

DOCUMENT RESUME

ED 473 865

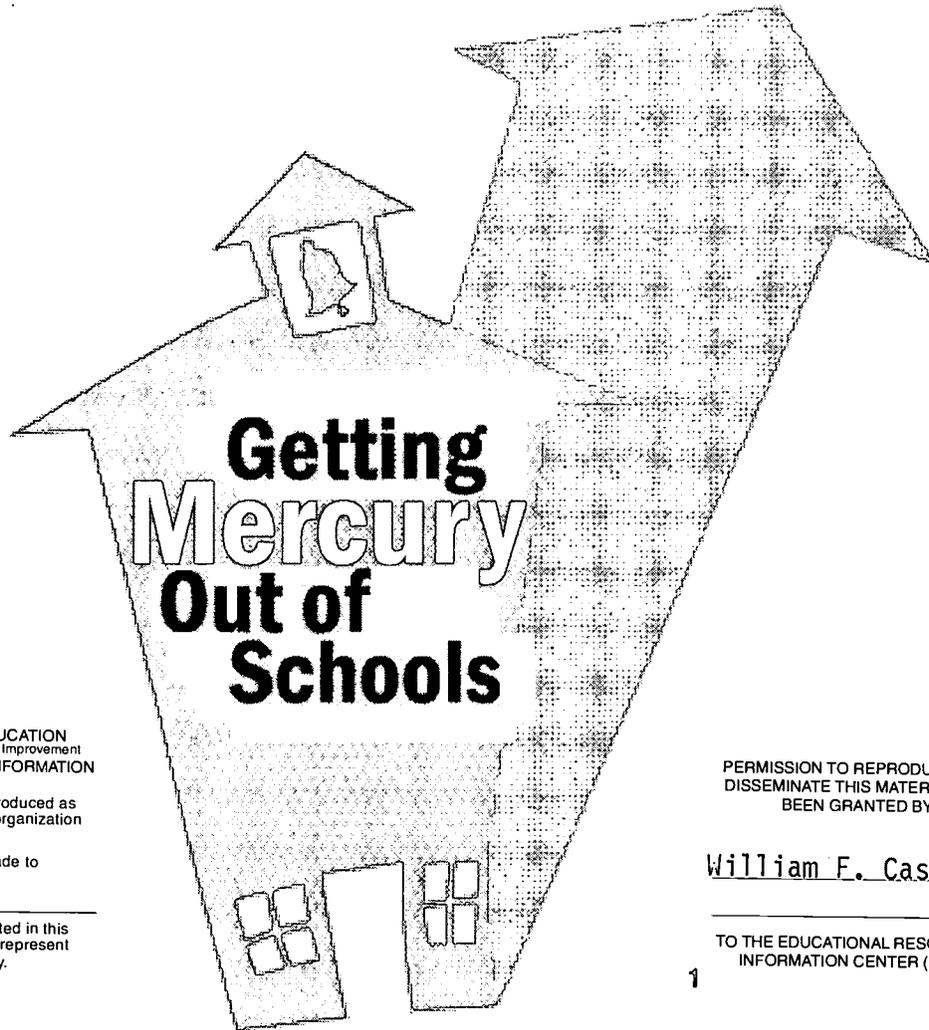
EF 006 195

TITLE Getting Mercury out of Schools.
PUB DATE 1999-00-00
NOTE 24p.; Produced by Massachusetts State Department of Environmental Protection, Massachusetts State Executive Office of Environmental Affairs, and Northeast Waste Management Officials Association.
AVAILABLE FROM For full text: <http://www.newmoa.org/newmoa/htdocs/prevention/mercury/schools>.
PUB TYPE Guides - Non-Classroom (055)
EDRS PRICE EDRS Price MF01/PC01 Plus Postage.
DESCRIPTORS Child Health; Cleaning; *Hazardous Materials; Laboratory Safety; *School Safety
IDENTIFIERS Fact Sheets; Massachusetts; *Mercury (Metal)

ABSTRACT

This guide was prepared while working with many Massachusetts schools to remove items that contain mercury and to find suitable alternatives. It contains fact sheets on: mercury in science laboratories and classrooms, mercury in school buildings and maintenance areas, mercury in the medical office and in medical technology classrooms in vocational technical schools, mercury in HVAC laboratories in vocational technical schools, establishing hazardous and universal waste collection areas, and mercury-free purchasing policies. The fact sheets contain information on items that contain mercury, non-mercury alternatives, storing unwanted items, how to handle a spill, and additional resources. (EV)

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Why it's a problem.

Where it is.

What to do.

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[http://www.newmoa.org/newmoa/
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Getting Mercury Out of Schools

Mercury is poisonous and can cause damage to the nervous system, kidneys, liver and immune system. Typical exposures to mercury come from breathing its fumes during an accidental spill or leak, or by eating fish contaminated with mercury. Children are most at risk to mercury's toxic effects and can suffer potentially serious neurological damage.

When products containing mercury are broken or leak, mercury can evaporate and be inhaled by people in the area. When products containing mercury are thrown in the trash or dumped down the drain, mercury can contaminate lakes, ponds or the ocean. It can concentrate in certain fish, potentially causing harm to people who eat them. Even small amounts of mercury can contaminate the environment. One pound of mercury may be enough to render more than 1,000,000 pounds of fish unsafe to eat.

Items that contain mercury and jars of elemental mercury are a liability for schools. Improper handling of mercury and spill incidents can cause significant financial and legal problems. At a school in Connecticut, the simple act of cleaning out a supply closet resulted in 12 broken mercury laboratory thermometers. The school was evacuated and paid clean-up costs totaling \$6,000. At another school, a broken mercury barometer resulted in clean-up costs totaling \$200,000.

Because of mercury's toxicity, especially to children; its ability to bioconcentrate into fish and its persistence once released into the environment, mercury pollution has been the target of extensive pollution prevention efforts in Massachusetts and the northeast. In June 1998, the New England Governors and the Eastern Canadian Premiers (NEG-ECP) unanimously adopted a comprehensive regional Mercury Action Plan (<http://www.cmp.ca/press-neg.htm>) calling for the virtual elimination of anthropogenic mercury releases. Interim mercury reduction goals of 50% by 2003 and 75% by 2010 were also established. Massachusetts played an important role in developing the NEG-ECP Mercury Action Plan and has adopted its own state-wide Zero Mercury Strategy. Reducing the use of mercury in products and getting mercury out of schools are priorities of both the regional and state plans.

Where are items containing mercury in schools commonly found?

- Medical offices
- Chemistry, Physics and Biology classrooms and laboratories
- School buildings and maintenance areas
- Heating, ventilation and air conditioning shops/laboratories in vocational-technical schools

Do you work with any of these items that may contain mercury?

- Fever, laboratory, candy or oven thermometers
- Thermostats
- Blood pressure devices
- Mercury Switches
- Relays
- Gauges: manometers, barometers, vacuum gauges
- Laboratory chemicals
- Thermostat probes
- Fluorescent lamps
- Mercury vapor lamps
- Metal halide lamps
- High pressure sodium lamps

If you do, take note. It is unsafe and, in many cases illegal, to dispose of mercury products in the trash, down drains or outdoors. Many products containing mercury must be handled as universal waste (a special designation of hazardous waste) or, in certain cases, hazardous waste. As municipal entities, schools may take advantage of state purchasing contracts with certain vendors that provide mercury recycling and disposal services at a negotiated rate. For information on these state contracts, see the Massachusetts Operational Services Division (OSD) publication "A Guide to Massachusetts State Contracts for Hazardous Material Collection and Management." A copy can be downloaded from www.state.ma.us/osd/enviro/material.htm, or contact Marcia Deegler at 617-720-3356 or Marcia.Deegler@osd.state.ma.us.

How to Use this Guidance

This Guidance was prepared while working with many Massachusetts schools to remove items that contain mercury and to find suitable alternatives. This piece itself is a stand-alone informational piece written for the Superintendent, Principal or Business Manager of a school or school system. The following fact sheets may accompany this piece:

- **Mercury in Science Laboratories and Classrooms**
- **Mercury in School Buildings and Maintenance Areas**
- **Mercury in the Medical Office**
- **Mercury in Heating, Ventilation and Air Conditioning Laboratories in Vocational Schools**
- **Establishing a Hazardous and Universal Waste Collection Area**
- **Sample Mercury-Free Purchasing Policy and Resolution**

The fact sheets are also stand-alone informational pieces and are intended to be distributed to the appropriate personnel within the school or school system.

For example, “Establishing a Hazardous and Universal Waste Collection Area” may be most appropriate for the science chairperson or the facilities manager or both if a school needs two or more collection areas to be set up. “Mercury in the Medical Office” may be most useful to the nurse.

Additional Information:

Toxics Use Reduction Case study on Burlington, Mass. schools by the Mass. Office of Technical Assistance <http://www.mass.gov/ota/cases/burlington.htm>

Massachusetts Fish Consumption Advisories from the Mass. Department of Public Health
<http://www.mass.gov/dph/beha/fishlst.htm>
<http://www.mass.gov/dph/beha/mercury/merchp.htm>

Regional Mercury Projects on the website of the Northeast Waste Management Officials' Association
<http://www.newmoa.org/prevention/mercury/schools>

“Mercury in Massachusetts: An Evaluation of Sources, Emissions, Impacts and Controls,” Mass. Dept. of Environmental Protection
<http://www.mass.gov/dep/files/mercury/hgtoc.htm>

Burlington, Mass. Board of Health
<http://208.58.133.9/health/Mercury.htm>

Contact the Massachusetts Mercury Hotline at 1-800-866-9MERCURY (1-866-963-7287).

Mercury in Science Laboratories and Classrooms including Physics, Chemistry, Biology, General Science

Items that contain mercury:

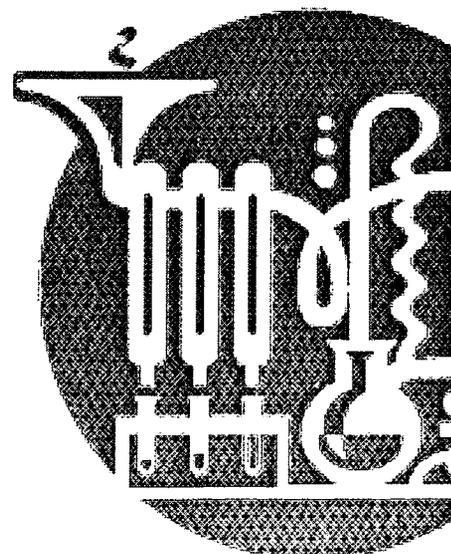
- bulk elemental mercury
- laboratory chemicals (e.g., mercury oxide, mercury chloride (Zenker's solution), mercury sulfate, mercury nitrate, mercury iodide)
- mercury laboratory thermometers, fever thermometers, sling psychrometers
- mercury barometers
- molecular motion demonstration devices with liquid mercury
- mercury switches

The educational benefit of using mercury in the classroom is not worth the potential risk.

Mercury Laboratory Chemicals and Non-Mercury Alternatives

Mercury is a common chemical in school laboratories. Elemental mercury has been used to demonstrate the concept of density, and mercuric salts may be used in various experiments. Many people can remember seeing the mercury beads roll across the desk of the science lab out of a broken thermometer or even playing with mercury. People know better now. Mercury spills can cost schools tens of thousands of dollars to clean up. The educational benefit of using mercury in the classroom is not worth the potential risk of having the mercury on-site.

Non-mercury experiments can adequately demonstrate the concept of density. For example, "Discovering Density" (publisher: Lawrence Hall of Science, University of California at Berkeley) offers comprehensive information on five visual representations of the concept. A microscale, non-mercury density experiment is also offered in "40 Low-Risk, Low-Waste Chemistry Labs" (publisher: J. Weston Walsh, see <http://www.cheminfonet.org>). In addition, the "Ask Eric" website offers a non-mercury density experiment. (See <http://www.askeric.org>).



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Chemical	Alternative
Mercury (II) Oxide	Copper catalyst
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 or for antifungal use (mercurochrome)	Ammonia/Copper Sulfate, Neosporin, Mycin
Zenker's solution	Zinc Formalin

Direct replacements for mercuric salts also exist, depending on the experiment. The table above offers some alternatives found in the Wisconsin Department of Natural Resources *Mercury Sourcebook: Educational Institutions*. (See <http://www.epa.gov/glnpo/p2.html>).

Mercury Laboratory Thermometers and Non-Mercury Alternatives

Laboratory thermometers with the silver bulb contain between 1.5 and 3 grams of mercury and should not be thrown in the trash.

Non-mercury alcohol and mineral spirit-filled laboratory thermometers are effective for most applications and are available from laboratory supply vendors. These alternatives may cost slightly more or less than mercury laboratory thermometers depending on the accuracy required.

Preservatives

Mercury compounds were often used as preservatives in reagents, buffers, stains and saline solutions. The mercury compound may be listed as thimersol, merthiolate, or by specific mercury compound name. Take care not to purchase solutions containing a mercury preservative.

Mercury Manometers and Vacuum Gauges and Non-Mercury Alternatives

Manometers, barometers, vacuum gauges and U-tubes with a visible silver liquid contain mercury. Liquid mercury in the gauges responds to air pressure in a precise way that can be read on a calibrated scale.

Non-mercury alternatives are widely available. Electronic (digital) gauges and aneroid (e.g., Bourdon tube, diaphragm, piston or capsule) pressure gauges are available and effective for most applications.

Storing Unwanted Items

Unwanted mercury laboratory chemicals (including jars of elemental mercury) must be managed as hazardous waste, not universal waste, and must be disposed of according to federal and state hazardous waste regulations.

Unwanted thermometers and gauges and other devices that contain mercury can be managed as universal wastes. Universal wastes are a subcategory of hazardous waste, with streamlined handling requirements. None of these materials should be disposed of in the regular trash. Every school should have a protocol for handling and managing hazardous and universal wastes.

Until you arrange for proper disposal, save old or broken mercury laboratory thermometers and gauges in two sealed, non-breakable containers (e.g., two sealed,

plastic bags, one inside the other). Label the containers “Universal Waste - Mercury-Containing Devices” and indicate the date that they were stored. See the fact sheet “Establishing Hazardous and Universal Waste Collection Areas” for more information on storage requirements.

How to Handle a Mercury Spill

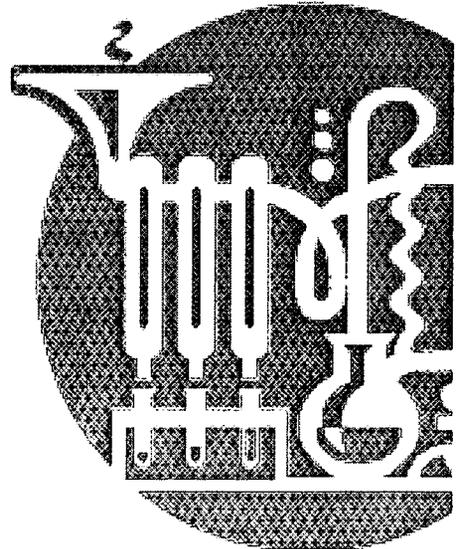
If a thermometer or gauge breaks and the spill is less than two tablespoons, you may be able to clean it up yourself. (Almost all thermometers contain less than this amount.) If you have a mercury spill kit and know how to use it, follow the instructions that come with the kit. Otherwise, follow these instructions:

- First ventilate the room to the outdoors and keep people and animals out of the area.
- Remove all jewelry from hands and wrists.
- Wear rubber gloves to avoid contact with the skin.
- Use an eyedropper or two pieces of stiff paper to scoop the mercury into an unbreakable container.
- Place all contaminated cleaning materials in two sealed, non-breakable containers (one inside the other).
- Remove contaminated carpeting and store with contaminated cleaning materials.
- Label the containers “Hazardous Waste - Mercury Spill Clean Up Materials” and indicate the date that they were stored. Store the containers in an appropriate location.
- Dispose of all contaminated materials as hazardous waste. (See the fact sheet “Establishing Hazardous and Universal Waste Collection Areas” for more information.)
- Replace the item with a non-mercury alternative.

If a spill is greater than two tablespoons, you should get professional spill response assistance. First, close off the area immediately. Call the Massachusetts DEP’s Spill Response Center at 888-304-1133, or your local fire department. To reduce volatilization, turn down the temperature below 65 degrees Fahrenheit. Open windows and ventilate the area. Surround and contain the spill as much as possible. For a release to the environment of one pound (approximately two tablespoons) or more, reporting to the state’s Spill Response Center is required.

NEVER use a vacuum cleaner or broom to clean up a mercury spill as this causes mercury to vaporize into the air, causing greater potential for health risks. **NEVER** pour mercury down the drain. Mercury is heavier than water and may get trapped in the plumbing system and continue to vaporize into the room, causing potential health risks.

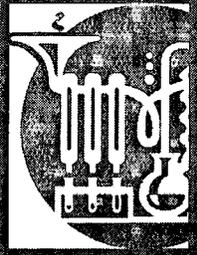
For more information, contact the Massachusetts Mercury Hotline at 1-866-9MERCURY (1-866-963-7287).



Additional Information

The University of Wisconsin's Solid and Hazardous Waste Education Center has developed a website called "Mercury in Schools." (See <http://www.mercury-k12.org>).

Through their "Rehab the Lab" project, King County Washington's Local Hazardous Waste Management Program developed a collection of "Least Toxic Chemistry Labs." (See <http://www.metrokc.gov/hazwaste/rehab>).



Mercury in School Buildings and Maintenance Areas

Items that contain mercury:

- fluorescent lamps
- high intensity discharge lamps - including mercury vapor, metal halide, and high pressure sodium lamps
- mercury thermostats
- mercury switches and relays (e.g., silent light, fire alarm)
- mercury thermostat probes and flame sensors

Fluorescent and High-Intensity Discharge Lamps

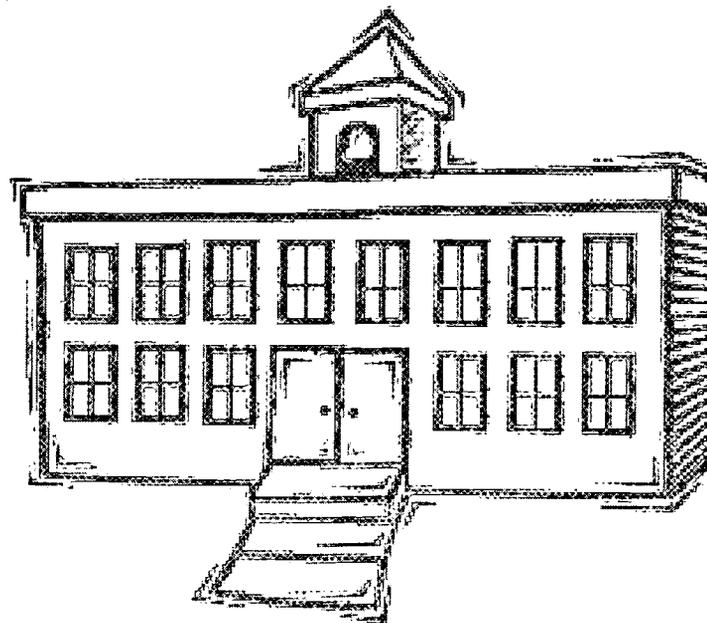
Fluorescent and High-Intensity Discharge (HID) lighting does provide the environmental benefit of energy efficiency; it can use up to 50 percent less electricity than incandescent lighting.

The most common fluorescent lamp is the tube style, used as overhead lighting in offices and businesses. Compact globe styles are used in homes and offices. HID lighting is used in security, outdoor, or warehouse applications (e.g., parking lot light poles and warehouse rafters).

Waste fluorescent and HID lamps release mercury when they are broken, burned in waste-to-energy plants, or buried in landfills. Therefore, waste lamps should be managed properly and recycled.

There are currently no mercury-free fluorescent light bulbs manufactured. There are "low-mercury" bulbs available, and they are sometimes mistakenly thought to be "mercury-free." However, all fluorescent bulbs available today still contain some mercury. Therefore, DEP recommends that all fluorescent bulbs be recycled.

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Never use a vacuum cleaner to clean up a mercury spill as this causes mercury to vaporize into the air.

The Massachusetts Universal Waste Rule [310 CMR 30.1000] was adopted to encourage recycling by streamlining requirements. It includes the following handling requirements for spent mercury-containing lamps:

- Store unbroken lamps inside a box or fiber drum to prevent breakage, and in a protected area.
- Label the containers “Universal Waste - Mercury-Containing Lamps.” If lamps are accidentally broken, store them in a sealed container. Collect spilled powder using a disposable rag, and add it to the sealed container. Mop the area clean.
- It is not necessary to have a special mercury spill kit for cleaning up broken lamps because the mercury in the lamps is not in a liquid form.
- Once a sufficient quantity of lamps is collected, contact a lamp recycler to collect them.

Some lamp recyclers in the northeast are listed below:

Superior Special Services
218 Canton Street
Stoughton, MA 02072
(781) 341-6080

Northeast Lamp Recycling
250 Main Street
East Windsor, CT 06088
(860) 292-1992

Superior Special Services is currently on state contract, available to schools and municipalities, for mercury recycling. In June 2001, the price for recycling fluorescent lights was 9.5 cents per foot for less than 7500 feet or 8.5 cents per foot for more than 7500 feet. Containers for storing the bulbs, pick up, and recycling are included in the price. To obtain the state contract pricing, contact Superior (2001 contact Amanda Poverchuk 781-341-6080 x213) and reference state contract #ST7J211.

For more information, consult the DEP fact sheet: “Fluorescent Lamp Management for Businesses and Institutions,” at <http://www.mass.gov/dep/files/lamps.htm>. Also, see <http://www.lamprecycle.org>

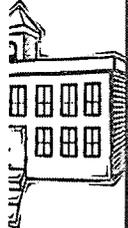
Mercury Thermostats and Non-Mercury Alternatives

Mercury-containing tilt switches have been used in thermostats for more than 40 years. The thermostats provide accurate and reliable temperature control, require little or no maintenance, and do not require a power source. However, each switch contains approximately three grams of mercury. Some thermostats may contain several switches.

To determine whether a thermostat contains mercury, carefully remove the front plate and look for the small glass ampules that contain silver liquid. Because the mercury in thermostats is completely enclosed, it does not pose an immediate threat to health or to the environment, unless the glass breaks or the product is disposed of in the regular trash.

Non-mercury thermostats, including air-controlled, reed switch, vapor-filled diaphragm, snap-switch and programmable electronic, are readily available.





Other Mercury-Containing Devices and Alternatives

- Mercury switches and relays
- Mercury thermostat probes and flame sensors

Mercury-containing switches and relays, including tilt switches and float switches and displacement/plunger relays, are found in a variety of items, including chest freezers, silent light switches, hot water heaters, bilge and sump pumps, septic tanks, and storage tanks. If a mechanical switch is not visible in these items, a mercury switch is probably being used.

Mercury-containing thermostat probes, also known as flame sensors or gas safety valves, may be found in several types of gas-fired appliances that have pilot lights, such as: ranges, ovens, clothes dryers, water heaters, furnaces, gas meters, and space heaters. The mercury is inside a tube and expands or contracts to open and shut the valve.

Because the mercury in these switches, relays and probes is completely enclosed, it does not pose an immediate threat to health or to the environment, unless the mercury is leaking or the product is disposed of in the regular trash.

When purchasing or replacing any of these items be sure that the new item has a non-mercury switch, relay, or thermostat probe. Alternatives to switches and relays include hard-contact switches, solid-state switches, electro-optical switches, inductive sensors, capacitive sensors, photoelectric sensors, and ultrasonic sensors. Most new float switches are now made without mercury. Non-mercury float control switches include magnetic dry reed switches, optic sensors, and mechanical switches. Alternatives to mercury-containing thermostat probes include electric flame sensors and electronic ignition.

Storing Unwanted Mercury Devices

To safely remove an unwanted mercury thermostat, use a screwdriver and a pair of wire cutters to remove the entire thermostat from the wall. **DO NOT** attempt to remove the switches themselves or dismantle the thermostat in any way.

When disposing of unwanted mercury thermostats, switches, relays or thermostat probes save the mercury devices in two sealed, non-breakable containers (e.g., two sealed, zip-lock plastic bags, one inside the other) in a safe place. Label the containers "Universal Waste - Mercury-Containing Devices" and indicate the date that they were stored.

Unwanted mercury devices are classified as universal wastes and should NOT be disposed of in the regular trash. Arrange for proper disposal of the universal wastes. For more information, see the fact sheet "Establishing Hazardous and Universal Waste Collection Areas."

For thermostats only, a consortium of thermostat manufacturers formed the Thermostat Recycling Corporation (TRC) to collect and recycle used thermostats. Thermostats are collected at participating Heating, Ventilation and Air Conditioning Supply Wholesalers. There may be a participating wholesaler in your area. For a list of participating wholesalers, see <http://www.nema.org/government/environment/>.

When disposing of a large item that you know contains a mercury switch, relay, or thermostat probe, alert your white goods hauler to the presence of mercury in the device. Alternately, if you have been trained and are confident that you can safely remove the switch, relay or thermostat probe yourself without disturbing the mercury, do so and, until you arrange for proper disposal, store the mercury-containing component as described previously.

How to Handle a Mercury Spill or Leak

If a mercury leak or spill occurs and it is less than two tablespoons, you may be able to clean it up yourself. If you have a mercury spill kit, follow the instructions that come with it. Otherwise, follow these instructions:

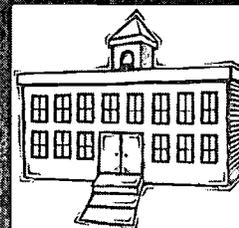
- First ventilate the room to the outdoors and keep people and animals out of the area.
- Remove all jewelry from hands and wrists.
- Wear rubber gloves to avoid mercury contact with the skin.
- Use an eyedropper or two pieces of stiff paper to scoop the mercury into an unbreakable container.
- Place all contaminated cleaning materials in two sealed, non-breakable containers (one inside the other).
- Remove contaminated carpeting and store with contaminated cleaning materials.
- Label the containers "Hazardous Waste - Mercury Spill Clean Up Materials" and indicate the date that they were stored. Store them in an appropriate location.
- Dispose of all contaminated materials as hazardous waste.
- See the fact sheet "Establishing Hazardous and Universal Waste Collection Areas" for more information.
- Replace the item with a non-mercury alternative.

If the spill is greater than two tablespoons, you should get professional spill response assistance. First, close off the area immediately. Call the Massachusetts DEP's Spill Response Center at 888-304-1133, or your local fire department. To minimize volatilization, turn down the temperature to below 65 degrees Fahrenheit. Open windows and ventilate the area. Surround and contain the spill as much as possible. For a release to the environment of one pound (approximately two tablespoons) or more, reporting to the Spill Response Center is required.

NEVER use a vacuum cleaner or broom to clean up a mercury spill as this causes mercury to vaporize into the air, causing greater potential for health risks. **NEVER** pour mercury down the drain. Mercury is heavier than water and may get trapped in the plumbing system and continue to vaporize into the room, causing potential health risks.

Additional Information

For additional information on facility systems, equipment and supplies that may contain mercury, see the website of the National Institutes of Health at <http://www.nih.gov/od/ors/ds/nomercury/systems.htm> or the website of the Burlington, Mass. Board of Health at <http://www.208.58.133.9/health/Mercury.htm>.



Mercury in the Medical Office and in Medical Technology Classrooms in Vocational Technical Schools

Items that contain mercury:

- glass fever thermometers with the silver bulb
- blood pressure devices with the silver liquid
- topical disinfectants - mercurochrome or tincture of merthiolate

Mercury Fever Thermometers and Non-Mercury Alternatives

Glass fever thermometers with the silver bulb contain between 0.5 and 1.5 grams of mercury. Mercury fever thermometers should not be thrown in the regular trash or down the drain.

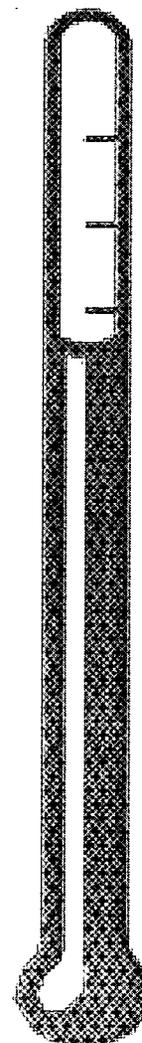
As an alternative to mercury glass fever thermometers, many schools are using the digital probe thermometers, which require AA batteries. Small digital thermometers are also an alternative. (These contain a button cell battery that may contain 5 - 50 mg of mercury and should be recycled through a battery collection program.) Non-mercury, non-digital fever thermometers are available including gallium-indium-tin and dot matrix models. These alternatives are available through medical supply companies and local pharmacies.

Mercury Blood Pressure Units and Non-Mercury Alternatives

Wall-mounted and portable blood pressure units (or sphygmomanometers) with the silver liquid contain approximately 110 grams of mercury. Older units may leak mercury. Most schools are replacing the mercury blood pressure units with aneroid sphygmomanometers. Studies have verified their accuracy. (See www.sustainablehospitals.org)

Topical Disinfectants and Non-Mercury Alternatives

Mercurochrome and tincture of merthiolate contain mercury. These disinfectants are not commonly used today and many alternative disinfectants are available and effective, such as alcohol and hydrogen peroxide.



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Products that contain mercury should not be disposed of in the regular trash.

Storing Unwanted Items

Unwanted mercury thermometers and sphygmomanometers can be managed as universal wastes (a category of hazardous wastes) in Massachusetts and should NOT be disposed of in the regular trash, nor should mercury spills be disposed of down the drain. Until you arrange for proper disposal, save old or broken mercury thermometers and sphygmomanometers in two sealed, non-breakable containers (e.g., two zip-locked plastic bags, one inside the other) in a safe place. Label the containers "Universal Waste - Mercury-Containing Devices" and indicate the date that they were stored. Universal wastes can be stored for up to one year before disposal. Dispose of these wastes as universal wastes. For more information, see the fact sheet "Establishing Hazardous and Universal Waste Collection Areas."

How to Handle a Mercury Spill

If a thermometer breaks or a sphygmomanometer leaks and the spill is less than two tablespoons, you may be able to clean it up yourself. If you have a mercury spill kit, follow the instructions that come with it. Otherwise, follow these instructions:

- Ventilate the room to the outdoors and keep people and animals out of the area.
- Remove all jewelry from hands and wrists.
- Wear rubber gloves to avoid mercury contact with the skin.
- Use an eyedropper or two pieces of stiff paper to scoop the mercury into an unbreakable container.
- Place all contaminated cleaning materials in two sealed, non-breakable containers (one inside the other).
- Remove contaminated carpeting and store with contaminated cleaning materials.
- Label the containers "Hazardous Waste - Mercury Spill Clean Up Materials" and indicate the date that they were stored. Store in an appropriate location.
- Dispose of all contaminated materials as hazardous waste.

- See the fact sheet "Establishing Hazardous and Universal Waste Collection Areas" for more information.
- Replace the item with a non-mercury alternative.

If the spill is greater than two tablespoons, you should get professional spill response assistance. First, close off the area immediately. Call the Massachusetts DEP's Spill Response Center at 888-304-1133, or your local fire department. Turn down the temperature to below 65 degrees Fahrenheit. Open windows and ventilate the area. Surround and contain the spill as much as possible. For a release to the environment of one pound (approximately two tablespoons) or more, reporting to the Spill Response Center is required.

NEVER use a vacuum cleaner or broom to clean up a mercury spill as this causes mercury to vaporize into the air, causing greater potential for health risks.

NEVER pour mercury down the drain. Mercury is heavier than water and may get trapped in the plumbing system and continue to vaporize into the room, causing potential health risks. It will also contaminate waste water.

Additional Information

For additional information on thermometers, sphygmomanometers and other medical devices that may contain mercury, see the website of the Sustainable Hospitals Project at the University of Massachusetts Lowell (www.sustainablehospitals.org) or the website of Health Care Without Harm (www.noharm.org).

For more information, contact the Massachusetts Mercury Hotline at 1-866-9MERCURY (1-866-963-7287).

Preservatives

Mercury compounds were used as preservatives in contact lens solutions and nasal sprays. The mercury compound may be listed as thimersol, merthiolate, or by a specific mercury compound name. Take care not to purchase or use these products that contain a mercury preservative.

Mercury in Heating, Ventilation and Air Conditioning Laboratories in Voc-Tech Schools

Items that contain mercury:

- mercury thermostats with the silver liquid
- U-tubes (or vacuum gauges) with the silver liquid
- mercury switches
- mercury relays
- mercury thermostat probes

These devices are commonly used in heating, ventilation and air conditioning (HVAC) applications. Students entering the HVAC field will come in contact with devices that contain mercury. Because of this, teachers may decide to keep some mercury devices for instructional or demonstration purposes. If so, it is important that a mercury spill kit is located in the laboratory and that at least two staff people are trained in its use.

Once they are working in the HVAC profession, students will come in contact with devices that contain mercury

Mercury Thermostats and Non-Mercury Alternatives

Mercury tilt switches have been used in thermostats for more than 40 years. They provide accurate and reliable temperature control, require little or no maintenance, and do not require a power source. However, each switch contains approximately three grams of mercury.

To determine whether a thermostat contains mercury, carefully remove the front plate and look for small glass ampules that contain silver liquid. Because the mercury in thermostats is completely enclosed, it does not pose an immediate threat to health or to the environment unless the glass breaks or the product is disposed of in the regular trash.

Non-mercury thermostats, including air-controlled, reed switch, vapor-filled diaphragm, snap-switch and programmable electronic, are readily available from wholesale and retail heating and plumbing supply stores.

Mercury U-Tubes and Non-Mercury Alternatives

Vacuum gauges with a visible silver liquid contain mercury. Liquid mercury in the gauges responds to air pressure in a precise way that can be read on a calibrated scale.

Non-mercury alternatives are available. Electronic (digital) gauges and aneroid (e.g., Bourdon tube, diaphragm, piston or capsule) pressure gauges are available and effective in most applications.

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Other Mercury-Containing Devices and Non-Mercury Alternatives

- mercury switches
- mercury relays
- mercury thermostat probes

Mercury switches are found in a variety of items, including hot water heaters, bilge and sump pumps. If a mechanical switch is not visible in these items, a mercury switch is probably being used.

Mercury thermostat probes, also known as flame sensors or gas safety valves, may be found in gas-fired appliances that have pilot lights, such as ranges, ovens, clothes dryers, water heaters, furnaces, or space heaters. The mercury is inside a tube and expands or contracts to open and shut the valve.

Because the mercury in these switches, relays and probes is completely enclosed, it does not pose an immediate threat to health or to the environment unless the glass breaks or the product is disposed of in the regular trash.

When purchasing any of these items, be sure that the new item has a non-mercury switch, relay or thermostat probe. Alternatives to mercury switches include hard-contact switches, solid-state switches, electro-optical switches, inductive sensors, capacitive sensors, photoelectric sensors, and ultrasonic sensors. Alternatives to mercury thermostat probes include electric flame sensors and electronic ignition. Most new float switches are made without mercury. Non-mercury float control switches include magnetic dry reed switches, optic sensors, and mechanical switches.

Storing Unwanted Items

To safely remove an unwanted mercury thermostat, use a screwdriver and a pair of wire cutters to remove the entire thermostat from the wall. **DO NOT** attempt to remove the switches themselves or dismantle the thermostat in any way.

When disposing of unwanted mercury vacuum gauges, thermostats or switches, save the mercury devices in two sealed, non-breakable containers (e.g., two zip-locked plastic bags, one inside the other) in a safe place. Label the containers "Universal Waste - Mercury-Containing Devices" and indicate the date that they were stored.

Unwanted mercury devices are classified as universal wastes (a category of hazardous wastes) and should **NOT** be disposed of in the regular trash. Arrange for proper disposal of the universal wastes. For more information, see the fact sheet "Establishing Hazardous and Universal Waste Collection Areas."

For thermostats only, a consortium of thermostat manufacturers formed the Thermostat Recycling Corporation (TRC) to collect and recycle used thermostats. Thermostats are collected at participating Heating, Ventilation and Air Conditioning Supply Wholesalers. There may be a participating wholesaler in your area. For a list of participating wholesalers, see <http://www.nema.org/government/environment/>.

When disposing of a large item that you know contains a mercury switch, relay, or thermostat probe, alert your white goods hauler to the presence of mercury in the device. Alternately, if you have been trained and are confident that you can safely remove the switch, relay or thermostat probe yourself without disturbing the mercury, do so and, until you arrange for proper disposal, store the mercury-containing component as described previously.



How to Handle a Mercury Spill or Leak

If a mercury leak or spill occurs and it is less than two tablespoons, you may be able to clean it up yourself. (Most thermostats contain less than this amount.) First ventilate the room to the outdoors and keep people and animals out of the area. Remove all jewelry from hands and wrists. Wear rubber gloves to avoid mercury contact with the skin.

If you have a mercury spill kit, follow the instructions that come with it. Otherwise, follow these instructions:

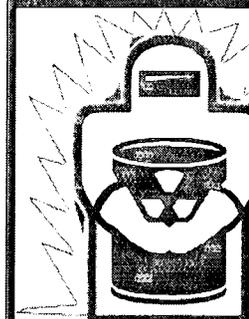
- Use an eyedropper or two pieces of stiff paper to scoop the mercury into an unbreakable container.
- Place all contaminated cleaning materials and the gloves in two sealed, non-breakable containers (e.g., two zip-locked plastic bags, one inside the other).
- Remove any contaminated carpeting and store with contaminated cleaning materials.
- Label the containers "Hazardous Waste - Mercury-Containing Devices" and indicate the date that they were stored.
- Replace the item with a non-mercury alternative.
- Dispose of all contaminated materials as hazardous waste. (See the fact sheet "Establishing Hazardous and Universal Waste Collection Areas.")

If the spill is greater than two tablespoons, you need to get professional spill response assistance. First, close off the area immediately. Call the Massachusetts DEP's Spill Response Center at 888-304-1133, or your local fire department. To minimize volatilization, turn down the temperature to below 65 degrees Fahrenheit. Open windows and ventilate the area. Surround and contain the spill as much as possible. For a release to the environment of one pound (approximately two tablespoons) or more, reporting to the Spill Response Center is required.

NEVER use a vacuum cleaner or broom to clean up a mercury spill as this causes mercury to vaporize into the air, causing greater potential for health risks. **NEVER** pour mercury down the drain. Mercury is heavier than water and may get trapped in the plumbing system and continue to vaporize into the room, causing potential health risks.

Additional Information

For additional information on facility systems, equipment and supplies that may contain mercury, see the website of the National Institutes of Health at <http://www.nih.gov/od/ors/ds/nomercury/systems.htm> or the website of the Burlington, Mass. Board of Health at <http://www.208.58.133.9/health/Mercury.htm>



Establishing Hazardous and Universal Waste Collection Areas

A hazardous waste is generally defined as a toxic, corrosive, reactive or ignitable substance. Most hazardous wastes from schools are generated in science laboratories, shops, art rooms, photography studios and maintenance operations. Hazardous wastes found in schools could include solvents, alcohols, paint thinners, solvent-based paints and stains, acids, bases, photographic chemicals, toxic metals and automotive fluids. Any school that produces hazardous waste as part of its operations must register with the Massachusetts Department of Environmental Protection (DEP) as a generator of hazardous waste. Registration forms can be obtained by contacting DEP at 800-462-0444.

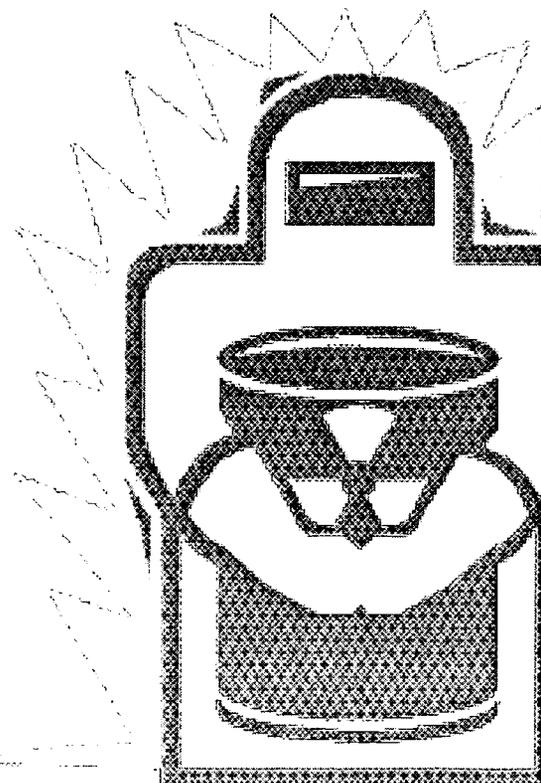
Generators of hazardous waste are classified by the amount of waste they generate; the requirements vary based on this status, as indicated below. The amount of hazardous waste generated is the total of all hazardous waste per address, excluding waste oil, which is counted separately.

- A Very Small Quantity Generator (VSQG) generates less than 27 gallons per month of hazardous waste. Most schools fall into this category.
- A Small Quantity Generator (SQG) generates between 27 and 270 gallons per month of hazardous waste.
- A Large Quantity Generator (LQG) generates more than 270 gallons per month of hazardous waste.

Hazardous Wastes and Universal Wastes

Discarded mercury-containing devices are considered hazardous waste but may be managed as universal waste. Universal wastes are subject to streamlined requirements. The following sections discuss universal and hazardous waste storage and disposal specifically for mercury materials.

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Most hazardous wastes from schools are generated in science laboratories, shops, art rooms, photography studios and maintenance operations.

Setting up a Hazardous Waste Storage Area

The following mercury materials commonly found in schools are classified as hazardous wastes (not universal wastes) once you decide to dispose of them:

- elemental mercury
- mercury compounds
- spill clean up materials contaminated with mercury

Hazardous wastes must be stored in a segregated and secure area with markings to delineate the area (such as black and yellow marking tape) and a sign “Hazardous Waste Accumulation Area” in letters at least one inch high. Wastes must be stored in appropriate containers.

All hazardous wastes must be labeled with the following information:

1. The words “hazardous waste.”
2. The identity of the waste (e.g., waste mercuric oxide)
3. The hazard associated with the waste (e.g., toxicity, corrosivity, ignitibility, reactivity)
4. The date you began accumulating the waste

If you are a VSQG, you do not have a specific time limit for accumulation of your hazardous wastes. However, you must dispose of your hazardous wastes when you have accumulated 165 gallons of waste. Hazardous waste must be shipped off-site by an authorized hazardous waste transporter, or you can self-transport up to 55 gallons of hazardous waste to an authorized generator or hazardous waste contractor who agrees to accept it.

Storage and transport of hazardous waste may be subject to additional recordkeeping and other management requirements, beyond those required for universal wastes.

For more information, contact the Massachusetts DEP at (617) 292-5898.

In addition, on-site technical assistance is available through the Massachusetts Executive Office of Environmental Affairs’ Office of Technical Assistance (OTA). At no charge, OTA staff will conduct a confidential walk-through of a school and provide detailed guidance on proper management of mercury and other hazardous materials and wastes, risk reduction, employee training and opportunities for reducing or eliminating environmental concerns and liabilities. A person may contact OTA at 617-626-1060 to request a visit or ask specific questions. Assistance may also be available through local recycling programs, boards of health and special programs being implemented by the Massachusetts DEP, EOE and municipal solid waste combustors. For more information on special programs, contact Judy Shope of the Massachusetts DEP at 617-292-5597.



Setting up a Universal Waste Storage Area

The following mercury-containing devices commonly found in schools can be managed as universal wastes once you decide to dispose of them:

- mercury fever and laboratory thermometers
- mercury thermostats
- mercury switches
- mercury relays
- mercury gauges: manometers, barometers, vacuum
- mercury thermostat probes
- fluorescent lamps
- mercury vapor lamps
- metal halide lamps
- high pressure sodium lamps

Universal wastes must be stored in a secure area. Wastes should be in double containment (e.g., inside a plastic bag which is inside a plastic container with a tight-fitting lid). Universal Wastes must be labeled "Universal Waste - Name of Waste - Date storage began." Universal wastes can be stored for up to one year.

Universal waste handlers are divided into two categories depending on the amount of universal waste stored:

- Small Quantity Handler - less than 5,000 kg of universal waste on site at any one time. No notification or recordkeeping is required. Most schools fall into this category.
- Large Quantity Handler - 5,000 kg or more total of universal waste on site at any one time. Notification and recordkeeping are required.

Disposing of Waste

All schools must set up a program for the proper disposal of hazardous and universal wastes. It is illegal and unsafe to dispose of these wastes in the regular trash or down the drain. Following are three possible options for disposing of these wastes.

1. Many schools have made arrangements with their communities to dispose of hazardous and/or universal waste during the city or town's household hazardous products collection event. This arrangement can result in a lower cost to the school because the school saves on transportation and labor costs. A VSQG (generating less than 27 gallons per month) can legally transport hazardous wastes to another hazardous waste generator (such as the town department implementing the household hazardous products collection) for disposal by a licensed hazardous waste contractor. The person transporting the waste should be trained in chemical safety and emergency response.

2. Alternately, some schools coordinate hazardous and/or universal waste disposal with another municipal department, possibly saving money on transportation and labor costs.

3. A third option is hiring a hazardous waste contractor. As municipal entities, schools may take advantage of state purchasing contracts with certain vendors that provide waste handling services at a negotiated rate. In order to get the state contract pricing, you must ask for it in your initial contact with the contractors. Reference contract #ST9J213A.

For information on these state contracts, see the Massachusetts Operational Services Division (OSD) publication "Recycled and Environmentally Preferable Products and Services." Visit www.mass.gov/osd/enviro/material.htm, or contact Marcia Deegler at 617-720-3356 or Marcia.Deegler@osd.state.ma.us.

Working with Contractors

In 2001, the Massachusetts state contractor for recycling mercury from mercury devices is:

Superior Special Services
218 Canton Street
Stoughton, MA 02072
ph: (781) 341-6080).

Superior will pick up and recycle the mercury from the following items:

- Mercury fever and laboratory thermometers
- Mercury thermostats
- Mercury switches
- Mercury relays
- Mercury gauges: manometers, barometers, vacuum
- Elemental mercury
- Mercury thermostat probes
- Fluorescent lamps
- Mercury vapor lamps
- Metal halide lamps
- High pressure sodium lamps

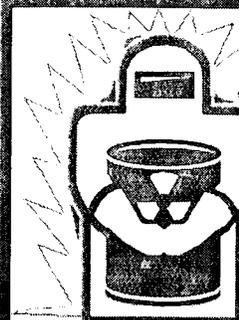
In June 2001, the price for recycling of mercury devices and elemental mercury was \$4.75/pound and fluorescent lights cost 9.5 cents per foot for less than 7500 feet. Containers for storing the mercury devices, pick up and recycling are included in the price. To obtain the state contract pricing, contact Superior (2001 contact Amanda Poverchuk 781-341-6080 x213) and reference state contract #ST7J211. Check the "Recycled and Environmentally Preferable Products and Services" Guide for updated contract information (under Fluorescent Lamps).

Alternately, some of the mercury materials listed above and other mercury chemicals (e.g., mercuric oxide) may be disposed of along with other hazardous wastes using a hazardous waste contractor. The following two companies are currently on the state contract for hazardous waste collection:

Clean Harbors
2001 contact Dave Batagowski
800-282-0058x337

Triumvirate
2001 contact Leah Ross
800-966-9282 x225 or 617-628-8090

Other hazardous waste contractors are also available and obtaining quotes from a few vendors is recommended.



Mercury is widely present in consumer products, and in many cases, less toxic or non-mercury products are available.

Sample Resolution for Mercury-Free Purchasing

A resolution encouraging the purchase of alternatives to products containing mercury.

WHEREAS mercury is a particularly hazardous chemical that does not degrade in the environment; and

WHEREAS once mercury is released into the air it can travel long distances before depositing on water and land with rain or snow, where it pollutes the environment; and

WHEREAS once mercury is ingested by living organisms it can increase in concentration as it is carried up the food chain to fish, animals and humans; and

WHEREAS mercury can cause damage to the nervous system, brain and kidney as well as many other debilitating health effects; and

WHEREAS mercury contamination has led to fish consumption advisories in over 80 Massachusetts waterbodies and in over 2,500 waterbodies in 47 states; and

WHEREAS the Commonwealth of Massachusetts and the New England states have made mercury elimination a priority; and

WHEREAS mercury is widely present in consumer products, and in many cases, less toxic or non-mercury alternatives are available; and

WHEREAS purchasing non-mercury products helps reduce the amount of mercury that eventually enters the waste stream, thereby limiting its adverse impacts on the environment; and

WHEREAS purchasing non-mercury products helps protect the health and safety of the public, workers and students; now, therefore

Be It Resolved: That the (*Your School*) will purchase non-mercury products whenever possible. In cases where a non-mercury alternative is not available or practicable, the School will purchase products containing less mercury where possible. In cases where no non-mercury alternatives are available, the School will include clauses in its purchasing contracts to encourage product manufacturers to take back and recycle used mercury-containing products, and/or commit to recycling these products whenever possible.



Adapted from "Sample Resolution for Mercury-Free Purchasing" prepared by INFORM, Inc. as part of their work on products containing persistent, bioaccumulative and toxic chemicals (PBTs) and safer alternatives.

For additional information, visit their website at www.informinc.org.

Sample Mercury Purchasing Policy

In June of 1998 then Massachusetts Governor Paul Cellucci, as Co-Chair of the Conference of the New England Governors and Eastern Canadian Premiers, adopted a Regional Mercury Action Plan with the goal of virtually eliminating anthropogenic (human-made) releases of mercury to the environment. In July 2000, Environmental Affairs Secretary Bob Durand, Department of Environmental Protection Commissioner Lauren Liss, and Department of Public Health Commissioner Howard Koh released the Massachusetts Zero Mercury Strategy, which stated the goal of virtually eliminating both the use and the release of anthropogenic mercury.



Mercury is toxic to the nervous system, especially of children. Mercury contamination across the state has resulted in fish consumption advisories on over 80 waterbodies in Massachusetts, along with a statewide advisory for pregnant women, women of childbearing age, and children under the age of 12.

As a result of the known environmental and health impacts of mercury, and existing state and regional policies, *(Your School)* will not knowingly purchase any product containing mercury, unless the product is required for school operation and no non-mercury alternative is available, or is part of an energy-efficient lighting system. Should no non-mercury product be available, the school will arrange a take-back or recycling agreement with the vendor or a third party. The item containing mercury will be labeled as such and recycled or disposed of in a responsible manner at the end of its useful life.



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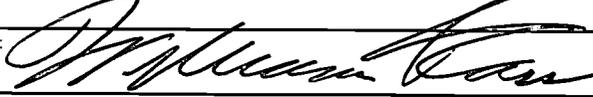
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