

Guide to Recycling Mercury-Containing Lamps

for the Industrial, Commercial, & Institutional Sector



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Introduction

Mercury is a contaminant and an essential component of many lamps commonly used today. This guidance document was developed by the Department of Environment and Natural Resources (ENR) and is intended for property managers, building maintenance staff, electrical contractors or anyone else who handles mercury-containing lamps in the Industrial, Commercial and Institutional (ICI) sector.

Industrial

Construction, fabrication, light and heavy manufacturing, refineries, chemical plants, power plants, demolition, etc.

Commercial

Stores, restaurants, markets, office buildings, hotels, motels, print shops, service stations, auto repair shops, etc.

Institutional

Schools, hospitals, prisons, governmental departments, boards and agencies.¹



This Guide answers the following questions:

- I. What are mercury-containing lamps?
- II. Why should they be recycled?
- III. How are they recycled?
- IV. What are the benefits and costs of recycling?

What are Mercury-containing Lamps?

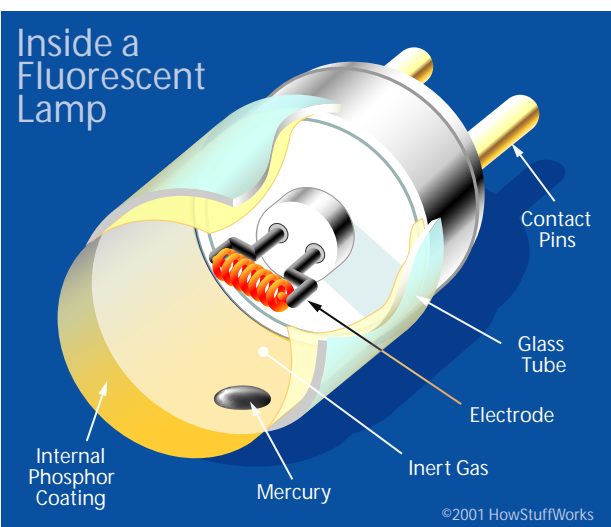
I.

Quantities of Mercury in Energy Efficient Lamps and Lamps with Reduced Mercuryⁱⁱ

Type of Lamp	Avg. Amount
Compact Fluorescent Lamps	1-25 mg
Fluorescent U-Tubes	3-12 mg
Fluomeric Lamp	Approx. 2 mg
Linear Fluorescent Lamps (LFL)*	10-50 mg
*Mercury Reduced (LFL)	3-12 mg
Mercury Vapour Lamps	25-225 mg
Metal Halide Lamps	25-225 mg
Sodium Vapour Lamps	20-145 mg



Mercury-containing lamps can be recognized by the universally recognized chemical symbol for mercury, 'Hg' on the lamp.



A typical fluorescent lamp (of any shape or type) is composed of a phosphor coated glass tube with electrodes at the end(s). The lamp contains mercury and a small amount of an inert gas, typically argon, kept under very low pressure. When an electrical charge is applied, the electrodes energize the mercury vapour, causing it to emit ultraviolet (UV) energy; the reason for the low energy usage. The phosphor coating absorbs the UV energy, causing the phosphor to fluoresce and emit visible light. Inside each lamp the mercury remains in a vapour-state for proper lamp operation.ⁱⁱⁱ

Mercury-containing lamps are used for their energy efficiency compared to other types of lighting. They are three to four times more efficient than non-mercury-containing lamps and reduce the need for fossil fuels in generating electricity. This results in a reduction in greenhouse gas emissions and overall mercury pollution from fossil fuel burning.

The majority of mercury-containing lamps used in the ICI sector in the Northwest Territories (NWT) are disposed of in landfills without any recycling or mercury collection. Recent information from Environment Canada states that, about 10 percent of end-of-life mercury-containing lamps are currently recycled Canada wide.^{iv} The use of linear fluorescent lamps (also known as linear fluorescent tubes) is the most commonly used mercury-containing lamp throughout the ICI sector in the NWT.

This guide does not focus on residential sources of mercury-containing lamps. Residential generation of mercury-containing lamps is estimated to be less than 15% of the total.^v

The different types of mercury-containing lamps are identified further in Appendix I.

Why recycle Mercury-containing Lamps?

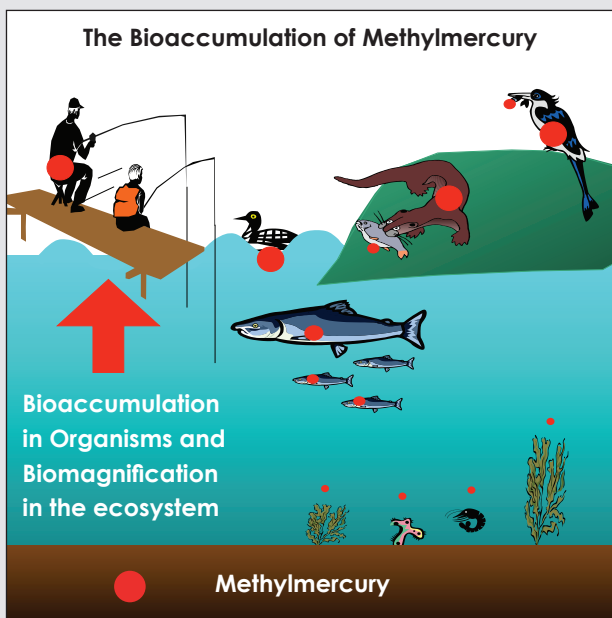
II.

The Canadian Council of Ministers of the Environment determined that mercury levels in fish and wildlife across Canada warrant efforts to reduce atmospheric and waterborne emissions derived from both deliberate use of mercury and from incidental releases of mercury.

Restrictions on the human consumption of fish in order to safeguard the health of both high fish consumers (sustenance and commercial fishers) and sensitive populations (infants, children and women of childbearing age) are widespread. Some of these restrictions are derived from lakes naturally high in mercury, others in lakes and rivers contaminated by historical point source discharges and still others in waters remote from identifiable sources. Traditional lifestyles may be profoundly influenced by mercury contamination.^{vi}

Mercury Effects Human Health

Today, the main effects of mercury exposure to humans are understood to be neurological, renal (kidney), cardiovascular and immunological impacts. Chronic exposure to mercury can cause damage to the brain, spinal cord, kidneys, liver and developing fetus. Exposure to mercury while in the womb can lead to neurodevelopmental problems in children. Mercury can impair the ability to feel, see, move and taste, and can cause numbness and tunnel vision. Long-term exposure can lead to progressively worse symptoms and ultimately personality changes, stupor, and in extreme cases, coma or death. Recent findings have described adverse cardiovascular and immune system effects at very low levels.^{vii}



Mercury (Hg) Bioaccumulates in the Environment^{viii}

Mercury exists as a gas and in a range of organic (carbon containing) and inorganic (not containing carbon) forms that vary in toxicity and persistence in living organisms. When atmospheric mercury falls to earth, it may be altered by bacterial or chemical action into an organic form known as methylmercury.

Methylmercury is much more toxic than the original metal molecules that drifted in the air, and has the ability to migrate through cell membranes and "bioaccumulate" in living tissue. Bioaccumulation is the process by which a substance builds up in a living organism from the surrounding air or water, or through the consumption of contaminated food. In the following figure, the concept of accumulated methylmercury is illustrated by the red dots, however the dots are not to scale.

Government Regulations

The Guideline for Industrial Waste Discharges outlines the leachate criteria for solid wastes suitable for landfill.^x Testing done in the NWT has confirmed that crushed mercury-containing lamps may not pass the leachate test and therefore, are managed as a hazardous waste. The mercury is embodied in the vapour and the phosphor powder of mercury-containing lamps and the mass of the entire lamp is considered mercury waste.

Unless laboratory results confirm the mercury-containing lamps meet Industrial Discharge criteria the mercury-containing lamps need to be managed as a hazardous waste according to the Guideline for the General Management of Hazardous Waste in the NWT.^x All mercury-containing lamps, whether hazardous or not, will release mercury into the environment when broken outside of a controlled recycling process. ENR encourages the recycling of all mercury-containing lamps.

Small Quantity Exemption

The Guideline for the General Management of Hazardous Waste in the NWT defines 'small quantity' to which the definition of hazardous waste does not apply.

Hazardous waste that is generated in an amount that is less than 5 kilograms per month if a solid or 5 litres per month if a liquid; and where the total quantity accumulated at any one time does not exceed 5 kilograms or 5 litres. This does not apply to wastes that are mercury or in classes 2.3, 5.1 or 6.1 of TDGR. These wastes must be generated in an amount less than 1 kilogram per month if a solid or 1 litre per month if a liquid; and where the total quantity accumulated at any one time does not exceed 1 kilogram or 1 litre.

Approximately 75% of mercury-containing lamps in Canada are four-foot (T-8 or T-12) fluorescent lamps.^{x1} The mass of the entire lamp is considered mercury waste and it takes approximately four of these four-foot fluorescent lamps to amount to 1 kg of mercury-containing lamps.^{x2}

4 lamps / month = 1 kg mercury waste / month

The average life of a T8 fluorescent lamp is approximately three years or 1000 days.^{x3} The rate at which a functioning lamp becomes a waste lamp is approximately 1/1000 days. The rate of waste lamps generated per month is calculated as follows:

**1 lamp / 1000 days x 30 days/month
= 0.03 lamps / month = 3% of total lamps.**

The amount of waste lamps generated per month represents approximately 3% of the total number of lamps.

The total number of lamps that generate 1 kg of mercury waste per month, or 4 lamps is calculated as follows:

**Total number of lamps = 4 lamps / 3%
= approximately 130 lamps**

It is understood the calculations above assume mercury-containing lamps come out of service at a uniform rate. In reality lamps come out of service in non uniform rates, and at any given time a building will generate more or less than a three percent of the total number mercury-containing lamps. The best practice is to recycle all waste mercury-containing lamps regardless of the total number of lamps.

Building with Less than 130 Fluorescent Lamps (bulbs)

The owners of buildings with less than 130 Fluorescent Lamps are strongly encouraged to seek out recycling options for fluorescent lamps. Based on the above approximations, a building containing less than 130 fluorescent bulbs generates less than 1kg of mercury-containing lamps per month. A generator is exempt from the requirements of the Guideline for the General Management of Hazardous Waste if the waste generated is less than 1 kg of hazardous waste per month.

Building with 130 or more Fluorescent Lamps (bulbs)

The owners of a building with more than 130 fluorescent lamps are required to divert mercury-containing lamps from regular solid waste and manage all these lamps as a hazardous waste.

How are Mercury-Containing Lamps recycled?

III.

Lamp Recycling is Easy

Fluorescent lamps are recycled by separating the glass, mercury, phosphor powder, and aluminum by crushing and then capturing the mercury vapour. There are currently no centralized facilities to recycle these components in the NWT. Drum top crushers may be used to crush the glass and capture the mercury vapour in filters. ENR can loan a drum top bulb crusher, at no cost, depending on availability of a unit and on the condition the employer develops a detailed safe work plan. Once the crushed lamps have been consolidated in drums, the materials are transported to facilities where further separation takes place under pressure and heat before recycling them separately.^{xiv} It is also possible to transport intact lamps directly to recycling facilities.

The Mercury-containing Lamp Recycling Flow Chart (upper right) can be used to help determine details suitable for specific facilities.

Staff Training

Prior to off-site disposal the following measures need to be taken:

- ▶ placing spent lamps in a designated storage area instead of the garbage;
- ▶ avoiding intentional breakage of lamps; and,
- ▶ preparing bulbs for transportation.

Prior to off-site disposal fluorescent lamps may be crushed on-site for volume reduction. This option requires the employer to develop a detailed safe work plan for the use of drum top bulb crushing equipment. The use of drum top bulb crushers requires careful attention to the use of the equipment to prevent worker exposure to mercury vapour. There is no cost to utilize the drum top bulb crusher from ENR. See the section on off-site disposal for further details.

Designate a Mercury-Containing Lamp Storage Area

- ▶ Assess the mercury-containing Lamp Storage Area and determine an accumulation limit.
- ▶ Label the area, (e.g. "Waste mercury-containing Lamp Storage Area")
- ▶ Include designated containers/boxes to store the used bulbs as they accumulate.



Take Mercury-Containing Lamp Out of Service

- ▶ Store mercury-containing Lamp in Designated Storage Area,
- ▶ Label boxes with expired mercury-containing Lamps differently from unused lamps.
- ▶ Ensure mercury-containing lamps are stored in a manner that prevents breakage, and close boxes.



Conduct Weekly Inspections of Storage Area

- ▶ Check for improperly stored bulbs or damaged bulbs
- ▶ Contain mercury-containing lamps showing evidence of breakage / damage. Do not try and remove debris from the bottom of a box.
- ▶ Leave broken lamps in box and seal the box and store separately from undamaged bulbs
- ▶ Record the number of lamps in the storage area and compare to accumulation limit



Once Accumulation Limit is anticipated, or has been reached contact "off-site disposal option".

Storage

The first step a generator of mercury-containing lamps must take is to inform all employees about the proper handling and procedures for damaged lamps. Health Canada's guidance on what to do when a lamp breaks (Appendix II) should be reviewed by owners and any staff handling mercury-containing lamps. It can also be viewed online at: www.hc-sc.gc.ca/hl-vs/iyh-vsv/prod/cfi-afc-eng.php. The normal handling of spent fluorescent lamps does not present any health and safety risks.

The second step in recycling lamps is to divert them from the waste stream and designate a suitable storage area. A dedicated storage area should be located in an area, which can be locked, away from human traffic to prevent tampering. The area should be dry and have good ventilation. It should not be a general workspace. The following factors should be considered when selecting a storage area:

- ▶ What type of lamps and how many are going to be collected between for offsite disposal or crushing operations?
- ▶ What types and size of recycling containers will be needed? Where should they be placed?
- ▶ What is the accumulation limit of the storage area or the number of bulbs that can be safely stored?
- ▶ How can it be kept convenient for employee access?



Improper Storage (above) and Good Storage (below)

Packaging and Handling of Mercury-Containing Lamps

- ▶ Do not tape lamps together. This makes them difficult to separate for crushing.
- ▶ Packaging in between lamps is not required but each box should be filled to capacity to prevent movement.
- ▶ Ensure the bottoms of boxes are secure and can support the weight of the contents.
- ▶ Do not over-pack a box or a drum so that any movement will cause a bulb to break.
- ▶ Do not place heavy objects on top of boxes or individual fluorescent lamps.
- ▶ Ensure each container is labelled to distinguish spent lamps from unused lamps.
- ▶ For high intensity discharge lamps or other non-straight lamps use any sturdy cardboard box for storage. Wrap one sheet of newspaper around the lamp, or slip it back into its original casing. Be sure to put a label on the box and date it.
- ▶ If a lamp breaks in the box or drum, leave it alone. Do not attempt to remove the broken lamp, or its parts, from the container. Broken bulbs can be added to a drum of crushed glass when available.

Record Keeping

It is important to keep a record of when the accumulation limit has been reached and off-site disposal or bulb crushing is required. The accumulation limit is different for each facility and depends on the size of the facility and the size of the storage space.

Record keeping of accumulation limits can be accomplished by following these simple measures:

- ▶ Keep a running total of the number of spent mercury-containing lamps placed in a storage area by updating a list each time a mercury-containing lamp is added to the area; or,
- ▶ Place the mercury-containing lamp in a specific accumulation area and identify the earliest date any mercury-containing lamp in the area became a waste.
- ▶ Record keeping is also required for off-site disposal. A movement document (hazardous waste manifest) is required to track the disposal of all hazardous wastes from registered generators, carriers, to registered receiving facilities.

A movement document is not required if intact bulbs are transported to a contractor for crushing prior to transportation to a registered receiving facility. In this case, some form of record keeping (e.g., waybill, chain of custody, bill of lading) outlining who is in charge, management, and control of the mercury-containing lamps at any given time is strongly recommended. A movement document is required when crushed lamps or intact lamps are transported to registered hazardous waste receiving facilities. ENR's Environment Division provides movement documents at no cost.

Drum-Top Crushing

Drum-top crushing is done using a mechanical device that fits on top of a 205 L (45-gallon) collection drum. Whole lamps are broken in the system but components are not separated. The drum will contain hazardous mercury, phosphor powder, glass and mixed metals. Crushing lamps into drums releases mercury into the filter. This filter medium also becomes hazardous. Drum-top crushing can be done safely by following manufacturer's instructions and developing a detailed safe work plan. The drum-top bulb crushing machines were intended to be used indoors in well-ventilated areas even though there is some mercury vapour released from the equipment while it is in operation. It is possible for workers to become overexposed if precautions are not followed.

If the preferred option for recycling fluorescent lamps is on-site crushing using available staff and ENR's bulb crusher, a detailed safe work plan will have to be developed. Please contact ENR's Environment Division for further information.



Off-site Disposal

There are several disposal options available to generators of waste mercury-containing lamps. These include:

- I. Obtaining the services of a hazardous waste contractor to remove bulbs from the building.
- II. Transporting intact bulbs to a receiving facility or contractor.
- III. Hiring a contractor to crush bulbs on site and then dispose of the crushed glass.
- IV. Using a drum-top bulb crusher and arranging transport directly.

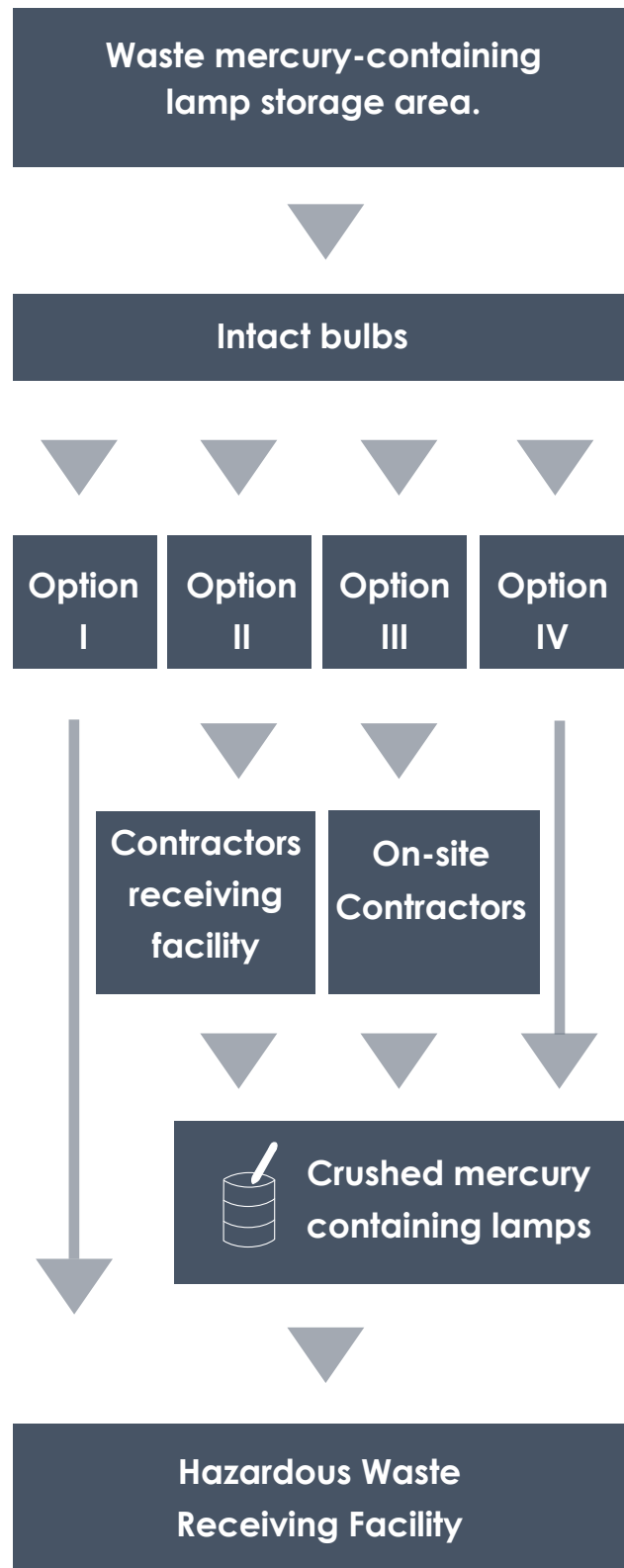
Mercury-containing lamps may be transported as intact bulbs, or as crushed glass in drums. There are different labelling and paperwork requirements for each transportation method.

Disposing of Intact Lamps:

- ▶ Must be packaged to prevent breakage during transport;
- ▶ Cannot be disposed of at community disposal facilities;
- ▶ May be transported to contractors for crushing before ultimate disposal;
- ▶ Does not need special labelling or paperwork requirements;
- ▶ Must confirm the lamps have been transported to contractors who are trained to manage mercury-containing lamps; and,
- ▶ May use a movement document (hazardous waste manifest) to track the shipment between generator and contractor or receiving facility.

Disposing of Crushed Lamps:

- ▶ Must be packaged in sound sealable means of containment (i.e. drums, pails);
- ▶ Must be labelled and shipped according to the requirements of the province or territory of destination;
- ▶ Must be accompanied by a movement document (hazardous waste manifest); and,
- ▶ Must be transported to appropriately receiving facilities of Hazardous Waste.



Selecting a Contractor

A range of contractors and services may be available to the generator, depending on the region. Some of the options mentioned in Section II may influence the decision to use the services of a contractor. It is important to select a contractor who can ensure mercury-containing lamps are effectively managed to prevent the release of mercury regardless of where the crushing of lamps takes place.

There are very few options in many communities to transport the mercury-containing lamps to registered receiving facilities. In these cases, a contractor acts as an intermediary between a generator and ultimate disposal at registered receiving facilities. The Guideline for the General Management of Hazardous Waste in the NWT states:

The generator is ultimately responsible for ensuring hazardous waste will be properly managed from the time it is generated to final disposal. Waste must be properly stored, transported, treated and disposed. Contractors can manage waste on behalf of the generator however, the generator is responsible for ensuring, in advance, that the waste management method is acceptable.

Important selection criteria to consider when choosing a contractor include:

- ↔ Is the company a hazardous waste contractor?
- ↑↓ Is the company a registered as a generator carrier or receiver with the applicable province or territory?
- ↔ Is the contractor's primary business suitable for the collection of mercury-containing lamps?
- ↔ Are they aware of applicable health and safety as well as environmental regulations?
- ↑↓ Does the contractor have a health and safety plan?
- ↑↓ What type of services does the contractor provide (i.e. pick-up, disposal, crushing)?
- ↔ What kind of assurances does the contractor provide that mercury-containing lamps will be disposed of at a registered receiving facility?

Suitable contractors may be waste management companies, electricians, or other technical trade people in the community. Please contact ENR's Environment Division if a suitable contractor cannot be found. The Recycling Council of Alberta list of companies that recycle mercury-containing lamps can be found on-line at: www.recycle.ab.ca/fluorescent-lamps-processing.

A list of hazardous waste receiving facilities in the Alberta and British Columbia can be found online at:

- ▶ <http://environment.gov.ab.ca/info/library/8121.pdf>
- ▶ www.hazwastebc.com/categories/mercury/



What are the benefits and costs of recycling Mercury-containing Lamps?

IV.

Benefits

- ▶ Reduced amount of mercury released into the environment.
- ▶ Reduced risk of occupational exposure to mercury from crushed bulbs in disposal containers.
- ▶ A property owner's positive image associated with disposing of mercury-containing lamps responsibly.
- ▶ Compliance with NWT environmental standards.

Costs

Estimated Costs of disposing of Fluorescent Lamps	
Disposal of a 205 L drum of crushed glass	\$250
Transportation (varies depending on community)	\$200 Est.
Cost of a drum	\$100 Est.
Total	\$550*

Each 205 L drum can contain approx. 800 4' bulbs**

Cost of one drum = \$550 / 800 bulbs
= approx. \$0.70/bulb

*This estimate does not account for staff time if crushing of the lamps is done on site or by a contractor.

**A drum will hold a lesser quantity of lamps if eight-foot lamps, or if compact fluorescent lamps are crushed.

High Intensity discharge (HID) lamps are more expensive to dispose because size reduction is not a viable option in the NWT. Based on estimates in the U.S., HID lamps are approximately five times as expensive to recycle as linear fluorescent tubes.^{xv}



Links to more information

ENR Headquarters and Regional Offices

Environment Division

600, 5102-50th Ave.
Yellowknife NT X1A 3S8
Tel: (867) 873-7654
Fax: (867) 873-0221

South Slave Region

Box 900
Fort Smith NT X0E 0P0
Tel: (867) 872-6400
Fax: (867) 872-4628

North Slave Region

Box 2668
Yellowknife NT X1A 2P9
Tel: (867) 873-7184
Fax: (867) 873-6230

Dehcho Region

Box 240
Fort Simpson X0E 0N0
Tel: (867) 695-7450
Fax: (867) 695-2381

Sahtu Region

P.O. Box 149
Norman Wells NT X0E 0V0
Tel: (867) 587-3500
Fax: (867) 587-3516

Inuvik Region

P.O. Box 2749
Shell Lake X0E 0T0
Tel: (867) 678-6650
Fax: (867) 678-6659

WSCC Workers' Safety & Compensation Commission

Yellowknife

5022 49th Street
5th Floor, Centre Square
Tower
Box 8888
Yellowknife, NT X1A 2R3
Tel: (867) 920-3888
Fax: (867) 873-4596
Toll Free
Tel: 1-800-661-0792
Fax: 1-866-277-3677

Inuvik

3rd Floor
Mack Travel Building
151 Mackenzie Road
Box 1188
Inuvik, NT X0E 0T0
Tel: (867) 678-2301
Fax: (867) 678-2302

Guideline for the General Management of Hazardous Waste in the NWT:

www.enr.gov.nt.ca/live/documents/content/General_management.pdf

GNWT 1998, Guideline for Industrial Waste Discharges in the NWT:

www.enr.gov.nt.ca/live/documents/content/industrial_waste_guidelines.pdf

Association of Lighting and Mercury Recyclers:

www.almr.org/

Recycling Council of Alberta Directory Listings:

www.recycle.ab.ca/ebguide

CCME Canada Wide Standard for Mercury-Containing Lamps:

www.ccme.ca/assets/pdf/merc_lamp_standard_e.pdf

Environment Canada, Mercury and the Environment:

www.ec.gc.ca/mercure-mercury/default.asp?lang=En&n=DB6D2996-1

Environment Canada, Technical Recommendations Document on the Management of End-of-life Mercury-Containing Lamps in Canada:

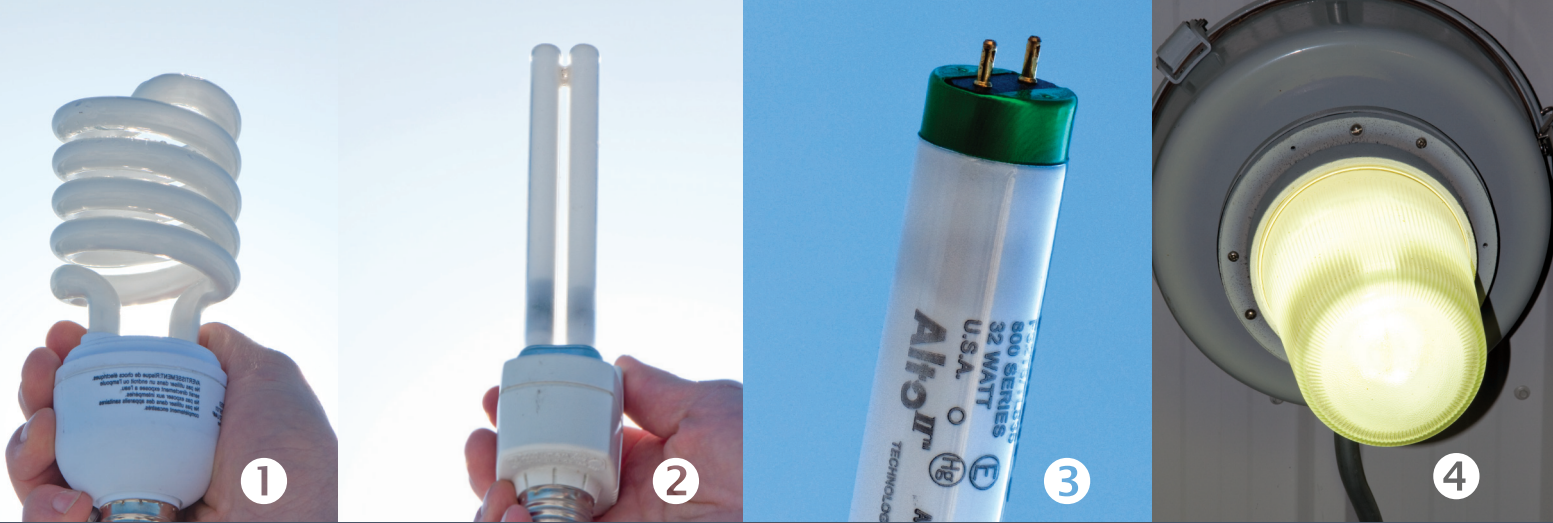
www.ec.gc.ca/mercure-mercury/default.asp?lang=En&n=5CA51DB2

Natural Resources Canada's Fluorescent Lamps - Questions and Answers:

<http://oee.nrcan.gc.ca/residential/business/manufacturers/11423>

Lamprecycle.org:

www.lamprecycle.org/



Appendix I : Types of Mercury-Containing Lamps

1 2 Compact Fluorescent Lamps

Use: Compact fluorescent lamps are frequently used in place of traditional incandescent lights in the hospitality industry, offices, and home lighting systems.

Description: Compact fluorescent lamps have all the same characteristics as linear fluorescent tubes, except they have been designed to replace incandescent bulbs, which are common in residential, commercial, industrial, and accent lighting applications.

Identification: Compact fluorescent lamps are similar in size to the incandescent bulb; however, the bulb has been replaced with a coiled, compact fluorescent tube.

Fluorescent U-Tubes

Use: Fluorescent U-Tubes are used in appliances, ceiling fixtures, and display cases. They are useful when fluorescent light is desired, but the available space is too small for traditional linear fluorescent lamps.

Description: Fluorescent U-Tubes have all the same characteristics as linear fluorescent tubes, except they take up half the space of a comparable linear fluorescent.

Identification: Fluorescent U-Tubes can be identified by the distinct U-shaped fluorescent tube.

Fluomeric Lamps

Use: Fluomeric lamps are used as replacement lamps for incandescent systems for a variety of applications. High-wattage fluomeric lamps have long-burning life (up to 20,000 hours) and are ideal for high-bay lighting applications such as industrial lighting, repair shops, street lighting, building facades, security lighting, billboards, and sports arenas. Smaller lower wattage models are suitable for schools, stores, and display lighting.

Description: These lamps are self-ballast and produce brighter light than incandescent lamps. No ballast, wiring, or special fixtures are required to retrofit existing incandescent fixtures (Duro-test lighting, 2003).

Identification: Fluomeric lamps are not very distinguishable from regular incandescent lamps. They can be clear, white (frosted colour), and reflector flood (aluminum reflector with a frosted face). Product labeling and packaging should be examined to determine whether the lamp is fluomeric.



3 Linear Fluorescent Lamps

Use: Fluorescent lamps are commonly used to illuminate offices, stores, warehouses, street corners, and homes.

Description: Fluorescent lamps are sealed glass tubes that contain small amounts of mercury (an essential component), inert gas, and phosphor powder coated along the inside of the tubes. Fluorescent lamps are highly efficient, using electric discharge through low-pressure mercury vapour to produce ultraviolet (UV) energy.

Identification: Fluorescent lamps generally range in diameter from 2.54 to 3.81 centimetres (1 to 1.5 inches); and in length from 0.61 to 2.44 meters (2 feet to 8 feet). Mercury-reduced fluorescent lamps can have a green band or writing at the ends.

4 Mercury Vapour Lamps

Use: Mercury vapour lamps are frequently found in several high intensity discharge (HID) lamp applications. They are used as farmyard lights, for street lighting and general floodlighting, and in parking lots.

Description: The lamp consists of a glass envelope with a pinched quartz glass tube and various metal electrodes within. An electronic current is passed through to form an arc to display light.

Identification: Light emission is identifiable by a bluish glow. The quality of colour rendition is not as good as metal halide or high-pressure sodium vapour lamps.

Metal Halide Lamps

Use: Metal halide lamps are used to light sport stadium fields and other areas where a very bright light is required.

Description: Metal halide lamps are the brightest light available and are frequently found in several HID applications. They offer better lighting than mercury or sodium vapour lamps. Metal halide lamps can take up to 5 minutes to light up after being switched on; or 20 minutes if turned off and on again (ignition and restrike). This light emits a bright white light close in quality to incandescent lamps. Lights must be matched up with ballasts. These lamps are not interchangeable with other high intensity discharge (HID) (Florida Power and Light, 2003).

Identification: Consists of glass envelope with a pinched quartz glass tube and various metal electrodes within. An electronic current is passed through to form an arc and then a light display.

Sodium Vapour Lamps

Use: Sodium Vapour lamps are economical high intensity discharge (HID) lamps used for street lighting and general floodlighting and in parking lots.

Description: Sodium vapour lamps consist of a glass envelope with a pinched quartz glass tube and various metal electrodes within. An electronic current is passed through to form an arc and then a light display. There are two general models of sodium vapour lamps: high-pressure sodium (70-1000 watts) and low-pressure sodium (35-180 watts) (Lampotech, 2003).

Identification: Light emission is identifiable by a yellowish glow.

Appendix II : What to do when a mercury-containing lamp breaks.

If you break a Mercury Containing Lamp follow these directions for clean-up:

Leave the room

- ▶ Remove people and pets from the room and keep them out of the room during the clean-up process.
- ▶ Avoid stepping on any broken glass.

Ventilation

- ▶ Ventilate the room for at least 15 minutes prior to starting clean-up by opening windows and doors to the outdoors. This will ensure that mercury vapour levels are reduced before you start cleaning.

Clean-up Directions for Hard and Carpeted Surfaces

- ▶ Do not use a vacuum to clean up the initial breakage, as it will spread the mercury vapour and dust throughout the area and may contaminate the vacuum.
- ▶ Wear disposable gloves, if available, to avoid direct contact with mercury and to prevent cuts.
- ▶ Scoop or sweep up the broken pieces and debris with two pieces of stiff paper or cardboard. Do not use a broom.
- ▶ Use sticky tape, such as duct tape or masking tape, to pick up any remaining fine glass or powder.
- ▶ Wipe the area with a damp paper towel, cloth or disposable wet wipe to remove any residual particles.
- ▶ Place the broken glass and clean-up materials in a glass container with a tight fitting lid to further minimize the release of mercury vapour.

Carpeting - Steps to Take After the Initial Clean-up

- ▶ If the rug is removable, take it outside, shake and air it out for as long as is practical.
- ▶ The first time you vacuum on installed carpet after the clean-up, shut the door to the room or close off the area as much as possible and ventilate the room in which the lamp was broken by opening the windows and doors to the outside. When the vacuuming is done, remove the bag, wipe the vacuum with a damp paper towel, cloth or disposable wet wipe, and then place the vacuum bag and paper towel in a sealed plastic bag outside. In the case of a canister vacuum, wipe the canister out with a wet paper towel and dispose of the towel as outlined above. Continue to ventilate the room for 15 minutes once the vacuuming is completed.

Broken Lamps inside a box

- ▶ When a broken mercury containing lamp is discovered in a box seal the box with tape if possible while still containing the broken glass inside the box.
- ▶ Do not attempt to remove the broken glass indoors or in a poorly ventilated area.
- ▶ Move the box outdoors in a secure area, and arrange to have the glass disposed of with other mercury containing lamps that are intact.

Disposal

- ▶ Immediately place waste material outside of the building in a protected area.
- ▶ Dispose of the waste along with other mercury containing lamps as soon as possible. Check the off-site disposal plan.

Washing

- ▶ Wash your hands after storing and disposing of waste.

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