

# Mercury Reduction Guidelines

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## University of Tennessee Safety Guide EC-042

**Document Contact:** EHS-Environmental Compliance

**Date effective:** September 30, 2016

**Revision Date:** September 30, 2016

### Purpose

This guide demonstrates the risks of mercury to people and the environment and provides guidance for responsible use and disposal

### Scope and Applicability

This applies to anyone using or possessing mercury containing equipment.

### 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. Because of its unique properties, mercury has many applications in industry. 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 methyl mercury, are formed when mercury combines with carbon. Microscopic organisms convert inorganic mercury into methyl mercury, 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 (i.e. mercury thermometer breaks), it evaporates. Heated mercury evaporates at a much faster rate, resulting in a 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. Roles and Responsibilities

### Mercury-Disposal and Regulations

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 affect survival, depending on the level of exposure. The EPA targets mercury as one of the top Persistent Bio-accumulative Toxic (PBT) chemicals being reduced on a global scale. 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. The typical household mercury thermometer contains enough mercury in it to contaminate a 20-acre fish pond!!

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 program. All mercury waste should be brought to EHS for disposal. Mercury waste generated at UTK is typically shipped for disposal to a mercury recycler to be reused in new products, which is now a requirement in the State of Tennessee.

## Options to Consider Regarding Mercury Waste Reduction

In many cases, there are cost effective alternatives for mercury that have been developed and are readily available. The following methods should be evaluated for use to reduce the amount of mercury waste generated on campus. Mercury spills from broken thermometers are the number one type of hazardous waste spill at the University, so EHS strongly encourages people to bring their mercury thermometers to EHS and replace them with a non-mercury alternative. A significant amount of money is spent each year by EHS to clean up these spills.

1. Micro-chemistry or using reduced volumes
2. Mercury Recycling
3. Substitution with a non-hazardous or less hazardous material (see list below for ideas)
4. Avoid mixing mercury waste with non-hazardous waste
5. Spill prevention
6. Limiting quantities of chemicals and consumer products purchased with mercury.
7. Inventory control
8. Good housekeeping measures

## List of Alternatives to Mercury

Products containing Mercury	Alternatives to Mercury
Thermometers	Alcohol-based; electronic temperature sensors; digital; expansion or aneroid devices (high temperature ovens)
Lamps: Fluorescent, High Intensity and Ultraviolet	LEDs, low sodium vapor tubes (yellow); optical, high-energy, 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

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