds are toxic substances listed on Schedule 1 of the *Canadian Environmental Protection Act, 1999* (CEPA 1999). Recognizing that products containing mercury need to be properly managed to protect the environment and safeguard human health, on November 19, 2014, the Government of Canada published the final *Products Containing Mercury Regulations* which prohibit the manufacture and import of products containing mercury or any of its compounds, with some exemptions for essential products that have no technically or economically viable alternatives. In the case of lamps, the Regulations set mercury content limits for fluorescent and other types of lamps, and require labels to inform consumers about the presence of mercury, as well as safe handling procedures and options available for the end-of-life management of these products.[1]

As part of the Government of Canada's approach to reducing mercury releases and emissions to the environment,[2] Environment and Climate Change Canada (the Department) has developed this proposed code of practice for the environmentally sound management of mercury-containing lamps at their end of life, which also includes options for diverting and managing spent lamps in remote and northern areas. Environmentally sound management of spent lamps means ensuring

[1] For more information on the *Products Containing Mercury Regulations*, see http://ec.gc.ca/lcpe-cepa/eng/regulations/detailReg.cfm?intReg=203.

[2] The proposed code of practice is part of the Government of Canada's broader risk management strategy for ensuring that mercury wastes are managed appropriately in Canada. The risk management strategy includes the *Notice Regarding Pollution Prevention Planning in Respect of Mercury Releases from Dental Amalgam Waste* and the *Notice Requiring the Preparation and Implementation of Pollution Prevention Plans in Respect of Mercury Releases from Mercury Switches in End-of-Life Vehicles Processed by Steel Mills*.

that they are collected separately from the general waste stream, stored, handled, transported and processed in a manner that prevents releases of the mercury to the environment. It also means that mercury from the waste products is recovered or stabilized prior to environmentally sound disposal in a hazardous waste landfill.

This code of practice is a voluntary tool developed to complement provincial, territorial and local efforts, and to promote best practices for managing end-of-life mercury-containing lamps. Several provinces have established, or are currently establishing, policies, legislation, programs and other measures for extended producer responsibility[3] to collect and manage end-of-life lamps. These measures contribute to the implementation of the Canada-wide Action Plan for Extended Producer Responsibility, which commits the Canadian jurisdictions to work towards the development of extended producer responsibility framework legislation or regulations to ensure that various end-of-life products and materials are diverted from landfills. During the development of this code of practice, the Department consulted with experts from provincial and territorial governments, industry and stewardship organizations, and other stakeholders.

## 2. Objective

The objective of this code of practice is to prevent the release of mercury to the environment by identifying best practices for collection, storage, transportation and processing of mercury-containing lamps at their end of life. It should be noted that the proposed code of practice does not prescribe specific methods or technologies; rather, it provides information on best practices, options and considerations for various activities of end-of-life management of mercury-containing lamps.

This code of practice is based on current environmentally sound management practices and concepts that have been developed by domestic and international bodies to prevent and reduce releases of mercury to the environment, taking into account economic and technical considerations. It also includes information on the diversion and end-of-life management options for northern and remote areas where access to recycling and disposal facilities is limited.

The code of practice may be used as guidance by various Canadian governmental jurisdictions within their waste management programs or regulatory frameworks and by other stakeholders. Aspects of the code of practice could also be referenced in industry plans for recycling programs that may be required under provincial and territorial waste management regimes.

## 3. Applicability

[3] Extended producer responsibility (EPR) is a policy approach in which a producer's responsibility, physical and/or financial, for a product is extended to the post-consumer stage of a product's life cycle. EPR shifts responsibility upstream in the product life cycle to the producer (i.e. brand owners, first importers or manufacturers) and away from municipalities and general taxpayers. Governments may adopt producer responsibility to achieve a greater recovery of secondary materials or as a means to divert materials from disposal.

This code of practice is intended to be applicable to facilities and operators who handle, collect, store, transport and process end-of-life mercury-containing lamps in Canada. The best practices in this code of practice cover various types of mercury-containing lamps including fluorescent tubes and compact fluorescent light bulbs, fluomeric lamps, metal halide lamps (e.g., for stadium or warehouse lighting applications), mercury vapour discharge lamps (e.g., for street and floodlighting applications), sodium vapour lamps (e.g., for street and floodlighting applications), cold cathode and external fluorescent lamps (e.g., for electronic display applications, signs), and automotive high- intensity discharge (HiD) lamps.

It should be noted that provincial and territorial jurisdictions may have requirements for managing end-of-life lamps. Some jurisdictions require end-of-life mercury-containing lamps to be recycled and managed in accordance with extended producer responsibility legislation. In jurisdictions where end-of-life lamps are considered hazardous waste, there may be additional requirements for their management. All applicable municipal, provincial, territorial and federal legal requirements must be met, and collection and storage sites and facilities, transporters, and waste management facilities must operate in accordance with all applicable municipal, provincial, territorial and federal legislation as well as the requirements that are set out under the permits or approvals issued by the appropriate jurisdiction.

## 4. Collection and Storage

The collection and segregation of end-of-life mercury-containing lamps for proper recycling and treatment prior to disposal diverts them from the general waste stream. This in turn reduces the amount of mercury going to municipal landfills or incineration, where it is difficult and expensive to address mercury releases to air, leachate and waste water effluent. The lamps should be properly and securely collected and stored, using the best practices that follow, until they are sent for processing, treatment and/or disposal at an authorized waste management facility.

### 4.1. Collection Mechanisms

Convenient collection services make it easier for consumers to return lamps, which improves diversion rates for lamp recycling programs. Examples of collection mechanisms used in Canada include:

- **Municipal collection stations or drop-off depots for household hazardous waste or special waste[4]:** Designated collection facilities owned and operated by municipalities accept end-of-life mercury-containing lamps for proper management. Municipal household hazardous waste depots located at the landfill are the most typical municipal drop-off locations. Other drop-off locations include municipal buildings and collection events. Accessibility of drop-off locations and frequency of service can vary from one municipality

[4] Household special wastes, which may be hazardous or non-hazardous substances or objects, are collected for recycling or treatment prior to disposal.

to the next depending on factors such as the size and population distribution of the municipality. Smaller municipalities are more likely to hold collection campaigns or event days rather than have permanent drop-off locations.

- **Retail take-back programs:** Retail take-back programs offer users an easy and convenient location to drop off spent lamps for proper recycling. Collection containers are typically placed near the store's entrance, and drop off is free of charge. This option is often found in provincial jurisdictions with regulated extended producer responsibility programs. It is common for retailers to only accept compact fluorescent lamps (CFLs), although some offer collection services for fluorescent tubes and other lamps as well.

- **Pick-up services:** Waste generators call their local municipality or supplier to schedule a pick-up of their spent lamps. Many of the regulated extended producer responsibility programs offer this service free of charge to residential and commercial users since the recycling fee is paid when the lamps are purchased. In Canadian jurisdictions without such regulated programs, service providers provide pick-up of spent lamps for a fee for commercial users.

- **Pre-paid shipping service:** A consumer purchases a box designed to store and ship spent lamps for recycling. The recycling service and shipping costs are included in the cost of the box. When the box is full, the user seals the box and ships it directly to the recycler. Pre-paid shipping boxes are convenient for small waste generators and, in particular, those in northern or remote locations with limited transportation options.

- **Procurement programs:** Commercial users recycle spent lamps via the procurement and acquisition of goods or services in a reverse logistics collection program. First, businesses include end-of-life management in their request for proposals or purchasing contracts for replacing spent lamps. Consequently, the cost of lamp recycling is part of the purchase price. Then, when the service provider replaces the mercury-containing lamps, they remove and transport the spent lamps, using the same truck used to transport the new lamps to the user, back to their warehouse where the lamps are stockpiled before being transported to an authorized lamp processor. A reverse logistics collection model improves efficiency by distributing and collecting lamps in the same trip.

## 4.2. Collection Sites and Facilities

There are three main types of collection and storage facilities: primary collection sites, intermediate consolidation storage facilities, and warehousing and commercial consolidation storage facilities.

Immediately following the collection from residents or businesses, end-of-life mercury-containing lamps are usually held at a primary collection site. These collection sites include municipal waste depots, municipal buildings, retail locations and private collection sites. Primary collection sites should have sufficient space to sort and separate different types of lamps, as certain processors require lamps to arrive at their facility pre-sorted. These sites should also have

adequate capacity to store lamps separately from other materials to prevent the mixing of incompatible materials and to maintain the integrity of the tracking system.

From the primary collection site, end-of-life lamps may be sent to an intermediate consolidation facility where they are added to other lamps prior to being sent to the processor. The requirements for managing end-of-life lamps at these facilities depend on the requirements of the Canadian jurisdiction and whether end-of-life lamps are considered hazardous waste under the provincial or territorial legislation in which the facilities operate. In some cases, spent whole lamps are exempted from provincial or territorial waste management legislation, and they can be managed in a manner similar to new lamps, as long as they are destined for a recycling facility. Crushed lamps are typically subject to provincial or territorial hazardous waste management regulations, and therefore may be subject to specific management requirements for such waste.

In addition, end-of-life lamps can be collected and temporarily stored at warehousing or commercial consolidation facilities provided that the material is not considered hazardous by the provincial or territorial jurisdiction in which the facility operates. A commercial consolidation facility can be a retail or commercial facility that collects small quantities of lamps from either the general public or other commercial operators.

### 4.3. Drum Top Lamp Crusher Devices

It is preferred that lamps are kept whole and unbroken during storage and transport in order to minimize potential human exposure to mercury and prevent releases to the environment by containing the mercury within the lamps until they reach the processing facility. However, it may be necessary or practical to store and transport lamps in a crushed state in some circumstances. Where storage space is limited or transportation is so costly (for example, in northern and remote communities) as to make it impractical to store or transport whole lamps, collection and storage facilities could choose to employ drum top crusher (DTC) devices to reduce high volumes of lamps to facilitate storage and transport. The use of DTC devices is an allowed practice by many provincial and territorial jurisdictions; however, it is important that DTC devices are equipped with mercury particle and vapour capture systems and are used properly to minimize potential risks to human health and prevent releases to the environment.

DTC devices can be manual, electrical or air powered. The crushing unit is typically mounted on the lid of a 205-litre drum. All of the crushed materials (glass, phosphor, metal, plastic and mercury) are contained in the drum. Airborne mercury phosphor powder and mercury vapour are captured by a combination of a series of High Efficiency Particulate Arrestor (HEPA) and activated carbon filter systems. The amount of airborne mercury particles that each filter can handle depends on the mercury content of the bulbs and the number of bulbs that are crushed. It should be recognized that older bulbs that are now reaching end of life are likely to have higher mercury content than those currently on the market. The manufacturer’s specifications and instructions should detail handling procedures that minimize human exposure and prevent mercury releases to the environment.

Operators and facilities that employ DTC devices should also be aware that changing mercury-containing bulbs from a whole to a crushed state may result in the material classification changing from a non-hazardous to a hazardous material under provincial, territorial and federal legislation. This change in classification can mean additional requirements for permits, management, transportation and/or disposal for the material. For example, exports and imports of crushed lamps that meet the leachate test criteria for mercury[5] would be considered hazardous waste or hazardous recyclable material under the federal *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations* and would be subject to the requirements of these regulations. The following are best practices for the use of DTC devices.

| Activity | Best Practices |
|---|---|
| **Drum top crushers** | • DTC devices should be used and operated according to the manufacturer's specifications and instructions, which may include, but are not limited to,<br>o handling procedures;<br>o a limit on the number of bulbs that can be processed before the filters must be changed;<br>o shutdown instructions;<br>o drum change instructions;<br>o maintenance and filter change schedules;<br>o inspection and maintenance procedures;<br>o procedures for air quality testing in the immediate operational area on a real-time basis; and<br>o information on the use of personal protective equipment such as puncture-resistant gloves, safety glasses, respirators and protective coveralls or clothing.<br><br>• Operators should carefully monitor and record (in a log) the number of lamps crushed to ensure that the containment drum is not over-filled and that the mercury vapour and particle capture systems are working efficiently and within capacity.<br><br>• Filters should be changed once capacity is reached or in accordance with the manufacturer's instructions and schedule. Spent filters should be managed in accordance with applicable federal, provincial and territorial regulations and requirements, which may include managing them as hazardous waste. |

[5] Under the *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations*, a waste or recyclable material that produces a leachate containing mercury in a concentration equal to or greater than 0.10 mg/L, determined in accordance with *Method 1311, Toxicity Characteristic Leaching Procedure*, July 1992, in *Test Methods for Evaluating Solid Waste, Volume 1C: Laboratory Manual, Physical/Chemical Methods*, Third Edition, SW-846, November 1986, published by the United States Environmental Protection Agency (without reference to section 7.1.3), is considered hazardous. The potential leachate produced from crushed lamps will depend on quantity of mercury in lamps which can vary with lamp type and date of manufacture.

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| | • Special care should be taken when the containment unit is full and the crushing unit is transferred to a new drum to minimize human exposure to mercury and prevent spills. Special care includes allowing the drum contents to settle before removing the crushing unit (US EPA 2009), wearing personal protective equipment, and handling the drum in a manner that does not tip the drum and cause spillage.<br>• Crushed lamps should not be transferred from one container to another, as this could result in increased amounts of mercury becoming airborne. The full drum of crushed lamps should be promptly sealed for shipment to an authorized lamp recycler or disposal facility.<br>• Maintenance logs and manufacturer's manual should be kept with the DTC device (US EPA 2009).<br>• Operators should be fully trained in the operation and use of the DTC device and be aware of the potential health risks from exposure to mercury. See section 12.<br>• The United States Environmental Protection Agency's document on Fluorescent Lamp Recycling[6] may be consulted for further information on best practices for using DTC devices. |

## 4.4. Handling, Collection, Packaging and Storage

End-of-life mercury-containing lamps should be handled, collected, packaged and stored in a manner that minimizes the potential for human exposure to the hazards associated with the material and prevents accidental breakage or contamination that can lead to releases of mercury to the environment. Effort should be taken to ensure the lamps remain whole and unbroken, which includes using proper storage containers and training staff on the safe handling of lamps. The following are best practices for the collection and storage of end-of-life mercury-containing lamps.

| Activity | Best Practices |
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| **Collection and handling** | • Operators of collection sites should post information on or near collection bins, boxes or containers with instructions on how the lamps should be deposited to prevent breakage. Instructions should clearly indicate that lamps be carefully placed one at a time into the container, to minimize |

[6] United States Environmental Protection Agency, Fluorescent Lamp Recycling (February 2009; EPA530-R-09-001) (www.epa.gov/wastes/hazard/wastetypes/universal/lamps/lamp-recycling2-09.pdf).

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| | free fall of the lamp to the extent possible, and to avoid putting a lamp into a full container.<br><br>• Designated containers should be used exclusively for end-of-life lamps and not other waste. Separate containers should be used to collect different types of lamps, e.g., fluorescent tubes should be collected in a separate container from CFLs. Containers for collecting CFLs should minimize free fall by installing soft, cascading baffles or flaps or other means to prevent breakage. Another option is for the consumer to give the lamp to a competent operator of a collection station to place in a container (UNEP 2011).[7]<br><br>• Containers should be monitored and replaced with an empty container when full.<br><br>• Containers should be located in a well-ventilated area, and away from high-traffic areas to avoid accidental bumping or tipping of the container.<br><br>• Collection sites should have sufficient space to sort and store lamps. Lamps should be sorted and stored by type, taking into consideration any pre-sorting requirements of the processing or recycling facility to which the lamps will be sent. |
| **Packaging and labelling** | • End-of-life lamps should be packed in a manner that prevents breakage during storage and transit and that provides containment of mercury vapour or airborne mercury-containing particles in the event of breakage. Do not try to fit more lamps than the container can hold or force a container to close. Use appropriate additional packaging material, as needed, to prevent loose lamps from moving freely in a container.<br><br>• End-of-life lamps received at collection sites and storage facilities that are loose or unpackaged should be packed in commercially available containers (e.g., 20-litre pails, 205-litre drums[8]) or alternative packaging that prevents breakage of lamps in transit. |

[7] Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. *Technical Guidelines for the Environmentally Sound Management of Wastes Consisting of Elemental Mercury and Wastes Containing or Contaminated with Mercury*. Adopted in 2011.[8] The most common and commercially available packaging options for loose end-of-life lamps are 20-litre pails and 205-litre drums. Most large municipalities use drums to collect and store tubes and bulbs. Some facilities could choose to use commercially available cardboard boxes to store small quantities of lamps, as cardboard boxes are less expensive and could be easily disposed after use (provided they are not contaminated so as to make them hazardous waste). However, cardboard boxes would need to be protected from moisture, would take up more space than a drum, and are not as sturdy as drums.

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| | • Containers for whole lamps should:<br>o be durable, structurally sound, undamaged, stay upright when partially and fully packed (i.e., not prone to tipping over) and constructed to provide protection from breakage during storage and transit;<br>o be clearly labelled to identify the contents, e.g., "waste lamps containing mercury" or "used lamps containing mercury";<br>o be closed at all times unless lamps are being added to the container[9]; and<br>o contain lamps only, and not contain other debris or hazardous material that could break the lamps, contaminate a larger amount of material, and/or hinder proper recycling and treatment.<br><br>• Containers for crushed lamps should:<br>o be durable, structurally sound, undamaged and constructed to prevent releases of mercury and mercury-containing materials to the environment (e.g., a steel drum with a secure fitting lid);<br>o be clearly labelled to identify the contents, e.g., "crushed lamps containing mercury";<br>o be closed or sealed at all times; and<br>o be managed by trained staff. |
| **Storage** | • Lamps should be kept apart from other wastes until they are sent to an authorized processing or waste management facility.<br><br>• Lamps should be stored for a limited period of time (e.g., no longer than one year), and as allowed by municipal, provincial or territorial jurisdictions.<br><br>• Storage containers should be stored in such manner that they will not tip, fall, or be hit or bumped.<br><br>• Lamps should be stored in a location that:<br>o is protected from the outdoor elements (ideally in an enclosed or covered facility or structure that is not usually frequented by people), with protective cover, wrapping or packaging to prevent breakage;<br>o is well ventilated. For large amounts of lamps, the storage area should be a separate area or room, preferably with a ventilation system segregated from the rest of the building. Crushed lamps |

easily disposed after use (provided they are not contaminated so as to make them hazardous waste). However, cardboard boxes would need to be protected from moisture, would take up more space than a drum, and are not as sturdy as drums.

[9] It is preferable that the containers be closed at all times to the extent possible. This can be accomplished by using a container lid, a swing lid mechanism, or an automatic container closure system.

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| | should be stored in a sealed container or drum outdoors and under protective cover;<br>o prevents exposure to and contamination with incompatible materials; and<br>o prevents unauthorized access to the materials.<br><br>• Storage sites should have posted signage indicating the presence of mercury-containing materials.<br><br>• Storage sites should have insurance as required by provincial or territorial jurisdictions to cover potential liability to third parties and for environmental cleanup.<br><br>• Inspection protocols should be implemented on a regular basis to ensure compliance with all proper storage requirements as well as health and safety protocols. |

## 5. Materials Management and Emergency Response Plans

Collection sites, storage facilities, transporters and waste management facilities should have a material or hazardous waste management plan, with an emergency response plan, to respond to spills, fires and other emergencies that might occur in accordance with federal, provincial, and territorial legislation and requirements.

| Activity | Best Practices |
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| **Materials management plan** | • Facility or transporter should have a material or hazardous waste management plan in place, with information specific to the handling and management of end-of-life lamps, including:<br>o proper and safe storage (see subsection 4.4);<br>o spill control, and cleanup protocols and procedures (see subsection 5.1);<br>o emergency plan and procedures, and access to emergency response equipment;<br>o worker health and safety training (including hazard identification, hazard mitigation, proper use and access of personal protective equipment); and<br>o record keeping (see sections 6 and 11). |

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| **Emergency response plan** | • Facility should have up-to-date emergency response plan(s). The principal elements of an emergency plan may include[10]:<br>o a description of the substance or material which may include: the properties and characteristics of the substance and the maximum expected quantity of the substance at the place at any time during a calendar year; the commercial, manufacturing, processing or other activity in relation to which the plan is to be prepared; the characteristics of the place where the substance is located and of the surrounding area that may increase the risk of harm to the environment or of danger to human life or health; and the potential consequences from an environmental emergency on the environment and on human life or health;<br>o the identification of any environmental emergency that can reasonably be expected to occur at the place and that would likely cause harm to the environment or constitute a danger to human life or health, and identification of the harm or danger;<br>o a description of the measures to be used to prevent, prepare for, respond to and recover from any environmental emergency identified;<br>o a list of the individuals who are to carry into effect the plan in the event of an environmental emergency and a description of their roles and responsibilities;<br>o the identification of the training required for the individuals who are to carry into effect the plan;<br>o a list of the emergency response equipment included as part of the environmental emergency plan, and the equipment's location; and<br>o a description of the measures to be taken by the facility or persons authorized by the facility to notify members of the public who may be adversely affected by an environmental emergency and to inform them of those measures and of what to do in the event of an environmental emergency.<br><br>• Emergency response plan and equipment should be readily accessible to facility workers and third-party responders.<br><br>• Facility workers and transportation operators should receive training on the emergency response plan and procedures to follow in case of accidental spills. |

[10] The information is based on the requirements under the federal *Environmental Emergency Regulations*. For more information on these requirements and the requirements for notification and reporting of environmental emergencies, please refer to the *Environmental Emergency Regulations*.

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| | • Emergency response plan should be updated and tested at least once a year to ensure that it continues to meet the requirements. |
| **Reporting of emergencies and spills** | • Emergencies and spills that occur during collection, storage, transportation and processing should be reported in accordance with federal, provincial and territorial legislation and requirements. |

## 5.1. Managing Spills and Broken Lamps

Collection sites, storage facilities and transporters should have a protocol for managing broken lamps and spills that may occur during storage or transit. Broken lamps should be cleaned up as soon as possible, and care should be taken during cleanup to minimize potential human health risks from exposure to mercury and prevent releases of mercury to the environment. Information on cleanup procedures for broken fluorescent lamps is published on Health Canada's website.[11] The United States Environmental Protection Agency also provides information on how to clean up broken lamps containing mercury.[12] Best practices for the cleanup and management of broken lamps include the following.

| Activity | Best Practices |
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| **Cleanup materials and spill kits** | • Commercially available spill kits specifically designed for cleanup of broken mercury-containing lamps and cleanup materials should be readily available to workers at all locations within the facility where lamps are being handled or stored.<br><br>• Spill kits should include gloves, storage containers for broken pieces, and paper towels and sticky tape (such as duct tape) to pick up any remaining small glass fragments and powder. |
| **Management of waste contaminated with mercury** | • Broken lamps and associated waste materials should be stored separately from whole lamps.<br><br>• Broken lamps should be managed as mercury waste and are usually accepted by the same end processors as whole lamps.<br><br>• Broken lamps should be stored in a sealed container (preferably glass or metal) in a cool, dry location and away from high-traffic areas. Containers of broken lamps should be closed at all times and not be |

[11] See on Health Canada's website "The safety of compact fluorescent lamps" at http://healthycanadians.gc.ca/security-securite/radiation/devices-dispositifs/consumer-consommateur/cfl-afc-eng.php.

[12] See on the United States Environmental Protection Agency's website "Cleaning Up a Broken CFL" at http://www2.epa.gov/cfl/cleaning-broken-cfl.

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| | opened to add or remove broken lamps. It is advisable that containers of broken lamps are single use; once broken lamp materials are placed in the container, the container should be sealed and disposed of similarly to other mercury wastes.<br><br>• Materials that have become contaminated with mercury (i.e., material used to clean up spills and broken lamps) should be managed and disposed of similarly to other mercury waste, and not with regular garbage. |
| **Reporting of spills** | • Spills that occur during collection, storage, transportation and processing should be reported in accordance with federal, provincial, and territorial legislation and requirements. |

## 6. Tracking and Inventory Systems

Collection facilities, waste management facilities and transporters should implement a tracking and inventory system to ensure that collected lamps are accounted for and reach the processing or disposal facility by following them through every stage of management including the primary collection site, intermediate storage, transportation, and processing and/or disposal.

The responsibility for tracking and maintaining inventory systems is shared among the collector, transporter, processor and waste management facility. Each of them has the responsibility to comply with all federal, provincial and territorial requirements for tracking and maintaining inventory systems.

When designing the tracking and inventory system, it is important to consider whether there is an extended producer responsibility program in the province or territory (which may have its own tracking and reporting mechanism or specific reporting requirements), the complexity of the chain of custody (e.g., the number of intermediate stops the lamps make as they move toward final processing), and whether the lamps are considered hazardous and require movement documents under federal, provincial and/or territorial legislation.

| Activity | Best Practices |
|---|---|
| **Tracking and inventory systems** | • A tracking and inventory system should record the types and quantities of lamps received, stored on site and shipped off site.<br><br>• Information contained in the tracking and inventory system of each point in the chain of custody should include:<br>o date of receipt of the shipment; |

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| | ○ point of origin of the end-of-life lamps;<br>○ type and quantity (in units, not weight) of lamps received, stored, shipped;<br>○ intended point(s) of delivery (materials should be delivered to an authorized receiver);<br>○ date of delivery;<br>○ description of the operations or activities to be undertaken at each point in the flow or chain of custody; and<br>○ name of a contact person for information and/or of the person who certifies that the information is correct.<br><br>• The tracking and inventory system should have the capacity to provide information on the actual number of lamps on site (for facilities) or in a shipping container (for carriers), how long the lamps have been on site or in a shipping container, and where the lamps are located within the facility.<br><br>• The tracking and inventory system should reconcile quantities received and stored with quantities shipped, while also tracking accumulation.<br><br>• To ensure that end-of-life lamps are destined for environmentally sound management, the tracking system should track the flow and handling of lamps from collection points through each downstream processor to the final point(s) of disposition or destination. |

## 7. Transportation

Transportation requirements are prescribed by the authority that has jurisdiction, which is typically the provinces and territories. End-of-life mercury-containing lamps should be transported in such a way as to avoid accidental spills and track the transportation of the waste to its destination. Whether transported between primary collection facilities to intermediate storage facilities or from intermediate storage facilities to final processing facilities, the following are best practices for the transport of end-of-life lamps.

| Activity | Best Practices |
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| **Authorized carrier** | • Transporters of end-of-life mercury-containing lamps may be authorized carriers as required by federal, provincial, or territorial legislation and requirements. |
| **Containers** | • Lamp container labels should be compatible with the tracking and inventory system and be in accordance with all applicable regulations and requirements. The label may include the following information:<br>○ name and address of shipper; |

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| | ○ quantity and type of lamp being transported within the container; and<br>○ name and address of receiver.<br><br>• Where the lamps are considered hazardous under federal, provincial and territorial jurisdictions, the containers with such material may be required to have the following additional information for the purposes of transport:<br>○ provincial or territorial waste description; and<br>○ movement document or manifest, if applicable.<br><br>• Where the lamps are considered "dangerous goods" under federal, provincial and territorial jurisdictions, the containers with such material may be required to have the following information for the purposes of transport :<br>○ appropriate shipping name, class, and packing group and hazard labels in accordance with federal, provincial or territorial transportation of dangerous goods regulations.<br><br>• Lamp containers should not be underfilled or overfilled. If underfilled, the contents can move and cause breakage; overfilled containers may crush the lamps. See subsection 4.4.<br><br>• Lamp containers should be properly secured during transport. Means for securing containers may include, but are not limited to, pallets (commercially available wooden or plastic structures that provide four-way access to material-handling equipment), strapping (either plastic or steel straps, used to hold goods on pallets), and tie-downs or anchor straps (either plastic or steel used to restrain pallets while in transit). |
| **Transporting crushed lamps** | • Crushed lamp materials may be considered "dangerous goods" under the federal *Transportation of Dangerous Goods Regulations*, and if so, there is a need to comply with these regulations when they are being transported.[13]<br><br>• Transboundary and interprovincial movements of mercury wastes defined as hazardous waste or hazardous recyclable material must |

[13] Under the federal *Transportation of Dangerous Goods Regulations*, a substance is dangerous goods when it is listed by name in Schedule 1 and is in any form, state or concentration that meets the criteria in Part 2 for inclusion in at least one of the nine classes of dangerous goods; or it is not listed by name in Schedule 1 but meets the criteria in Part 2 for inclusion in at least one of the nine classes of dangerous goods. Crushed lamps containing mercury may be classified as UN2809-Mercury or UN3506-Mercury contained in manufactured articles under Schedule 1 of the Regulations, and meets the criteria for inclusion in Class 6.1 (Toxic Substances) or Class 8 (Corrosives) of the Regulations. For more information, please refer to the *Transportation of Dangerous Goods Regulations.*

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| | comply with the requirements of the federal *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations* and the *Interprovincial Movement of Hazardous Waste Regulations*.<br><br>• Movements of mercury wastes that are considered hazardous would also need to comply with applicable provincial or territorial requirements. |
| **Insurance** | • A carrier transporting end-of-life lamps (whole or crushed) containing or contaminated with mercury may be required to have, in accordance with applicable federal, provincial and territorial regulations, some or all of the following:<br>o a minimum amount (e.g., $1,000,000) for commercial liability insurance;<br>o a minimum amount (e.g., $250,000) for load insurance;<br>o cross-liability for the generator of the materials;<br>o emergency response plan;<br>o on-board spill kit as part of its service;<br>o valid waste transporter permit where required;<br>o extended environmental impairment insurance;<br>o proof of staff training as required by the *Transportation of Dangerous Goods Regulations*;<br>o proof of staff training as required by environmental regulation;<br>o proof of on-vehicle containment; and<br>o proof of emergency response capability. |

## 8. Processing

Lamp processing should maximize the recovery of lamp materials while preventing releases of mercury to the environment and minimizing risks to human health. This involves crushing the lamps and separating the component parts (glass, metal, mercury phosphor powder) in sealed chambers and processing units equipped with pollution control devices (e.g., mercury vapour and dust and/or mercury-contaminated waste water capture systems) to prevent the release of mercury to the environment.

Whole lamps are transferred by a conveyor into an enclosed and sealed container or chamber for first-stage crushing. Then the material goes through a ferromagnetic separator, which separates the metals from the other materials. The metal is crushed or shredded further to prepare it for secondary (i.e., recycled or scrap) markets. The glass and mercury phosphor powder are separated by a ventilation system that consists of cyclones and filters. The glass then goes through a second-stage crusher. The glass may need further treatment to remove any traces of mercury before it can go directly to secondary markets. A thermal separation process separates the mercury and the phosphor powder by applying high levels of heat that vaporize the mercury. The mercury can then be condensed into liquid form. The separated phosphor powder is prepared

for secondary markets. The mercury, however, must be purified through a distillation process before being reused or stored as elemental mercury.

The following are best practices for processing of end-of-life mercury-containing lamps.

| Activity | Best Practices |
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| **Documentation and record keeping** | • The equipment and processes (e.g., air separation of mercury-phosphor powder, mechanical crushing to separate lamp components) should be defined and documented. A mass balance recording may be kept and audited. A mass balance recording indicates the amount of mercury entering the processing system versus the amount that is recovered.<br><br>• Documentation and record keeping to show proof of safe operations and environmentally sound practices (e.g., employee health and safety program and records, and environment and labour inspection reports) and proof that the facility and its operations meet all requirements. Record keeping should also track and reconcile units received and processed. Records should be kept for a minimum of five years, unless otherwise specified by federal, provincial, or territorial regulations or requirements. See sections 6 and 11.<br><br>• Under provincial requirements, the processor may be required to demonstrate its recovery rate (materials recovered versus those lost to disposal) for lamps and lamp packaging material received. The processor may also be required to maintain and make available upon request all documentation, waste diversion methodology, and explanations about how the diversion rate was achieved. |
| **Insurance** | • The processor should have insurance as required by provincial or territorial requirements, which could include comprehensive or commercial general liability covering bodily injury, property damage, environmental damage, complete operations and contractual liability appropriate to the size and type of operation. The scope of the coverage could also cover associated transportation and liability for program operators, overseers and regulators. Small operators could find that Environmental Impairment Liability insurance is appropriate for their operations. Processors could have a written statement from a licensed insurance broker or agent to confirm that the insurance policy and levels of coverage are appropriate for the size and type of operation. |
| **Restricted access** | • Access to the processing facility should be controlled and monitored, and unauthorized access should be prohibited with appropriate security measures (e.g., restricting access to authorized personnel, locking |

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| | access points, installing surveillance device(s) as appropriate). |
| **Processing and separation** | • Materials should be separated from other products or material types for efficient processing.<br><br>• Separation or processing activities, performed either manually or mechanically, should take place in a sectioned-off area or room with a ventilation system that is self-contained or completely separate from the general building ventilation system.<br><br>• Lamp processing should be undertaken under a negative pressure environment to prevent mercury emissions to the environment. |
| **Ventilation** | • The ventilation system for the processing room(s) should be monitored regularly to ensure that it is operating efficiently, and it should also be equipped with:<br>o an emission control system designed to prevent environmental emissions of, and minimize worker exposure to, toxic substances and particulate matter to above applicable regulatory requirements; and<br>o a means to recover mercury as liquid, vapour, airborne particles and/or compound, from the exhaust air flow recovered from the processing rooms, so that the treated air complies with legislation and regulatory limits before being released into the environment. Contaminated air should not be diluted with fresh air as a way to lower the final concentration levels to below regulatory limits. |
| **Air testing** | • Mercury concentrations in the air of work and non-work spaces in the facility should be regularly measured and monitored.<br><br>• Air sampling and testing should be performed by competent and qualified personnel trained to perform air sampling tests, at a frequency and in locations as identified according to a risk assessment.[14] This ensures that releases of pollutants, such as mercury, mercury vapour and phosphor powder, are kept within allowable limits as per provincial and territorial requirements. Risk assessments should be performed by qualified persons. The results of these tests should be kept in a central registry for five years, unless otherwise specified by federal, provincial, or territorial regulations or requirements. |

[14] A risk assessment is a process to identify and evaluate the human health risks associated with emissions of toxic air pollutants, and to determine the actions needed to mitigate those risks and reduce exposure to protect human health. Risk assessments are conducted in accordance with federal, provincial and territorial requirements.

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| **Waste water** | • All water used for washing phosphor from processed lamps or related materials and contaminated waste water from the washing of storage and processing containers, equipment, rooms or facilities should be collected and monitored to prevent and control environmental releases of mercury and as per federal, provincial and territorial requirements.<br><br>• Contaminated waste water may be classified, by legislation, as hazardous and/or industrial liquid waste, and may be subject to regulatory and management requirements. Contaminated waste water should be recovered and treated, as necessary, so that it complies with legislation and regulatory limits before being released into the municipal waste water or the environment. Contaminated water should not be diluted with clean water or other liquids as a way to lower the final concentration levels to below those of regulatory thresholds. Closed-loop water cleaning/filtering systems should be installed. |
| **Equipment design and operation** | • Equipment and machinery used for lamp crushing or processing should:<br>o be equipped with a system to collect mercury vapour or airborne mercury-containing particles;<br>o be designed so that under normal conditions of operation, mercury in vapour or liquid form, phosphor powder, or other materials of concern cannot escape from the equipment and be released into the surroundings or the environment;<br>o be designed so that all mercury, phosphor powder or other material of concern accumulated in the equipment can be removed and recovered safely; and<br>o include a means to recover mercury vapour and mercury phosphor powder from the exhaust air flow and waste water collection equipment or system. Contaminated air or water should not be diluted with clean air or water as a way to lower the final concentration level to below that of regulatory limits.<br><br>• Equipment and machinery used for lamp processing should be operated and maintained according to specifications and applicable regulations at all times.<br><br>• Equipment and machinery used for lamp processing should be operated and maintained by trained operators and technicians. |
| **Maintenance and inspection** | • Maintenance and cleaning should be:<br>o performed by trained personnel;<br>o performed according to the equipment manufacturer's instructions and recommendations; and<br>o recorded in a maintenance registry. |

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| | • The maintenance registry should include:<br>o description of the maintenance work that has been performed;<br>o location where the maintenance was performed;<br>o date of the maintenance work;<br>o name of the person who performed the maintenance; and<br>o records for the five years prior to the date of the last record, unless otherwise specified by the jurisdiction in which the facility operates.<br><br>• Inspection protocols should be implemented on a regular basis to ensure compliance with provincial and territorial requirements. |
| **Consumables** | • Consumables or disposable parts, such as filters for equipment, machinery or the ventilation system, that are contaminated with mercury should be managed in compliance with applicable federal, provincial and territorial regulations and requirements. Contaminated consumables may be considered hazardous waste, depending on the level of contamination. |
| **Facility closure or decommissioning plan** | • Processors should have a facility closure or decommissioning plan, which should contain details on how the processing of mercury-containing lamps will be discontinued, and/or how the facility will be decommissioned. The plan should describe how it will be funded to ensure that the tasks and risks (e.g., major pollutant releases) are adequately financed, such as with a security or performance bond. The plan should include provisions for long-term monitoring and future use of the site in accordance with provincial and territorial requirements. |

## 9. Recycling of Materials

Materials recovered from the processing of end-of-life mercury-containing lamps should be recycled whenever possible. These materials include, but are not limited to, mercury and mercury compounds, phosphor powder, other metal, glass, and plastic. Mercury may be recovered by way of thermal treatment/desorption, chemical oxidation, chemical precipitation, adsorption treatment, and distillation. Mercury recovery processes are described in the Basel Convention *Technical Guidelines for the Environmentally Sound Management of Wastes Consisting of Elemental Mercury and Wastes Containing or Contaminated with Mercury*[15] adopted in October 2011, and include:

[15] See on www.basel.int/Portals/4/download.aspx?d=UNEP-CHW-GUID-PUB-Mercury.English.pdf.

- Thermal treatment/desorption: Physical separation process whereby a mercury-containing material is heated to a high temperature to volatilize and separate the mercury from the other material, and then the mercury is collected. Thermal treatment system consists of two major components: the desorber that is equipped with a mercury vapour technology to recover the mercury, and an off-gas treatment system to prevent mercury emissions to the environment (UNEP 2011).

- Chemical oxidation: Chemical oxidation (using oxidizing reagents such as sodium hypochlorite, ozone, hydrogen peroxide, chlorine dioxide and free chlorine gas) is applied to elemental mercury and organomercury compounds to destroy the organics and to convert mercury to a soluble form (i.e., mercury halide, such as $HgCl_2$ or $HgI_2$), which can then be separated from the waste matrix and sent for further treatment. Chemical oxidation is effective for treating liquid waste containing or contaminated with mercury (UNEP 2011).

- Chemical precipitation: Chemicals are used to transform dissolved mercury to an insoluble solid, or to adsorb dissolved, colloidal or suspended mercury that is precipitated, and removed from a liquid matrix (UNEP 2011).

- Adsorption treatment: Chemical separation process whereby a mercury-containing or -contaminated liquid matrix is passed through an adsorption material, and the mercury is adsorbed on the surface of the material through chemical forces such as hydrogen bonds, dipole-dipole interactions and van der Waals forces (UNEP 2011).

- Distillation: Mercury is purified through a process involving a series of selective evaporation and condensation. The liquid mercury is heated to a temperature at which the impurities evaporate, or the mercury itself evaporates, and mercury is collected. The distillation process is performed multiple times, with the purity increasing each time, to achieve high-purity elemental mercury (UNEP 2011).

## 10. Disposal of Materials

If residual material cannot be recycled, then an appropriate and safe disposal option should be determined. Considerations for the disposal of mercury wastes include the following.

- Waste facilities should implement measures to prevent releases of mercury.

- Prior to disposal of mercury wastes in an engineered hazardous waste landfill, the waste should be treated or stabilized to meet all requirements for disposal in a landfill.

- Given that mercury in waste is emitted during incineration (i.e., mercury cannot be destroyed by incineration), the amount of mercury in the waste fed into the incinerator should be minimized, and the incinerator should be equipped with air pollution control devices in order to control emissions of mercury.

- Waste facilities should undertake monitoring and documentation, by qualified personnel, of facility releases and emissions of mercury to the environment (emissions, releases from landfills or run-offs, etc.).

- Inspection and testing of equipment and facilities should be carried out by a qualified independent third party on a regular basis, as required by applicable legislation and other requirements.

## 11. Record Keeping and Reporting

The following information, pertaining to mercury-containing lamps or processed materials received or shipped by the facility, should be recorded and kept in a central repository:

- date, number of units, description and origin of each shipment of lamps or material accepted at the facility, and acknowledgement that the shipment was inspected and corresponds with the information on the manifest or bill of lading;
- date, number of units, description and destination of each shipment of lamps or material shipped out of the facility, and confirmation of receipt of the shipments by the receiving facility; and
- monthly summaries of material movement.

All records, including repository, manifests, bills of lading, waste records, and chain of custody of end-of-life lamps, should generally be kept for a minimum of five years, unless otherwise specified by federal, provincial, or territorial regulations or requirements. The facility should assign a person to be responsible for keeping and maintaining records and documentation.

The selection of processors and waste management facilities (e.g., recyclers, commodity markets and/or safe disposal) should be a documented procedure that outlines the steps taken to define the requirements, develop the evaluation criteria and carry out the evaluation process.

## 12. Worker Training

Employee training requirements for hazardous materials are typically prescribed by the authority that has jurisdiction, which in most cases is the provincial or territorial health and safety regulator. The regulations set out the minimum standard of training that the employers must provide to their employees and may require that the employers document and be able to provide proof of the training. In addition, there are employee training requirements under other regulations, such as provincial fire codes, the federal *Transportation of Dangerous Goods Regulations* and provincial codes for commercial vehicle operators.

Where there are no specific training requirements for handling end-of-life mercury lamps, workers at lamp management sites should receive training in conjunction with other employee training that gives proper instruction on how to receive, store and manage hazardous materials (e.g., Workplace Hazardous Material Information System). This level of training could be

appropriate for municipal or retail staff at collection sites where various hazardous wastes are collected and not just mercury-containing end-of-life lamps.

| Activity | Best Practices |
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| **Worker training** | • Workers should be trained on the risks posed by mercury, the need for proper handling, and how to handle mercury to prevent releases.<br><br>• Workers should be properly trained on the cleanup of spilled or broken material. Information on cleanup procedures for broken fluorescent lamps is published on Health Canada's website.[16] The United States Environmental Protection Agency also provides information on how to clean up broken lamps containing mercury.[17]<br><br>• Workers should be trained on the proper use of personal protection equipment.<br><br>• Operators of the lamp processing equipment or machinery should receive instruction and training, as well as regular follow-up instruction and training, on:<br>o operation of the equipment, maintenance of seals and sealing surfaces, replacement and safe handling of filters and other consumables;<br>o proper use of personal protection equipment. Typical personal protection equipment includes mercury vapour and phosphor powder respirator, protective suit, eye protection, gloves, and boots; and<br>o cleanup procedures and the use of mercury spill kit. |

## 13. Other Considerations

Businesses or facilities that handle or manage end-of-life mercury-containing lamps need to consider the requirements and should consult any guidance for worker health and safety established by the jurisdiction in which they operate. Heath Canada's guideline for mercury exposure limit is 0.025 mg/m$^3$ (for elemental and inorganic mercury). The exposure limit for national occupational health standards is set by the *Canada Labour Code* and its Regulations, and is based on the Threshold Limit Values (TLVs) for Chemical Substances, as determined by the American Conference of Governmental Industrial Hygienists.[18] Please contact the Canadian

[16] See on Health Canada's website "The safety of compact fluorescent lamps" at http://healthycanadians.gc.ca/security-securite/radiation/devices-dispositifs/consumer-consommateur/cfl-afc-eng.php.
[17] See on the United States Environmental Protection Agency's website "Cleaning Up a Broken CFL" at http://www2.epa.gov/cfl/cleaning-broken-cfl.
[18] See on http://www.hc-sc.gc.ca/ewh-semt/pubs/contaminants/mercur/index-eng.php#q-59 and http://laws.justice.gc.ca/eng/regulations/sor-86-304/FullText.html

Centre for Occupational Health and Safety or the ministry responsible for occupational health and safety in your province or territory for more information.

# 14. Options for the Diversion and Management of End-of-life Mercury-containing Lamps in Northern and Remote Areas

The best practices presented in the previous sections should be applied to the management of end-of-life mercury-containing lamps by facilities and operators who handle, collect, store, transport and process these materials in Canada. However, recognizing that northern and remote regions often face unique challenges that can make it difficult to collect and manage end-of-life mercury-containing lamps, including limited storage facilities, absence of local recycling facilities, high cost of freight to southern markets, limited transportation options, and lack of regulatory or financial incentives for private industry to develop markets and infrastructure for recycling, the code of practice includes additional information for the implementation of the best practices that takes into consideration these challenges. This section presents information on options for the collection, storage and transportation of end-of-life management of mercury-containing lamps in northern and remote communities which can be used to facilitate the implementation of the best practices.

## 14.1. Collection and Storage

Generally, northern and remote communities are isolated from each other as well as from lamp collection and processing facilities. As such, end-of-life lamps could be dropped off at small primary collection locations established within each community when regional collection points may not be feasible. Once the accumulated quantities warrant it, the end-of-life lamps can be transported to a processor. Alternatively, end-of-life lamps may be sent directly from the waste generator to a lamp processor using pre-paid shipping boxes for recycling.

In areas where the quantity of end-of-life lamps generated is small compared with the quantity of hazardous and other special wastes generated, it may be more economical to consolidate collection services for a variety of hazardous or special waste products in order to reduce collection costs. For example, collection services for end-of-life lamps could be combined with the collection for batteries, small electronics, other mercury-added products, or other waste products or recyclables. Additionally, users may be more likely to take advantage of these services since they may drop off several waste products in one convenient location.

An alternative to long-term or permanent collection sites is scheduled collection days at temporary locations or mobile collection stations that travel from community to community to pick up and consolidate end-of-life lamps. Care would need to be taken to prevent accidental breakage and releases of mercury during collection and storage by using the most appropriate best practices identified in this code of practice.

A large part of the overall recycling costs in northern and remote areas is the transportation cost; therefore, to determine collection and storage needs, factors to consider will be the location of

the processor and available transportation options. In general, the further the distance from the processor, the higher the transportation cost. Controlling overall costs may mean less frequent shipments to the processor and, hence, the capacity to store larger quantities of materials between shipments. Consolidating lamp materials for storage from many waste generators provides an opportunity to share the costs of their management.

Due to limited storage capacity and high transportation costs, facilities in northern and remote communities may choose to employ DTC devices. The use of DTC devices is an allowed practice by many provincial and territorial jurisdictions; however, it is important that DTC devices are equipped with mercury particle and vapour capture systems and are used properly to minimize potential risks to human health and prevent releases to the environment. Subsection 4.3 of the code of practice provides information on best practices and considerations for the use of DTC devices.

## 14.2. Transportation

Transportation costs are typically the most significant cost for managing end-of-life lamps, and are often barriers to removing these lamps from northern and remote communities. Remote communities that are beyond the road-line may be accessed by air, rail, seasonal roads or boat. All of these modes of transportation are subject to weather constraints, which can further limit access to these communities. Various types of partnerships may provide ways to reduce these costs, including partnerships between communities, with large commercial operators, or by adding lamp collection to existing local recycling programs.

End-of-life lamps could be shipped by one of these modes of transportation to a partner community that has access to a road or greater transportation network. Once the material has reached a road or railhead, it can be shipped to a processing facility; for example, remote communities that are accessible by infrequent barge or air transport could ship end-of-life lamps to a partner community to be consolidated and transported by road or rail to a processor.

There are a number of large year-round commercial operations, such as mining facilities, in various parts of northern Canada that may be able to provide access to their transportation providers for the removal of end-of-life lamps. These commercial operations could act as intermediate storage sites prior to the material being sent to a processor or could support transport of spent materials out of the communities.

It may be feasible to take advantage of existing local recycling programs (i.e., stewardship or collection efforts for other hazardous or special waste products) to coordinate the collection of lamps with other types of materials or wastes for shipment to processing or intermediate storage facilities. Northern and remote communities often receive new goods by road, air or barge. Opportunities to partner with shipping companies or retailers to leverage backhaul options could reduce costs as well as the number of transport trips required to bring end-of-life lamps to a processor.

## 15. Review of Progress and Need for Further Action

This code of practice will be reviewed and updated periodically to take into account advancement in technologies and practices and new developments under international agreements. In addition, the Department will monitor and assess the effectiveness of the code of practice in achieving its goal of environmentally sound management of end-of-life mercury-containing lamps to prevent the release of mercury to the environment from the management of such wastes.

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## Acronyms and Initialisms

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| CEPA 1999 | *Canadian Environmental Protection Act, 1999* |
| CFL | Compact fluorescent lamp |
| DTC | Drum top crusher |
| HEPA | High Efficiency Particulate Arrestor |
| HiD | High-intensity discharge |

Pour des renseignements supplémentaires :

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