Mercury Spill Response & Clean-up Guidance Document

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Disclaimer

The purpose of this document is not to replace any previous work performed on guidance document development regarding mercury spill response and/or cleanup, but rather be consistent with and compatible with existing documents, specifically, U.S. EPA, Region-5 *Mercury Response Guidebook*.

This guidance document does not replace formal training and/or education and does not purport to address every situation where mercury may be present or spilled.

The information contained herein is based upon data believed to be reliable, but is provided without any guarantee or warranty of any kind, either expressed or implied and Ohio Spill Planning, Prevention and Emergency Response Association (OSPPERA) disclaim any liability incurred from the use thereof.

The products and mercury described herein should be stored, handled and used in accordance with municipal, state and federal laws and regulations.

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Introduction

When elemental mercury is spilled, it forms beads or droplets that can accumulate in the smallest of places. These beads or droplets can emit dangerous vapors that are odorless & colorless in air. It is this vapor that poses a serious hazard to anyone within close proximity to a mercury spill or release.

Mercury has been found in Egyptian tombs dating back to 1500 or 1600 B.C. As early as A.D. 23-79 mercury was know to be dangerous, and it was not until A.D. 500-700 that mercury was considered a metal. In the 1800's the term "mad as a hatter" was coined. This term described the physical symptoms of mercury poisoning that hat makers experienced from having their hands immersed in vats as they shaped felt hats.

Mercury is the only metal that remains in a liquid state at room temperature, the higher the temperature, the more vapor is released. The vapor pressure of mercury will double when the temperature increases from approximately 64.4 F to 78.98 F.

> **In this guidance document, no distinction is made between home, school, or industrial settings during a spill or release. Appropriate clean up methods and safety considerations are vital for each setting. Throughout this document, the clean-up levels will be distinguished for each setting.**

It is the experience of many in the environmental field that most mercury spills are preventable. Special recognition is given to the Ohio Mercury Reduction Group (ORMG), chaired by Ohio EPA for educating the public and sponsoring many programs to remove mercury from homes, medical facilities, schools, industry and other places where mercury is used and a suitable replacement are available. Additionally, the Ohio Mercury Reduction Group educates the public on the dangers of mercury through direct means as well as outreach programs.

Special recognition is also given to Bowling Green State University (BGSU) for its sponsorship of the Ohio Mercury Reduction Program. BGSU and its partners provide for the safe transportation and reclamation of elemental mercury and mercury-containing devices throughout Ohio at no charge.

The information contained herein was obtained from a number of sources and is believed to be the most accurate and up-to-date information on mercury, its behavior, its hazards and cleanup methods. Several trade names are used in this document, however OSPPERA does not endorse, recommend or warrant these products. They are used only as examples of products that may be available for use in the cleanup of a mercury spill or release.

Mercury Reduction and Spill Planning & Prevention

Every effort should be made to prevent a mercury spill from occurring due to the health effects of mercury vapor, the cost associated with the clean-up and the difficulty in removing mercury vapor from certain areas. The best way to prevent a release of elemental mercury is not to have it! Proper disposal or reclamation of the mercury is strongly recommended. If you must keep mercury-containing devices, please follow these precautionary measures

- Always store mercury in unbreakable container.
- Store in well-ventilated area.
- When using mercury-containing devices, do so over plastic containment tray. Make sure container is of sufficient size to contain the greatest amount of mercury that may be spilled.
- Transfers of mercury should be done under an appropriate exhaust hood and over a plastic containment tray. Make sure container is of sufficient size to contain the greatest amount of mercury that may be spilled.
- Maintain an appropriate spill kit in area where mercury is used or stored. Know and follow all manufacturer directions.
- Whenever possible, choose non-mercury containing devices.
- If you use fluorescent lights, remember they are considered universal waste and should be managed as such (40 CFR 273). (Note: Citizens are exempt.)
- Work surfaces should have few crevices and carpeted areas should never be used.
- Appropriate training is required for anyone working with or cleaning up a mercury spill.
- Have written spill plan for mercury releases, practice and update often.

Defining Mercury Spill Size & Suggested Definitions

Spill Size

Small Spill (Contained):	A spill that may result from a broken thermometer or thermostat. The amount of mercury contained in these devices is usually around 3 grams.
Small Spill (Spread out):	A spill that may result from a broken thermometer or thermostat. This spill has spread out either by the beads of mercury breaking apart upon impact with another surface or by tracking either by humans or animals. This spill usually is confined to one room and the impacted area may cover up to 50 square feet.
Large Spill:	A spill from any source of mercury that involves multiple rooms, buildings, motor vehicles or where the impacted area covers more than 50 square feet.

Suggested Definitions

Clean Area:	Where mercury vapor is demonstrated to maintained below 1 µg/m^3 for no less than 4 consecutive hours following adequate and appropriate decontamination procedures. (ATSDR Residential Occupancy Level)
Restricted Area:	Where mercury vapor levels exceed 1 µg/m^3 but less than 10 µg/m^3. An approved APR with mercury vapor cartridges should be worn in these areas.
Controlled Area:	Where mercury vapor levels exceed 10 µg/m^3. An approved SCBA should be worn in these areas.

Types, Sources and Properties of Mercury

Metallic Mercury (Elemental Mercury)

- Shiny, silver-white metal that exists as a liquid at room temperature.
- Expands and contracts evenly with temperature changes.
- Highly toxic.
- Readily vaporizes at or near 55°F.
- Reaches gaseous state at 300°C.
- Alloys with copper, silver, nickel, gold and zinc to form amalgam.
- Bioaccumulates in humans, animals and the environment.
- Found in thermometers, barometers, thermostats, pressure gauges, dental offices, blood pressure devices, fluorescent light bulbs and some tennis shoes that light up.
- Very high level of electrical conductivity (but has no charge), used in batteries, rectifiers, oscillators, power control switches and vapor lamps.
- Is not water-soluble.
- Used in the production of chlorine gas (amalgamates with sodium in sodium chloride), caustic soda and gold extraction.
- Used in the production of paint
- Medicinals: Used primarily in dental offices for cavity filling.
- Herbal and religious remedies in Latin America, Asia and Caribbean. Sold under the name “Azogue”.
- Vapor can accumulate in wall spaces, attics, etc.
- Vapor can accumulate in electronic equipment, especially computers. Mercury re-vaporizes when device is turned on and heat is generated.

Identification

Symbol:	Hg
CAS Number:	7439-97-6
Atomic Weight:	200.59
Boiling Point:	674^{o} F
Solubility in Water:	Insoluble
Specific Gravity:	13.6 (metal)
Vapor Pressure:	0.0012 mm Hg
Freezing Point:	-38^{o} F
Vapor Density:	7.0
Appearance:	Silvery-White, heavy, mobile, and liquid metal

Inorganic Mercury

- Also called mercury salts.
- Occurs when mercury combines with elements such as chlorine, sulfur and oxygen.
- Most are white powders and/or crystals.
- Ionized.
- Easily associates with particles and water in the atmosphere.
- Used for fungicides and skin lighting creams.

Organic Mercury

- Formed when mercury combines with carbon.
- Most common form is methyl mercury.
- Form most available to zooplankton, insects, fish, and humans.
- Bioaccumulates in tissues.
- Volatile.
- Water-soluble.

Health Effects

Very high exposures to mercury vapor can cause acute poisoning and/or death. Symptoms usually begin with cough, chest tightness, difficulty breathing and upset stomach.

Acute inhalation of mercury vapor may result in chills, nausea, general malaise, tightness in the chest, chest pain, difficulty breathing, cough, kidney damage, stomatitis, gingivitis, salivation, diarrhea and death.

Mercury is considered a poison and the routes of exposure include inhalation, ingestion and absorption. **The most common route of exposure for elemental mercury is inhalation**. The most common route for of exposure for organic mercury is ingestion.

Mercury has a delayed burning sensation to the skin and eye of several minutes up to several hours.

The central nervous system is very sensitive to mercury vapor. Chronic exposure is characterized by behavior changes, weakness, fatigue, weight loss, gastro-intestinal dysfunction, tremors in fingers, eyelids and lips, memory loss, insomnia and depression.

Medical Monitoring

Taken from OSHA Technical Link, Occupation Safety and Health Guideline for Mercury Vapor, Revision Date: 27 April 1999.

MEDICAL SURVEILLANCE

OSHA is currently developing requirements for medical surveillance. When these requirements are promulgated, readers should refer to them for additional information and to determine whether employers whose employees are exposed to mercury vapor are required to implement medical surveillance procedures.

* Medical Screening

Workers who may be exposed to chemical hazards should be monitored in a systematic program of medical surveillance that is intended to prevent occupational injury and disease. The program should include education of employers and workers about work-related hazards, early detection of adverse health effects, and referral of workers for diagnosis and treatment. The occurrence of disease or other work-related adverse health effects should prompt immediate evaluation of primary preventive measures (e.g., industrial hygiene monitoring, engineering controls, and personal protective equipment). A medical surveillance program is intended to supplement, not replace such measures. To detect and control work-related health effects, medical evaluations should be performed (1) before job placement, (2) periodically during the term of employment, and (3) at the time of job transfer or termination.

* Pre-placement medical evaluation

Before a worker is placed in a job with a potential for exposure to mercury vapor, a licensed health care professional should evaluate and document the worker's baseline health status with thorough medical, environmental, and occupational histories, a physical examination, and physiologic and laboratory tests appropriate for the anticipated occupational risks. These should concentrate on the function and integrity of the eyes, skin, respiratory system, central and peripheral nervous systems, and kidneys. Medical surveillance for respiratory disease should be conducted using the principles and methods recommended by the American Thoracic Society. A pre-placement medical evaluation is recommended to assess medical conditions that may be aggravated or may result in increased risk when a worker is exposed to mercury vapor at or below the prescribed exposure limit. The health care professional should consider the probable frequency, intensity, and duration of exposure as well as the nature and degree of any applicable medical condition. Such conditions (which should not be regarded as absolute contraindications to job placement) include a history and other findings consistent with diseases of the eyes, skin, respiratory system, central and peripheral nervous systems, or kidneys.

* Periodic medical evaluations

Occupational health interviews and physical examinations should be performed at regular intervals during the employment period, as mandated by any

applicable Federal, State, or local standard. Where no standard exists and the hazard is minimal, evaluations should be conducted every 3 to 5 years or as frequently as recommended by an experienced occupational health physician. Additional examinations may be necessary if a worker develops symptoms attributable to mercury vapor exposure. The interviews, examinations, and medical screening tests should focus on identifying the adverse effects of mercury vapor on the eyes, skin, respiratory system, central and peripheral nervous systems, or kidneys. Current health status should be compared with the baseline health status of the individual worker or with expected values for a suitable reference population.

* Termination medical evaluations

The medical, environmental, and occupational history interviews, the physical examination, and selected physiologic or laboratory tests that were conducted at the time of placement should be repeated at the time of job transfer or termination to determine the worker's medical status at the end of his or her employment. Any changes in the worker's health status should be compared with those expected for a suitable reference population.

* Biological monitoring

Biological monitoring involves sampling and analyzing body tissues or fluids to provide an index of exposure to a toxic substance or metabolite. No biological monitoring test acceptable for routine use has yet been developed for mercury vapor. However, total inorganic mercury can be measured in the urine by preshift sampling. A mercury level of 35 micrograms per gram of creatinine should be used as the biological exposure index. In addition, total inorganic mercury can also be measured in the blood by sampling at the end of shift at the end of the workweek. A mercury level of 15 micrograms per liter of blood should be used as the biological exposure index.

Taken from CPL 2-2.6 OSHA Instruction October 30, 1978, OSHA Program Directive #300-2, Inorganic Mercury and Its Compounds

MEDICAL SURVEILLANCE

Each employer should institute a medical surveillance program for all employees who are or will be exposed to airborne concentrations of mercury vapor or the dust of its inorganic compounds above the permissible exposure limit. The program should provide each employee with an opportunity for biological monitoring and medical examination performed by or under the supervision of a licensed physician and provided during the employee's normal working hours without cost to the employee.

Medical Examination

a. Each employer should provide a medical examination which includes a complete medical history and physical examination, complete blood count, routine urinalysis (specific gravity, sugar, protein determinations, and microscopic examination), and voluntary pregnancy test, where appropriate, to each employee exposed to mercury or its inorganic compounds in excess of the permissible exposure limit.
b. Medical examinations should also be made available:
    i. To employees prior to their assignment to areas in which airborne concentrations of mercury or its inorganic compounds are above the permissible exposure limit;
    ii. At least annually for each employee exposed to airborne concentrations of mercury or its inorganic compounds above the permissible exposure limit at any time during the preceding six months;
    iii. For each employee whose urine analysis sampling series indicates elemental mercury level at or above 0.02 mg per liter of urine or total mercury level in excess of .200 mg per liter of urine, which is not receding;
    iv. Immediately upon notification by the employee that the employee has developed signs or symptoms commonly associated with toxic exposure to inorganic mercury or its compounds.
c. Where medical examinations are performed, the employer should provide the examining physician with the following information:
    i. The reason for the medical examination requested;
    ii. A description of the affected employee's duties as they relate to the employee's exposure;
    iii. A description of any personal protective equipment used or to be used;
    iv. The results of the employee's exposure measurements, if available;
    v. The employee's anticipated or estimated exposure level;
    vi. The results of the employee's biological monitoring; and

vii. Upon request of the physician, information concerning previous medical examination of the affected employee.

Biological Monitoring

Urine sampling and analysis should be the biological monitoring method used. The method of analysis for total, ionic and elemental mercury in urine is described in the American Industrial Hygiene Association Journal, September 1974, pp. 576-580. For the analysis at least 100 ml of urine should be collected during a workday when sampling is scheduled.

Accuracy of Measurement. Sample analysis should have an accuracy to a confidence level of 95% as it pertains to the repeatability of several analyses from any given urine sample.

Frequency of Monitoring (a) If possible, a urine sample should be obtained of all employees who will be assigned to work with mercury or its inorganic compounds prior to exposure to the work area. (b) For employees exposed to less than permissible levels of airborne mercury, urine sampling and analysis should be done every six months. (c) For employees exposed to airborne mercury vapor or inorganic mercury compounds above the permissible exposure limit, urine sampling and analysis should be performed every three months for each employee. It should continue at least six months after the last known exposure above the permissible exposure limit if the employee is available for sampling. (d) Where the total mercury level exceeds .200 mg of mercury per liter of urine, or 0.02 mg of elemental mercury per liter of urine, sampling should be accelerated to a weekly basis. The activities of the employees should be observed to detect the potential source of mercury intake. (e) If the total mercury level in urine does not decrease during the one-month sampling period, or if the elemental mercury level in urine does not decrease in two weeks, a physician should be consulted.
The results of employee urine sampling should also be considered as a group exposure by area of assignment and/or by job description. Elevated group urine mercury levels should be a cause for review of operational practices, process controls, and a change in either or both to reduce employee exposures. If several employee urine samples from the same area of assignment indicate excessive elemental mercury urine levels, the employer should start corrective action in the area immediately.

Physician's Written Opinion

The employer should obtain and furnish the employee with a written opinion from the examining physician containing the following: (a) The signs or symptoms of mercury exposure manifested by the employee, if any; (b) A laboratory report of the mercury content in blood or urine if such analysis is performed by or under the supervision of the physician, or reported to the physician by a laboratory to which such samples have been submitted for analysis; (c) The physician's

opinion as to whether the employee has any detected risk of material impairment to the employee's health from exposure to mercury or its inorganic compounds or would directly or indirectly aggravate any detected medical condition; (d) Any recommended limitation upon the employee's exposure to mercury or its inorganic compounds or upon the use of personal protective equipment and respirators; and (e) A statement that the employee has been informed by the physician of any medical condition which requires further examination or treatment. (ii) The written opinion obtained by the employer should not reveal specific findings or diagnoses unrelated to occupational exposure to mercury or its inorganic compounds. (iii) If the employer determines, on the basis of the physician's written opinion, that any employee's health would be materially impaired by maintaining the existing exposure to mercury or its inorganic compounds, the employer should place specific limitations, based on the physician's written opinion, on the employee's continued exposure to mercury or its inorganic compounds.

Agency Jurisdiction & Notification

Ohio EPA:	Reportable Quantity, One (1) pound
U.S. EPA:	Reportable Quantity, One (1) pound TCLP: (RCRA) 2 mg/l Underlying Hazardous Constituent: 0.025 mg/l TCLP TSCA: 250 mg/kg
SARA (Title III):	Not subject to reporting requirements
US DOT:	Reportable Quantity, One (1) pound Corrosive labels required Must be shipped in conformance with HM 181 Performance Oriented Packaging Standards DOT Number: UN2809 ERG Number: 172

Telephone Numbers

Ohio EPA:	800-282-9378
Local Health Department:	See OSPPERA Directory
Local EMA/LEPC:	See OSPPERA Directory
ATSDR, Emergency Response Hotline:	404-639-0615
ATSDR, General Information:	800-447-1544
National Response Center:	800-424-8802
Superfund Information Hotline:	800-424-9346
Local Poison Control Center:	See local telephone book
Ohio Department of Health	614-466-1390

Understanding Units of Measure

Measurement of concentrations in air:

Concentrations of chemicals in air are measured in units of the mass of the chemical per volume of air in cubic Meters (m^3). One (1) cubic Meter (m^3) equals 35.31 cubic feet.

1 milligram (mg)	=	1/1,000 gram
1 microgram (µg)	=	1/1,000,000 gram
1 nanogram (ng)	=	1/1,000,000,000 gram
1 milligram (mg)	=	10,000 nanograms (ng)
1 microgram (µg)	=	1,000 nanograms (ng)
1 nanogram (ng)	=	1.0 nanogram (ng)

Exposure Limits

ACGIH TWA/TLV	0.025 mg/m³	Normal 8 hour workday & 40 hour workweek
OSHA PEL	0.1 mg/m³	At no time can this level be exceeded
OSHA IDLH	10 mg/m³	Immediately Dangerous to Life & Health
NIOSH REL	0.05 mg/m³	10 hour workday & 40 hour workweek
*****There is also a skin designation for mercury exposure*****		
Suggested Action Levels for Mercury (ATSDR)		
ATSDR MRL	0.2 µg/m³	Minimal Risk Level
ATSDR ROL	≤ 1.0 µg/m³	Level acceptable for occupancy of any structure after a spill. (Residential Occupancy Level
ATSDR	10 µg/m³	Isolate residents from exposure
	10 µg/m³	Acceptable level in a modified test procedure to allow personal effects to remain in the owner's possession
ATSDR	3.0 µg/m³	Re-occupancy after a spill of an occupational or commercial setting where mercury is not usually handled
ATSDR	25 µg/m³	Occupational settings where mercury is handled
ATSDR	25 µg/m³	Response Worker Protection Equipment Upgrade
ATSDR	10,000 µg/m³	Immediately Dangerous to Life & Health

Minimum Response Equipment & Personnel

- OSHA 40 Hour, General Site Worker trained personnel (minimum 2).
- Approved mercury specific vacuum in good working order and properly maintained.
- Personnel Protective Equipment
  - Minimum OSHA Level C: The concentration(s) and type(s) of airborne substance(s) is known and the criteria for using air-purifying respirators are met. The following constitute Level C equipment; it may be used as appropriate.
    - Full-face or half-face air purifying respirator, NIOSH approved. Mercury vapor cartridges with end-of-life indicator.
    - Hooded, chemical resistant clothing (coveralls; disposable chemical-resistant overalls)
    - Coveralls (optional, as applicable)
    - Gloves, chemical resistant outer
    - Gloves, chemical resistant inner
    - Boots, chemical resistant outer with steel toe & shank (optional, as applicable)
    - Boots, chemical resistant outer, disposal (optional, as applicable)
    - Hard Hat (optional, as applicable)
    - Escape mask (optional, as applicable)
    - Face shield (optional as applicable)

- Personal Protective Equipment
  - If mercury vapor concentrations exceed 25 µg/m³ OSHA Level B should be utilized. The highest level of respiratory protection is necessary but a lesser level of skin protection is needed.
    - Positive pressure, full-face piece self-contained breathing apparatus (SCBA), or positive pressure supplied air respirator with escape SCBA (NIOSH Approved)
    - Hooded, chemical-resistant clothing (overalls and long-sleeved jacket; coveralls; one or two piece chemical-splash suit; disposable chemical-resistant overalls)
    - Coveralls (optional, as applicable)
    - Gloves, outer, chemical resistant
    - Gloves, inner, chemical resistant
    - Boots, outer, chemical resistant steel toe and shank
    - Boots-covers, outer, chemical resistant (disposable) (optional, as applicable)
    - Hard hat (optional, as applicable)
    - Face shield (optional, as applicable)

- Mercury amalgamating product
- Mercury vapor suppressant
- Ventilation fans & extension cords
- Duct Tape
- Large trash bags or drum liners
- Mercury Vapor Analyzer
- Spray bottles
- Propane, gas or electric heater
- Thermometer (non-mercury containing)
- Clean 1 or 5 gallon buckets
- Clean brushes (for applying amalgam paste)
- Razor Knives (for carpet removal)
- Scrapers (for carpet removal)
- Plastic container (for recovered elemental mercury)
- DOT approved shipping containers (for waste material)
- Mop & bucket
- Flashlight (with optional red lens)
- Plastic dust pan (small)
- Eye dropper
- Plastic coated playing cards
- Zip top plastic baggies
- Plastic sheeting
- Typical chemical decontamination supplies (pools, brushes, etc.)

Special Notice on APR use with Mercury Vapor Cartridges

Because mercury vapors are colorless and odorless, "end-of-service-life" indicators must be incorporated into the mercury vapor cartridges being used and must be readily visible to the user without manipulation while wearing the respirator. **DO NOT USE** APR when concentrations of mercury vapor are immediately dangerous to life and health, are unknown, or when the concentration exceeds 10 times the PEL with half-face respirators or 50 times the PEL with full-face respirators.

Special Notice on Coveralls and other PPE

It has been reported that cotton and nylon clothing will absorb mercury vapor so it is important that all exterior clothing (PPE) be of an appropriate material such as Tyvek® or equivalent. Coveralls should be manufactured with hoods and elastic wrist and ankle openings.

Mercury Spill, ***Initial Actions***

When notified of a mercury spill or release, the following information should be given to the individual reporting the incident. The health and safety of individuals exposed or potentially exposed is the first priority when a mercury spill occurs. Performing the following activities will help to reduce the danger posed by mercury vapors at the time of a release. Once all individuals have evacuated an area of mercury release, re-entry should not be permitted without appropriate personal protective equipment (PPE) and personnel training.

1. Evacuate immediate area and do not allow pregnant women, small children or pets to enter area. Individuals within the spill zone should remove shoes prior to exiting the area.
2. Do not attempt to vacuum spilled mercury without approved mercury specific vacuum.
3. If mercury came in contact with clothing, including shoes, remove and place in plastic bag and seal. Place plastic bag containing contaminated clothing out of doors and downwind.
4. If mercury came in contact with exposed skin, immediately wash exposed areas with warm water and mild detergent.
5. Open window to out of doors if mercury was spilled in an area with an outside window.
6. Turn off HVAC and/or other ventilation to and from impacted area.
7. If possible, place towels or other impervious material on floor to stop vapors from exiting under doorways. Place duct tape along door edges to contain vapor.
8. Notify Ohio EPA at 800-282-9378.
   Notify Local Health Department (See OSPPERA Directory).
   Notify Spill contractor experienced in mercury spill remediation (See OSPPERA Directory).
   Notify others as appropriate.
9. If possible, unplug and place all computers and monitors into trash bags and seal with tape. Do not remove from area.
10. DO NOT RE-ENTER AREA.
11. If school or other public location, identify one person to coordinate and manage incident with regulatory agencies, parents, media, response contractor and other who may be impacted by the incident.
12. Identify potentially exposed individuals.
13. Identify possible satellite spill locations (school buses, other rooms, homes, automobiles, etc. Isolate as needed.

Removal of Mercury from Hard Surfaces
(Concrete, tile, porcelain, metal, plastic) (Excluding Wood)

1. Remove all jewelry, including eyeglasses prior to donning PPE and entering spill area. Also, be sure all exposed metal objects such as pens, pagers, cellular phones, blue jean rivets, work boot grommets etc. are removed or covered by PPE prior to entering spill area.
2. Physically remove all visible mercury using approved mercury specific vacuum. Exercise care while vacuuming to ensure all areas are vacuumed, paying particular attention to joints between tiles. Mark each vacuumed square with piece of duct or masking tape to show vacuuming has been completed. If elemental mercury is visible, plastic coated playing cards, duct tape, shaving cream or other items may be used to recover the mercury prior to vacuuming.
3. Wash impacted area with mercury vapor suppression solution.
4. With area secured (windows sealed, HVAC isolated, etc.) heat area to at least 85^{o} F for four (4) hours.
5. After four (4) hours of heating area, open doors and/or windows and ventilate to outside for at least one (1) hour. Utilize blowers and/or ventilation fans to facilitate air movement throughout entire area.
6. During ventilation, thoroughly mop floors with clean, clear hot water. Change bucket out as water temperature cools or water appears dirty.
7. Allow entire area to dry as ventilation continues.
8. Thoroughly vacuum entire area with approved mercury specific vacuum as ventilation continues. Exercise care while vacuuming to ensure all areas are vacuumed, paying particular attention to joints between tiles. Mark each vacuumed square with piece of duct or masking tape to show vacuuming has been completed.
9. Monitor vapor concentrations with mercury vapor analyzer. Vapor levels should be below 10 µg/m^3. Covering the area with plastic sheet and creating “head-space” prior to monitoring vapor concentrations may also be used.
10. Repeat all the above if mercury vapor levels exceed 10 µg/m^3 after one (1) hour of ventilation to out of doors.
11. After performing 1-10 above, high levels of mercury vapor may still be detected. Apply (with brush) two (2) coats of a clear finish, fast drying polyurethane lacquer to affected surface.
14. Once polyurethane is applied and cured, verify mercury vapor concentration is below 10 µg/m^3.

Removal of Mercury from Carpeted Surfaces and Wood Floors

1. Remove all jewelry, including eyeglasses prior to donning PPE and entering spill area. Also, be sure all exposed metal objects such as pens, pagers, cellular phones, blue jean rivets, work boot grommets etc. are removed or covered by PPE prior to entering spill area.
2. Physically remove all visible mercury using approved mercury specific vacuum. Exercise care while vacuuming to ensure all areas are vacuumed, paying particular attention to joints between carpeting and molding. Be sure to vacuum both with and against the carpeting nap so ensure miniscule mercury beads are removed from the carpeting. For wooden floors, pay particular attention to joints between flooring sections. Mark each vacuumed square with piece of duct or masking tape to show vacuuming has been completed.
3. Wash impacted areas with mercury vapor suppression solution.
4. With area secured (windows sealed, HVAC isolated, etc.) heat area to at least 85^{o} F for two (2) hours.
5. After two (2) hours of heating area, open doors and/or windows and ventilate to outside for at least one (1) hour. Utilize blowers and/or ventilation fans to facilitate air movement throughout entire area.
6. Repeat 1-5 above.
7. Allow entire area to dry as ventilation continues.
8. Thoroughly vacuum entire area with approved mercury specific vacuum as ventilation continues. Exercise care while vacuuming to ensure all areas are vacuumed, paying particular attention to joints between carpeting and molding. Be sure to vacuum both with and against the carpeting nap to ensure all amalgam and residual Mercury is removed from the carpeting. For wooden floors, pay particular attention to joints between flooring sections. Mark each vacuumed square with piece of duct or masking tape to show vacuuming has been completed.
9. Monitor vapor concentrations with mercury vapor analyzer. Vapor levels should be below 10 $\mu g/m^3$. Covering the area with plastic sheet and creating “head-space” prior to monitoring vapor concentrations may also be used.
10. Repeat all the above if mercury vapor levels exceed 10 $\mu g/m^3$ after one (1) hour of ventilation to out of doors.
11. If, after one (1) hour of ventilating the area to outside the mercury vapor concentration still exceeds 10 $\mu g/m^3$, the carpeting or wooden flooring should be removed, along with any padding or sub-flooring under the carpeting and/or wooden flooring. Once the carpeting/pad and/or wooden flooring/sub-floor are removed, the procedures for removing mercury from hard surfaces should be used.

Removal of Mercury from Contaminated Furnishings and/or Clothing

1. Wrap and seal contaminated items in plastic sheeting or place into plastic trash bags or drum liners.
2. Set up disposable structure (tent) to hold contaminated personal belongings and furnishings downwind of work area and of other structures.
3. Place several industrial or shop grade electric, gas or kerosene powered heaters inside tent and place blowers at exhaust points inside tent.
4. Post at least one (1) ten-pound fire extinguisher outside of structure and smoke/fire detector inside of structure.
5. Maintain temperature inside structure at no less than 85^{o} F.
6. Place contaminated items inside structure, segregated by source and/or level of contamination.
7. Heat contaminated items in the structure to force the vaporization and removal of mercury for at least two (2) or three (3) days. Longer heating periods may be required for heavily contaminated furnishings and clothing.
8. No person should enter this “decontamination structure” unless trained and protected with a minimum of OSHA Level C protection.
9. Clothing or furnishings such as draperies may be heated and ventilated using a commercial clothes dryer set to the highest heat setting. Cycle items at least twice before screening and cycle the dryer empty and on the highest heat setting between batches of contaminated clothing and/or furnishings.
10. All clothing and furnishings should be screened using a mercury vapor analyzer. If mercury vapor readings consistently exceed 10 $\mu g/m^3$, disposal of the items should occur.
11. Appropriate decontamination and disposal of all materials and supplies, including the actual decontamination of the structure should occur prior to dismantling the structure.

Option: Wash clothing in commercial or household washing machine substituting the detergent with a mercury vapor suppressant. Wash in longest cycle, using hot water. Dry clothing on hottest heat setting. See above protocol if mercury vapor reading exceed 10 $\mu g/m^3$. Clothing may be placed in a sunny, warm and open-air area to facilitate vaporization of mercury from clothing. Exercise care when choosing such a site to protect downwind exposure.

Removal of Mercury in Plumbing

Mercury in plumbing is usually contained in the traps adjacent to the plumbing fixture such as sinks, drains and toilets. Dismantling is the preferred method of recovering the elemental mercury from the plumbing in this setting. Once the mercury is recovered from the drains, the mercury vapor concentration should be obtained using a mercury vapor analyzer. For concentrations exceeding 1000mg/m³, refer to the Removal of Mercury from Hard Surfaces protocol.

If dismantling of the plumbing is not possible or practical, a magnetic amalgam powder may be used. The magnetic amalgam powder can be gently poured into the plumbing fixture containing the mercury and gently forced into the trap by use of drain plunger. This technique should be employed with extreme caution so as to avoid forcing the mercury farther into the plumbing system. Wait several minutes, allowing the magnetic amalgam powder to react with the mercury, and introduce a plastic covered magnet into the plumbing system. Removal of the mercury is achieved by slowly withdrawing the plastic covered magnet.

Removal of Mercury from Humans and Animals

Humans

1. Issue trash bag or drum liner to each individual contaminated.
2. Remove shoes and place into bag and seal.
3. Provide disposable shoe covers to person to allow them to walk to showering facilities.
4. Once at showering facilities, have exposed individual remove all clothing and jewelry and place into trash bag or drum liner and seal. Provide receipt to individual for items recovered describing what was placed into bag (include color, size, etc. and other identifying marks). Use separate bag for jewelry items. Assure privacy for all individuals.
5. The exposed individual should then shower, including the washing of hair in warm water using mildly alkaline soap. A commercial product such as HgX® Hand Cream and Cleaner may also be used.
6. Once showered, each individual should be screened using a mercury vapor analyzer. Levels of mercury vapor should be less than 1 $\mu g/m^3$.
7. Individuals should be issued a Tyvek® coverall and shoe covers following showering and clearance of mercury vapor.
8. Individual clothing and jewelry should be assessed using the Mercury Removal from Contaminated Furnishings and/or Clothing protocol.

Animals

1. Issue trash bag or drum liner for each animal contaminated.
2. Remove collar or other items from the animal and place into bag and seal.
3. The exposed animal should be showered in warm water using mildly alkaline soap. A commercial product such as HgX® Hand Cream and Cleaner may also be used.
4. Once showered, each animal should be screened using a mercury vapor analyzer. Levels of Mercury vapor should be less than 1 $\mu g/m^3$.
5. The collar and/or other items removed from the animal should be assessed using the Mercury Removal from Contaminated Furnishings and/or Clothing protocol.

Removal of Mercury from Soils

In most cases, mercury contamination is close to the surface. An investigation should be conducted to determine the quantity of mercury spilled and whether or not surface and/or ground waters have been impacted. For contaminated soils, excavation to 50% beyond the depth of contamination is required to ensure removal of the contaminant. The contaminated soils can be placed into DOT approved 55-gallon drums or other suitable containers for off site disposal at a facility licensed to treat and/or dispose of the waste.

The only published standards for soil clean up levels are found in the Voluntary Action Plan (VAP) published by Ohio EPA. Although mercury spills are not VAP cleanups, these levels are provided as reference only.

Residential land use:	16 mg/kg	3745-300-08(c) (OAC)
Commercial land use:	250 mg/kg	3745-300-08(d) (OAC)
Industrial land use:	230 mg/kg	3745-300-08(e) (OAC)

Miscellaneous Mercury Removal Guidelines

Appliances

Screen washer and dryer.
Remove and ventilate any clothing.
If appliances screen <10 μg/m^3, run on high heat setting for multiple cycles.

Vacuum Cleaners

Screen and assess each component of vacuum (hoses, bags, etc.).
Remove any porous material.
Decontaminate non-porous sections (see above protocol) or dispose.

General Clean-up Guidelines

- Wash all impacted areas with mercury vapor suppression solution.
- Screen all appliances
- Allow for appropriate reaction time for mercury vapor suppression solution to work.
- Rinse all areas with clean, clear water and change often.
- Re-screen for mercury vapor as appropriate.
- Isolate non-impacted areas prior to ventilation.
- Utilize cross ventilation in impacted areas using high velocity fans; vent into area from non-impacted areas and out of doors. Vent to out of doors
- Allow at least 24 hours for appropriate ventilation
- Screen both impacted and non-impacted areas to measure effect of decontamination**.**
- If screening is above action levels, a mercury source likely still exists.
- If screening is below action levels, consider heat/ventilate cycles.
- If screening is well below action levels, sampling may be conducted.
- Seal off impacted areas prior to sampling
- Increase room temperature
- Allow impacted area to stabilize over 4 – 6 hours prior to sampling.
- Collect samples from 3 – 4 feet above floor (breathing zone for children). NIOSH Method 6009 or equivalent (8 hour).
- Maintain records of screening location(s) and changes over time; along with any activity(s) that may have occurred to cause such as change.
- Often, it is helpful to grid an area off in 1 foot by 1-foot squares. Use string or tape to mark the grid. As vacuuming and/or decontamination occur, a piece of tape may be used to show the grid square has been vacuumed/decontaminated.

Mercury Vapor Analyzers

Adapted from Ohio EPA OSC Guidance Document
Used with Permission

Jerome MVA

The range of detection on Jerome MVA's varies according to the model of the instrument.

- Jerome MVA Model 411: 0.000 to 1.999 mg/m^3
- Jerome MVA Model 431: 0.000 to 0.999 mg/m^3

The sensitivity of both instruments is 0.003 mg/m^3 Hg.
The accuracy of both instruments is ±5% at 0.107 mg/m^3 Hg.

NOTE: Realistically, the Jerome MVA is accurate only when mercury vapor concentrations are greater than 0.01 mg/m^3 or 10 g/m^3. Therefore, all air sampling should be confirmed utilizing NIOSH Method 6009. Jerome interferences include smoke, nitrogen, and sulfide compounds.

Adapted from Ohio EPA OSC Guidance Document
Used with Permission

Lumex RA-915+ Mercury Vapor Analyzer

Ohio Lumex Company, Inc.
5405 East Schaaf Road
Cleveland, Ohio 44131
216-642-9700 (sales)
216-642-8515 (service)

The Lumex method gives instantaneous real-time sample results even at very low concentrations. The Lumex RA-915+ is a portable atomic absorption spectrometer designed to determine the mercury vapor content in ambient air, water, soil, natural and stack gases, etc. It has a built-in compressor and internal rechargeable source as well as a car adapter for field monitoring in remote areas.

- This instrument can detect low-level mercury vapors.
- It is a high sensitivity and selectivity instrument that does not require gold amalgam pre-concentration and subsequent regeneration steps; this enables the user to conduct real-time monitoring.
- Data collection and data logging are done in real-time and stored as a separate file.
- Low mercury detection limits and sensitivity of the device are achieved by combination of a total of 10 meter multi-pass optical cells and the use of Zeeman Atomic Absorption Spectrometry using High Frequency Modulation.
- There are no known interferences with this instrument.
- The detection range of the Lumex RA-915+ is 2 nanograms per cubic meter (ng/m^3) to 26 micrograms per cubic meter (g/m^3) in air.
- The sample volume is set at 20 liters per minute.
- There is an on-board display with a set point level alarm.
- The required gas to operate the Lumex RA-915+ is argon, nitrogen, or helium.

Mercury Tracker 3000

ST² Service Technologies, Inc.
8550 W. Ken Caryl Avenue
Littleton, Colorado 80128
Phone: (303) 972-3740
Fax: (303) 972-1493

The mercury concentration is measured in an optical cell entirely made of a high purity grade fused silica. A maintenance-free membrane pump continuously feeds the sample gas to the optical cell where light absorption measurement takes place. This so-called “cold vapor” measuring method is extremely sensitive for mercury determination and has been used successfully for many years.

- Total background noise is less than 0.1 µg/m³
- Measurements is displayed in real time
- Built in rechargeable battery with a capacity of 6 hours
- Measurements are made by UV-Absorption
- Measuring Range is 0 –100 µg/m³
- Sensitivity is 0.1 µg/m³
- Sample volume is 1, 5 liters per minute

Mercury Sniffer/PM2

Nippon Instruments Corporation
Brandt Instruments, Inc.
18568 Oak Grove Parkway
Prairieville, LA 70769
Phone: 225-673-6776
Fax: 225-673-6725

- 0 –5 ng range with resolution of 0.001 ng
- Built in data logger
- No known interferences
- Gold-amalgamation cold vapor atomic absorption method
- Sampling time 1-60 seconds
- Sampling flow rate is 0 to 0.5 liters per minute, variable

Air Sampling Equipment

Adapted from Ohio EPA OSC Guidance Document
Used with Permission

MSA Flow-Lite (or Gilian™ or SKC) "low-flow" air sampling pumps and a mini-Buck Calibrator are to be utilized for air sampling.

The following types of sorbent tubes are to be utilized for air sampling.

Supelco 1-800-247-6628

Size: 6 x 70 mm
200 mg
ORBO-1002 hopcalite Part #20863
$76.50 for a box of 50 tubes

Size: 8 x 110 mm
500 mg
ORBO-1008 hopcalite Part #20866
$128.80 for a box of 50 tubes

Note: Use Gilian™ sorbent tube holder model S-225 for 200-mg tubes and Gilian™ sorbent tube holder model THH-L-240 for 500-mg tubes.

SKC 1-800-752-8472

Size: 6 x 70 mm
200 mg
Catalog #226-17-1A carulite (HYDRAR)
$72.00 for a box of 50 tubes

Size: 8 x 110 mm
500 mg
Catalog #226-17-3A carulite (HYDRAR)
$121.00 for a box of 50 tubes

Note: Use Gilian™ sorbent tube holder model S-225 for 200-mg tubes and Gilian™ sorbent tube holder model THH-L-240 for 500-mg tubes.

Confirmatory Air Sampling Procedures

Laboratory air sampling should be conducted utilizing modified NIOSH Method 6009. The analytical method detection limit should be set at 0.1 ug/m^3.

The sampling height of the sorbent tube should be set at approximately three feet. This height simulates the breathing zone for children. The location of each sampling pump should be in the area of the home where maximum exposure to mercury contamination would occur (i.e., the bedrooms and living room).

The sampling duration should be set at 6 hours using a flow rate of 500 ml/min. Consult your commercial laboratory for verification of required sample volume for analysis.

Appendix

Mercury Vapor Suppression and Mercury Amalgamating Products

HgX® Mercury Decontaminant Powder

Acton Technologies
100 Thompson Street
P.O. Box 726
Pittston, PA
18640
Phone: 570-654-0612
Fax: 570-654-2810
Internet: www.actontech.com

Directions for the Reduction of Mercury Vapor using HgX®

Used with Permission

For use on all surfaces exposed to Metallic Mercury-Mercury Salts-or containing Mercury in any form. HgX® is particularly recommended for rough surfaces, such as worn concrete floors, having cracks or crevices-wooden floors with open joints, etc.

Directions (Dry Method)

Distribute 8 oz. Of HgX® powder even over 100-sq. ft. of floor area to be treated. Brush or sweep HgX® lightly into all cracks and crevices, then spray, sprinkle or swab with water.

Directions (Wet Method)

For the initial treatment add 1½ pounds of HgX® slowly or sift to 5 gallons of water – do not dump. Following applications may be reduced to 1 pound for each 5 gallons of water. HgX® solutions should be milky – if clear increase quantity. Apply with a sprayer, large whitewash brush, or mop – saturated wooden floors thoroughly – allow standing over night, preferably over holidays or weekends. Rinse mop or sponge with clear water to remove residual HgX® if necessary.

We suggest washing or generous spraying of all floors and wall surfaces every two weeks in operating areas with HgX® with will provide a coating or film on Metallic Mercury or reduce to non-vaporizing form. HgX® will also react with various Mercury compounds and materially reduce Mercury contaminated air from such sources.

For regular sweeping we suggest saturating ordinary sawdust with HgX® solution as described herein, you will reduce the dust hazard and treat the area at the same time.

Directions (Closed System)

To decontaminate closed systems which cannot be treated practically by the wet method outlined above, fill the system with HgX® solution (1½ pounds in 5

gallons of water) and agitate or circulate the solution for several hours. Drop the solution and flush thoroughly with clear water. Repeat if necessary.

Notice

If the HgX® is caked or lumpy, due to storage, simply remove the entire plastic bag and roll the bag and its contents on a flat surface or simply squeeze by hand until powdered.

Due to the variations in the water supply in certain areas the quantity of HgX® may require some adjustment. If the water, after adding the recommended quantity of HgX®, does not turn milky (white) within 15 minutes or half hour, add additional HgX® until it does. The solution upon standing several hours (overnight) will turn clear but retain if efficiency. The precipitation on the bottom of the container is merely the excess above saturation.

Caution

Be sure to properly ventilate all areas suspected of Mercury contamination. Continue adequate ventilation during decontamination procedures until Mercury vapor concentration is lowered to acceptable levels. HgX® Powder and HgX® solution may cause corrosion to some metals. Clean all treated metal surfaces with clear water and dry thoroughly.

Avoid contact with eyes, skin or clothing. Use rubber gloves. Do not mix HgX® with other cleaning agents or any other material. Use cold tap water to make up solutions.

HgX® Hand Cream & Cleaner
Acton Technologies
100 Thompson Street
P.O. Box 726
Pittston, PA
18640
Phone: 570-654-0612
Fax: 570-654-2810
Internet: www.actontech.com

Directions for HgX®Hand Cream & Cleaner

Used with Permission

Directions

Before exposure rub a small quantity vigorously into the skin of both hands especially under the fingernails, rinse in cold water and pat lightly. Adjust the amount used so there is no detectable difference in the "feel" of your hands. After exposure repeat the application and wash with hot water and dry thoroughly.

Notice

Individuals subject to allergies should make a patch test before using.

Note

Good housekeeping is vital to prevent mercury contamination. Cleanliness promotes safety. In addition to using HgX® hand cream, avoid spilling liquid metallic mercury, mercury salts or liquids containing mercury. Keep all containers tightly closed. It is easier to prevent an accident than to clean one up.

EPS Chemicals, Inc.
161 –145 Tyee Drive
Pt Roberts, WA
98281
Phone: 800-663-8303
Fax: 604-946-3663
Internet: www.epsross.com

Product Description

MERCON Mercury Spill Kits - Fully contained kits for safe and effective clean up, storage and decontamination of mercury spills. Available in four configurations:

1. MERCONKIT I - A sturdy wall mountable metal kit includes MERCONspray, MERCONvap, tools for pick-up, MERCONtainer, MERCONwipes, gloves, glasses and full instructions. Reusable.
2. MERCONKIT II- same as KIT I in an economical corrugated cardboard box with a plastic handle for portability.
3. MERCONKIT III - MERCONspray, MERCONvap, tools for pick-up, MERCONtainer, gloves, glasses and full instructions.
4. MERCONDRUM - for larger mercury spills, MERCONspray, MERCONtainer and MERCONvap for up to 10kg (20lbs) of mercury [drum serves as large MERCONtainer].

MERCONspray - reduces airborne mercury vapor prior to clean up [250ml].

MERCONtainer – mercury waste storage container with foam liner to suppress vapor [475ml].

MERCONvap - liquid decontaminant for treating surfaces after removal of mercury, absorbs into surfaces treating inaccessible contamination [475ml, 1000ml, 22l].

MERCONwipes - 70 convenient towelettes charged with mercury vapor suppressant for final wipe of surfaces or cleaning delicate instruments.

MERCONtray - work surface tray with protective grill lined with MERCONsponge (replace every 6 months) collects and suppresses mercury beads.

MERCON Aspirator -A simple and easy to use waste mercury pick-up tool. Effective on hard surfaces and under water, it allows for quick clean up of spilled mercury.

Procedures:

1. For indoor spills, block off spill site (minimum 2-metre radius) from foot traffic. Open windows and shut off ventilation system. Check clothing and footwear

for mercury and remove contaminated apparel. For outdoors spills, ventilation is usually not a problem, however be aware that when mercury is spilled on un-compacted soil or other surfaces, it will continue to sink lower and lower (due to its high density).

2. Wearing protective clothing, eyewear, and gloves spray MERCONspray into ambient air starting at eye level and work down towards the floor including the visible spill.

3. Use MERCONvap to cover visible mercury beads. CAUTION: After applying MERCONspray or MERCONvap, floor may be slippery.

4. Use Mercury Aspirator to pick up mercury beads and deposit into MERCONtainer. Ensure tip is below rim. (Refer to product insert for detailed description on Aspirator usage). If a mercury aspirator or filtered suctioning system is not available, you may use hard plastic or card to carefully pick up the mercury. Spray and clean any materials used to clean up mercury spills with MERCONspray. Do not use brushes to clean up mercury, since they will break up the spill into fine beads, which are very difficult to locate and clean up.

5. NOTE: MERCONtainer may be re-used, provided it is no more than ½ full, for up to six months. Always have a usable container available for future spills.

6. Wipe contaminated surfaces clean with MERCONvap liquid or [MERCON ™wipes (Kits 1&2 only)]

7. Wipe shoes, gloves and other contaminated items with MERCONwipes or disposable towels saturated with MERCONvap. Place contaminated items in plastic bag and spray with MERCONspray.

Label contaminated items with " Caution Mercury Waste" labels. Dispose of mercury contaminated items as Hazardous Waste in accordance with all environmental regulations. Do not incinerate mercury contaminated spill materials.

Mercury Specific Vacuum Systems

Minuteman®
Minuteman International
111 South Rohlwing Road
Addison, IL 60101-4244
Phone: 630-627-6900
Fax: 630-627-1130
Internet: www.minutemanintl.com

Minuteman® Mercury Recovery Vacuum Systems

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This specially adapted critical filter vacuum system recovers liquid mercury and cleans mercury contaminated dry and liquid soil and air. All MRS units feature a 115v or 220v AC/DC air-cooled motor which is also usable as a high performance, standard vacuums cleaner when the special filter modules are removed. Each unit comes with the basic tools to handle most clean-up jobs.

Mercury has emerged as one the most toxic contaminants in common use today. People who work with mercury or mercury oxides run serious health risks if strict cleaning procedures are not enforced using qualified equipment. This contamination can occur not only in the factory stations, where mercury or mercury oxides are being used, but also in less obvious situations such as technical laboratories, medical and dental labs, control rooms or dental offices. The Minuteman MRS Series is designed to control this danger and the MRS Maxi-Guard is intended for situations wherein although the mercury threat is potentially serious, the volume of the contaminants is relatively small.

Application

Minuteman Mercury Vacuums feature a unique modular 4-element system that allows user tailoring to fit almost any need. Typical uses for the system are found in dental and research labs, shipboard applications and in instrument manufacturing facilities.

Selection

The Minuteman Mercury Recovery Vacuum System can be tailored to fit almost any particular need. The MRS-1, 2, 3 and 4 units are available with painted or stainless steel 15-gallon tanks. The MRS-6 Maxi-Guard II is a small, portable 6-gallon vacuum. Included with each unit is a wand, 24” crevice tool and small nozzle to handle most clean-up jobs.

Options

You may choose from a wide range of tools and attachments in a variety of sizes. Dry only units can be adapted for wet pick-up with the addition of a water shut-off module. A complete line of filters and collection bags are also available.

Nilfisk Advance
300 Technology Drive
Malvern, PA 19355
Phone: 610-647-6420
Fax: 610-647-6427
Internet: www.pa.nilfisk-advance.com

Nilfisk VT & SS Mercury Vacuum Systems

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Nilfisk VT Mercury Vacuum

For large spills, the VT Mercury Vac collects liquid Mercury and granular Mercury compounds by passing it through a specially designed separator and into an airtight, unbreakable polycarbonate jar for future reuse or disposal. An internal HEPA filter captures 99.999% of all particulates to 0.3 microns in size. An activated carbon adsorbent filter purifies exhaust air of Mercury vapors.

Features and Benefits

- Smooth-lined PVC hose reduces mercury droplet residue.
- Centrifugal droplet separator collects liquid mercury.
- A two-ply, 12-gallon disposal bag is available for dry spills.
- Internal HEPA (High Efficiency Particulate Air) filter captures 99.97% of particles down to 0.3 microns in size.
- Activated carbon adsorbent filter.
- Microstatic diffuser protects the motor and acts as a barrier to superfine carbon particles.
- Detachable trolley features sturdy polyethylene construction and large, smooth wheels for easy decontamination.
- Positive safety latches offer added security and discourage unauthorized disassembly of the vacuum cleaner.

Nilfisk SS Mercury Vacuum

The SS Mercury vacuum recovers small liquid mercury spills and granular mercury compounds while eliminating mercury vapors. Built-in activated carbon filtration prevents mercury from escaping through the vacuum's exhaust. A reusable GORE-TEX® membrane filter bag collects liquid mercury for reuse or reprocessing.

Features and Benefits

- Stainless steel container and trolley ensure easy decontamination.
- Positive twist safety latches offer added security and discourage unauthorized disassembly of the cleaner.
- Pre-HEPA prevents harmful particulate from damaging carbon filter
- Activated carbon adsorbent filter prevents mercury from escaping via the vacuum's exhaust.
- Smooth-lined, transparent Tygon® hose reduces mercury droplet residue.

- 1½-quart reusable collection bag collects mercury for reuse or reprocessing.
- Heavy-duty trolley and locking wheels provide stability and safety.

Mercury Recyclers

The following information was obtained from Ohio EPA, Office of Pollution Prevention.

The following is a list of mercury recyclers that Ohio EPA maintains on file. Please note that this list is only a partial representation of mercury recyclers and is updated periodically. If you wish to be added to the list please notify Ohio EPA Division of Hazardous Waste Management in writing. This list should not be seen as an endorsement or approval of these facilities by Ohio EPA. Users of this list are encouraged to research the compliance status of any company they utilize.

A & B Iron & Metal Company, Inc. 329 Washington Street Dayton, Ohio 45402 Phone: 513-228-1561	Cohen Brothers, Inc. P.O. Box 67 Middletown, Ohio 45042 Phone: 513-422-3696
Adrow Chemical 2 Lines Avenue Wanaque, NJ 07465 Phone: 201-839-2372	DF Goldsmith Chemical and Metal 909 Pitner Avenue Evanston, IL 60202 Phone: 847-869-2531
AERC.com, Inc. 2591 Mitchell Avenue Allentown, PA 18103 Phone: 610-797-7608	Environmental Enterprises, Inc. 10163 Cincinnati-Dayton Road Cincinnati, Ohio 45241 Phone: 800-722-2818
Advanced Recovery Systems, Inc. P.O. Box 2231 North Canton, Ohio 44720 Phone: 216-494-9364	Gletzers Aluminum Alloys 2040 Parsons Avenue Columbus, Ohio 43207 Phone: 614-443-7774
Ashtabula Salvage Company P.O. Box 800 Ashtabula, Ohio 44004 Phone: 216-997-5341	Marcon Recycling Center P.O. Box 2001 Marietta, Ohio 45750 Phone: 614-374-5467
Bethlehem Apparatus 890 Front Street Hellertown, PA 18055 Phone: 610-838-7034	Molise Paper & Metal Recycling 1271 East 289th Street Wickliffe, Ohio 44092 Phone: 216-944-8819
Bellefontaine Recycling 117 Buckingham Avenue, West Bellefontaine, Ohio 43311 Phone: 513-592-2514	Mercury Recovery Services (MRS) 700 5th Avenue New Brighton, PA 12205 Phone: 412-843-5000
C & E Recycling 204 East Railroad Street Columbiana, Ohio 44408 Phone: 216-482-2357	Mercury Refining Company 1218 Central Avenue Albany, NY 12205 Phone: 518-459-0820
Clean Harbors 2940 Independence Road Cleveland, Ohio 44115 Phone: 216-429-2402	Mercury Waste Solutions, Inc. 21211 Durand Avenue Union Grove, WI 53182 Phone: 800-741-3343

Contact Bowling Green State University for disposal of elemental mercury: 419-372-2173

ELEMENTAL MERCURY COLLECTION AND RECLAMATION PROGRAM

Adapted from www.bgsu.edu/offices/envhs/environmental_health/mercury/program.htm
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The elemental mercury collection and reclamation program began as a formal program in January 1998. The program was established following the report of young children who had contaminated themselves and several buildings with elemental mercury. Participants in the program include Bowling Green State University, Ohio EPA District Offices (Division of Emergency and Remedial Response), Rader Environmental Services, OSPPERA and Toledo Environmental Services. The Wood County Emergency Management Agency and the Wood County Health Department have also assisted in this effort.

The program involves the collection of uncontaminated elemental mercury from a variety of sources. These sources include thermometers, manometers, barometers, sphygmomanometers (blood pressure measurement devices), mercury-containing heating thermostats, mercury switches, as well as individual containers of elemental mercury. The program is available and FREE to individuals, academic institutions, small businesses, industries, medical and dental facilities, emergency response and other governmental agencies, spill response companies, and any additional entity having unwanted, uncontaminated elemental mercury. Although this service is free, you are welcome to make a tax-free donation to help defer the costs of running this program.

The process involved in the program is relatively straightforward. The entity having the mercury makes contact with one of the main participants in the program (see below) to arrange for the collection of the mercury. At the time of the initial contact, instructions are provided for the proper packaging of the container(s). These instructions include sealing the cap/lid of the container with electrician's tape, placing the container in a plastic ziplock bag (if possible), sealing the bag and placing it in a secondary plastic/metal container or box. Newspaper or other material should then be placed around the bagged container of mercury to provide some shock resistance. The secondary container should be closed/sealed for further protection. Thermometers and other mercury-containing devices are placed into protected and sealed containers as their size allows.

The container(s) of mercury are collected by one of the program participants according to the specific arrangements. The movement of mercury by private individuals is not encouraged. Only those having the technical knowledge relating to mercury hazards and the capability of moving the material safely are permitted to collect the containers.

During transportation of the mercury, the containers may be placed into other storage units (e.g. small plastic coolers) for additional safety. Vehicles used to transport the mercury contain mercury spill materials and protective gloves should a spill occur. Vehicle/cellular phones are also available should an incident

occur. A Bill-of-Lading shipping paper system is used to track the shipments of mercury from pickup to final disposition.

Primarily, the containers of mercury are brought to Bowling Green State University's Hazardous Waste Storage Facility. The facility is located in the northern section of the campus, away from academic buildings and easily accessible by highway. The containers are placed into a separate room specifically designed for poisonous materials. The mercury remains in that area until the mercury is consolidated. Rader Environmental Services, a hazardous waste management company, consolidates the mercury into lead casks. The consolidation takes place under a working fume hood within the facility. Should there be a need for consolidation in other locations not having a working fume hood, the consolidation is performed using a clean five-gallon plastic pail containing dry ice. The dry ice is used to minimize the release of mercury vapors during the transfer. The individual transferring the mercury also uses personal protective equipment, including a respirator.

As often as necessary, the casks of mercury are transported using a regulated transport vehicle to Environmental Recycling, Inc. of Bowling Green, Ohio. Environmental Recycling then retorts the mercury as the initial portion of their recycling efforts. Bills of Lading are used during the transport and Certificates of Recycling are obtained for the mercury sent for reclamation.

Since the program began, over 4,000 pounds of mercury have been removed from a variety of sources throughout Ohio as well as from locations in southern Michigan, eastern Indiana, and western Pennsylvania. Other counties in Northwest Ohio (Allen, Erie, Henry, Huron, Ottawa, Paulding, Defiance, Mercer, and Williams) have also established cooperative mercury collection programs. We are also assisting the Ohio EPA Pollution Prevention Unit in helping hospitals and other medical care facilities with pollution prevention programs. We are acting as a resource for removal of elemental mercury from those facilities.

Participants in the program will continue to provide information on the potential hazards associated with elemental mercury through news releases, formal presentations, and other feasible means.

It is hoped that others will take advantage of this valuable program and we will succeed in reducing the amount of mercury in locations where it is not necessary.

It is up to individual citizens, academic institutions, medical facilities, industries, and others to make the determination to take advantage of this most important program. In doing so, we decrease the risk of spills and the potential of unnecessary personal and environmental contamination.

For additional information, contact Dave Heinlen, Bowling Green State University, Bowling Green, Ohio 43403, 419-372-2173.

Local Governments Reimbursement

Adapted from www.epa.gov/superfund/programs/er/lgr
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MISSION

EPA'S Local Governments Reimbursement (LGR) program provides Federal funds to local governments for costs related to temporary emergency measures conducted in response to releases or threatened releases of hazardous substances. The program serves as a "safety net" to provide supplemental funding to local governments that do not have funds available to pay for these response actions. Eligible local governments may submit applications to EPA for reimbursement of up to $25,000 per incident.

On February 18, 1998, EPA published a new LGR regulation that simplifies and streamlines the process for applicants. EPA has designed the reimbursement process to be very straightforward. Local governments obtain and complete a simple LGR application form, that requires a local government to provide basic information about the incident, document its response costs by attaching copies of receipts, and certify that certain program requirements have been met. An applicant may receive a reimbursement check from the federal government in as little as two to three months after EPA's receives the application. Local governments can take action today to help ensure that they are eligible to participate in the LGR program in the future.

EPA's LGR Program is just a telephone call away. If you have any questions about the LGR program and how it works, you can call the LGR Help Line at 800-431-9209 or e-mail us at lgr.epa@epa.gov.

ELIGIBILITY

To be eligible for the LGR Program, your local government must meet the following guidelines:

The applicant must be a general-purpose unit of local government. Local governments that are eligible to receive reimbursement under the LGR program include any general-purpose unit of local government, such as a county, parish, city, town, township, and municipality. Federally recognized Indian Tribes are also eligible for reimbursement as a local government under the LGR program.

States are NOT Eligible. States are not eligible for reimbursement under the LGR program and no state may request reimbursement on the behalf of political subdivisions within the state.

The applicant must have legal jurisdiction over the site where the incident occurred. Only one request for reimbursement will be accepted for each hazardous substance release or threat of release requiring immediate response at the local level. When more than one local government has participated in such a response, the local government that has legal jurisdiction over the site where the incident occurred must submit the application. The application can be made on behalf of all participating local governments. If more than one local government or agency has jurisdiction over the site, then the respondents must determine which single government or agency will submit the request on behalf of them all.

Reimbursement cannot be made to a responsible party. If the local government applying for reimbursement is also the responsible party, the application will be denied. Responsible parties are liable for response cost regardless of whether or not they are a local government.

Substances released must be designated as hazardous under CERCLA. Incidents involving petroleum products including petroleum, natural gas, crude oil, or any other specified fractions thereof that are not specifically designated as CERCLA hazardous substances do not qualify under this program. Mixtures of hazardous waste and petroleum, and in some cases petroleum waste, may be allowable.

Maintain Your Eligibility

To ensure that the local government is best prepared to meet the application requirements once an emergency response occurs, the local government should consider the following:

- **Assign an LGR Coordinator.** Identify a person to coordinate the reimbursement process. This person will be responsible for meeting the program's requirements throughout the response and the application process.

- **Know the Program.** Before an incident occurs, obtain a copy of the LGR application package, which includes a copy of the application and a copy of the LGR regulations. Have the application on hand and be familiar with its contents in order to facilitate the application process.

REQUIREMENTS

Once a local government has decided that it is eligible to apply for reimbursement, there are a number of basic requirements that must be met to comply with the regulations for the LGR program. When completing the LGR application, local governments should pay special attention to the following requirements to facilitate reimbursement:

Reimbursement cannot supplant local funds normally provided for a response. In other words, if a local government budgets for emergency response activities, it must draw from this budget to pay for the cost of a response. However, if a local government's funds have been depleted, then it may be eligible for reimbursement under EPA's LGR program. In addition, other items that may not be budgeted for (e.g., overtime pay, unanticipated materials and supplies) may also be reimbursable under the LGR program.

Cost recovery must be pursued prior to applying for reimbursement. The applicant must complete the Cost Recovery Summary Table, included in the application, to documents the background and current status of cost recovery efforts. It should be clear that all available sources of cost recovery (i.e., responsible parties and their insurance, the state and local government insurance) have been or are being pursued. Although not required, it is recommended that a copy of all related correspondence also be included in the application to document the applicant's cost recovery efforts. Potential cost recovery sources should be given a minimum of 60 days to respond before an LGR application is filed. The LGR program is self-certifying, so a local government is not required to provide extensive documentation of its cost recovery efforts. By signing on the last page of the application, a local government is certifying that cost recovery was pursued according to the program requirements.

Detailed cost documentation must be submitted with the application. The applicant must complete the detailed Cost Breakdown Table, included in the application. All costs for which reimbursement is being requested must be listed and supporting documentation (e.g., invoices, sales receipts, or rental agreements) must be attached. Please note: Costs incurred for long-term remedial measures do not qualify under the LGR program. Reimbursement is made only for temporary emergency measures conducted in response to hazardous substance release incidents.

The local government’s highest-ranking official must sign the application. Examples of the highest ranking official include: Mayor, Head of Town Council, or head of a federally recognized Indian Tribe. In instances where the highest-ranking local official is unable to sign the application form, they must send a letter of delegation along with the application that authorizes a delegate to sign the application on his or her behalf.

Applications must be received by EPA within one year of the "date of completion" of the response, For the LGR program, the date of completion is the date when all field work has been completed and all project deliverables (e.g., lab results, technical expert reports, or invoices) have been received by the local government. The date of completion is not determined by cost recovery efforts, which can continue after an application for reimbursement is submitted. In general, a local government should allow at least 60 days for each potential source of reimbursement to respond to a request for repayment before submitting an application to LGR. EPA will consider late applications on a case-by-case basis.

Only one request for reimbursement will be accepted for each hazardous substance release or threat of release requiring immediate response at the local level. When more than one local government has participated in a response, the local government that has legal jurisdiction over the site where the incident occurred must submit the application. The application can be submitted on behalf of all participating local governments. If more than one local government or agency has jurisdiction over the site, then the respondents must determine which local government will submit the request on behalf of them all.

MSDS of Mercury Vapor Suppression and Amalgamating Products

MSDS of Elemental Mercury

NIOSH 6009 Sampling Method

Mercury Information Resources

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Ohio EPA Mercury Information Page
http://www.epa.state.oh.us/opp/mercury_pbt.html

ATSDR (Agency of Toxic Substances and Disease Registry)
http://www.atsdr.cdc.gov/ToxProfiles/phs8916.html

CDC (Centers for Disease Control)
http://www.cdc.gov/

General Mercury Links
http://www.tekran.com/hotlinks.html
http://www.pp.okstate.edu/ehs/links/mercury.htm

OSHA Guide to Hg Cleanups in Nursing Homes
http://www.osha-slc.gov/SLTC/nursinghome_ecat/maintenance/maintenance.html#Mercury%20Spills

OSHA Mercury Information
http://www.osha.gov/SLTC/healthguidelines/mercuryvapor/recognition.html

Ohio EPA/BGSU Mercury Collection Program
http://www.bgsu.edu/offices/envhs/mercury.htm

Ohio Mercury Reduction Group – Ohio EPA
http://www.epa.state.oh.us/opp/mercury-pbt/omrg.html

References

- OSHA Directive CPL2-2.6 – Inorganic Mercury and its Compounds, 10-30-1978
- ATSDR, ToxFAQ for Mercury, April 1999
- ATSDR, Public Health Statement for Mercury, March 1999
- ATSDR, National Alert, A Warning About Continuing Patterns of Metallic Mercury Exposure, July11, 1997
- 29 CFR 1910.120, Appendix B, General description and discussion of the levels of protection and protective gear.
- USEPA, Mercury Standard Operating Procedures
- NIOSH Pocket Guide to Chemical Hazards
- OSHA, Occupational Safety and Health Guideline for Mercury Vapor
- Ohio EPA, DERR, Ohio EPA Emergency Response to Mercury Spills
- Safety and Health Practices for Working with Metallic Mercury, First Edition October 19, 1985, Woodhall Stopford, MD, Duke University Medical Center Durham, NC
- Wisconsin Draft Mercury Sourcebook
- Massachusetts Department of Environmental Protection, 1996 Mercury Forms, Fate & Effects
- New Jersey State Department of Health, The Health Effects of Mercury
- MADEP, Mercury in Common Household Products Fact Sheet
- IDEM, Mercury Spill Information and Clean-up Guidance, April 2002
- Lab Safety Supply, Working with Mercury #235
- Wisconsin Department of Health and Family Services, Household Mercury Cleanup Options, 12-00
- Ohio EPA, Office of Pollution Prevention, Mercury Recyclers
- Techniques for Hazardous Chemical and Waste Spill Control, L.A. Weaver Company
- U.S. EPA, Region V, Mercury Response Guidebook
- Suggested Action Levels for Indoor Mercury Vapors in Homes or Businesses with Indoor Gas Regulators, ATSDR, 12-12-00