

# MERCURY USE: HOUSEHOLDS

Mercury is a versatile metal, and has been used in more than 2,000 commercial and industrial products. Many of these products may be found in the common household in the following settings:

- ✓ Batteries
- ✓ Detergents/ Cleaners
- ✓ Lamps
- ✓ Medical Products
- ✓ Old Paints and Coatings
- ✓ Old Pesticides
- ✓ Switches
- ✓ Thermometers
- ✓ Thermostat Probes

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## Keeping Mercury Out of Wastewater

When a mercury-containing product such as a thermometer is broken over a sink or improperly cleaned up after a spill, the mercury could get flushed down the drain and enter the wastewater stream of a household.

Once mercury enters a wastewater treatment plant, most of it concentrates in wastewater biosolids during treatment. Since most treatment plants dispose of generated solids by land spreading, mercury enters the terrestrial environment by this process. Some of this mercury spread on land may, over time, be volatilized to the atmosphere. This mercury may then be deposited into lakes and streams, methylated, and ingested by fish, eventually reaching wildlife and humans.

To prevent such occurrences, it is important to educate families on proper spill response measures. Instruments or products containing mercury should be labeled and proper procedures should be followed when cleaning, handling, or replacing instruments that contain mercury. Instrument cleaning or refilling should take place in a well ventilated area, and, if possible, over a tray to contain any spills.

Of course, pollution prevention or “source substitution” is the best way to handle mercury use in your household. This simply involves purchasing products that are mercury-free. You will find that many of the mercury-containing items that you may have in your home have safe and effective alternatives that do not contain toxic substances.

## ABOUT THIS HANDOUT

This is one chapter of the “Wisconsin Mercury SourceBook.” The SourceBook was written as a guide for communities to help identify and reduce the purposeful use of mercury. The SourceBook contains background information on mercury contamination and provides a seven-step outline for drafting a mercury reduction plan.

This handout is one of the nineteen sectors that were highlighted in the SourceBook as a potential contributor of mercury in any given community.

### What you will find in this handout:

- ★ Information on mercury-containing products and that are unique to the automotive industry
- ★ Information on mercury-containing products that are found both in the automotive industry and in a wide variety of other sectors (e.g., fluorescent lamps, switches)
- ★ Case studies that describe the source substitution experiences of businesses in the automotive industry
- ★ Action ideas that describe pollution prevention, recycling, and management practices for a mercury reduction plan for a business the automotive industry. This provides a good overview of the types of mercury-containing products and alternatives that may exist in the automotive industry.
- ★ A sample proclamation that explains the mercury issue and possible mercury minimization options for the automotive industry
- ★ Current mercury projects in the automotive industry

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For more information, please contact:

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## WHY SHOULD I BE CONCERNED ABOUT MERCURY?

Some of you may remember playing with mercury when you were a child. Its silvery white shimmer was entrancing, and the ability of its glistening mass to split and come back together again was magical. But scientists are now beginning to realize that there is another side to mercury's wily nature. In fact, it is some of mercury's most elemental qualities that make it a difficult substance to handle.

Mercury is a common element that is found naturally in a free state or mixed in ores. It also may be present in rocks or released during volcanic activity. However, most of the mercury that enters the environment in Wisconsin comes from human uses.

Because mercury is very dense, expands and contracts evenly with temperature changes, and has high electrical conductivity, it has been used in thousands of industrial, agricultural, medical, and household applications.

It is estimated that half of the anthropogenic mercury releases in Wisconsin are the result of the purposeful use of mercury. The other half of mercury emissions originate from energy production.

Major uses of mercury include dental amalgams, tilt switches, thermometers, lamps, pigments, batteries, reagents, and barometers. When these products are thrown in the trash or flushed down a drain, the mercury doesn't go away.

The good news is that the majority of products that use mercury purposefully have acceptable alternatives. For example, electric vacuum gages, expansion or aneroid monitors are good alternatives to mercury blood pressure monitors. Mechanical switches, magnetic dry reed switches, and optic sensors can replace mercury tilt switches.

Replacing mercury-laden products with less toxic alternatives is referred to as *source reduction*. Source reduction allows us to

eliminate the use of mercury in certain waste streams. This is especially beneficial considering the volatile nature of mercury, because mercury can so easily transfer from air to soil to water.

Practicing source reduction in combination with recycling the mercury already in the waste stream can have a significant impact on reducing mercury levels in the environment.

## HEALTH EFFECTS OF ELEMENTAL MERCURY

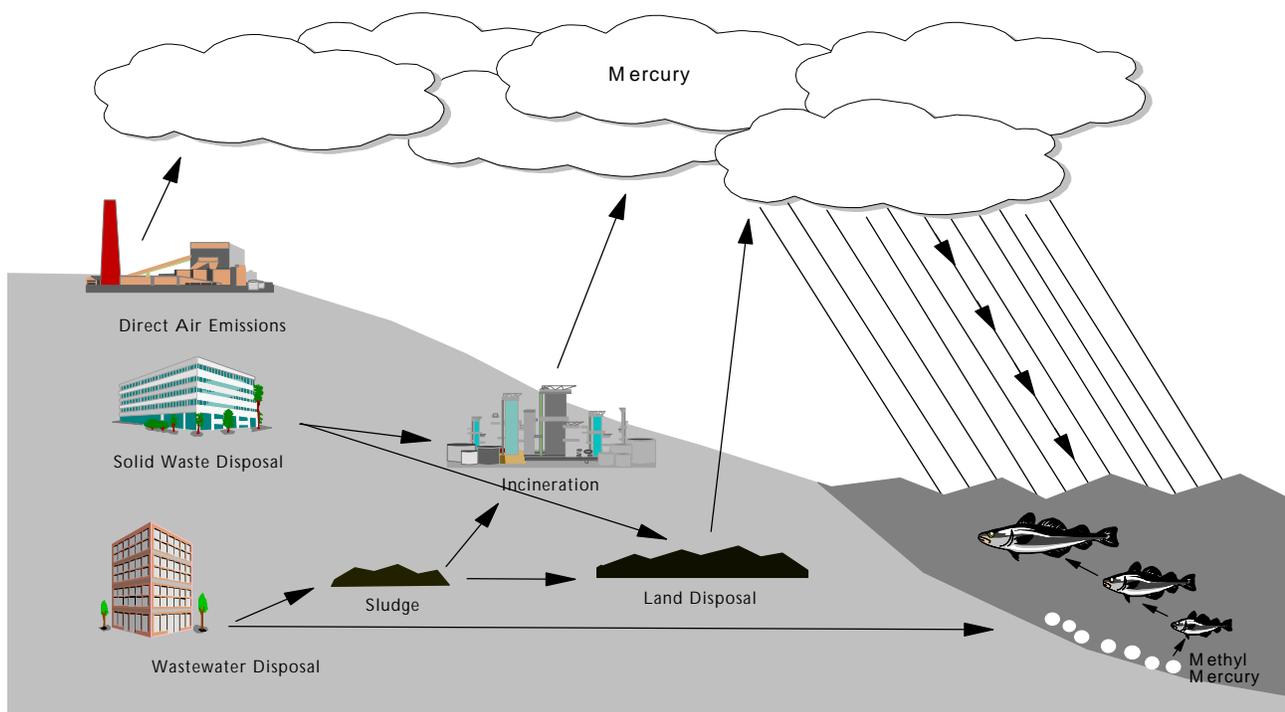
The toxicity of mercury has long been known to humans. Hat makers during the 19th century developed symptoms of shaking and slurring of speech from exposure to large amounts of inorganic mercury, which was used to give a metallic sheen to felt hats. This gave rise to the term "mad as a hatter."

The hat makers were suffering from neurological damage from the inhalation of mercury fumes. Exposure to elemental mercury vapors can cause acute respiratory problems, which are followed by neurologic disturbances and general systemic effects. Acute exposure to inorganic mercury by ingestion may also cause gastrointestinal disturbances and may effect the kidneys.

## SO WHAT'S THE BIG DEAL?

Mercury is a bioaccumulative, persistent, toxic substance that threatens the health of humans and wildlife throughout North America. The USEPA, Environment Canada, the International Joint Commission, the Commission for Environmental Cooperation and many state and provincial governments have identified mercury as one of the most critical pollutants for significant elimination and/or reduction.

## Mercury Transport and Bioaccumulation



Mercury can enter the environment from a number of paths. For example, if a mercury-containing item is thrown into the garbage, the mercury may be released into the atmosphere from landfill vapors or leachate, or the mercury may vaporize if the trash is incinerated. If mercury is flushed through a wastewater system, the mercury will likely adhere to the wastewater sludge, where it has the potential to volatilize and be deposited elsewhere. Mercury can enter the atmosphere through these various means because it evaporates easily. It then travels through the atmosphere in a vaporized state.

Once mercury is deposited into lakes and streams, bacteria convert some of the mercury into an organic form called *methylmercury*. This is the form of mercury that humans and other animals ingest when they eat some types of fish. Methylmercury is particularly dangerous because it *bioaccumulates* in the environment. Bioaccumulation occurs when the methylmercury in fish tissue concentrates as larger fish eat smaller fish. A 22-inch Northern Pike weighing two pounds can have a mercury concentration as much as 225,000 times as high as the surrounding water.

These concentrations are significant when one considers the potential toxic effects of methylmercury. Methylmercury interferes with the nervous system of the human body and can result in a decreased ability to walk, talk, see, and hear. In extreme examples, high levels of methylmercury consumption has resulted in coma or death.

Many animals that eat fish also accumulate methylmercury. Mink, otters, and loons in Wisconsin have been found to have high levels of mercury in their tissue. Mercury can interfere with an animal's ability to reproduce, and lead to weight loss, or early death.

### Fish Consumption Advisories

There are currently 260 lakes and more than 350 miles of rivers in Wisconsin that have fish consumption advisories because of mercury.

Approximately 1 out every 3 sites that is tested is listed on the advisory; no sites have ever been removed. Forty-eight states now issue fish consumption advisories to protect human health. Most of these warnings are related to mercury contamination.

## Mercury Product Focus: Batteries

### ✓ Mercuric Oxide Batteries

Prior to the 1980s, most primary batteries and some storage batteries contained mercury in the form of mercuric oxide (HgO), zinc amalgam (Zn-Hg), mercuric chloride (HgCl<sub>2</sub>), or mercurous chloride (Hg<sub>2</sub>Cl<sub>2</sub>). Although the amount of mercury used in each of these batteries was very small, the number of batteries sold in the US was enough to make alkaline batteries the largest component of mercury in the solid waste stream in 1989.

Great pollution prevention progress has been made in this field. In the last decade, the US battery industry has achieved a 99 percent reduction in their use of mercury! The use of alternative materials and different manufacturing techniques have eliminated the use of mercury in almost all battery applications.

Mercury does exist in mercury zinc, carbon zinc, silver oxide, and zinc air batteries. The amount of mercury discarded in mercury zinc batteries is expected to decline in the future as the use of silver oxide and zinc air batteries increases. The use of mercury in zinc air and silver oxide batteries is expected to be discontinued.

Today, mercuric oxide batteries are the only batteries that use mercury to any measurable

degree. There are two basic types of mercuric oxide batteries: button cell and larger sizes. The button cell batteries are the types that are most often sold for personal use; they are used in hearing aids, watches, and other items requiring a small battery.

Mercuric oxide batteries offer a reliable and constant rate of discharge. Therefore, the larger mercuric oxide batteries (which look like 9-volt or fat AA batteries) are often used in military, hospital, or industrial uses. The mercury content in these mercury oxide batteries total 33 to 50 percent mercury by weight of the battery.

### 1993 Wisconsin Act 74

The 1993 Wisconsin Act 74 prohibits the sale in Wisconsin of any alkaline manganese battery manufactured after January 1, 1996, unless the manufacturer can prove that the alkaline manganese battery contains no intentionally introduced mercury. Alkaline manganese button cells can only be sold if they contain no more than 25 mg of mercury.

Zinc Carbon batteries manufactured after July 1, 1994 for sale in Wisconsin must contain no intentionally introduced mercury. Beginning July 1, 1994 mercuric oxide batteries, except button cells, may not be sold in Wisconsin unless the manufacturer identifies a collection site that meets prescribed standards, informs each purchaser of the collection site and a telephone number to call for information on recycling batteries, and informs the Department of Agriculture, Trade, and Consumer Protection and DNR of this collection site. The law also states that only a certified collection site may treat, store, or dispose of mercuric oxide batteries, and they must be recycled if possible.

## Batteries and Mercury Content

From "Household Batteries Waste Management Study," by Gershman, Brickner, and Bratton, Inc., 1992; "Managing Used Dry-Cell Batteries: A Household Hazardous Waste Fact Sheet," MPCA

Type of Battery	Example of Use	Mercury Content
<b>Alkaline</b>		
Cylindrical or rectangular cells; the most commonly recognized battery. Labeled "alkaline."	Flashlight, radios, toys, calculators, remote controls, electronic games, portable radios and televisions, garage door openers.	Previously contained an average of 0.5 percent mercury to control the zinc reaction. 1993 Wisconsin Act 74 mandates that all alkaline manganese batteries sold in Wisconsin after January 1, 1996 be mercury free. Alkaline manganese button cell batteries to contain no more than 25 milligrams of mercury .
<b>Zinc Carbon</b>		
Cylindrical or rectangular cells; labeled as "General Purpose", "Heavy Duty", or "Classic"	Best used in slow drain applications like clocks, garage door openers, pagers, and smoke detectors. Have much shorter life span than Alkaline batteries.	Use of mercury in these batteries is being phased out. 1993 Wisconsin Act 74 mandates that all zinc carbon batteries for sale after July 1, 1994 be mercury free.
<b>Silver Oxide</b>		
Button shaped with no distinguishing marks	Watches, calculators, toys, greeting cards, musical books	Contain about one percent mercury by weight. Mercury use in these batteries is expected to be discontinued.
<b>Zinc Air</b>		
Usually button shaped. Identify by pin hole on one side	Hearing aids	Contain about one percent mercury by weight. Mercury use in these batteries is expected to be discontinued.
<b>Mercury Zinc (Mercuric Oxide)</b>		
Button shaped, marked with + ; larger mercuric oxide batteries look like 9-volt or fat AA batteries	Hearing aids, watches, and other items requiring a small battery. In consumer applications, mercuric oxide batteries are being replaced by zinc-air button cells.  The larger mercuric oxide batteries are often used in military, hospital, or industrial uses.	Contain significant amounts of mercury ; total 33 to 50 percent by weight of the battery.  Wisconsin Act 74, requires a collection system for those selling mercuric oxide batteries, and requires the recycling of mercuric oxide batteries unless no reasonable alternative exists.

## Mercury Product Focus: Detergents and Cleaners

The Massachusetts Water Resources Authority (MWRA), in conjunction with MASCO (a consortium of Longwood Medical and Academic Area Institutions), has been working with their area hospitals and academic institutions to identify and address the problem of mercury contamination in hospital and medical waste streams. As part of this process, the MWRA group also worked to identify “other sources” of mercury contaminants. These are common products, such as bleach, alcohol, laboratory lids, not otherwise thought to be of significant importance or concern, that might contain low levels of mercury. Thus far, a total of 118 products has been identified by this team. This information is applicable in a variety of settings.

### “Other Sources of Mercury”

*Information from the Massachusetts Water Resources Authority/MASCO*

Product	Mercury Content (ppb)
Ajax Powder	0.17
Comet Cleaner	0.15
Lysol Direct	<0.011
Soft Scrub	<0.013
Kodak Fixer	6.9; 3.7
Kodak Developer	2.65; 6.0
Alconox Soap	0.004 mg/kg 0.005 mg/kg <0.0025 mg/kg
Derma Scrub	<5.0 <2.5
Dove Soap	0.0027
Ivory Dishwashing Liquid	0.061
Joy Dishwashing Liquid	<0.01
Murphy’s Oil Soap	<0.012
Soft Cide Soap (Baxter)	8.1
Sparkleen Detergent	0.0086
Sunlight Dishwashing Detergent	<0.011

## Mercury Product Focus: Lamps

- ✓ fluorescent
  - bilirubin blue
  - general purpose straight, U-bent, circline, compact
  - high output
- ✓ germicidal lamps
  - cold cathode
  - hot cathode
  - slimline
- ✓ metal halide
- ✓ high pressure sodium

There are a number of electric lamps that use mercury as an intrinsic part of their functioning. These lamps include fluorescent, mercury vapor, metal halide, and high pressure sodium lamps. These lamps may be used indoors or outdoors in heat lamps, film projection, photography, dental exams, photochemistry, water purification, or street lighting.

Fluorescent lamps contain mercury in a vapor form. The electric current of the lamp “excites” the mercury atoms, which then give off invisible ultraviolet light. The ultraviolet light then “excites” a powdery phosphorus coating inside the tube that emits visible light. The mercury that is contained in these lamps is emitted into the atmosphere when the lamps are broken, disposed of in landfills, or incinerated.

Fluorescent lamps are still a good option. They last longer and cost

less to run than incandescent lights because they use up to 50 percent less electricity. This energy savings helps reduce mercury emissions because small amounts of mercury are present in coal that is burned in power plants. The less energy we use, the less mercury will be released into the environment when coal is burned.

Phillips Electronics has developed a long-life fluorescent that contains so little mercury it is no longer considered a hazardous waste. “Typically fluorescent lamps have an overabundance of mercury, because mercury loses its effectiveness due to physical and chemical reactions. So manufacturers put in an overdose of mercury to compensate for these reactions,” said George Preston, a scientist at Philips Lighting Co. Currently, a four-foot lamp contains about 22.8 milligrams of mercury, down from 38.4 milligrams in 1990. Philips’s new lamp contains less than 10 milligrams of mercury. The new lamp, named ALTO™, relies on a “buffering mechanism” that blocks the physical and chemical reactions that cause the mercury to lose its effectiveness over time. The lamp also uses a new form of phosphors patented by Philips.

*-From “Philips Unveils a Fluorescent Lamp With Less Mercury and a Long Life,” Wall Street Journal, June 9, 1995*

## Recycling Your Fluorescent Lamps

Several Wisconsin companies are in the business of recycling fluorescent lamps and incandescent bulbs. The copper coils, and aluminum or brass end pieces are smelted and reused as raw materials for non-food products. The glass can be purified and used to make fiberglass. The mercury is distilled from the phosphor powder and reused in new lamps and thermometers.

State hazardous waste regulations prohibit businesses from disposing of waste lamps and light bulbs in sanitary landfills if those lamps and bulbs contain levels of heavy metals that exceed hazardous waste limits. For information on the storage, collection, and transport of fluorescent lamps, please see the informational handout, "Recycling Your Fluorescent Lamps," in the "Resources" section of this sourcebook.

## Types of Bulbs and Lamps that Contain Mercury

- ◆ **Fluorescent Lamps** - the tube-style were first used as overhead lighting in offices, now they also come in compact globe shapes for a variety of home and office uses
- ◆ **Mercury Vapor Lamps** - the first high intensity discharge (HID) lamps with blue-white light, originally used as farmyard lights
- ◆ **Metal Halide Lamps** - newer, more efficient HID lights found in homes and offices
- ◆ **High-Pressure Sodium Vapor Lamps** - white-yellow HID lights used for street lamps and outdoor security lighting
- ◆ **Neon Lamps** - brightly colored lamps typically used in advertising; most colors contain mercury except red, orange, and pink

- *From the Wisconsin Recycling Markets Directory*

## Mercury Product Focus: Medical Uses

*John Gilkeson of the Minnesota Pollution Control Agency has been working on a project to identify mercury use in products. Here is what he reports finding about mercury use in medical products:*

Mercury use in human drugs and biological products is regulated by the Food and Drug Administration (FDA). For topical and over the counter (OTC) products, the FDA is preparing several Final Rules that will likely eliminate mercury use from these products. These Final Rules will limit mercury to prescription medications and require that they go through the New Drug Approval (NDA) process to ensure safety and efficacy. It is quite likely that manufacturers will simply withdraw the mercury-containing products from the market rather than go through the approval process. Current prescription medications will also need to go through the NDA process in the near future in order to remain on the market, and manufacturers will likely withdraw these also.

A Freedom of Information Act request was submitted to the FDA to obtain product names, manufacturers and concentrations in biologic products. The FDA supplied the requested product name and manufacturer information. Thimerosal is used primarily in Hemophilus, hepatitis, rabies, tetanus, influenza, diptheria, and pertussis vaccines.

For OTC products, thimerosal, phenylmercuric acetate, phenylmercuric nitrate, and a few other compounds are still in use as preservatives. Primary uses are in ophthalmic products, contact lens solutions, and nasal sprays. Topical antimicrobials (e.g., tincture of merthiolate) can still be sold, but they have largely disappeared from the market. A mercuric preservative (PMN) was used until quite recently in one brand of hemorrhoid products. The availability of many similar or otherwise identical products without mercury preservatives indicates that mercury use in these products is not essential.

Mercury was used commonly in conventional medicine well into the 1980's. However, virtually all uses have been discontinued and the few remaining uses are likely to be knocked out by the requirements of the New Drug Approval process which requires a manufacturer to demonstrate that the medication is safe and effective. Mercury is acutely and chronically toxic at levels of parts per million and parts per billion, respectively, if there is continuous intake. Moreover, mercury used in medication will be excreted and will contribute to the global pool of mercury.

### Medical/Pharmaceutical Use of Mercury - Human Contact

*Information from The Minnesota Pollution Control Agency*

Product	Notes
Diuretic	Mersalyl and salts are still manufactured. Extent of use unknown
Eye area cosmetics	Up to 65 ppm mercury (preservative)
Hemorrhoidal ointments and creams	Preservative, discontinued early 1995
Merbromin/water solution	Used in plastic/reconstructive surgery as a disinfectant and marker
Mercuric chloride peritoneal lavage in cancer surgery	Great Britain
OTC ophthalmic and contact lens products	Preservative
OTC disinfectants	"Mercurochrome" [merbromin], tincture of Merthiolate; both are alcohol solutions
OTC nasal sprays	Preservative
Skin bleaching creams	OTC discontinued in US by early 1970s, available by prescription?
Teething powder	Discontinued in early 1950s
Vaccines and other biologic products	US FDA has responded to FOIA request

## Homeopathic Remedies

Homeopathy's roots go back almost 200 years, to a time when mercury and its compounds were freely used for many purposes. A number of compounds are used, typically in dilutions of 6x to 12x. This means that the remedy contains  $1 \times 10^{-6}$  to  $1 \times 10^{-12}$  parts of the mercury compound. Two companies have provided information from various *Materia Medica*, as the homeopathic formularies are known. One of these formularies identifies seventeen mercury compounds that are used in homeopathic medicine. A commonly used substance is mercurius solubilis, which is "mercurous amide nitrate with varying amounts of mercuric oxide and metallic mercury." In homeopathic medicine, substances are chosen on the basis of the symptoms they generate at "high" doses in "provings," a type of double blind study. Then a very low concentration of the substance is used to remedy that same symptom of interest, regardless of the symptom's cause. This methodology causes a potential pitfall in the use of mercury. As many researchers have noted for hundreds of years, the toxic effects of mercury are "protean." Mercury poisoning is extremely difficult to diagnose because it can manifest itself in so many different kinds of symptoms, most of a general or systemic nature. Mercury can cause inflammation of nearly every organ or system in the body. As a result, one could justify, under the homeopathic philosophy, the use of mercury to treat a multitude of symptoms. This could occur regardless of whether mercury has any homeopathic or conventional therapeutic value or whether there is a safer and comparably effective homeopathic alternative.

## Spiritist Use

The USEPA is currently developing a partnership with the Chicago Department of Public Health to research the religious use of mercury in the Haitian and Caribbean communities in Chicago. USEPA staff were easily able to purchase mercury ("Azogue") in religious goods stores ("Botanicas") to verify that it is easily available. This group has identified a number of unsafe household uses of mercury that may be widespread:

- \* sprinkling or spreading mercury in the house or car
- \* mixing mercury with water or other liquids and using this mixture as a washing solution in the home
- \* burning mercury in candles for good luck (white magic)
- \* swallowing mercury as a folk remedy to treat constipation, colic, or stomach ache (empacho)
- \* carrying it as a charm

There are many risks associated with these religious or folk medicinal uses of mercury. The inhalation of mercury fumes can cause serious lung damage and even death. Elemental mercury vapor also effects the central nervous system and the kidney. A particularly severe manifestation of mercury poisoning is a syndrome known as acrodynia that occurs almost exclusively in children. Symptoms of acrodynia include apathy, anorexia, fever, kidney damage, and most characteristically, a painful blistering and peeling of the skin on the hands and feet.

(source: grant proposal)

## Mercury Product Focus: Paints and Coatings

*Information from M2P2*

In 1989, a four year old boy was diagnosed with acrodynia, a rare manifestation of childhood mercury poisoning, from the inhalation of mercury fumes released from latex paint application. In response to pressure of a USEPA mandatory cancellation of mercury in latex paints, there was a national voluntary cancellation of all product registrations for mercury in interior latex paints. In 1991, the cancellation was extended to mercury in exterior latex paints.

Although the voluntary ban on mercury in interior and exterior latex paints has been in place since 1991, you should check your house for old paint stockpiles for paint manufactured before August 1990. If you do have some of this paint, take it to a clean sweep site or be sure to use it only for exterior use.

## Mercury Product Focus: Pesticides

*Information from the MPCA*

Mercury was traditionally used in agricultural chemicals as a fungicide, mildewcide, or pesticide. All food uses of mercury-containing pesticides were cancelled in 1969, and all US pesticide registrations were canceled in as of early 1995. The last four uses to be cancelled were turf fungicide, mildewcide for fresh cut wood, latex paint fungicide/preservative, and outdoor fabric treatment. However, many mercury-containing chemicals may still be present in the form of old stockpiles. These materials should be targeted by waste pesticide collection programs or clean sweep programs to prevent further emissions to the environment.

John Gilkeson of the Minnesota Pollution Control Agency began his extensive inventory of mercury-containing products through an examination of mercury used in pesticides. He has developed a list of over 150 trade and chemical names of pesticides used between the 1950's and present that contain mercury. Please see the "agriculture" chapter for a list of these materials.

## Mercury Product Focus: Switches

Mercury tilt switches may be used in a variety of home applications

(From Gilkeson):

- ✓ building security systems (tilt and trembler devices)
- ✓ cameras (still, video, film: overridable position sensor to protect CCD from sunlight damage)
- ✓ chest freezer switches (for light)
- ✓ electric organs (non-keyboard controls such as tone)
- ✓ electric space heaters (safety shut-off)
- ✓ fishing lure
- ✓ ice fishing tip-up light
- ✓ lap-top computer (screen shut-off when closed)
- ✓ lawn/tractor riding mower fuel level indicator
- ✓ outboard motors (safety shut-off)
- ✓ portable phone (mute/privacy switch when phone is in horizontal position)
- ✓ silent wall switches (manufactured before 1991)
- ✓ steam irons (safety shut-off)
- ✓ security system applications (various products where movement of a “momentary contact” switch can trigger an alarm)
- ✓ septic systems/sump pumps
- ✓ temperature control

- ✓ thermostats
- ✓ washing machine lids (spin cycle shut-off)

Another source of mercury that homeowners may encounter is mercury switches. A small electrical switch may contain 3,500 milligrams of mercury; industrial switches may contain as much as eight pounds of mercury. Mercury is used in temperature-sensitive switches and in mechanical switches. The mechanical (tilt) switches are activated by a change from a vertical to a horizontal position. These are used in products like thermostats and silent switches. Mercury-containing tilt-switches may also be present in or under the lids of clothes washers and chest freezers - they stop the spin cycle or turn on a light. Mercury tilt switches are also found in motion-sensitive and position sensitive safety switches in clothes irons or space heaters. If a mechanical switch is not visible in these items, a mercury switch is probably being used.

Mercury tilt switches have been used in thermostats for more than 40 years. According to Honeywell, Inc., a major manufacturer of thermostats, more than 50 million mercury-containing thermostats have been sold since the 1950s for use in homes and offices. Mercury in these thermostats provide accurate and reliable temperature control, require little maintenance, and do not need a power source. However, each mercury switch in a thermostat contains about 3

grams of mercury. (There may be one or more of these switches in a single thermostat, each switch in a sealed glass bulb.) Alternatives to these products include electronic thermostats, which can be programmed to set room temperatures at predetermined times. (*blue brochure: the waste connection*)

Float control switches may be used in septic tank and sump pumps to turn the equipment on and off when water is at a certain level. Often, these switches are visible. Temperature-sensitive switches may be used in thermostats. Yet another type of mercury switch, the plunger or displacement relay, is used in high current, high voltage applications that could include lighting, resistance heating, or power supply switching (*M2P2*).

## Reduction Works!

Honeywell Corporation has been running a free take-back program in Minnesota to collect any brand of used mercury-containing thermostat through either a reverse distribution system or a recycle by-mail system.

Honeywell works with heating, ventilating, and air-conditioning (HVAC) wholesalers who sell their products. Honeywell has one license (called a network license) for all the wholesalers who are participating as a consolidation point for the thermostats. HVAC wholesalers contact their Honeywell customer service representatives to order containers for used thermostats, and Honeywell sends the wholesaler a plastic container with an attached lid that holds 100 thermostats.

Homeowners who replace their own thermostats without contractor assistance or with contractors who are not currently participating in the Honeywell program may recycle their thermostats through the free recycle-by-mail system. These individuals can call a toll-free number to receive a free postage paid thermostat mailer.

## Mercury Switches in Electrical Applications

(source: Michigan Mercury Pollution Prevention Task Force, 1996)

Switch	Quantity of Mercury	Available Alternatives
<b>Tilt Switch</b>		
· Thermostats	3,000 - 6,000 mg	Electronic type and snap switches
· Float Control (septic tank and sump pumps)	?	Magnetic dry reed switch, optic sensor, or mechanical switch
· Freezer Light	2,000 mg	Mechanical switch
· Washing Machine (power shut off)	2,000 mg	Mechanical switch
· Silent Switches (light switches prior to 1991)	2,600 mg	Mechanical switch
<b>Thermo-Electrical Applications</b>		
· Accustat ("mercury in glass thermostat," a calibrated device resembling a thermometer is used to provide precise temperature control for specialized applications)	~ 1,000 mg	?
· Flame Sensor (used in residential and commercial gas ranges, mercury is in capillary tube when heated mercury vaporizes and opens gas valve or operates switch. Used for both electrical or mechanical output.)	2,500 mg	Hot surface ignition system for devices or products that have electrical connections.

## Mercury Product Focus: Thermostat Probes (also known as mercury thermocouples)

*(from blue waste connection pamphlet + draft text)*

### Mercury flame sensors or safety valves

- ✓ some ovens/ranges (Robertshaw and Harper-Wyman)
- ✓ some unit heaters (Robertshaw and Harper-Wyman)
- ✓ Some furnaces (White Rodgers)

Stainless steel bulb, capillary tube, bellows/control device: Used for “unsupervised burners” in certain gas fired devices with standing pilot or electronic ignition pilot.

Mercury-containing thermostat probes may be found in several types of gas-fired appliances that have pilot lights such as ranges, ovens, clothes dryers, water heaters, furnaces, or space heaters. The metal probe consists of a metal bulb and thin tube attached to a gas-control valve. The mercury is inside the tube and expands or contracts to open and shut the valve. A high percentage of gas stoves, ovens and space heaters contain a mercury thermostat probe. Electric stoves

and hot water heaters (gas, electric, and oil) may contain mercury thermostat probes. Although non-mercury thermostat probes have been used in these appliances, you should treat all probes as though they contain mercury, unless you know that they do not.

Mercury thermostat probes, also known as flame sensors or gas safety valves, are most commonly present as part of the safety valve that prevents gas flow if the pilot light is not lit. In this application the bulb of the thermostat probe projects into or near the pilot light. These are commonly present in gas ovens and may be present in any other appliance with a pilot light.

A mercury-thermostat probe may also be present as part of the main temperature controlling gas valve. In this application, the probe is in the air or water that is being heated and is not directly in contact with any flame. These are typically found in older ovens, clothes dryers, water heaters, or space heaters.

## Mercury Product Focus: Temperature Measurement and Sensing Devices

### Thermometers

- ✓ candy/deep fry thermometers
- ✓ fever thermometers
- ✓ oven thermometers
- ✓ weather thermometers

Digital or aneroid thermometers are good alternatives for most applications of mercury thermometers.

## Other Uses of Mercury in a Home Environment

Other products that may be found in a household rely on the mechanical properties of mercury (mercury is a fluid metal that has high density and low friction):

- ✓ archery bow stabilizer (two models: 6" 8 oz.; 10" 11 oz. "Neutralizer")
- ✓ DC watt hour meters (eg., Duncan, no longer manufactured but may still be in use)
- ✓ weight/counterweight in grandfather clocks

Still other mercury-laden products can be found in the home. This time mercury was introduced in toys:

- ✓ Quicksilver Maze toy
- ✓ Shoes that light up (LA Gear's "My Lil' Lights" if bought before June 1994)

There are two laws in Wisconsin that relate to mercury. The first, the battery law discussed above, limits the amount of mercury in batteries that can be sold in Wisconsin. The second law relates to mercury use in toys. It is now illegal to sell the Quicksilver Maze toy in Wisconsin. Shoes that light up are now made with mercury-free alternatives.

## Household Contributions to Residential Greywater

*The Central Contra Costa Sanitary District in California has carried out a residential metals study to determine household contributions to residential greywater. The following is, in part, an excerpt from that study.*

### Percent contributions of Significant Sources of Mercury to CCCSD Residential Greywater

Supply Water	5%
Laundry greywater	28%
Thermometers	13%
Food Wastes	2%
Human Wastes	33%
Other household products	4%

The laundry greywater figure assumes an average of 300 gallons of greywater per household per week. It does not include detergent effects. Significantly higher levels of mercury were found in color laundry greywater than in white laundry greywater. This may be attributable to the fact that clothing dyes, which are often metallically-based, often leach out during laundering (as evidenced by the fact that clothes fade after repeated washing). Another explanation may be that colors are more often outer clothing, while whites are often linens and underwear. Outdoor clothing is more likely to be exposed to dirt, and may also have metal fixtures. Some of the mercury in laundry greywater may also be attributed to mercury based mildewcides or fungicides that may be applied to clothing in developing countries prior to shipping to the United States.

A survey carried out by CCCSD employees found that 17 of 129 respondents reported breaking mercury thermometers in the past year. Of those, two respondents (1.6% of the total) disposed of the materials into a sink or toilet. While these results are based on a relatively small sample with its inherent limitations, they were used to estimate the effect of improper disposal of mercury from this source. A typical mercury thermometer contains 0.5 grams of mercury. The survey results were expanded to the service area on a per household basis (i.e., 1.6% of 110,000 households discarding one thermometer to the sewer in the past year).

Human wastes were based on a Seattle Metro study and adjusted for CCCSD service area on a per capita basis. This may be attributable to the fact that there is a half life of methylmercury in the human body (of about 70 days). For example, once a person eats a fish that is contaminated with methylmercury, it will take the body 70 days to eliminate half of the load consumed (if no more methylmercury is ingested during that period).

The figure for "other household products" was based on values from Seattle Metro (1993). This includes laundry and dish products, general purpose cleaners, soaps, hair products, and toilet tissue.

## What Are My Exposure Risks?

*from Mercury in Michigan's Environment*

Potential sources of exposure to mercury for the general population include inhalation of the compound in ambient air, ingestion of contaminated water and food, and dental and medical treatments.

A multimedia analysis of exposure to mercury in Canada has demonstrated that food consumption appears to be the most significant route of exposure to both methylmercury and Hg (II). Fish and shellfish are the single greatest contributor of methylmercury. This study also indicated that dental amalgams are the most significant source of exposure to total mercury, contributing 17 to 42% of total mercury absorbed for age groups greater or equal to 5 years of age. However, the levels of mercury found in urine and other tissues of the body likely associated with an average number of filled teeth does not approach levels associated with toxic effects.

### Fish Consumption

*from charlene drumm:*

The most common route for methylmercury to reach humans is through consumption of contaminated fish products. Even though levels in some fish populations are high (>1 ppm), repeated consumption is required to dramatically elevate human blood levels to the point of toxicity. This requirement narrows the adult risk group substantially to include only those who eat a lot of fish for ethnic and/or economic reasons. For example, one study on

Chippewa Indians found that fish consumption was highest in unemployed males and tried to correlate human blood levels to the species of fish consumed.

### Workplace Exposure

*from Mercury in Michigan's Environment*

In 1980 and 1983, The National Institute for Occupational Safety and Health (NIOSH) indicated that 67,551 workers, including 21,153 women, in 2,877 workplaces were potentially exposed to mercury in the workplace in 1980. Most of the exposed workers were employed in the health services, business services, special trade contractors, and in chemical and allied products industries as chemical technicians, science technicians, registered nurses, and machine operators. The use of fluorescent tube compactors may also expose workers in adjacent areas or those working the compactors to increased levels of mercury if proper filters, scrubbing devices, and ventilation are not used. These estimates were derived from observations of the actual use of mercury (97% of total estimate) and the use of trade-name products known to contain the compound (3%).

Workplace environments presenting the largest potential sources of occupational exposure to mercury include chlor-alkali production facilities, cinnabar mining and processing operations, and the manufacture and use of instruments containing liquid mercury. Previous estimates of occupational exposure identified clinical laboratory technologists and technicians, machine operators, stock handlers, grinding machine operators,

autobody repairmen, and miscellaneous mechanics and repairmen as the largest potential sources of occupational exposure to mercury exposure.

The principal route of occupational exposure to mercury is vapor phase inhalation of mercury from workplace atmospheres. Exposure of mercury may result from mercury transported to the home on clothes from individuals occupationally exposed to mercury. Increased exposure to mercury has also been reported in children of occupationally exposed workers. Children whose parents work in facilities that use mercury but do not wear protective uniforms or footgear are most at risk because the mercury may be transferred to the worker's home on clothing or shoes.

### Other Exposure Factors

Persons using skin lightening creams and soaps containing mercury are exposed to higher levels of mercury than the general populations (still in use?). The use of other products containing mercury, such as laxatives and antimicrobial agents, can also lead to increased exposure. Two cases of chronic mercury exposure have been reported from laxative abuse. Increased exposure to mercury has also been reported from accidental causes, such as broken thermometers and the misuse of mercury as a cleaning agent.

### Florida Children Play Dangerous Game with Mercury

August 1994- More than 500 students in Belle-Glade, Florida were contaminated with liquid mercury after three boys found four jars filled with the silvery metal in an abandoned van. The boys brought the jars of mercury to school and passed it out to their friends. The students played with the mercury, rubbing it on their teeth, throwing it at each other, dipping their jewelry in it, and pouring it into a local canal. Many children took home samples in paper cups and bags.

Hundreds of children had to be decontaminated. The local hazardous waste materials team, dressed in yellow safety suits, stood the children in a wading pool, hosed their arms, and scrubbed their skin with brushes. Doctors at area hospitals were on call 24 hours a day for several days to examine children and adults exposed to the mercury and to give free blood tests. More than 20 homes had concentrations high enough to be of concern to the USEPA. Families had to be evacuated while the EPA decontaminated these homes.

A hospital spokesperson said that he did not think any children had come into contact with enough mercury to cause any serious damage. No permanent damage to the children is expected.

In 1989, four people died in Lincoln Park, Michigan when one of the individuals attempted to recover silver from dental amalgams through a home smelting process. This released mercury throughout the home in lethal amounts. All four of the individuals died from mercury poisoning within 11-24 days after exposure.

## ACTION STEPS FOR HOUSEHOLDS TO CONSIDER

### Pollution Prevention

- ✓ Never use mercury fishing lures or ice-fishing tip-ups that contain mercury.
  - ✓ Substitute zinc air or silver oxide batteries for your mercuric oxide (mercury-zinc) batteries.
  - ✓ When remodeling or replacing old equipment, replace thermostats containing mercury switches with thermostats containing electronic type and snap switches, and replace “silent” light switches with mechanical light switches.
  - ✓ Additionally, check for these other products that may contain mercury switches and consider mercury-free alternatives when remodeling or replacing old equipment:
    - building security systems (tilt and trembler devices)
    - cameras (still, video, film: overridable position sensor to protect CCD from sunlight damage)
    - chest freezer switches (for light)
    - electric organs (non-keyboard controls such as tone)
    - electric space heaters (safety shut-off)
    - lap-top computer (screen shut-off when closed)
    - lawn/tractor riding mower fuel level indicator
    - outboard motors (safety shut-off)
    - portable phone (mute/privacy switch when phone is in horizontal position)
    - steam irons (safety shut-off)
    - security system applications (various products, including automotive, computer lockdowns, and other applications where movement of a “momentary contact” switch can trigger an alarm)
    - washing machine lids (spin cycle shut-off)
    - archery bow stabilizer (two models: 6" 8 oz.; 10" 11 oz. “Neutralizer”)
    - DC watt hour meters (eg., Duncan, no longer manufactured but may still be in use)
    - weight/counterweight in grandfather clocks
- Mercury flame sensors or safety valves
- some furnaces (White Rodgers)
  - some ovens/ranges (Robertshaw and Harper-Wyman)
  - some unit heaters (Robertshaw and Harper-Wyman)
- ✓ Use mercury-free thermometers. Digital and alcohol based models are good alternatives.
  - ✓ Purchase septic tank and sump pumps that contain magnetic dry reed switches, optic sensors, or mechanical switches instead of mercury tilt switches.

- ✓ Chose mercury-free alternatives to the following medical products. Look for these mercury-containing compounds on the bottles and avoid them.
  - diuretics
  - eye area cosmetics
  - contact lens solutions
  - disinfectants
  - nasal sprays
  - homeopathic medications
  
- ✓ Check your house for any old paints manufactured before August 1990. These paints may contain mercury.
  
- ✓ Check your house for any old stockpiles of mercury-containing pesticides. If you find any, take them to a clean sweep site.

## Recycling

- ✓ Recycle your mercury-zinc button batteries. Call your local solid waste department about collection options.
  
- ✓ Continue to use fluorescent lamps! Even though fluorescent lamps contain mercury, they are a good choice because they use much less energy than regular bulbs. Consider the use of low-mercury fluorescent lamps; recycle your fluorescent lamps currently in use. Try not to break these lamps because some of the mercury will escape into the air.
  
- ✓ If you have an old toy that contains mercury, such as the “Quicksilver Maze” toy, or shoes that light up (LA Gear’s “My Lil’ Lights” if bought before June 1994), take them to a clean sweep site.
  
- ✓ Recycle any other mercury-containing products in your home by taking them to the local clean-sweep site

## Good Management Practices

- ✓ What to do with spill
  
- ✓ Educate children about the dangers of mercury.

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## *Current Mercury Work – Household*

Collection Programs	
<b>Project:</b>	<i>Household Hazardous Waste Collection Program</i>
<b>Description:</b>	Collection, transportation and disposal of agricultural and household hazardous wastes in MI, MN, and WI in 1995
<b>Agencies working on this project:</b>	MDEQ MPCA/OEA WDNR
<b>Project:</b>	<i>Minnesota-Wisconsin Household Hazardous Waste Collection</i>
<b>Description:</b>	WLSSD will run a permanent household hazardous waste collection facility for WI and MN residents
<b>Agencies working on this project:</b>	WLSSD
<b>Project:</b>	<i>NW Wisconsin Permanent Household Hazardous Waste Collection Center</i>
<b>Description:</b>	Mobile collection service for northwest Wisconsin counties
<b>Agencies working on this project:</b>	NW (WI) Regional Planning Commission
General Outreach/Research	
<b>Project:</b>	<i>MercAlert</i>
<b>Description:</b>	Mercury education and waste reduction program focusing on dentists and the general public
<b>Agencies working on this project:</b>	WLSSD
<b>Project:</b>	<i>Mercury Reduction Reduction for Tribes</i>
<b>Description:</b>	EPA is in the process of finalizing an \$85,000 grant award under the Environmental Justice through Pollution Prevention grant program to a group in Minnesota to work on mercury reduction for tribes in MN, WI, MI
<b>Agencies working on this project:</b>	MPCA/OEA
<b>Project:</b>	<i>Mercury and PCBs: Outreach and Collection</i>
<b>Description:</b>	Outreach and collection program with a pilot collection program in the Lake Superior basin
<b>Agencies working on this project:</b>	MPCA/OEA
<b>Project:</b>	<i>Public Awareness Campaign for Lake Superior and Lake Michigan</i>
<b>Description:</b>	Unified pollution prevention public awareness campaign; developed literature
<b>Agencies working on this project:</b>	IDEM MDEQ MPCA/OEA WDNR

## *Current Mercury Work – Household*

### General Outreach/Research

**Project:** *Public Education/Awareness*

**Description:** As part of Detroit's Mercury minimization Program, DWSD is implementing community awareness programs that encourage proper disposal of contaminants. P<sup>2</sup> program for households.

**Agencies working on this project:**

Detroit Water and Sewerage Department