

MERCURY

Federal Facilities Mercury Info-guide

What is Mercury?

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Mercury (Hg) is a naturally occurring element. It can exist in a gaseous, liquid, or solid form. Possessing the properties of both a liquid and a metal at room temperature, mercury is commonly used in consumer products to conduct electricity or to measure temperature and pressure. Mercury's ability to readily change physical states allows it to circulate in air, water, and soil. As an element, mercury cannot be destroyed by combustion or through biological degradation. Mercury is volatile and can be transported over long distances before being deposited on land or in water.

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Mercury may be deposited into water bodies, either directly from water discharge, air deposition or indirectly in runoff. Microorganisms then convert elemental mercury to methylmercury, which can be readily absorbed by the fish that feed on the microorganisms. The methylmercury then bioaccumulates as it moves up the food chain in fish-eating mammals and other wildlife. Methylmercury is more harmful to people and animals than elemental mercury.

Health and Environmental Impacts of Mercury

Mercury can be inhaled, ingested, or absorbed through the skin. At room temperature, mercury has an appreciable vapour pressure. Mercury's health effects are primarily neurological, causing tremors, insomnia, memory loss, headaches, irritability, and nervousness, but it can also cause serious damage to the kidneys. Methylmercury and metal vapours are more harmful than other forms, as more mercury in these forms reaches the brain. In the workplace, most exposures occur following the breakage and improper cleanup of mercury-containing products or the inhalation of mercury vapour from spills.

Mercury is toxic, is persistent, and has a tendency to bioaccumulate in the environment. Therefore, it is listed in Schedule 1 of the *Canadian Environmental Protection Act, 1999 (CEPA)*, the List of Toxic Substances.

Very small amounts of mercury can do significant damage to the environment. For example, one gram of mercury per year is enough to contaminate all the fish in a lake with a surface area of 8 hectares. When mercury-bearing products are poured down the drain or thrown into the trash, mercury enters the waste disposal cycle and the environment. When trash in Ontario is combusted, mercury from this source enters the air and is deposited on land and in water. When mercury enters the sewer system, it collects in sewer pipes and contaminates the wastewater treatment sludge. This sludge may be applied to the land, disposed of in landfills, or combusted, and the remainder is discharged as effluent.

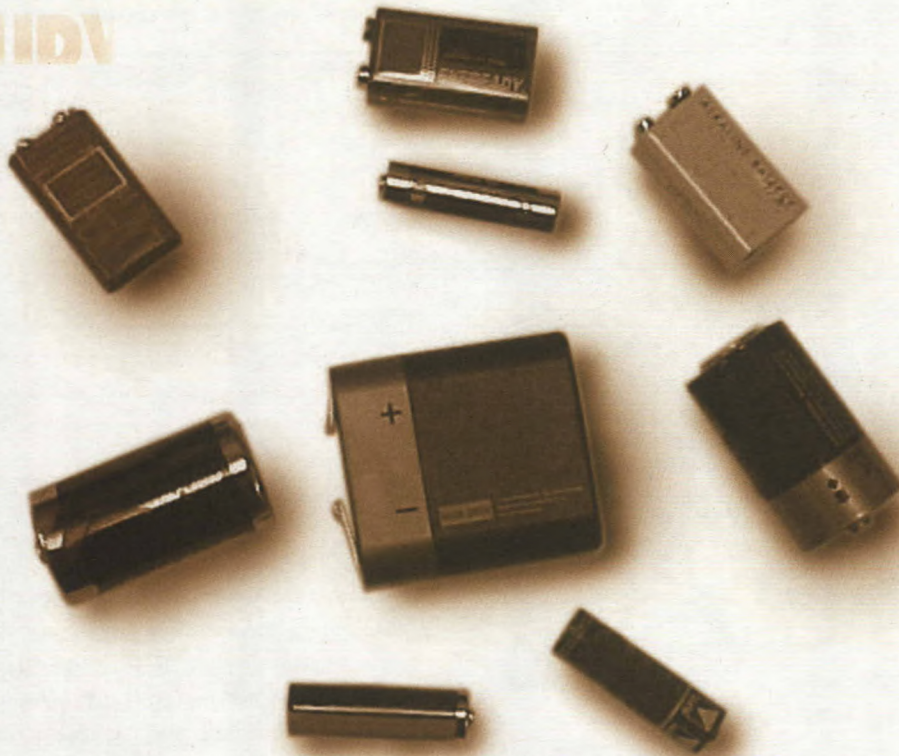
The Use of Mercury Products

The largest use of mercury in Ontario and in Canada is in electrical products and in temperature/pressure devices. Products such as batteries, fluorescent lamps, thermometers, manometers, and electrical switches are the most common. Improper disposal of these mercury products pose a health and environmental threat through breakage and subsequent mercury spills. The disposal of mercury-containing products can create wastes that are often classified as hazardous. In Ontario, wastes that leach mercury in concentrations exceeding 0.1 milligrams per litre are considered hazardous.

Batteries

Use and Location

As of January 1996, the manufacture of mercury oxide batteries was discontinued in Canada. The Canadian Household Battery Association has voluntarily eliminated mercury from all alkaline, zinc carbon, and zinc chloride batteries. Manufacturers still use small amounts of mercury in button cell batteries that are found in calculators, cameras, watches, and hearing aids. The small size of the battery required for these applications demands use of a tightly compacted electrolyte such as mercury.



Alternatives

Existing mercury oxide batteries can be replaced with lithium, zinc air, and solar batteries. Alkaline and solar-powered batteries are some of the alternatives to button cell batteries. There is a lithium battery recycling facility located in Trail, British Columbia. For further information, visit (www.toxco.com).

Recycling Options and Disposal Methods

Contact your local waste management facility for further information regarding battery recycling programs. Ensure that old mercury-containing batteries are disposed of properly through a certified carrier or sent to a recycling facility. Most cities, regions, or counties have take-back programs in place for mercury oxide batteries. There are companies claiming to collect, recycle, or treat used batteries containing mercury. A list of companies can be found at (www.nema.org/index_nema.cfm/666/).

Mercury-Containing Thermostats

Use and Location

The mercury in thermostats serves to connect two electrodes, thereby completing an electrical circuit that triggers heating and air-conditioning units to turn on. Each switch contains approximately 3 to 4 grams of mercury in a glass ampoule, typically attached to a metal coil. To determine if a thermostat contains mercury, remove the front plate. Mercury-containing thermostats may contain one or more small mercury switches. These types of thermostats are used in most residential and commercial heating.

Alternatives

There are many mercury-free thermostats available on the market. Programmable electronic thermostats can provide more features than mercury thermostats and are more energy-efficient.

Recycling Options and Disposal Methods

Do not remove the switches from thermostats. Check to see if any wholesalers consolidate thermostats from heating contractors for shipment to manufacturers.

Thermostat



Honeywell, for example, will accept used thermostats. The mercury bulbs are removed, bulked, and shipped to a mercury reclamation facility. Honeywell then purchases mercury from the reclamation facility to use in new thermostats. Contact your local municipal works department for further information about where you can send mercury thermostats for proper disposal.

Mercury Thermometers

Use and Location

Mercury is used in thermometers because a slight change in temperature causes it to increase or decrease in volume. The mercury in thermometers is found in a glass tube calibrated to give a precise measurement of temperature. Most of the thermometers used in laboratory and medical applications contain mercury and therefore should not be disposed of in landfills. Medical thermometers contain about 0.7 grams of mercury, but larger American Society for Testing and Materials and laboratory thermometers contain up to 3 grams of mercury. Weather thermometers used to measure air and water temperature also contain approximately 3 grams of mercury per unit.

Alternatives

There are numerous alternatives to mercury thermometers. Examples include alcohol-filled "red bulb" thermometers, galinstan (blend of gallium, indium, and tin) thermometers commonly used as medical thermometers, and digital thermometers.

Mercury thermometers are accurate to a tenth of a degree, whereas alcohol thermometers are not as sensitive. Digital thermometers are as accurate as mercury thermometers, last longer because they do not break as easily, and cost less in the long run.

Recycling Options and Disposal Methods

Old and broken thermometers should be saved in a secure, closed container. When enough thermometers are collected, they should be sent to a certified carrier for recycling. You can also contact your local municipal works department for further hazardous waste collection information.

There is potential for release of mercury to the environment when mercury thermometers break, since the mercury-containing glass tube is fragile and susceptible to breakage itself. Some laboratories are purchasing Teflon-coated thermometers to prevent the mercury from dispersing if the unit is broken. Proper cleanup of spilled mercury and adequate ventilation can help minimize health risks even further.

Environment Canada has planned a pilot-scale Mercury Fever Thermometer Take Back Program for volunteering retail pharmacies in Thunder Bay, London, and Ottawa, Ontario. The pilot program is scheduled for February 2002.

Thermometer



Fluorescent and High-Intensity-Discharge (HID) Lamps

Use and Location

Mercury is an essential component in both fluorescent lamps and high-intensity-discharge (HID) lamps used in streetlights and floodlights. The mercury is in a vapour form and in the phosphor coating inside the lamp tube. The mercury vapour discharge emits ultraviolet radiation that is converted to visible light by the phosphor powder that coats the interior of the light.

Most commercial buildings use fluorescent lamps for lighting. There are about 5000 different fluorescent lamp products on the market. The 1.2-metre (4 foot) lamp is the highest-volume lamp sold, accounting for approximately 75% of the market. The average 1.2-metre fluorescent lamp contains about 11.6 milligrams of mercury. Other lamps that contain mercury include mercury vapour lamps, metal halide lamps, and neon lamps.

Alternatives

At this time, no viable replacement has been found for mercury fluorescent lamps. Most lamp manufacturers are working to reduce the mercury content of fluorescent lamps to the minimum amount technically feasible without reducing lamp life. Environmentally marketed lamps are available that claim to use 70% less mercury than the industrial averages. The lowest level of mercury in a lamp currently produced is 3.5 milligrams. Mercury-free fluorescent lamps are available using xenon; however, their efficiency is about 30% of that of a normal mercury-based fluorescent lamp. Mercury-free HID lamps have been recently developed and are becoming more readily available.

Recycling Options and Disposal Methods

The best disposal method for fluorescent tubes is recycling. There are several recycling companies in

makes more sense for functional, regulatory, environmental and economic reasons for businesses and government to contact third-party recyclers. Additional information on lamp recycling can be found through the (www.lamprecycle.org) website.

Ontario federal facilities should assume that their lamps are hazardous waste unless tests of their spent lamps and fragments confirm that the wastes are non-hazardous as described in the *Toxicity Characteristic Leaching Procedure (TCLP), Method 1311, U.S. EPA Publication SW-846*. This is the test method required by Ontario Regulation 347/90 – General Waste Management. The TCLP attempts to measure the amount of hazardous substance that might dissolve into the ecosystem. Fluorescent lamps would be classified as 146T on the Generator Registration Report. In Ontario, any waste that fails the TCLP and is managed off-site is required to be manifested, transported by a certified carrier, and shipped to a certified receiver. The generator must also be registered. Generators that produce less than 5 kilograms a month are subject to the Small Quantity Exemption (SQE) from the regulation. The 5-kilogram SQE limit applies to the total weight of the fluorescent tube, including all its components and packaging.

Used lamps must be handled carefully to ensure that they do not break or implode and release mercury. Lamps must be stored properly to prevent them from



Fluorescent lamp

Ontario that will accept fluorescent lamps. Contact your local Ministry of the Environment office for a list of certified receivers. It is the facilities' responsibility to ensure that they have a generator number for shipping any hazardous waste in Ontario. Contact your local municipal works department for further information on hazardous waste depots that may be in place for collecting fluorescent tubes.

Experience in other jurisdictions has shown that take-back programs for fluorescent tubes through the original manufacturer's distribution system are both inefficient and costly. As a result, the U.S. National Electrical Manufacturers Association has determined it

breaking, such as in the boxes in which the lamps were housed or in the boxes supplied by lamp recyclers. On-site crushing of lamps prior to transportation reduces the volume of waste by as much as 80% and eliminates the chance of lamps releasing mercury to the air when accidentally broken during storage and transportation (*National Electrical Manufacturers Association, 1999*). The lamp crusher must have a mercury filter and comply with strict air quality standards for mercury. This is important, because certain lamp crushers may contribute to mercury poisoning for those exposed during the crushing of fluorescent tubes if the facility does not have the proper exhaust ventilation, engineering controls, and filters.

High-intensity Discharge Lamp



Mercury Switches and Relays

Use and Location

The most common types of switch containing mercury are tilt switches. These mechanical switches are activated when moved from a vertical to a horizontal position. Thermostats are a common example of a mercury tilt switch. Mercury tilt switches are also found in numerous other products, including chest freezer lids, clothes washers, and laptop computers. In cars, “convenience lights,” like the ones that operate when a trunk is opened, also contain a tilt switch with about 0.8 grams of mercury. Some “silent” light switches, those that do not “snap” into position like a standard light switch, often contain a tilt switch with approximately 3 grams of mercury. If you cannot see a physical mechanism that switches a device on or off when it is tilted, there may be a mercury switch imbedded.

A specialized type of tilt switch is the “float switch.” These are typically used in sump pumps, septic tanks, and bilge pumps to activate or deactivate the equipment and are often very visible. The arm of the float will be attached to a control box, which contains the mercury tilt switch. The movement of the arm turns the switch on or off.

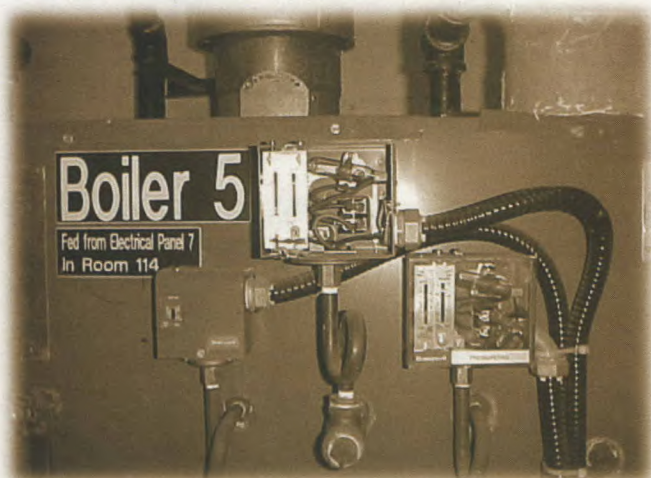
Another type of mercury switch is the displacement or plunger relay. The “wetted reed relay” or “wetted reed switch” is found in small circuit controls for low-voltage electronic devices. These switches are more likely to contain mercury in older, more specialized equipment. Larger plunger or displacement relays are used in high-current lighting and heating. These switches can contain up to 160 grams of mercury. Large commercial and industrial cooling and heating equipment may also contain mercury switches. Consult the manufacturer for the location of these mercury switches and proper disposal methods for the unit.

Alternatives

Most new float switches are made without mercury. Alternatives to mercury-bearing switches are available and include hard-contact mechanical switches, inductive sensors, capacitive sensors, and ultrasonic sensors. Mechanical or pressure switches can be used as replacements for some of the traditional mercury switches or relays. Ball-bearing switches are also available for convenience lighting in cars.

Recycling Options and Disposal Methods

Prior to disposal, remove all mercury switches from appliances or vehicles and store them in a covered container marked “Mercury Switches for Recycling.” If the switch cannot be easily located, an appliance or vehicle repairperson can often quickly find and remove the mercury switch. Arrange to have mercury switches collected by a certified carrier. To protect your facility from future liability, make sure the invoices track the date of shipment, the amount of waste, the location from which the wastes are being shipped, and the destination of the shipment. Contact your local municipal works department for further information on hazardous waste depots that may be in place for collecting mercury.



Gauges: Barometers, Flow Meters, Manometers, and Vacuum Gauges

Use and Location

All these devices have a gauge for reading air pressure. Liquid mercury in the gauges responds to air pressure in a precise way that can be read on a calibrated scale. Many barometers, sphygmomanometers (blood pressure monitors), vacuum gauges found in machinery, etc. contain mercury ranging from 100 to 500 grams or more.

Alternatives

Mercury-free gauges and monitors that operate on the same principle as mercury gauges are available. Analogue, needle, or bourbon gauges operate under a vacuum with a needle indicator. Electronic gauges can be used to measure pressure, but still need to be calibrated with a mercury manometer.

Recycling Options and Disposal Methods

Store mercury waste from servicing manometers and other mercury-containing gauges in a covered, airtight container that will not break. Smaller vials can be stored in a larger covered, airtight container, such as a 10-litre plastic pail. A certified carrier should collect containers with mercury waste. Contact your local Ministry of the Environment office for a listing of certified carriers in your area.

Mercury-Containing Thermostat Probes

Use and Location

Mercury-containing thermostat probes consist of a metal bulb and thin tube attached to a gas control valve. The mercury is inside the tube and expands or contracts to open and shut the valve and prevent gas from flowing. In this case, the probes act as flame sensors or gas safety valves and prevent gas flow if the pilot light is not lit. The probes may be found in several types of gas-fired appliances that have pilot lights, such as water heaters, furnaces, and space heaters. A mercury thermostat probe may also be present as part of the main temperature-controlling gas valve. In this case, the probe would be located in the air or water that is being heated, and not in direct contact with the flame. This type of probe is typically found in older clothes dryers, water heaters, and space heaters.



Barometers



Alternatives

Newer brands of water heaters, furnaces, and clothes dryers, among other types of domestic and commercial appliances, use electric thermostat probes that do not contain mercury. All probes should be treated as if they contain mercury, unless you can confirm that they are mercury-free.

Recycling Options and Disposal Methods

Remove any thermostat probes from the equipment when it is taken out of service, and store the probes in a covered container marked "Mercury Thermostat Probes for Recycling." Some probes may be difficult to locate, and an experienced repairperson may be required to provide assistance. Once the probes have been removed, arrange to have all mercury collected by a certified carrier. Contact your local Ministry of the Environment office for a listing of certified carriers in your area. Remember to keep all invoices that track your wastes and include the date of shipment, amount, location from which the wastes are being shipped, and destination of the shipment.

For further information

FOR FURTHER INFORMATION

about the Pollution Prevention Program for federal facilities in Ontario, please contact:

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