Mercury Elimination Technical Brief

Green Guide for Health Care **Materials & Resources Prerequisite 2, Credit 4.2 (*Construction* section)**

Green Guide for Health Care **Environmentally Preferable Purchasing Credit 4.1 (*Operations* section)**

Overview

Mercury is the only metal found on the periodic table that is liquid at room temperature. Its usefulness stems from its unique combination of weight, ability to flow, electrical conductivity, chemical stability, high boiling point and relatively low vapor pressure. For centuries, mercury was the ideal choice for use in medical devices that measure temperature (thermometers) and pressure (sphygmomanometers), and in other applications where density and flexibility were needed (esophageal dilators). In chemicals, including pharmaceuticals, mercury was used as a preservative. In buildings, mercury's electrical conductivity combined with its ability to flow prompted its widespread use in electrical switches and gauges. For these and many other applications, mercury-containing devices and materials have been an integral part of health care facility operations for decades. Until recently, a typical large hospital might have contained over one hundred pounds of mercury onsite, incorporated into hundreds of different devices in dozens of locations. Awareness among facility staff through mercury reduction programs such as Hospitals for a Healthy Environment's Making Medicine Mercury Free awards program have contributed to significant progress nationwide. Hospitals for a Healthy Environment (H2E) estimates that 97% of hospitals in the U.S. have implemented mercury reduction/elimination programs since 1998. Over the past five years, green building tools such as the *Green Guide for Health Care* have begun to raise a similar level of awareness among construction teams. Inclusion of a mercury elimination requirement in the 2006 *AIA Guidelines for Design and Construction of Health Care Facilities* reflects the growing awareness in the health care industry that mercury elimination should be a priority in facility design and operations and in medical care.

Mercury is a potent neurotoxin, a global priority pollutant and a PBT – a persistent, bioaccumulative and toxic chemical. PBTs break down slowly in the environment, in some cases requiring thousands of years to neutralize. They also accumulate in animal tissue, resulting in increasingly higher concentrations as they travel up the food chain. Each of these conditions is further complicated by the toxicity of these chemicals, leading to long-term toxic exposure and resultant threats to human health and the environment.

As a neurotoxin, mercury impacts the central nervous system. Exposure can damage the brain, spinal cord, kidneys and liver. Mercury easily crosses the placenta, passing from mother to unborn child, where it can impact the neurological development of the fetus. A July 2000 National Academy of Sciences (NAS) report indicates that more than 60,000 children may suffer from exposure to methylmercury while in-utero. According to the Centers for Disease Control and Prevention (CDC), 1 in 8 women in the United States has a blood mercury level high enough to adversely impact fetal development.

Up to 50 times more mercury has been found in medical waste than in general municipal waste, reflecting the high usage of mercury-containing devices in health care settings. Studies have documented mercury releases from device breakages during transport, use, and maintenance. When broken, or at the end of product life, mercury products may inappropriately enter the solid or regulated waste stream, resulting in releases during incineration, landfill, or autoclave (a treatment method for hazardous waste). According to

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1990 data, medical waste incinerators emitted 50 tons of mercury per year (tpy). A 1997 U.S. EPA study found that medical waste incinerators were the fourth largest source of anthropogenic (i.e., human-generated) mercury emissions. Additionally, hospitals were found to contribute about 5% of the total wastewater mercury load in some regions, and mercury fever thermometers were found to contribute about 17 tons of mercury to solid waste landfills annually.

The three Mercury Elimination credits are unique to the *Green Guide for Health Care* and reinforce the connection between green building practices and human health.

GGHC v2.2 Materials & Resources Prerequisite 2 requires incorporating mercury elimination strategies into the health care facility's Waste Management Plan, requires dental facilities to install amalgam separation devices, and references the *2006 AIA Guidelines for Design and Construction of Health Care Facilities* section on mercury elimination. Additionally, the prerequisite does not allow mercury vapor high intensity discharge lamps or non-LED exit signs in the project and sets maximum mercury content thresholds for the most common interior fluorescent lamps.

GGHC v2.2 Materials & Resources Credit 4.2 promotes further life cycle mercury reductions by requiring minimum lamp life for low mercury fluorescent lamps. The credit also does not allow circular fluorescent lamps or standard metal halide lamps on the project.

GGHC v2.2 Environmentally Preferable Purchasing Credit 4.1 requires health care facilities to replace all mercury-containing medical devices and equipment over time through a purchasing program and dispose of mercury-containing devices properly at the end of their useful life.

The Challenges

Recent studies on the cause of mercury contamination in fish and breast milk have sparked a greater public awareness of the hazards associated with mercury-containing devices. However, many consumers either are unaware that viable mercury-free alternatives exist or continue to prefer mercury-containing devices, such as mercury thermometers, instead of healthier alternatives. In addition, many hospitals do not report the frequency of product breakages and spills to their staff, creating a false sense of confidence in the durability of mercury-containing devices. In some cases, the observation that liquid elemental mercury is not readily absorbed into the body compounds the false sense of security about its toxicity. In fact, mercury evaporates at room temperature, converting to a clear, odorless gas. In its gaseous state, mercury easily passes through the lungs and into the bloodstream.

Many mercury products contain a "hidden" component (e.g., switches, relays) within a larger component. As a result, purchasers may not know the products they are purchasing contain mercury. Additionally, purchasing departments and group purchasing organizations may not flag these devices if they are uninformed by state and/or local laws prohibiting sale or purchase of mercury-containing products.

Best Practices

Comprehensive Mercury Elimination Plan

Successful implementation of the *Green Guide* mercury elimination credits requires an understanding of potential sources of mercury within the building. Developing a list of potential sources and an action plan for their removal/avoidance are the first steps in mercury elimination.

The following plan paraphrases, with permission, the Health Care Without Harm "Mercury Alternatives" website, http://www.noharm.org/mercury/alternatives.

1. Identify mercury-containing items using resources from organizations such as Health Care Without Harm, National Institutes of Health, U.S. EPA, and Hospitals for a Healthy Environment.
2. Implement a mercury-free specification and purchasing policy that targets construction materials, equipment, and medical supplies. Most purchasing policies allow for phasing in substitutions as

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existing equipment ages rather than rushing premature equipment replacement. The policy must also develop a plan for proper disposal or recycling of mercury-containing materials as they are replaced.

3. Set mercury reduction goals for mercury-containing devices in use at the facility. Policies that phase in substitutions in conjunction with a facility-wide education campaign will raise the level of awareness among the staff regarding the importance of eliminating mercury use.
4. Measure success through a program such as the Hospitals for a Healthy Environment "Making Medicine Mercury Free" award.

Mercury-free Construction Specifications

1. Ensure that purchasing specifications cover the following topics at a minimum:
   - Mercury-free thermostats, switches and other stand-alone measurement devices that may contain mercury.
   - Amalgam separation devices (a common best practice in dental installations).
   - Low-mercury fluorescent lamps (widely available and reasonably priced).
2. Some building equipment, particularly equipment associated with the HVAC system, continues to be manufactured with internal mercury-containing measurement devices. Purchasing specifications should pay particular attention to requiring disclosure of mercury content in the following equipment:
   - Heating and cooling systems (switches and thermostats)
   - Systems that move, store, meter, or regulate liquids (measurement devices, valves, flow switches, float control on septic tanks and pumps)
   - Air flow/fan controls, relays, and generators
   - Renovation and disposal of older fire suppression and security systems
3. High quality, cost-effective, and readily available alternatives are available for most of both categories of equipment and supplies listed below. However, due to the number of devices that contain "hidden" mercury components or are not labeled as mercury-containing products, it is important to specify mercury-free components in all relevant sections of the construction specifications.

Environmentally Preferable Purchasing: Products That May Contain Mercury

Equipment	**Medical Supplies**
Switches: lights, fire alarm, washing machine, freezer lids, etc. Air flow/fan controls Security systems Thermostats and pressure gauges Float control on septic tanks and sump pumps Relays Flow meters Generators	Thermometers Sphygmomanometers Gastrointestinal tubes Pharmaceutical supplies Batteries Lamps: fluorescent, germicidal, high-intensity discharge, ultraviolet Electron microscope Laboratory chemicals

Benefits

Health

When mercury enters water, biological processes convert it into methyl mercury, a chemical that is highly toxic to humans. According to the U.S. EPA, in the U.S., human exposure to mercury is largely attributed to fish consumption. Almost all humans contain at least a trace amount of methyl mercury in their

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systems. Once inside the body, mercury is slow to pass out of the system. However, methyl mercury passes across the placenta with ease, creating conditions that could potentially harm the development of a fetus's brain and nervous system. In large doses, methyl mercury can reach a harmful level of toxicity in adults, as well. For more information about the negative health effects of mercury and methyl mercury, visit http://www.epa.gov/earlink1/mercury/effects.htm.

Ecologic

Mercury converts from a liquid to a gas at room temperature. Once airborne, it enters water sources through rain, dust, or gravity where it is transformed into methyl mercury, which accumulates in fish and other animals farther up the food chain. Contamination has been known to reach levels toxic enough to cause mortality. Even small concentrations have been shown to reduce an animal's fertility, slow development, and cause abnormal behavior that compromises an animal's survival instincts. The mercury that contaminates U.S. rivers, lakes, and oceans is generated locally, nationally and internationally. Because it is carried by the wind as a gas, mercury is difficult to contain after it has been released into the atmosphere.

Economic

Most alternatives to mercury-containing devices in the health care setting are competitively priced. Mercury waste is regulated under the Resource Conservation Recovery Act (RCRA), which regulates the handling and disposal of all hazardous waste. Failure to meet RCRA requirements can result in up to a $25,000 fine per day, in addition to the cost of properly disposing of hazardous waste. Eliminating mercury from a hospital setting is an effective way to limit liability and to stay one step ahead of mercury-elimination regulations at all levels of government. In July 2005, EPA passed a rule adding mercury-containing equipment to the universal waste rule. This process encourages recovery and improved, safe management of mercury waste. Final disposing and recycling requirements are the same as for other federally regulated hazardous waste. EPA estimates that 1,877 generators handling about 550 tons of mercury-containing equipment will be affected by this rule.

Case Study

Strong Memorial Hospital, Rochester, NY

Strong Memorial Hospital in Rochester, NY, began a mercury reduction plan in 1997 in response to the costs associated with mercury spill response, disposal, and training. The program was formally established through a memorandum of understanding signed by the hospital and the Monroe County Health Department. The support of high-level hospital staff was mirrored by facility-wide training in program objectives, mercury awareness, how to identify mercury-containing devices, and proper spill response and disposal techniques. Information on hazardous materials was incorporated into training for new nursing staff, annual Resource Conservation Recovery Act (RCRA) training, and the project manager's renovation and construction manual.

The hospital developed new procedures to collect mercury-containing devices, such as specially labeled containers to collect mercury thermometers. Signs on sharps containers remind staff not to place thermometers in medical waste containers. Battery drop-off locations were established throughout the facility, and a centralized location was identified to collect spent fluorescent lamps.

Through its policy and education initiatives, Strong Memorial Hospital successfully replaced all mercury sphygmomanometers, reduced mercury thermometer use by over 90%, replaced all mercury-filled GI tubing with tungsten-filled tubing, and discontinued use of mercury compounds in the histopathology and other clinical laboratories. Only one year after the program was initiated, the annual JCAHO survey cited Strong Memorial as a successful example of a quality improvement initiative.

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Resources

In addition to the resources noted in the Green Guide for Health Care, the following may offer additional guidance:

Health Care Without Harm, http://www.noharm.org

INFORM, Purchasing for Pollution Prevention: Fact Sheet on Specifying and Sourcing Mercury-Free HVAC and Building Equipment, http://www.informinc.org/fact_P3hvac.php

Sustainable Hospitals, http://www.sustainablehospitals.org

U.S. Environmental Protection Agency, http://www.epa.gov/earlink1/mercury/index.htm

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