



Exhibit F
Mercury Fact Sheet



Introduction

This fact sheet was developed jointly by East Bay Municipal Utility District (EBMUD) and the University of California Berkeley (UCB) for an *Educational Institutions Mercury Reduction Program* pilot study currently conducted at UCB. The fact sheet provides an overview of the following items:

- Mercury Toxicity
- Mercury Pollution Prevention
- Mercury Sources at Educational Institutions
- Mercury Exposure Hazards
- Mercury Best Management Practices
- Mercury Spills
- Mercury Spills Cleanup Costs
- Alternatives to Mercury Containing Devices

Mercury Toxicity

Mercury, a potent neurotoxin, is most dangerous to children and pregnant women and their unborn fetuses, though it can cause long lasting health effects to all humans. Children poisoned by mercury show lowered intelligence, impaired hearing and poor coordination. Mercury is one of the 12 toxic pollutants identified by the U.S. EPA as impairing San Francisco Bay. Mercury bioaccumulates and persists in the environment, which makes it a priority for removal from both the environment and the workplace.

Mercury Pollution Prevention

Mercury Pollution Prevention at educational institutions involves several approaches. These include reducing or eliminating mercury-containing reagents used in laboratory processes, promoting the use of non-mercury containing devices, implementing a campus-wide mercury-free purchase policy, and coordinating mercury collection and exchange programs.

Mercury pollution prevention awareness can be promoted and instilled by educational institutions, so that today's students/tomorrow's professionals can implement pollution prevention in their professional and personal endeavors.

Mercury Sources

Educational institutions contain many sources of mercury. The following list describes some common sources:

- Thermometers, manometers, barometers, "forgotten" elemental mercury and reagents in laboratories
- Fluorescent light fixtures and thermostats installed throughout campus
- Light switches in fleet vehicles
- Traces of mercury in custodial supplies
- Medicines, fever thermometers, blood pressure-measuring devices in medical centers/nursing stations.
- Accumulated mercury in sink p-traps and/or floor drains.

Mercury Exposure Hazards

Mercury use in small quantities and in well-ventilated areas is a safe laboratory practice. However, long-term chronic exposure to mercury vapors can be quite dangerous.

Mercury can present a health hazard under the following conditions:

- Mercury waste from spills not cleaned up promptly may vaporize at a rate faster than the room's ventilation can safely remove the toxic fumes.
- Breakage of mercury thermometers in ovens may occur when the oven's temperature is increased above the thermometer's capacity.
- Inadequate connections in pressure systems may result in the release of mercury into high air velocity systems, which will atomize the mercury into extremely small particle sizes over a large surface area.
- Mercury dumped into drains may accumulate in the p-trap or the drain and continuously emit vapors into the surrounding air.
- Workers using a torch to free a plumbing joint where improperly disposed mercury has accumulated may be unexpectedly exposed to mercury vapors.

Mercury Best Management Practices

The following lists some key pollution prevention best management practices that can be implemented by faculty, staff, and students:

- Audit the laboratory/shop for mercury containing devices and reagents.
- Eliminate all nonessential mercury-containing devices/reagents. Contact EH&S for disposal details.
- Replace essential mercury-containing devices/reagents with nonmercury substitutes if available.
- Adopt a mercury-free purchase policy for the laboratory/shop. Encourage vendors to identify and label products containing mercury, and to offer non-mercury alternatives whenever feasible alternatives exist that do not compromise the product.
- Avoid inhaling mercury vapors by working with mercury-containing reagents in a fumehood or well-ventilated area, away from any contact with heat.
- Store mercury-containing reagents and waste in tightly capped containers away from sinks and drains.
- Remove personal gold or silver jewelry when working with mercury. The mercury will amalgamate and irreversibly damage the jewelry.
- Use appropriate gloves when working with mercury.
- Have a mercury spill kit on site to handle small spills.
- Collect/Contain mercury spills in a glass, plastic or steel tray/container, to prevent the mercury from amalgamating with surface of the tray/container.

Mercury Spills

UCB's Office of Environmental Health & Safety (EH&S) responds to campus hazardous materials spills and releases. EH&S staff receives on average 25 calls regarding mercury spills each year. Mercury spill clean ups, typically broken thermometers, are the most common response activity performed. Broken thermometers are also the number one source of potential mercury discharges to the sanitary sewer system. One fever thermometer contains enough mercury, approximately 1.5 grams, to contaminate 200 million gallons of water. Laboratory thermometers are a much larger source.

Unidentified elemental mercury may hide under benches, continuously exposing staff/researchers and students to released vapors. Mercury containing devices may also be broken inside a laboratory fume-hood or sink thereby releasing vapors into the air from plumbing p-traps. The spilled mercury may potentially end up in the wastewater discharge to EBMUD's wastewater treatment plant and possibly affect the water quality in San Francisco Bay.

Handling of Mercury Spills

Report all mercury spills to EH&S. If EH&S determines that the spill can be handled by onsite staff, implement the following cleanup steps:

- Isolate the exposed area.
- Avoid mercury exposure and injury by wearing gloves, a lab coat, and safety glasses/goggles.
- Turn off equipment if the mercury spill occurred in a water bath/heated object. Move the equipment to a fume-hood to minimize mercury vapor exposure.
- Collect the spilled mercury and broken thermometer or other contaminated objects in a leak-proof glass or plastic container. Use an eyedropper or two stiff pieces of paper to collect the elemental mercury.
- Avoid dropping/scattering the collected mercury waste.
- Prevent mercury from entering sink/floor drain.
- "Soak-up" mercury waste by amalgamating it with fresh zinc dust. Dispose of the mercury/zinc dust mixture as hazardous waste.
- Avoid sprinkling elemental sulfur on spilled mercury. The reaction is insignificant at room temperature.
- Contact EH&S if cleanup requires the use of a special mercury vacuum. Standard vacuum cleaners should not be used.
- Label the mercury waste container with a hazardous waste label "mercury spill cleanup debris." Contact EH&S for hazardous waste pickup.
- Contact EH&S if further mercury contamination is suspected.

Mercury Spills Cleanup Costs

Eliminating as much mercury as possible is low-cost insurance for educational institutions. The average cost to clean up a mercury spill is \$75 to \$110. This cost does not include the disposal and replacement cost of contaminated laboratory equipment or staff time. Cleanup may involve costly remediation measures such as decontamination, air monitoring and hazardous waste disposal. In 1998 and 1999, UCB spent an annual average of \$35,450, for the cleanup of broken mercury-containing devices for its College of Chemistry alone.

Mercury-Free Alternatives

One simple way for a laboratory/shop to become virtually mercury-free is to eliminate all nonessential mercury-containing devices. For example, there are many reliable nonmercury thermometers and thermostats available today. The following lists some of the more common types of nonmercury thermometers. Also review the enclosed document, titled - *Alternatives for Mercury-Containing Devices and Chemicals* for more suggestions on mercury-free replacements.

- Spirit-filled thermometers - nonhazardous (filled with petroleum-based mineral spirits); comparable price; comparable accuracy.
- Alcohol-based mercury-free thermometers - non-hazardous; comparable price; tend to be less accurate than mercury thermometers.
- Microprocessor-based thermometers - non-hazardous; digital readout; excellent accuracy; more expensive than spirit/alcohol filled thermometers.

If a laboratory/shop requires at least one mercury-containing thermometer, invest in a teflon-coated mercury thermometer, which is breakage resistant and performs at comparable accuracy. The cost is slightly higher than a standard mercury-containing thermometer.

Many old style thermostats contain a mercury capsule. Several manufacturers, including *Honeywell* and *General Electric*, have a thermostat-recycling program where the contractor can return the old thermostat in a specially designed box to the manufacturer for proper disposal.

Many laboratory chemicals and custodial supplies contain mercury. There are mercury-free alternatives available. However the alternative depends on the reason why that the mercury is present. Is it an active ingredient, a preservative, or a contaminant introduced during the manufacturing process? Mercury may be present in such a small quantity that it may not be an obvious "ingredient." Manufacturers are not required to report ingredients that contribute a very small percentage to the product formula. The contribution of many low-concentration sources may account for a large fraction of mercury in the wastewater stream.

Request that all vendors disclose the mercury content of their products on a *Certificate of Analysis*. The mercury content should be listed in parts per billion and not a percentage. Some substitutes may carry some environmental risk, but it will probably be less than the risk associated with mercury. Check with EH&S to determine the safety of the mercury substitutes.