

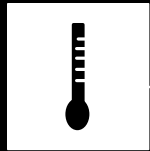


POLLUTION PREVENTION FACT SHEET

Pollution Prevention Program - Federal Programs Division

Fact Sheet

#21:



Managing Mercury-Bearing Electrical Products

This Pollution Prevention Fact Sheet is one in a continuing series prepared under the Pollution Prevention Program of the Federal Programs Division of Environment Canada, Ontario Region. This Program is intended to help federal departments in Ontario become model environmental citizens by managing beyond compliance. This Fact Sheet presents the following:

- An overview of the environmental impact of Mercury;
- Use of Mercury in electrical products;
- Recycling and alternatives to products containing Mercury;
- Regulations related to Mercury;
- Success stories; and
- Further sources of information



What is Mercury ?

Mercury is a naturally occurring element found almost everywhere in the environment, in rocks, soil, water, air and living organisms. Mercury can be used to conduct electricity, measure temperature and pressure. It can also be used as a disinfectant and works as a biocide and industrial catalyst. It has a very diverse set of physical and chemical properties and uses. Mercury can exist in the form of a gas, liquid or solid and once it enters the environment, it remains there and does not break down. Mercury is a potential threat to the health of both humans and wildlife. Many government agencies and groups, including Environment Canada have identified it as one of the most critical pollutants to eliminate and/or reduce.



Health & Environmental Impacts of Mercury

Mercury is one of the most poisonous substances in the environment. It is toxic at very low concentrations and can be harmful to fish, waterfowl,

wildlife and humans. It has the potential to build up in concentration over time in aquatic food chains, making consumption of contaminated fish hazardous to birds, mammals and humans. It is a neurotoxin which affects the central nervous systems causing impairment of vision, hearing, and the ability to walk and talk. It is most dangerous to fetuses and infants. Chronic exposure to mercury can lead to skin rashes and kidney damage. It can also cause neurological and reproductive disorders in humans and wildlife. When mercury vapour is inhaled, as much as 80% of the inhaled mercury may be absorbed into the bloodstream causing adverse effects on human health.

When products containing mercury are disposed of improperly, such as in a landfill, the mercury will be exposed to the atmosphere. Mercury released from waste incinerators, landfills or wastewater treatment facilities does not disappear, but accumulates in the environment. Mercury easily absorbs to soil, migrates in surface water, and settles in bottom sediment of rivers and lakes. The mercury from one fluorescent light tube, approximately 23mg, can contaminate 30,000 litres of water above recognized safe drinking water limits.



Sources of Mercury Contamination

Mercury can be emitted to the atmosphere through natural and anthropogenic (human made) sources.

Natural sources include:

- volcanic eruption
- wind-born soil particles
- volatilization from surface of soils, oceans and forest fires.

Human-made sources include:

- mining and smelting
- burning of fossil fuels and wood
- cement and lime kilns
- crematoriums
- petroleum refining
- solid waste/sludge incineration

Approximately two-thirds of mercury in the atmosphere originates from human-made sources. Mercury contamination often occurs when products containing mercury are disposed of in a landfill, or poured down the drain. The total amount of mercury that enters the environment, through anthropogenic sources in Ontario is approximately 5,100 kg per year.



Use of Mercury in Electrical Products

Mercury has many useful properties and has been widely used in household, medical and industrial products. The largest use of mercury in Ontario is in electrical products. Products such as batteries, fluorescent lamps, thermometers and electrical switches are the most common. These products are found in residences, office buildings, commercial and industrial buildings.

Improper disposal of mercury products poses a serious health risk for everyone. In addition, the disposal of mercury-containing products can create wastes which are often classified as hazardous. Therefore, proper disposal of these wastes and reduction in use of mercury bearing products should be seriously considered.

Batteries

Mercury serves an important role in the manufacture and functioning of batteries. It helps to control chemical reactions between components,

prevent hydrogen build-up, prevent corrosion of battery cases, and extend battery shelf-life. Mercury is emitted in the form of particulate matter and as vapour during the manufacturing process. As of January 1996, the manufacture of mercury oxide batteries was discontinued in Canada. Alternative substances are now used in the production of these batteries. However mercury may still be entering the waste stream as batteries are discarded in Ontario. Button batteries which contain mercury are often found in calculators, cameras, watches and hearing aids. In 1994, mercury released into the Ontario environment from discarded mercury oxide batteries was approximately 430 kg.

Fluorescent Lamps

Mercury is used as an electrical conductor in various electronic lighting devices, such as fluorescent, high-intensity discharge (HID) lamps, mercury vapour, metal halide and high-pressure sodium lamps. These lamps are often an excellent business and environmental choice because they operate with 75% less energy than incandescent lights. However, used lamps must be managed properly to minimize releases into the environment.

The amount of mercury used in fluorescent lamps is approximately 23mg for a standard 4 foot and 50mg for standard 8 foot long bulbs. About 2.7 tonnes of mercury are used in Canada to manufacture lamps annually. The total emission from these lamps is estimated at 225 kg per year. Currently these lamps cannot be produced without mercury. However the amount of mercury used in lighting production has been reduced. Virtually all commercial buildings use fluorescent lamps for lighting. This means that your organization probably has used fluorescent lamps that need to be disposed of properly. Please see the section on *Reducing and Recycling* for proper disposal methods.

Thermostats

Mercury-containing tilt switches are used in most thermostats. The mercury-bearing switches provide accurate and reliable temperature control and do not require a power source. These types of thermostats are used in most residential and commercial heating. Approximately 3-4 grams of mercury is used in each thermostat.

Switches

Mercury is used both in temperature-sensitive and mechanical switches often found in households, automotive, communication industries and other industrial applications. These include typical wall switches, garage door openers, clothes dryer lids, auto trunk and hood lights, thermostats, reed switches, x-ray machines, microwave ovens, proximity sensors, etc.. Float switches are typically used in sump pumps and bilge pumps to activate or deactivate the equipment. Relays that have mercury switches will activate airbags, anti-lock brakes, and some seat belt systems. Some agricultural equipment, military vehicles, mass transit vehicles and fire hook and ladder equipment also contain mercury switches.

Switches containing mercury are common especially in older buildings and equipment. The mercury content present in a typical light switch is approximately 3 grams per unit. The total mercury released from discarded light switches in Ontario is approximately 15 kg per year.



Other Mercury Uses

Other products in which Mercury is used include: solvents, pesticides, preservatives, biocides in paper and paints, cosmetics, dental amalgam, pigments, barometers, manometers, vacuum gauges, relays, sensors and pharmaceuticals. Dental amalgam contains approximately 50% mercury. Although most dentists today use a prepared amalgam, a small percentage of dentists still uses bulk mercury to prepare amalgam. The use, removal and improper disposal of amalgam down the drain can seriously contaminate a wastewater treatment plant. Mercury is used in paints, coatings and textiles as a preservative to prevent mildew. It is also used as a biocide in papermaking. Mercury is present in many laboratory chemicals and mercury compounds are used as preservatives in nasal sprays, topical antimicrobial products, and vaccines for both humans and animals. Although most of these uses have been discontinued, old products containing mercury may still be in circulation and can end up in landfills and sewer systems due to improper disposal.

Below is a Mercury use tree, showing just a few of the mercury-containing products you may encounter in your daily operations.

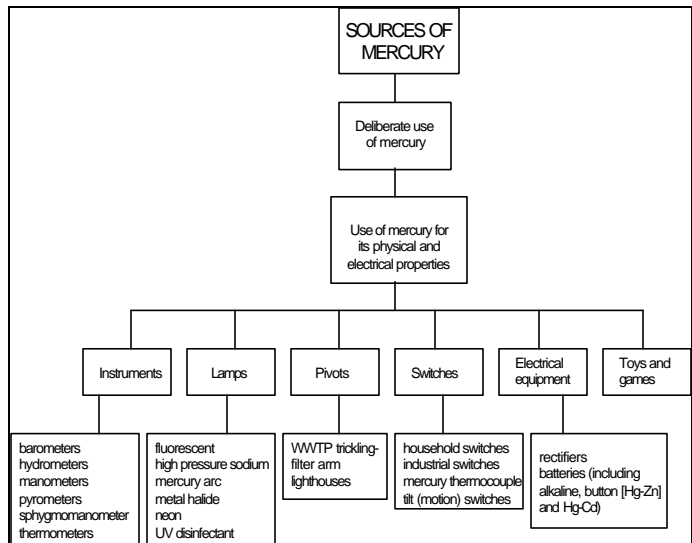


Figure 1: Mercury Use Tree

The following is a list of *Mercury sources* to the environment:

- | | |
|---------------------------|----------------------|
| Hospitals | Dentists |
| Sewer Cleaning Practices | Septic Haulers |
| Residential Wastewater | Industrial Laundries |
| Laboratories | Veterinary Clinics |
| Printing Industry | Pottery and Arts |
| Automobile Service | Scrap Dealers |
| Paint & Paint Stripping | Landfill Leachate |
| Pollution Control Devices | |



Recycling and Alternatives to Mercury-Containing Electrical Products

The best option for pollution prevention is probably to eliminate the contaminant at the source. In cases where alternatives for mercury cannot be found, recycling options should be considered. The easiest way to reduce mercury emission into the environment is by becoming more energy efficient. This would cut down on burning of fossil fuels, especially coal for generating energy.

Mercury pollution prevention measures can be achieved by eliminating or reducing mercury in products, switching to alternative products and also reducing mercury emissions associated with energy production.

Batteries

Mercury is no longer used in the production of mercuric oxide batteries. The Canadian Household Battery Association has voluntarily eliminated mercury from all alkaline, zinc-carbon and zinc chloride batteries. The use of mercury-containing batteries is expected to decline to zero by the year 2000. Presently there are many excellent and cost-effective alternatives to mercury batteries on the market. Please ensure that your old mercury-containing batteries are disposed of carefully. Contact your local waste management facility for information about a battery recycling program.

Fluorescent Lamps

Currently fluorescent lamps cannot be produced without mercury, however the amount used has been significantly reduced. Used lamps must be handled carefully to ensure that the lamps do not break or implode and jeopardize employee safety. Presently there are several companies that can recycle used lamps effectively and efficiently. You have the options of arranging for a pick up by a certified recycling company, purchase a lamp recycling system for your facility, or lease a recycling system for the time period that you may require to dispose of the lamps. The recycling technology separates the lamps into five components: aluminum end caps, brass, glass, mercury/phosphor powder and bakelite insulation. Prior to recycling, the facility managers need to take a few initial steps to prepare the lamps for pick-up.

- The spent lamps should be stored in their original boxes to prevent them from breaking.
- The boxes should be marked "fluorescent lamps for recycling"
- Do not break or crush lamps because mercury may be released
- If lamps are accidentally broken, pick up all the pieces, including the spilled powder and store in a sealed container.

Another helpful option is to replace existing lamps with low-mercury lighting. One company, Philips Lighting, recently introduced a low-mercury fluorescent lamp to the Canadian market. According to the company, these lamps use 70% less mercury than the industry average. This could be a viable option if your facility uses a large amount of fluorescent lighting.

Thermostats

Although mercury is still used in thermostats, there are mercury-free thermostats currently available in the

market. Electronic thermostats are able to provide the same functions and features as mercury thermostats. The use of this product will result in savings in fuel cost and environmental benefits from burning less fuel. Presently, there are only a few recycling facilities that will accept mercury thermostats for recycling.

Switches

Alternatives to mercury-bearing switches are available such as hard-contact switches, inductive sensors, capacitive sensors and ultrasonic sensors. However, very little replacement of non-mercury switches is now taking place. More research is needed to find more suitable alternatives which do not contain hazardous materials.

Remember

If you work with mercury-containing products, be sure to keep them out of the trash or drain when they reach the end of their useful lives.

Regulations related to Mercury



Under federal and provincial hazardous waste disposal regulations, companies who are disposing of mercury-bearing products are required to perform a standard leachate test for mercury. In Ontario, under Regulation 347, if the leachate results exceed 0.01 mg/kg, then the company must handle the waste as hazardous waste. This means that the waste cannot be disposed of in an ordinary landfill. Virtually all fluorescent and HID lamps will exceed the leachate toxicity limit, therefore these wastes must be registered and treated as hazardous waste or sent for recycling.

The quantity limit for mercury waste that can be disposed in a landfill is 5 kg per month, which is approximately equivalent to 17 standard 4 feet, 1.5 inch diameter tube lights (amounts of mercury vary from brand to brand).

The following is a list of some of the recycling companies that accept mercury-bearing products.

Abbatec Ltd.	Thermostats Switches	(613) 741-3372
Battery Broker Environmental Services	Batteries	(416) 255-3321
Chem-Serv Environmental Services	Batteries Lamps	(905) 688-5161
Electro-Waste 2002 Ltd.	Batteries	(613) 821-3224
FLR Inc.	Lamps	1-800-324-9018
RPR Environmental	Batteries	1-800-667-5217
Raw Materials Corp.	Batteries	(905) 835-6731
Raylex Environmental Services	Lamps	(905) 681-7110
Republic Environmental Systems	Batteries Lamps Thermostats	(905) 994-1900
Tallon Metal Technologies	Lamps	(514) 335-0057



Success Story: Honeywell Limited

Honeywell Limited-Limité is a company working to reduce the presence of mercury in homes. They specialize in control systems for security, environment and electronics in homes, businesses and industry. In 1994, Honeywell formed a partnership with Union/Centra and Consumers Gas and established an industry/utility pilot project in the Toronto and Hamilton area. The purpose of the project was to replace mercury thermostat switches in single family homes, each of which contain approximately 3 grams of mercury, with new mercury free thermostat switches. Honeywell has been replacing and accepting mercury switches turned into them for the past 30 years but this project has them actively involved in removing mercury thermostat switches. Union/Centra or Consumers Gas employees replaced the thermostats when upgrading furnaces or improving a homes energy efficiency, and turned the mercury thermostats over to Honeywell for recycling. The program was not limited to specific brands or types of thermostat switches. The initial trial of this

program replaced 1,800 switches, representing 5.5 kg of elemental mercury recovered. All mercury collected was “sold” to a licensed recycler. Plans to expand this project are in the works. Honeywell itself uses only recycled mercury where mercury is still used in their operations.



Success Story: PWGSC Lamp Recycling

As part of the Federal Buildings Initiative developed by Natural Resources Canada, Public Works and Government Services Canada has been retrofitting or upgrading government offices in the National Capital Region to improve energy and water efficiency and in some cases to reduce waste. The program has been replacing standard fluorescent lamps with new energy efficient, low-mercury lamps. To date 165,000 lamps have been recovered and recycled. There is approximately 40 mg of mercury per lamp, which represents 6.6 kg of pure elemental mercury diverted from the waste stream. The glass, aluminum end caps and cadmium are also recovered from the lamps and recycled. This program is continuing, and they are expecting to replace at least another 165,000 lamps in the next year.

Success Stories

Does your department have a pollution prevention success story to share? Other government departments in Ontario would like to hear about your experience in dealing with a particular problem. Please provide relevant information to the Pollution Prevention Advisor, Federal Programs Division, Environment Canada. We will ensure that all interested parties receive this information.

Further Sources of Information

Blueprint for Mercury Elimination: Mercury Reduction Project Guidance for Wastewater Treatment Plants 1997.

Western Lake Superior Sanitary District. 2626 Courtland Street, Duluth, Minnesota 55806-1894.

Mercury in Ontario: An Inventory of Sources, Uses and Releases. Prepared by Susan Sang and Bruce A. Lourie. 1996. Pollution Probe. Tel: (416) 926-1907. Fax: (416) 926-1601.

Mercury in the Health Care Sector: The Cost of Alternative Products. 1996. Pollution Probe. Tel: (416) 926-1907. Fax: (416) 926-1601.

The Case Against Mercury: Rx for Pollution Prevention 1995. Terrene Institute. Tel: (202) 833-8317 Fax: (202) 296-4071.

Lamp Replacement Guide: Energy Efficiency Regulations for Fluorescent Lamps and Incandescent Reflector Lamps. 1995. Natural Resources Canada. Fax: (819) 994-1498.

Energy Efficiency Regulations: Guide to Canada's Energy Efficiency Regulations 1996. Natural Resources Canada. Cat. No. M92-98/1996E. Fax: (819) 994-1498.

Commission for Environmental Cooperation
(514) 350-4300 or fax (514) 350-4314
Email: rvincent@ccemtl.org
Internet: www.cec.org

Mercury Study Report

Executive summary of the report is available on the Environmental Protection Agency's internet site at www.epa.gov/airlinks

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

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All Fact Sheets can be found on the Internet at:
www.on.ec.gc.ca/epb/fpd
(aussi disponible en français)