DEP ISSUE PROFILE

Mercury Management in the Health Care Environment

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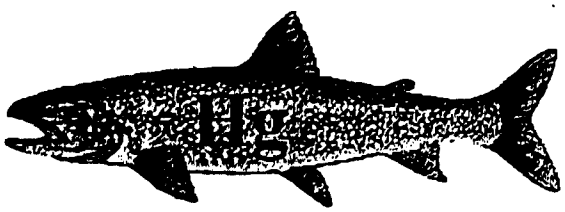
- **Background**

Several years ago, researchers took tissue samples of fish from the wilds of Northern Maine with the idea that laboratory test results from these samples could be used to reflect natural or background concentrations of several pollutants accumulated in fish tissues. What they found were surprisingly high concentrations of mercury. Those findings prompted more widespread sampling and resulted in the statewide fish consumption advisory that we have today.



Although industry and agriculture are perhaps the most obvious sources of mercury in the environment, mercury-containing technologies and chemicals are prevalent at most health care facilities. As a result, proper mercury management at your facility is essential to reducing mercury-related health risks for workers, patients, the public, and the environment.

This pamphlet can help you better manage mercury and reduce mercury-related problems. It contains the following information to help your facility:

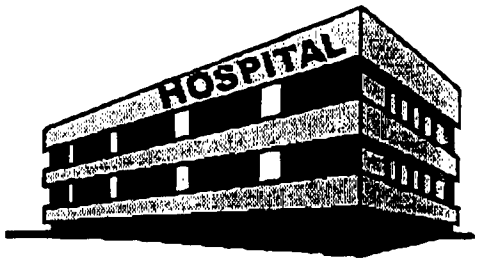
- Identify sources of mercury
- Educate staff and purchasers about mercury-containing materials
- Safely clean up mercury spills
- Effectively manage mercury waste-streams, and
- Find alternatives to mercury containing technologies and chemicals

As a common, naturally occurring metal, easily obtained by roasting its principal ore, cinnabar, mercury has a long history with man. For centuries, powdered cinnabar was the source of the bright red artist's pigment vermilion. Mercury was also used in such various roles as a biocide, and a catalyst in gold mining. "Hatters" in the felt hat industry of the 19th century used mercury in the hat making process. Further, mercury has a lengthy past in the folklore of several cultures.

Sometimes called "Quicksilver," mercury is a heavy, silver-colored liquid in its elemental form. How many of you can remember passing around a glob of mercury in science class, wondering at its weight and surface tension? These unusual physical properties have made it useful in many current technologies, such as pressure gauges and switches where fluidity and weight are desirable.

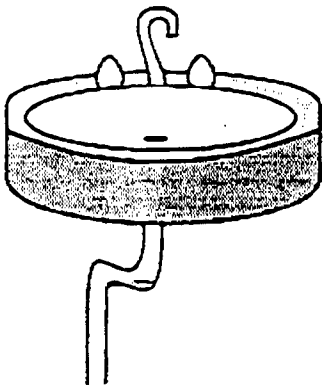
- **Mercury and Today's Health Care Facilities.**

Health care facilities use a number of mercury-containing products. Some examples include:



- Thermometers
- Batteries
- Electronic switches and relays
- Blood pressure monitoring devices (sphygmomanometers)
- Mirrored instruments
- Fluorescent light bulbs and high pressure sodium lamps
- Laboratory chemicals, especially histology stains containing Thimersol, Zenker's Solution, mercuric chloride and mercurochrome

Wastewater streams emanating from hospitals often show a higher than expected level of mercury. Apparently, the mercury, being much heavier than water, has deposited itself in drain traps and pipes over the years. Facilities that have cleaned or replaced these fixtures have subsequently noticed a drop in mercury levels in their wastewater. Of course, once the drains are cleaned or replaced, the facilities face the challenge of keeping mercury-containing materials from continuing to go down the drain. Some hospitals have installed sample spigots in their drains to monitor their wastewater periodically. These sample ports also make pinpointing sources easier. Hospitals are also discovering that the spaces between floor tiles and carpet fibers can accumulate mercury from instrument breakage and chemical spills.



As mercury-containing products are identified, health care facilities are responsive to finding alternative materials or technologies. For example, blood pressure monitors and thermometers are now available in mercury free technologies. Nonetheless, even with the best of efforts, significant levels of this toxic metal can still be found in the health care waste stream.

- **Where should my health care facility begin to address the mercury problem?**

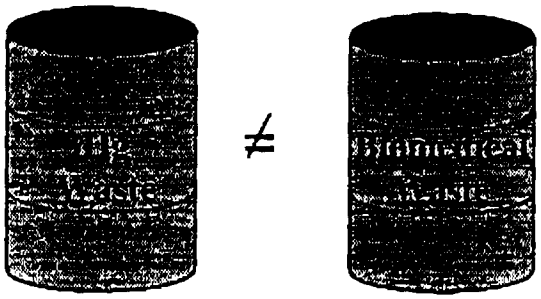
There are several approaches that health care facilities can take to minimize their contribution of mercury to the environment.

- The first step toward effective mercury management is **identification**.

  Keep in mind that Material Safety Data Sheets (MSDS) may not be particularly useful for this process. Often mercury is present in relatively small quantities or is a proprietary ingredient, and therefore is not listed or addressed on the MSDS. This is especially true for histology laboratory chemicals. Therefore, checking product labels and developing a mercury-awareness by your purchasing staff is very important.

- The second step toward effective mercury management is **education**.

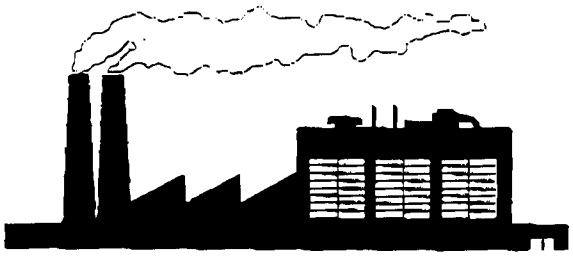
  An effective training program must emphasize that there is a difference between mercury-containing waste and biomedical, or so called "Red-Bag" waste. Mercury-containing waste is a toxic hazardous waste. Although biomedical waste may contain trace amounts of mercury, it is by definition a waste that contains human pathogens of sufficient virulence and in sufficient concentrations that exposure to them could result in disease. Biomedical waste is not necessarily a hazardous waste. Mercury waste must be managed as a hazardous waste, which begins with segregation and accumulation in a labeled container. The hazardous waste is then typically shipped offsite using a DEP licensed hazardous waste transporter.



- The third step toward effective mercury management is **segregation**.

Since mercury-containing waste is often mixed with biomedical waste, and biomedical waste is not always managed as a hazardous waste, segregation of waste types is critical.

The final disposition of biomedical waste is usually incineration, often in small biomedical incinerators located at health care facilities. These biomedical incinerators have never been required to utilize advanced afterburner pollution control technologies. Therefore, they have a greater potential for introducing pollutants into the environment than do larger incinerators, such as those of trash-to-energy plants.



Several recent studies aimed at identifying potential sources of atmospheric mercury pollution have concluded that biomedical waste incineration is a significant source of atmospheric mercury. The United States Environmental Protection Agency recently enacted regulations that will dramaticaly reduce allowable emissions for several pollutants, including mercury. Retrofitting the biomedical incinerators will be financially prohibitive. The result of this action in Maine will be the closure of small incinerators located at hospitals.

Your staff needs to know this to understand why a sharps container is not an appropriate place for a mercury-containing waste, such as a broken mercury thermometer. Segregation of mercury-containing waste from biomedical waste is crucial.

- **What is the best way to clean up a mercury spill?**

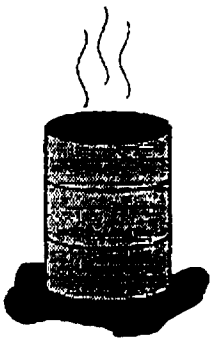
Mercury spills, although usually small in volume, present some unique problems for complete and proper cleanup. Perhaps the best cleanup method is to use a commercially available mercury spill kit.

- Most of these kits have an aspiration-driven vacuum trap with a mercury "sweeper", which is actually a copper brush. Copper is used because mercury readily forms amalgamations with all metals except iron. This device should recover all the mercury.

- Once recovered, the mercury should be accumulated in a labeled container and stored in a secure area, perhaps with other hazardous wastes generated by the facility.

- After the mercury has been recovered, the spill area should be washed with a dilute calcium sulfide or nitric acid solution.

- Appropriate personal protective equipment (PPE) needs to be worn. Consult a Material Safety Data Sheet for the mercury-containing chemical and cleaning solution to identify the specific items necessary.



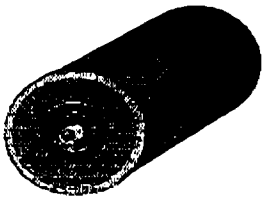
Note: Spilled mercury will release vapors and continue to do so over time. Remember, material used in spill clean up activities that is contaminated with mercury is a hazardous waste and must be managed as such. Some vendors imply that their spill kit materials may be discarded in the regular trash after use, but to do this allows the mercury to enter the environment. Maine's Hazardous Waste Management Rules prohibit this method of disposal.

- **Are there other ways mercury can become airborne?**

Another area of concern is from mercury vapors. Mercury vapor can be present at any spill, but is of special concern from broken fluorescent light tubes. Air monitoring at sites where fluorescent tubes have been broken have documented mercury levels in excess of health

standards. All staff should be trained to carefully handle these bulbs to minimize breakage. If breakage does occur, the proper cleanup procedure to follow is the same as for the liquid mercury spill. Spent lamps can be accumulated for recycling. Many companies are dramatically reducing the mercury content in new bulb manufacturing, something that should be considered when purchasing new bulbs. Contact the DEP for a fact sheet about fluorescent lamps.

- **Do batteries have a lot of mercury in them?**



Surprisingly, the typical flashlight and radio batteries, or alkaline batteries as they are known in the trade, are no longer a source of mercury. That's because in the last five years, major manufacturers have dramatically reduced or eliminated the mercury content in the batteries. Since 1995, the U.S. manufacturers have stopped adding mercury to alkaline batteries altogether.

Mercury batteries have a zinc anode (the negative terminal that releases electrons), a mercuric oxide cathode (the positive terminal that accepts electrons), and an electrolyte containing an aqueous solution of potassium or sodium hydroxide. The mercuric oxide cathode is usually 20 to 50 percent mercury by weight, or 400,000 ppm. At the other end of the scale, silver-oxide button batteries usually contain 25 ppm of mercury. Other types of batteries do not, as a rule, contain mercury.

Most mercury battery applications have been eliminated. Mercury batteries are being used less frequently in the health care industry, although there are still some mercury battery applications in hospitals that cannot be phased out until expensive equipment is replaced. Fortunately, the only mercuric oxide battery manufacturer (Alexander Battery) has a collection program in place for spent mercury batteries, so there is no reason for them to be discarded into the waste stream. Alexander Battery can be contacted at 1-888-527-2539 about their take-back program.

- **Are dental practices a problem for mercury entering the environment?**

The major source of mercury in a dental practice is from amalgams. A dental amalgam is a mixture of powdered silver, tin, copper and elemental mercury which quickly harden to form a solid mass. It usually contains approximately 50% mercury. There is some debate as to the safety of these amalgams, and a small segment of the population does show symptoms of mercury sensitivity. Present science states that this mercury is not readily available as a pollutant once the amalgam is installed in the patient's mouth. To date, tests performed on amalgams have had mixed results. However, mercury dust, from replacement filling work and particles, suctioned from the mouth and discharged down the drain, could be an area of concern. The screens in the drains catch most of the mercury fragments. When these drains are cleaned, the amalgam chunks should be collected and stored as hazardous waste. They should **not** be flushed down the drain or entered into either the biomedical or

Alternatives for Mercury Uses in the Medical Facility*	
PRODUCTS (containing mercury)	**ALTERNATIVES**
Batteries Defibrillators Hearing aids Pacemakers	Lithium, zinc air, and alkaline batteries
Electrical equipment	Fiber optics, solid state devices, mechanical switches
Esophageal devices Cantor tubes Miller Abbot tubes	Tungsten tubing (tungsten for weight)
Lamps Fluorescent High intensity Ultraviolet	Ordinary glow lights; low sodium vapor tubes (yellow); optical, high-energy, long-lasting lights[1]
Sphygmomanometers	Electronic vacuum gage, expansion, aneroid[2]
Thermometers	Electronic (digital), expansion, aneroid
CHEMICALS	**ALTERNATIVES**
Mercury (II) chloride Zenker's solution Histological fixatives	 Zinc Formalin Freeze drying
Staining solutions and preservatives for such products as buffers and vaccines: Thimerosal, Immu-sal, Carbol-fuchin stain, Gram iodine stain, phenolic mercuric, acetate, alum, Hematoxylin "Solution A"	Replace with a variety of chemical compounds[3]
Mercury (II) oxide	Copper catalyst
Mercury chloride	None identified
Mercury (II) chloride	Magnesium chloride/sulfuric acid or zinc formalin, freeze drying
Mercury (II) sulfate	Silver nitrate/potassium/chromium-(III) sulfate
Mercury iodide	Phenate method
Mercury nitrate (for corrosion of copper alloys) for antifungal use (mercurochrome)	Ammonia/copper sulfate, neosporin, mycin

[1] No effective substitute exists for high energy fluorescent lights, but technology is reducing the volume of mercury required in such lights.

[2] Mercury thermometers and manometers should be phased out because good substitutes exist. Mercury recycling should be practiced for old medical instruments.

[3] Mercury's use in chemical analysis can be phased out in many cases, especially in Zenker's solution and histological fixatives. Some substitutes, such as copper, tin and chromium compounds also have some risk, but less than the risk associated with mercury. The total use of mercury remaining in such products as antiseptics, diuretics and skin preparations is minimal; mercury should not be used in skin lightening soaps and creams.

* *Reproduced from Michigan Department of Environmental Quality Report on Mercury in the Environment, April, 1996.*