

Mercury Waste Management Guidelines-University of Tennessee Knoxville

1. Mercury-Properties and Health Effects

Mercury is a naturally occurring element that is found in air, water and soil. It exists in several forms: elemental or metallic mercury, inorganic mercury compounds, and organic mercury compounds. Elemental mercury is a shiny, silver-white metal that is liquid at room temperature, and is used in thermometers, fluorescent light bulbs and some electrical switches. Inorganic mercury compounds (in the form of salts), are typically used as fungicides, antiseptics or disinfectants. Organic mercury compounds, such as methylmercury, are formed when mercury combines with carbon. Microscopic organisms convert inorganic mercury into methylmercury, which is the most common organic mercury compound found in the environment.

Exposure to excessive levels can permanently damage the brain and kidneys. Organic compounds of mercury, such as methyl mercury, are considered the most toxic forms of the element. Inhalation of elemental mercury vapor is the most common route of exposure. When mercury is spilled or allowed to come into contact with air, it evaporates. Heated mercury evaporates at a much faster rate, resulting in significantly greater risk of exposure. Absorption of elemental mercury through the skin can cause allergic reactions. Direct contact of mercury to the skin can lead to dermatitis.

Mercury is a persistent threat to the environment. Mercury accumulates in the tissue of fish and exposes birds and mammals that eat the fish. This, in turn, causes mortality (death), reduced fertility, slower growth and development and abnormal behavior that affects survival, depending on the level of exposure. The EPA targets mercury as one of the top Persistent Bio-accumulative Toxic (PBT) chemicals to be reduced on a global level. In addition, mercury is listed by the EPA as one of the 31 priority chemicals that EPA is pushing to substantially reduce or eliminate production (see www.epa.gov/mercury for more information on the environmental effects of mercury).

The typical household mercury thermometer contains enough mercury in it to contaminate a 20-acre fish pond!!

2. Mercury-Hazardous Waste

Mercury is regulated by the EPA as a hazardous waste. Mercury cannot be dumped down the sanitary or storm sewers, or thrown in the regular trash. Mercury waste must be managed according to all federal, state regulations and UTK's hazardous waste management policy. Mercury must be properly labeled and stored in an appropriate waste container. Mercury waste should be segregated from other waste streams when stored. All mercury waste should be brought to EHS for disposal. Mercury waste is typically shipped for disposal to a mercury reclaimer to be reused in new products.

3. Mercury Spills:

The best method of dealing with mercury spills is to prevent them in the first place. Examine all uses of mercury to see if substitutes are available. If not, use trays or other secondary containment to store the mercury in the event of a spill. Most elemental mercury spills do not pose a high risk; however, mercury vapors are toxic, so appropriate procedures should be followed. If you do have a mercury spill (i.e. thermometer breaks), and you decide to clean up the spill yourself, make sure you have a mercury spill kit available. If a thermometer or other mercury containing instrument breaks in a heated appliance (i.e. water bath), make sure you turn off the equipment and allow it to cool before cleaning up the spill. Try to dam the mercury to keep it from spreading and keep it away from drains, cracks and crevices. Mercury is dense, has a high surface tension and low viscosity, therefore, spills tend to break up into

small droplets. Droplets easily break up into smaller and smaller pieces and can become too small to see. Extremely small droplets often collect in cracks on common surfaces (ex. bench tops, vinyl floor tiles). Use caution when collecting spilled mercury to avoid further disturbance of the material. If you do not feel comfortable cleaning up a mercury spill, then please call EHS during regular office hours (M-F 8:00-5:00) at 974-5084, or after hours, please contact the EHS safety one-call number at 974-9586.

Regardless of the size of the mercury spill, you should:

- Dam the mercury (using rags or other disposable items) to prevent spreading. Divert the mercury from drains, cracks and crevices.
- Keep people who are not involved in the cleanup away from spill area to limit exposures and to prevent the spread of contamination.
- Close doors to other indoor areas. Immediately ventilate spill area - open doors and windows and use fans that exhaust to outdoors. Keep air flowing through the room with the mercury spill - but make sure it is ventilating outside.
- Turn off heating, ventilating or air conditioning systems that circulate air from the spill area to other parts of the building.
- If you have come in contact with the mercury, avoid spreading the contamination to other areas. Put contaminated clothing/shoes into a trash bag and wipe off any visible mercury beads into the bag. If it is a small spill that you are cleaning up yourself, shampoo and shower after the cleanup is complete. If it is a large spill, contact local health department and a contractor who specializes in cleanup of toxic spills, and leave the area.
- Use a chemical to coat the mercury or form an amalgam with the mercury, this will keep the mercury from vaporizing and being released into the air.

There are some don'ts to follow when cleaning up mercury as well:

- NEVER touch mercury with bare hands.
- NEVER use a vacuum cleaner on a mercury spill, it will cause vaporization.
- NEVER use a broom to cleanup a mercury spill; it will cause the mercury to break up into smaller beads which will be difficult to collect
- NEVER put mercury waste down the drain, in the trash or incinerator.
- NEVER use household cleaners to cleanup mercury spills. Never use nitric acid to clean up spills, because the mercury and nitric acid will react, creating toxic nitrogen oxide gases and a mercury nitrate waste.
- DO not walk around areas where mercury has been spilled to prevent from spreading contamination.

A Mercury Spill Kit should consist of the following supplies:

- 4-5oz sealable bags
- Trash bags (2-6mm)
- Nitrile gloves
- Shoe covers
- Paper towels
- Disposable capillary or transfer pipette
- Sponges
- Dust pan
- Scraper
- Mercury Absorb powder (see below)



Any mercury collected from a spill should be managed as hazardous waste. This means the waste should be labeled as Waste Mercury and stored according to UTK's hazardous waste policy and disposed of through EHS. For questions concerning management of mercury waste, contact EHS at 974-5084. For more information about mercury, check EPA.gov.

4. Mercury Alternatives:

Table 1: List of alternatives that can be used for mercury substitution

Products containing Mercury	Alternatives to Mercury
Batteries	Lithium, zinc-air, alkaline
Thermometers	Alcohol-based; electronic temperature sensors; digital; expansion or aneroid devices (high temperature ovens)
Lamps: Fluorescent, High Intensity and Ultraviolet	Ordinary glow lights; low sodium vapor tubes (yellow); optical, high-energy, long-lasting lights; compact fluorescent
Electrical equipment (i.e. thermostats)	Fiber optics, solid state devices, mechanical switches
Sphygmomanometers	Electronic vacuum gauge, expansion, aneroid
Manometers	Replace with phthalate or other suitable liquid or aneroid and electronic manometers and analog gauges (vacuum gauges)
Staining solutions and preservatives: Thimerosal, Immu-sal, Carbol-fuchin stain, Gram iodine stain, Phenolic mercuric, Acetate, Alum, Hematoxylin "Solution A"	Replace with a variety of chemical compounds
Mercury (II) oxide	Copper catalyst
Mercury (II) chloride	Magnesium chloride/sulfuric acid
Mercury (II) sulfate	Silver nitrate/potassium sulfate/chromium-(III) sulfate
Mercury iodide	Phenate method

Mercury nitrate (for corrosion of copper alloys)	Ammonia/copper sulfate
Colorimetric chloride analysis	Ion-selective electrode method
Mercury (II) chloride Zenker's solution Histological fixatives	Zinc formalin Freeze drying

Source: Inform: Strategies for a Better Environment (www.informinc.org)

Mercury Thermometer Replacements:

Table 2: List of thermometers that EHS recommends for substitution of mercury-filled thermometers. All of these thermometers can be purchased from Fisher Scientific. Prices are subject to change.

Catalog #	Price/Ea	Temperature Range	Comments
14-997	\$6.61/each	-20 to 110°C	Standard size (12" length); basic in disposable plastic pack; No NIST* certification; for partial immersion
15-160-34	\$12.26/each	-10 to 110°C	Shorter size (8" length); has NIST certification; for partial immersion
S63344	\$8.74/ea	-20 to 150°C	NIST certification; for partial immersion; standard size; compressed scale
S63343	\$8.62/ea	-20 to 110°C	No NIST certification; for partial immersion; standard size; easy to read scale

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