



Conducting an Internal Mercury Audit for Manufacturing Facilities

Why Conduct an Internal Mercury Audit?

- *Comply with environmental regulations*

Internal mercury audits are important for manufacturing facilities specifically because wastewater discharges of mercury and mercury compounds may be above permitted limits but still be undetectable by normal analytical methods. In other words, a facility may not detect mercury in a waste stream using EPA-approved testing methods, but the total amount of mercury discharged may be above acceptable limits. A company can demonstrate it is properly managing all potential sources of mercury by doing a thorough mercury audit.

- *Identify opportunities for pollution prevention*

A mercury audit enables a company to document how it is managing materials and processes to prevent the release of mercury into the environment. This documentation includes a description of processes and equipment associated with mercury waste, an inventory of mercury sources, and a management plan for any mercury containing materials that will minimize or eliminate mercury discharge.

- *Prevent the release of mercury and mercury compounds into the environment*

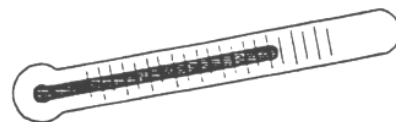
Methyl mercury is a mercury compound that bioaccumulates in aquatic food chains. Methyl mercury can be produced wherever bacteria and mercury are present. An example of this process is the accumulation of methyl mercury in the tissue of fish. When a human eats a contaminated fish, the methyl mercury is readily absorbed into the body where it affects the central nervous system.

To prevent adverse environmental effects, it is important to minimize release of mercury and mercury compounds into the environment. Mercury audits and pollution prevention techniques help a company work toward virtual elimination of mercury from waste streams.

What Are the Goals of a Mercury Audit?

Limit discharge of mercury to the environment by doing the following:

- *Define* sources, quantities and types of mercury in the facility.
- *Collect* information on processes, products, inputs of mercury to production, water usage and waste generation.
- *Encourage* development of effective release minimization and waste management strategies.
- *Share* waste reduction efforts with all employees to highlight importance of proper management of mercury sources.



Note: For additional information about mercury audits and mercury waste, contact SHWEC Pollution Prevention Specialists at 608-262-0385.



How Do I Best Conduct an Internal Mercury Audit?

- *Obtain* management approval, resources, and manpower.
- *Communicate* audit process and goals to employees. Establish a "no blame" policy and solicit employee input.
- *Set up* an audit team to collect, interpret, and communicate audit findings.
- *Conduct* the audit with production processes in normal operation and during work hours so that questions can be asked of employees. Since processes change from day to day, collecting data over a period of time makes for more realistic results.
- *Recommend* waste reduction and pollution prevention steps in line with the audit findings. Recommendations are generally the responsibility of the audit team, in addition to employee input.
- *Conduct* a new audit whenever large changes occur, such as changes in processes, prices of raw materials, regulations, and disposal costs, and to follow up on implementation of prior audit recommendations.

What Are the steps of a Mercury Audit?

Phase 1: *Understand* the processes in your plant.

Phase one of the mercury audit involves going into the plant and developing a sound understanding of all the process components and their interrelationships. It is worthwhile at this stage to solicit help from employees who are familiar with the day to day operations of the plant.

- Step 1:* List unit processes.
- Step 2:* Construct a process flow diagram.
- Step 3:* Construct a waste flow diagram.

Phase 2: *Inventory* possible sources of mercury.

Phase two of the mercury audit encompasses identifying and managing sources of mercury to best minimize and eliminate mercury waste. A key component of this stage is to insure employees have a strong understanding of mercury management practices in the facility.

- Step 4:* Inventory mercury content of raw materials.
- Step 5:* Identify mercury created during the manufacturing process.
- Step 6:* Identify other in-plant sources of potential mercury contamination.

Steps of a Mercury Audit

Phase 1

Understand Plant Processes

- *List* unit processes.
- *Construct* process flow diagram.
- *Construct* waste flow diagram.

Phase 2

Inventory Sources

- *Inventory* mercury content of raw materials.
- *Identify* mercury created during manufacturing process.
- *Identify* other in-plant sources of potential mercury contamination.

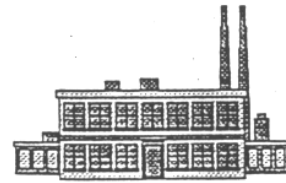
Phase 3

Identify Possible Contamination

- *Identify* possible points of environmental release of mercury.
- *Define* best management practices.
- *Train* employees to use best management practices.

Phase 3: *Identify* discharges and emissions from the facility that could become contaminated with mercury.

- Step 7:** Identify possible points of environmental release of mercury
- Step 8:** Define best management practices to prevent release.
- Step 9:** Train employees to follow best management practices.



What Are Potential Sources of Mercury in Manufacturing Industries?

Elemental Mercury

| Instruments* | Lamps* | Switches* |
|---|--|---|
| <ul style="list-style-type: none"> • barometers • thermometers • hydrometers • pyrometers • manometers | <ul style="list-style-type: none"> • fluorescent • mercury arc • metal halide • high pressure sodium neon • UV disinfectant | <ul style="list-style-type: none"> • thermostats • mercury thermocouple • tilt switches • industrial switches |

Laboratory

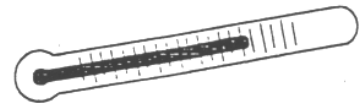
| Catalyst | Biocide or Preservative | Electroanalysis |
|--|-------------------------|--|
| <ul style="list-style-type: none"> • oxidation of organic compounds | | <ul style="list-style-type: none"> • cathodes |

Electrical Equipment

| Batteries* | Rectifiers* | Electroanalysis |
|--|---|----------------------------|
| <ul style="list-style-type: none"> • alkaline • mercury-zinc (button) • mercury-cadmium | <ul style="list-style-type: none"> • latex paint • marine paint • gold porcelain paint | <p>Electrolysis</p> |

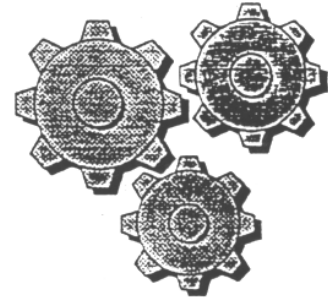
Sources of Mercury in Manufacturing

- Elemental Mercury
 - Laboratory
 - Electrical Equipment
 - Mining/Metals
 - Coloring
 - Preservative
 - Photography
 - Plastics
- Chlor-Alkali Plants
 - Contaminant
 - Combustion
 - Vaporization



Mining/Metals Industry

| | | |
|--|--|--|
| <p>Etching</p> <ul style="list-style-type: none"> etching steel/iron | <p>Electroplating</p> <ul style="list-style-type: none"> electroplating aluminum | <p>Extracting</p> <ul style="list-style-type: none"> extracting gold from lead extracting gold from ore extracting silver from ore |
| <p>Fire Gilding</p> | <p>Cathodes</p> <ul style="list-style-type: none"> Cathodes used in electrolysis | <p>Smelting and Casting</p> |



Coloring

| | | |
|---|---|---|
| <p>Pigment</p> <ul style="list-style-type: none"> colored papers stains inks linen plastics rubber sealing wax porcelain | <p>Paint</p> <ul style="list-style-type: none"> latex paint marine paint gold porcelain paint | <p>Preservative</p> <p>Tanning</p> <p>Kyanizing Wood</p> |
|---|---|---|

Photography

Plastics

Chlor-Alkali Plants

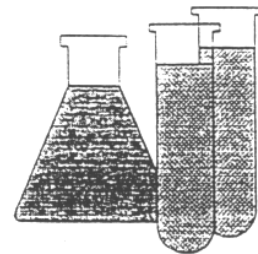
| | | |
|---------------------------|--|---|
| <p>Intensifier</p> | <p>Catalyst</p> <ul style="list-style-type: none"> catalyst for curing | <p>Chlorine</p> <ul style="list-style-type: none"> used in chlorine production <p>Sodium Hydroxide</p> <ul style="list-style-type: none"> used in production of sodium hydroxide (caustic soda) |
|---------------------------|--|---|

Success Factors

- *Obtain* management approval and resources
- *Communicate* audit process and goals
- *Set up* audit team
- *Conduct* the audit during normal operations
- *Recommend* pollution prevention solutions
- *Conduct* follow-up audits

By-product/Contaminant

Mercury can be a contaminant in many raw materials. If your facility uses large quantities of reagents such as sodium hydroxide, have the raw material tested for mercury content. Mercury can also be produced as a by-product of refining and burning fuels, processing solid waste and wastewater, and mining.



| Contaminant | Combustion | Vaporization |
|--|--|--|
| Chlorine <ul style="list-style-type: none"> chlorine production - contaminated products | Incineration <ul style="list-style-type: none"> municipal solid waste medical waste sewage sludge | Landfill Gas <ul style="list-style-type: none"> by-product of bioorganic breakdown |
| Sodium Hydroxide <ul style="list-style-type: none"> sodium hydroxide production - contaminated products | Fuel Combustion <ul style="list-style-type: none"> coal oil natural gas wood | Petroleum Refining Wastewater Treatment Plants Mining <ul style="list-style-type: none"> smelting crushing roasting |

What Are Methods of Best Managing and Preventing Mercury Waste?

Prevent Pollution

- From the "end of pipe", trace back to contributing processes or materials and make substitutions or process changes that will avoid the use or creation of a mercury containing waste stream.
- Modify** manufacturing processes to avoid contact between mercury cooling materials and wastewater discharges.
- Close** the loop of processes or uses that include mercury to prevent release into the waste stream or the environment.
- Evaluate** new inputs to production of mercury and investigate mercury-free alternatives.
- Reduce** mercury emitted from fuel combustion by continuing to encourage demand-side management, promoting energy audits, and encouraging the use of low-mercury fuels or alternative noncombustion methods of generation.
- Use improved mercury control technology for reduction of atmospheric loading.

Preventing and Managing Mercury Waste

- Prevent* pollution at the source
- Use* mercury-free alternatives
- Avoid* waste stream contamination with mercury in manufacturing processes
- Close* the loop of manufacturing processes to reclaim and recycle mercury
- Reduce* energy consumption
- Use* mercury control technology
- Recycle* fluorescent bulbs
- Manage* removeable sources of mercury



Recycle Fluorescent Bulbs

Waste lamps and bulbs are regulated as **hazardous waste** because they contain toxic heavy metals such as mercury. If these lamps are burned or thrown into landfills, the mercury in them can be released into the environment where contamination problems can occur.

Place waste lamps in the cardboard sleeves or boxes of replacement tubes or bulbs and mark the containers as hazardous waste. Then store the lamps where they can't be broken, making sure to mark the area as a hazardous waste storage area. If tubes do break, store them in heavy plastic bags placed inside a rigid container. Broken lamps should be managed as hazardous waste.

Waste lamp generators may contract with a solid or hazardous waste **transporter** to move lamps to a recycler. Hazardous waste transportation rules apply to the transportation of lamps containing mercury.

Manage Removable Sources of Mercury*

Identify removable sources of mercury such as **switches and instruments**. Establish a management policy to ensure that the removable sources are properly handled and recycled.

Researched and written by Kristin Andersen, Pollution Prevention Intern, under the guidance of David S. Liebl, Pollution Prevention Specialist, 5/94.

Mercury Recyclers

SHWEC, by providing this list, does not endorse or certify specific companies.

- **Bethlehem Apparatus**
890 Front St.
Hellertown, PA 18055
(215)838-7034
- **Inmetco**
PO Box 720
Ellwood City, PA 16117
(412)758-5515
- **Mercury Refining Company (MEREKO)**
790 Watervliet-Shaker Rd.
Latham, NY 12110
(800)833-3505

❖ For More Information, Contact Your County Extension Agent or SHWEC ❖

County Extension Information

SHWEC Offices

UW—Green Bay

University of Wisconsin
Environmental Science 317
2420 Nicolet Drive
Green Bay, WI 54311
414/465-2707
FAX 414/465-2143

UW—Madison

610 Langdon Street, Rm. 529
Madison, WI 53703
608/262-0385
FAX 608/262-6250

UW—Stevens Point

College of Natural Resources
University of Wisconsin
Stevens Point, WI 54481
715/346-2793
FAX 715/346-3624