

Policy Subject: Mercury Reduction Policy	Effective: 10/1/10
Affected Area: Any areas on UTK campus	Reviewed/Revised: 4/1/14

## Policy

It shall be the policy of the University of Tennessee Knoxville to conduct business in an environmentally responsible manner. A key component of this objective is to minimize the production of hazardous waste, specifically, mercury waste, to the greatest extent feasible. This policy applies to the reduction of mercury waste for all areas of the UTK campus by all students, faculty and staff, as required by the Environmental Protection Agency (EPA) and the Tennessee Department of Environment and Conservation (TDEC).

## Purpose

The primary purpose of this policy is to reduce the generation of mercury waste to the extent that is technically and economically feasible. Other objectives include: improved environmental compliance, reduced risk to employees, and conserving resources. Improper disposal of mercury or unreported mercury releases pose a significant threat to the environment, and could lead to costly regulatory consequences for UT. EHS shall establish goals for the reduction of mercury waste on campus. The goal is to reduce the nonessential uses of elemental mercury or mercury-based compounds by 90% on the UTK campus by 2015.

### A. 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.

## **B. 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 policy. 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.

On April 30, 2010 the State of Tennessee legislature signed the "Mercury Product Disposal Control Act" into law. The regulation is based on three findings:

1. Mercury is a persistent and toxic pollutant that bio-accumulates in the environment.
2. According to recent studies, mercury deposition is a significant problem in the Southeast.
3. The removal of mercury-containing products from solid wastes that are collected and disposed of in landfills or through incineration is a means of reducing the deposition of mercury into the environment and mercury's threat to public health and the environment.

The new regulation becomes enforceable on Jan. 1, 2011. It prohibits mercury-added consumer products such as fluorescent light bulbs, thermometers, mercury switches, etc. from being disposed of in landfills. This bill requires businesses to ensure that discarded mercury-added consumer products are managed as universal or hazardous waste and sent for recycling, treatment, or disposal to either a universal waste destination facility or a hazardous waste management facility. UTK already ships most of their mercury waste for recycling; however, this legislation provides further incentive to reduce the volumes of mercury waste that is generated on campus.

## **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 Appendix A 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

### **Implementation:**

University departments possessing large quantities of mercury containing items shall work with Environmental Health and Safety (EHS). Generators of mercury waste shall be queried about the availability and feasibility of further mercury waste reduction. EHS shall work with the Department Safety Contacts/Chemical Hygiene Officers and the Office of Research to implement mercury waste reduction efforts. EHS will make public safety announcements educating campus about the Mercury Reduction Policy.

EHS strongly recommends that non-mercury thermometers should be used, especially in incubators and heated water baths. If a mercury thermometer that is not safety sealed is used in equipment, and the thermometer breaks inside the equipment, EHS reserves the right to permanently remove the equipment from the workspace and dispose of it as hazardous waste. This could occur if all of the mercury cannot be safely removed from the equipment and there is still a risk of mercury exposure.

### **Program Oversight and Review:**

This policy shall be reviewed at least annually and amended as necessary by EHS. When it becomes apparent that the plan is deficient, it shall be revised. EHS will continue to monitor the volumes of mercury waste generated on campus to determine whether goals are being met to eliminate mercury waste generation. This will be done by documenting mercury waste minimization efforts, and review mercury waste reduction results from the Annual Hazard Waste Report that is filed with the Tennessee Department of Solid Waste.

### **Standard**

EPA 40 CFR 260-270 (Hazardous Waste)

Tennessee Code Annotated, Title 68, Chapter 211, Mercury Product Disposal Control Act

### **Forms**

None

### **Appendices**

**Appendix A:** List of alternatives that can be used for mercury substitution

**Appendix B:** Historical Data

## Appendix A

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

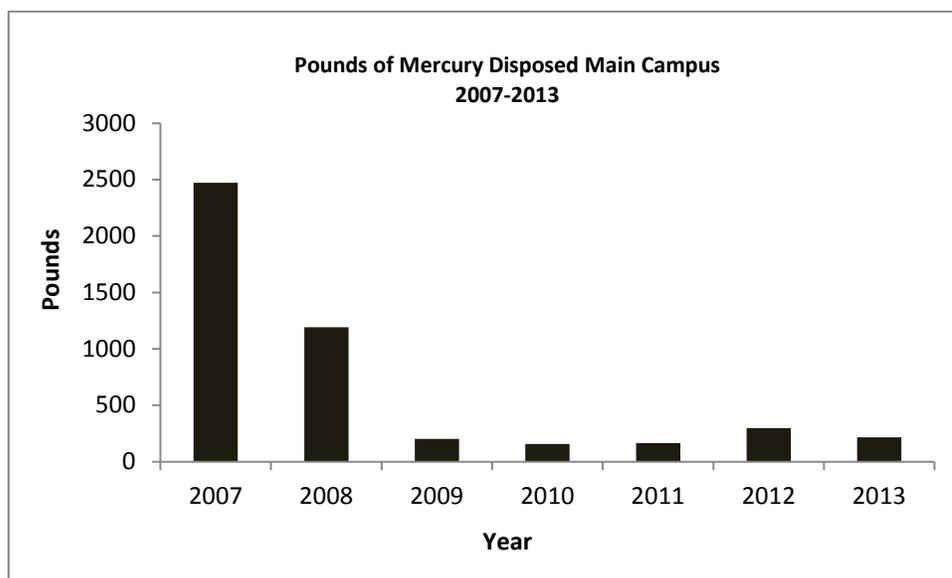
Products containing Mercury	Alternatives to Mercury
Thermometers	Alcohol-based; electronic temperature sensors; digital; expansion or aneroid devices (high temperature ovens)
Lamps: Fluorescent, High Intensity and Ultraviolet	LEDs. low sodium vapor tubes (yellow); optical, high-energy, compact fluorescent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

## Appendix B

### Historic Data:

Below are some graphs depicting the volumes of mercury waste generated on the UT Knoxville Campus.

Overall, the total volume of mercury waste disposed of on Main Campus has continued to decrease from 2007 to 2013. There has been a 91% decrease in the amount of mercury waste disposed from 2007-2013. This is due to more labs making efforts to replace their mercury-containing equipment, such as thermometers and manometers with less hazardous substitutes. EHS hopes to continue to see a decrease in the volumes of mercury disposed of overall.



In 2011, the Main Campus initiated a mercury thermometer exchange program. We exchanged one mercury thermometer for one ethanol thermometer in the Chemistry and Biology teaching labs. A total of approximately 800 thermometers were exchanged during this program.

The Graduate School of Medicine (GSM) ensures that all fluorescent lamps that contain mercury are recycled. They no longer purchase mercury-filled equipment, and are trying to phase out mercury containing equipment, as they have funds available to replace those items. In addition, they recycle mercury filled blood pressure gauges. Because of these phasing out efforts, the amount of mercury disposed of as hazardous waste increased by roughly 60% from 2005-2009. There are still a few mercury thermometers, but the labs are slowly replacing these with

alternatives. In 2010, EHS initiated a mercury thermometer exchange program in which employees exchange mercury thermometers for a non-mercury alternative. Approximately 35 thermometers were replaced.