Controlling Metallic Mercury Exposure in the Workplace

A Guide for Employers

Division of Epidemiology, Environmental and Occupational Health
Occupational Health Surveillance Program

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December, 2004 (revised)

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Introduction

The purpose of this publication is to provide comprehensive information to ensure that everything possible is done in the workplace to prevent or reduce exposure to metallic mercury. Pages 5 to 11 of this document contain a systematic nine-step framework for assessing and controlling mercury exposure. Appendices A through F and Appendices 1 through 7 contain additional information on a variety of mercury-related topics and are attached at the end of the document and referred to throughout. A **Resources** section on pages 11-12 lists sources of additional information and assistance for employers.

Metallic Mercury is a silver-gray liquid. Because of its unique properties as a liquid metal, metallic mercury is especially challenging to control. When exposed to the air or if spilled, mercury metal vaporizes into the air where it can be breathed into the lungs and absorbed by the body. The warmer the temperature, the more quickly the mercury gets into the air. A temperature increase from 64.4°F to 78.8°F doubles mercury's vapor pressure. Metallic mercury can also be absorbed or injected through the skin. Metallic mercury is not absorbed efficiently by the body if swallowed and therefore is less harmful if ingested, unless it becomes lodged in the digestive system. If spilled mercury is not cleaned up completely, it easily gets spread around. Metallic mercury forms droplets that can accumulate in the smallest spaces like cracks between floorboards and under fingernails. These droplets are very slippery and hard to remove from work surfaces or skin. Mercury can be spread around work, car, and home from shoes, clothing, hair and other objects contaminated with mercury. If a worker is contaminated with mercury, it is important to promptly clean and decontaminate the worker before the employee leaves the work area. Simple hygiene practices, such as washing hands before eating and drinking or smoking, should always be followed even in the absence of obvious contamination. Smoking contaminated cigarettes will volatilize the mercury and result in the inhalation of mercury.

Some of the places mercury metal may be found:

- thermometers, thermostats, barometers, electrical switches
- dental fillings and some medical equipment (e.g., traditional blood pressure gauges)
- some light bulbs, including fluorescent
- high intensity, mercury vapor high-pressure sodium, and metal halide lamps
- some clock pendulums
- switches and circuits of some athletic shoes, toys, and cards that light up or make noise
- electrical applications in several manufacturing processes
- laboratories
- some chemical and pharmaceutical manufacturing

It is extremely important to realize that there are many forms of mercury that may be used in industry; <u>this document applies only to metallic mercury</u> (Hg^0, the type typically found in standard mercury thermometers, sometimes called elemental mercury). Other forms of mercury behave differently and may require different or additional control measures. For example, inorganic mercury compounds (e.g., mercury salts, Hg^{1+} or Hg^{2+}) are water-soluble and less efficiently absorbed through the skin and more efficiently absorbed through ingestion when compared to metallic mercury. Many forms of organic mercury (e.g., methyl mercury) are extremely and acutely toxic, absorbed very well through all potential routes of exposure, and can easily penetrate many common forms of protective gloves. This document does <u>not</u> apply to these other forms of mercury.

Health Effects

Breathing metallic mercury vapor over time can affect many different organs in the body, especially if the exposure is high. The human central nervous system (i.e., brain and spinal cord), kidneys, lungs, liver, stomach, intestines, skin, muscles, cardiovascular system (heart and blood vessels), and eyes can be affected by very large exposures. Symptoms of metallic mercury poisoning can include nausea, vomiting, diarrhea, increased blood pressure and heart rate, chest tightness and decreased performance of the lungs, stomatitis (inflammation of the oral mucus membranes), drooling, increased white blood cell counts, skin rashes (especially for those allergic to mercury), mood changes, inability to concentrate, memory loss, a fine shaking or tingling, loss of feeling (in the hand, tongue, or eyelid), discoloration of the cornea and lens of the eye, disturbances of vision, and kidney disease.

Although there are a multitude of effects that have been associated with metallic mercury poisoning, in most cases the exposure is much smaller and therefore the health effects are much more subtle and require careful medical evaluation by a trained physician. **The brain and kidneys are particularly susceptible and therefore are the most likely to be affected at smaller levels of exposure.**

For more detailed and comprehensive information about mercury health effects, please contact the Agency for Toxic Substances and Disease Registry (ATSDR) and request:

ATSDR Toxicological Profiles: Mercury
Agency for Toxic Substances and Disease Registry
Division of Toxicology/Toxicology Information Branch
1600 Clifton Road NE, E-29
Atlanta, GA 30333

Breathing a lot of mercury metal vapor in a short time can poison quickly. Symptoms begin with cough, chest pain, trouble breathing, and upset stomach. Chemical pneumonia, which can be fatal, can then develop.

Children are more susceptible than adults to mercury poisoning and can be affected if mercury is carried home on clothing, skin, or hair.

Pregnant women and developing fetuses may also be particularly susceptible to the effects of mercury. High levels of exposure may increase the rate of spontaneous abortion, miscarriage, still-birth and birth defects. The rate of spontaneous abortion may also be elevated among couples when **the male partner has been exposed** (perhaps through damaged sperm). These health studies are not conclusive, but suggest the potential for these effects.

Persons with pre-existing kidney, liver, lung, or nervous system diseases may be at an increased risk of adverse health effects from exposure to mercury.

Before You Begin: Can You Find a Substitute for Mercury?

Do you really need to use mercury? Can you reduce your use of mercury? Can you use another safer chemical, metal or alloy in place of mercury? Can you eliminate or replace equipment or instruments that contain mercury? Substitution of a safer chemical for mercury is a very effective way to reduce exposure in the workplace. Be sure, however, that any substitute is less hazardous then mercury and will be able to be used safely. In addition, after substitution you may still need to correctly clean-up and decontaminate areas and items with pre-existing mercury contamination.

Your Company's Health and Safety Program is Important

Metallic mercury control will be more effective if you have a program and staff for the management of *all* workplace health and safety issues. That way it will be easier to decide who should carry out Steps 1 to 9 involved in controlling mercury exposure which are described in this document. In order to deal successfully with mercury and the whole range of hazardous substances and conditions in your workplace, you need a health and safety program, with the following four components:

1. Management Commitment

- Illness and injury prevention as a goal
- Voluntary OSHA compliance
- Health and safety staff with sufficient:
  - ✓ Responsibility
  - ✓ Authority
  - ✓ Staffing levels
  - ✓ Competence
- Appropriate use of consultants:
  - ✓ Privately-hired
  - ✓ **free** consultation (see page 4 under Resources)
- Adequate health and safety budget

For more information on health and safety programs see:

- OSHA Safety and Health Program Management Guidelines
- OSHA Program Evaluation Plan
- www.osha.gov

***For more information on consultants see*:**

- Selecting and Using a Health and Safety Consultant *(Appendix C)*
- Make sure you and the consultants know exactly what they are being employed to do
- Work with consultants rather than leaving them to do the task in isolation
- Act on the recommendations proposed

2. Employee Involvement

- Joint worker-management health and safety committee
- Employee training and education
- Employee access to safety data

3. Hazard Identification

- Record-keeping and analysis of both accidents and "near-misses"
- Accident/incident/spill investigation

4. Implementing Controls

- Short and long-term plans
- Company health and safety manual of policies and procedures
- Enforcement of policies and procedures
- Preventive maintenance
- Prompt repairs of broken control equipment

Resources

- The New Jersey Department of Labor and Workforce Development has a **free** health and safety consultation service for private industry employers and employees. They can provide expertise and guidance on many workplace safety and health issues. They can be contacted at: (609) 984-0785 or via the Internet at www.nj.gov/labor/lsse/lsonsite.html.

- The New Jersey Department of Health and Senior Services' Public Employees Occupational Safety and Health (PEOSH) Program provides **free** consultation services for the public sector. They can provide expertise and guidance on many workplace health issues. Public employees and employers (e.g., school districts) can contact the PEOSH Program at (609) 984-1863 or via the Internet at www.state.nj.us/health/eoh/peoshweb.

- Additional publications on occupational health can be found by calling (609) 984-1863 or online at: www.state.nj.us/health/eoh/survweb/odispubs.htm.

A Systematic Framework for Controlling Mercury Exposure

For assistance in completing Steps 1 and 2 use:
Example worksheet for Gathering Information About Work Involving Metallic Mercury (*Appendix D)*

Step 1. Gather information about the work that involves mercury and their associated working practices

- ❑ List all the locations in the workplace where mercury is used or present.

- ❑ List the number of employees on each shift working with or near mercury. Consider all workers, those directly exposed as well as those with "bystander" or indirect exposure. Consider the following types of workers:
  - Permanent
  - Temporary
  - Housekeeping
  - Maintenance
  - Research and Development
  - Crane, forklift, and truck drivers
  - Supervisors and managers
  - Office, administrative, and clerical
  - Storekeepers
  - Shipping and receiving
  - Contractors
  - Interns and students
  - Visitors and customers

- ❑ Take notes on each applicable job title and their job duties:
  - Break down duties by how often they are done (frequency in days/week) and how long they last (duration in hours/day)

- ❑ List all applicable work locations: departments, processes, floors, machines, work stations.

- ❑ Take notes on usual, occasional, overtime, and emergency work shifts.

- ❑ Take notes on both typical and atypical activities:
  - Breakdowns
  - Staff shortages
  - Changes in personnel

- ❑ Also note:
  - Changes in volume of production
  - Trial runs, pilot production, and test batches
  - Temperature of the workplace (higher temperatures increase metallic mercury volatilization)
  - Any other condition that you think may be relevant and important

Step 2. Observe and conduct interviews to find out how employees might be exposed

Exposure refers to any direct or indirect contact with metallic mercury. Metallic mercury is efficiently absorbed into the body through the skin and though inhalation of vapors. Metallic mercury can also be inadvertently ingested by putting contaminated objects (e.g., food, hands) in the mouth. Activities that can contribute to or enhance exposure can include, but are not limited to:

- Direct contact with mercury.
- Splashing or spilling onto skin.
- Handling objects that have touched mercury.
- Contamination of the inside of gloves, clothing, shoes, jewelry, eyeglasses.
- Failure to wash skin, fingernails and hair at end of work shift.
- Contamination of hair, face, skin, clothing, gloves.
- Contamination of work surfaces.
- Open containers from which mercury may vaporize.
- Contamination of cigarettes that are smoked.
- Contamination of beverage containers, food, or utensils brought into the work area.
- Handling contaminated sharp objects such as broken glass.
- Contamination on the inside of respirators.
- Improperly selected, maintained, or used respirator.
- Improperly designed, maintained, or used ventilation.
- Improperly selected gloves, since all gloves are not necessarily impermeable to mercury.

Several other factors can contribute to exposure as a result of metallic mercury's behavior. For example, sources of heat (e.g., temperatures above 68^{o}F) can increase mercury vaporization and hence increase exposure by breathing the vapors. Metallic mercury can potentially contaminate employees' automobiles and homes because metallic mercury is difficult to clean and remove from surfaces, such as work clothing and shoes.

Industrial hygienists often sample and document metallic mercury contamination by using either commercially available mercury spill kits or by using direct reading mercury vapor meters to detect the presence of mercury. (*See list of mercury vapor meters in Appendix 3*). It is important to also understand how and where metallic mercury vapor will be carried by the air flow in a workplace as employees working far away from a source of metallic mercury could potentially be exposed to the vapors as they diffuse throughout the workplace. Industrial hygienists often use smoke generators, incense, or inert trace gases and the floor plan to track air movement within a workplace. Knowledge of the air flow can provide insights into where vapors could potentially travel. It is particularly important to understand the air flow around work areas using metallic mercury to prevent the diffusion of vapors into other work areas within a facility. Industrial hygienists and engineers often will use specially designed ventilation systems to exhaust any released metallic mercury vapor directly to control devices, thereby reducing or eliminating the possibility of exposure. It is important to assure that there is enough fresh make-up air to replace the air being exhausted when using local exhaust ventilation.

Step 3. Observe employees at work and conduct employee interviews to find out what controls are in place to prevent mercury exposure, using the following menu of controls

Additional information about workplace controls can be found in our Industrial Hygiene Fact Sheet on this topic, *Controlling Chemical Exposure*, available online at www.state.nj.us/health/eoh/survweb/odispubs.htm or ordered by calling the Occupational Health Surveillance Program at (609) 984-1863.

For assistance in completing Step 3, use:
- A simple floor plan to note the location of controls as you walk through the workplace
- Example Worksheet for Gathering Information About Controls for Metallic Mercury *(Appendix E)*

Often multiple controls are necessary to prevent unacceptable exposures to employees. Some control options may include:

1. Isolate/regulate area for where mercury is used:

- Close doors.
- Restrict entry to essential workers.
- Restrict time in area.
- Control movement of air in work area with properly designed ventilation systems (consult professional industrial hygienist/engineer for design).

2. Control technology/work station design:

- Glove box.
- Lab hood.
- Local exhaust ventilation.
- Temperature control below 20°C (68°F).
- Purchase mercury in containers sized for particular process needs and sized to fit enclosed addition systems.
- Store and transfer mercury-containing items in covered containers.
- Continuous fixed monitor set to alarm at ½ the acceptable airborne concentration (*see Appendix A*).
- Smooth, impermeable work surfaces (stainless steel) with drainage along the front work surface sloped to a collection bottle and a lip along the other sides to prevent spillage.
- Impermeable floors (epoxy, polyurethane, vinyl sheeting) that are smooth but not slippery; there should be no wood or carpeted flooring.
- Dark colored floors to aid in visualizing mercury.
- Caulking around table legs and the space where floors meet walls.
- Keep mercury in non-breakable, closed containers.

3. Standard written work practices/operating procedures:

- Job training.
- Spill clean-up procedures.
- Local exhaust ventilation.
- Dilution ventilation.

4. Housekeeping equipment and procedures:

- Daily cleaning of floors, work surfaces, and all hand-contact points, tools, door knobs, and table tops.
- Prohibit eating, drinking, and smoking in work areas.

- Clean up spills promptly *(See Appendix F).*
- Vacuum regularly with a special mercury vacuum *(See Appendix 2).*
- Prohibit dry sweeping or wiping.
- Prohibit the use of compressed air for cleaning.
- Prohibit the use of vacuum pumps for cleaning.
- Used wipe rags and paper towels should not be rehandled, reused, put in pockets, or dried on heaters.

5. Personal Protective Equipment:

- Eye and face protection.
- Emergency eye and body wash.
- Daily clothing and glove changes.
- Respiratory protective equipment and practices *(See Appendix 5)*.

The improper use of personal protective equipment, especially respirators, is dangerous. Such equipment requires training, supervision, and maintenance and should only be used if:

- Workplace exposures are properly assessed
- The equipment is properly selected, fitted, maintained, and used
- Employees are trained concerning why, when, and how to use the equipment
- Employees are medically able to use personal protective equipment. This is especially true of respirators. Consult a physician for guidance and to comply with OSHA rules.

6. Change room and locker room facilities and practices:

- Provide employees with proper work clothes and safety shoes that are to be worn at work only. In addition, provide proper impact resistant safety eyeglasses. These work clothes should be laundered by a commercial laundry service. Shoes, safety eyeglasses, and work clothes should not be worn or taken home since these items may be contaminated.
- Provide clean storage for street clothing, shoes, and personal belongings during work time.
- Prohibit personal belongings in work areas (street clothing or shoes, combs, purses, rings, watches and other jewelry, wallets).

7. Hand washing and showering facilities and practices:

- Keep lavatories clean.
- Provide soap, disposable towels, fingernail brushes, and warm water.
- Provide additional hand-washing facilities in work areas.
- Keep showers clean and provide soap, shampoo, fingernail brushes, towels, and warm water.
- Assure that employees shower, wash their hair, wash their fingernails, and clean any other items that may have become contaminated at work before the employee goes home.

8. Lunchroom facilities and practices:

- Provide clean storage for food, beverages, cigarettes, gum, etc.
- Assure that employees wash hands before entering lunchroom.
- Assure that employees wash hands and face prior to eating, drinking, or smoking.
- Provide a lunchroom that is separate from work areas.
- Vacuum lunchroom daily with a special mercury vacuum (*see Appendix 2*).

9. Medical surveillance:

- Biological monitoring.
- Medical removal from exposure.

For more information on medical surveillance see Appendix B:

- Recommended Medical Monitoring for Workers Exposed to Metallic Mercury

10. Hazard communication:

- Inventory of hazardous materials.
- Labeling of containers.
- Warning signs.

Step 4. Decide what additional controls can be implemented, using the Step 3 menu of possible controls

The Hierarchy of Controls
1) Substitute a safer chemical
2) Substitute a safer process
3) Mechanize and isolate the process
4) Enclose the operation
5) Provide exhaust ventilation
6) Provide respirators, gloves, and other protective equipment

Use the information collected in Steps 1 – 3 to make decisions about necessary controls. Consult a professional occupational health and safety professional if necessary. There are many possible work activities involving metallic mercury and the range of effective controls is equally extensive. However, the Step 3 menu of possible controls should direct your thinking to many of the relevant possibilities. Some control techniques are more effective then others, for example, engineered controls that are designed into the workplace are preferred because they can constantly maintain a healthy environment. What has been called the *Hierarchy of Controls* (see sidebar) demonstrates that controls at the top of the list are preferred over the controls at the bottom of the list. Prevention of hazardous environments is always preferred over allowing employees to work in hazardous environments. Some things, like good housekeeping and hygiene, should always be in place. Control technology should be used as needed. Respirators and other personal protective equipment should be used only when other controls are not sufficient.

Step 5. Make a record of the assessment

Record sufficient information to show why decisions about exposures and controls have been made. If it has been decided that there will be reliance on personal protective equipment, then the assessment should make it clear why other controls were not implemented or sufficient.

Step 6. Make sure you have complied with OSHA/PEOSH regulations

The following OSHA/PEOSH regulations are applicable to most situations involving the control of mercury exposure. Call the OSHA publications office at (202) 693-1888 or online at: www.osha.gov/pls/publications/pubindex.list for copies of the publications listed below which give simple explanations of each standard. For PEOSH publications call (609) 984-1863 or online at www.state.nj.us/health/eoh/peoshweb/.

- ***1910.134- Respiratory Protection***-See OSHA Publication 3079, Respiratory Protection
- ***1910.132- Chemical Protective Gloves and Clothing***- See OSHA Publication 3077, Personal Protective Equipment
- ***1910.1200- Hazard Communication*** - See OSHA Publication 3084, Chemical Hazard Communication or PEOSH Hazard Communication, N.J.A.C. 12:100-7
- ***1910.120- Spill clean-up/emergency response*** - See OSHA Publication 3088, How To Prepare for Workplace Emergencies
- ***1910.20- Access to Medical and Monitoring Data*** - See OSHA Publication 3110, Access to Medical and Exposure Records
- ***1910.1000, Table Z-2- Acceptable Ceiling Concentration for Mercury***
- ***1904.1 to .22- Recording and Reporting Occupational Injuries and Illnesses*** - See OSHA Publication entitled Recordkeeping Guidelines for Occupational Injuries and Illnesses.

Step 7. Budget funds for controls and implement the safety plan

Assure that you have an appropriate amount of resources to implement the proper safety plan.

Step 8. Check on the effectiveness of controls

- The safety plan should be a dynamic process that is constantly reviewed and updated. Review Steps 2 and 3.

> ***For more information see:***
> - Metallic Mercury in Air Exposure Limits *(Appendix A)*
> - Mercury Industrial Hygiene Monitoring Methods *(Appendix 3)*

- Conduct full shift personal sampling and compare to the American Conference of Governmental Industrial Hygienists Threshold Limit Value (ACGIH TLV) for metallic mercury.
- Conduct wipe sampling of work surfaces and skin.
- Review Step 4, if necessary.
- Assess employees' automobiles and homes, if necessary
- Under the guidance of a physician, conduct biological monitoring of employees if necessary. It is important to ask the attending physicians for guidance on appropriate medical testing, as a simple blood test may not be informative without a corresponding urine test.
- Refer any overexposed employees to an occupational health physician for medical evaluation.

It is important to reassess and improve your exposure control plan if sampling determines that employees are overexposed. An effective exposure control plan should assure that employees are protected from overexposure.

Step 9. Review Steps 1-8 if plant, process, operations, control methods, or materials change, or if health effects or elevated biological monitoring results are reported

The purpose of this review is to see if the existing assessment is still suitable and sufficient. If it appears that the assessment is no longer valid, those parts of the safety plan that do not reflect the new situation need to be updated.

<u>Please Note</u>: Consult industrial hygienists or other occupational health and safety professionals for guidance as necessary.

Resources

- ***Free on-site workplace consultation*** is available for:
  - <u>Private sector employers</u> – from the New Jersey Department of Labor and Workforce Development, Occupational Safety & Health On-Site Consultation Program. Call 609-984-0785.
  - <u>Public sector employers</u> – from the New Jersey Department of Health & Senior Services, Public Employees Occupational Safety and Health (PEOSH) Program, Consultation Project. Call 609-984-1863.

- ***OSHA publications*** are available through the OSHA publication office:
  U.S. Department of Labor/OSHA
  OSHA Publications
  PO Box 37535, Washington, D.C. 20013-7535
  Telephone: (202) 693-1888
  or by Fax: (202) 693-2498

OSHA publications can also be ordered online at: www.osha.gov/pls/publications/pubindex.list. The publications office can also be contacted by calling 1-800-321-6742, menu option #4. To see everything available, ask for the OSHA publications catalog.

- ***OSHA resources for small business*** – are available from the OSHA Web site at www.osha.gov/dcsp/smallbusiness/index.html. In addition, two publications from OSHA designed for small businesses can be ordered from the OSHA publications office at the numbers listed above or downloaded as follows: *Q's & A's for Small Business Employers* at www.osha.gov/publications/osha3163.pdf and *Small Entity Compliance Guide for the Revised Respiratory Protection Standard* at www.osha.gov/publications/secgrev-current.pdf

- ***OSHA telephone consultations*** are available from your local OSHA Area Office: *Marlton* 856-757-5181; *Avenel* 732-750-3270; *Parsippany* 973-263-1003; *Hasbrouck Heights* 201-288-1700.

- ***NIOSH publications*** are available by calling 1-800-35-NIOSH, select appropriate menu option. Or order online at: www.cdc.gov/niosh/pubs.html

- ***NIOSH telephone consultation*** is available at 1-800-35-NIOSH

- ***Listing of proficient industrial hygiene labs*** appears in the American Industrial Hygiene Association Journal every March, June, September, and December

- ***Listing of industrial hygiene consultants*** appears in the American Industrial Hygiene Association Journal every January and July

- ***List of Physicians in New Jersey Specializing in Occupational and Environmental Illness*** is available from NJDHSS at (609) 984-1863 or download the updated list at: www.state.nj.us/health/eoh/survweb/oemdlist.htm

- ***Training*** is available from the Environmental and Occupational Health Sciences Institute at UMDNJ at 732-235-9450 or online at: www2.umdnj.edu/ophpweb/

- ***Industrial pollution prevention*** – The New Jersey Program for Manufacturing Excellence (NJME) helps employers find safer substitutes for hazardous chemicals and processes. NJME can be contacted at:

  New Jersey Program for Manufacturing Excellence
  CAES, Rutgers University
  640 Bartholomew Rd.
  Piscataway, NJ 08854-8003
  Phone: (732) 445-8289
  Fax: (732) 445-0730
  E-mail: njme@caes.rutgers.edu
  http://njme.rutgers.edu

Appendices

Appendix A
Metallic Mercury in Air Exposure Limits for Workplaces and Occupational Settings

These standards are for occupational settings only. Metallic Mercury (sometimes also called elemental mercury) refers to Hg^0.

1) Legally enforceable standards for metallic mercury vapor are:

- Occupational Safety and Health Administration (OSHA) – for private sector employees:
  - ✓ Permissible Exposure Limit (PEL): **0.1 milligrams per cubic meter of air (mg/m^3)** (ceiling limit, not to be exceeded for any length of time)

- New Jersey Public Employees Occupational Safety and Health (PEOSH) Program – for New Jersey public sector employees only:
  - ✓ Same as OSHA; **ceiling limit**: **0.1 mg/m^3** (not to be exceeded for any length of time)

2) Guidelines recommended by technical organizations are:

- American Conference of Governmental Industrial Hygienists (ACGIH):
  - ✓ **Threshold Limit Value** (TLV): **0.025 mg/m^3** (8-hour time-weighted-average) The TLV notes that metallic mercury is also absorbed through the skin.

- National Institute for Occupational Safety and Health (NIOSH):
  - ✓ **Recommended Exposure Level** (REL): **0.1 mg/m^3** (ceiling limit, not to be exceeded for any length of time)

Please note: If you work in a private sector company, your organization may also have an internal exposure guideline as company policy. All guidelines must be equal to or below the legally enforceable limits listed above. It is a violation of law to exceed the OSHA or PEOSH levels at any time.

Appendix B
Recommended Medical Monitoring for Workers Exposed to Metallic Mercury

Introduction

Medical monitoring is the periodic evaluation of exposed workers to ensure that they are experiencing no adverse effects from potentially hazardous workplace exposures. It serves as back-up for a program of routine air and biologic monitoring, which are the primary means for ensuring that exposure levels are below those associated with adverse health effects. A medical monitoring program should be designed to detect adverse effects of exposure as early as possible, at a stage where they are still reversible, so that exposures can be controlled and serious adverse health effects prevented.

Baseline and Periodic Examinations

An initial medical examination should be performed on all employees potentially exposed to mercury. The purpose of this examination is to provide a baseline for future health monitoring.

The examination should include the following:

- A complete medical history and symptom questionnaire, with emphasis on:
  - ✓ the nervous system (target organ for acute and chronic exposure),
  - ✓ the kidneys (target organ for acute and chronic exposure),
  - ✓ the oral cavity (target organ for chronic exposure),
  - ✓ the lungs (target organ for acute exposure),
  - ✓ the eyes (affected by chronic exposure),
  - ✓ the skin (since mercury is a known skin sensitizer)
  - ✓ and reproductive history.
- Symptoms of the earliest signs of mercury intoxication should be elicited; these include: personality changes, weight loss, irritability, fatigue, nervousness, loss of memory, indecision, and intellectual deterioration. Complaints of tremor and loss of coordination should also be sought.
- Physical examination should focus on the target organs described above.
- A baseline handwriting sample should be obtained.
- Laboratory evaluation should include at minimum a complete urinalysis (see below).

This examination should be repeated annually. Results should be compared with the findings on the baseline examination for changes suggestive of mercury toxicity. Handwriting samples should be compared to the baseline sample for evidence of tremor. Interim evaluations should be conducted if symptoms suggestive of mercury intoxication are occurring.

Confidentiality of Medical Information

Questionnaire and physical examination results from periodic examinations should be compared to the baseline examination to detect any change that might be attributed to mercury intoxication. The results should be conveyed in detail to the worker. The examining physician must notify the New Jersey Department of Health & Senior Services, Occupational Health Service, if mercury intoxication is suspected on the basis of symptoms or results of the physical examination or laboratory tests. Information and reporting forms can be obtained by calling (609) 984-1863 or can be downloaded at the following Web address: www.state.nj.us/health/forms/occ-31.dot A copy of the reporting form is also included in *Appendix 7*. ***The results of the physical exam should be kept confidential, and no management personnel other than health professionals may have access to the medical records. The New Jersey Department of Health and Senior Services will not release or reveal the name of any employee with mercury intoxication reported to the Occupational Health Service. The purpose of reporting is to allow industrial hygienists to evaluate and intervene at work locations that may have significant mercury exposures, while allowing employees to remain completely anonymous.***

If intoxication is suspected, the worker should be removed from exposure and expert medical consultation should be sought.

Importance of Evaluating Group Results

The results of the questionnaire and physical examination should also be evaluated on a group basis. This is important because early mercury poisoning might cause only very mild, clinically insignificant increases in symptomatology in each individual employee which, when seen in aggregate for all workers at a particular worksite, might provide an important clue that toxic exposure to mercury is taking place at a particular worksite.

Who Should Perform the Medical Examinations?

All medical monitoring of exposed employees should be conducted by a physician knowledgeable in occupational medicine. Board Certification in Occupational Medicine is a sub-specialty, very much like any other specialty in medicine. A list of physicians in New Jersey that are board-certified in occupational medicine can found at the following Web address: www.state.nj.us/health/eoh/survweb/oemdlist.htm

Interpretation of the group data should be undertaken only by trained occupational health professionals with expertise in performing such analyses.

Using More Sensitive Medical Tests

Several studies have shown that there are some special tests that can be performed by physicians to detect early signs of mercury toxicity.

Neurobehavioral tests, designed to detect early changes in concentration, response time, memory, and hand-eye coordination, can be useful on both an individual and a group basis in detecting early nervous system effects of mercury exposure.

Early kidney damage may be detected by looking for the presence of low molecular weight proteins in the urine. The presence of these proteins in the urine indicates that kidney damage has occurred long before a routine urinalysis indicates an abnormality. ***Beta-2- microglobulin*** and ***N-acetyl-B-D-glucosaminidase (NAG)*** are two of the proteins that can be measured in the urine. The tests are useful on both an individual and group basis.

These special tests should be arranged and interpreted only by a trained occupational physician or other physician with special expertise in these areas.

Biologic Monitoring

Biologic monitoring is the measurement of a chemical agent in the blood, urine, or other body tissue of exposed individuals to determine how much of the chemical has been absorbed into the body. It serves as an additional evaluation of environmental exposures and can be important because air measurements cannot assess skin exposure or the effects of protective equipment and work practices. *Biological monitoring can be a better estimate of risk for adverse health effects than air monitoring since it measures the amount of an agent actually absorbed into the body. However, biological monitoring should be guided by a physician trained to plan the tests and understand the results since improper testing and timing of the test can result in misleading and inaccurate results.*

There is no ideal biologic monitor for evaluating the risks of mercury intoxication from metallic mercury. Mercury can be measured in both blood and urine. Individual levels may vary greatly from day to day and even within a given day. While proper interpretation of the results can be difficult, the measurements can nevertheless provide information on potential overexposure. Measurements should be carried out regularly (several times per year) in chronically exposed workers, and individual as well as group results should be evaluated. Baseline levels should be obtained before exposure begins for comparison purposes.

Mercury in Urine

Measurement of mercury in urine is the recommended biologic monitor for workers exposed to metallic mercury. Ideally, the collection should be over 24 hours, but this is seldom feasible.

Spot urine samples may also be taken, but care must be taken to always collect them at the same time of day near the end of the work week after several months of steady exposure. Overnight samples may also be collected; this collection extends from the time the employee goes to bed through the first urination of the morning.

Samples must be collected in mercury-free containers that must be provided by the laboratory because a preservative must be added. At least 25 cubic centimeters (cc) of urine must be collected. Great care must

be taken to prevent contamination of the sample containers or the urine with mercury from the skin or workplace air.

When results are interpreted, the urine values should be corrected for grams of creatinine in the sample, and should be expressed in the analytical results as micrograms of mercury per gram of creatinine in the urine (μg Hg/g creatinine). In persons not occupationally exposed to mercury, urine levels rarely exceed 5 μg Hg/g creatinine. ***Levels greater than or equal to 20 μg Hg/g creatinine*** are reportable to the New Jersey Department of Health and Senior Services' Occupational Health Service by clinical laboratories and physicians/advanced practice nurses. See *Appendix 7* for reporting form**.**

While many laboratories indicate that mercury levels only above 150 μg Hg/L should be considered toxic, there is strong evidence that early signs of mercury intoxication can be seen in workers at much lower concentrations.

Exposed individuals with levels above 35 μg Hg/g creatinine in their urine should be placed in a non-exposed job until the reason for their overexposure has been identified and corrected. They should not return to their work involving mercury until their urine levels have fallen below this biologic threshold limit value. This value is based on the ACGIH Biological Exposure Index (BEI) (ACGIH, 2003).

Mercury in Blood

The concentration of mercury in blood reflects exposure to organic mercury as well as metallic and inorganic mercury; thus, *it can be influenced by the consumption of fish containing methyl mercury that has bioaccumulated from the environment.* Therefore, blood tests are ***not*** recommended for the evaluation of occupational metallic mercury exposure.

If blood samples are taken despite the limitation cited above, they should always be taken at the same time of day near the end of the work week after several months of steady exposure. The biological half-life of metallic and inorganic mercury in blood is relatively short and therefore results can only indicate recent exposure. Whole blood should be collected in mercury-free heparinized tubes after careful skin cleansing. The recommended tubes are those sold for trace metal analysis; these generally have royal blue stoppers.

Blood levels greater than or equal to 2.8 micrograms of mercury per deciliter (μg Hg/dL) are reportable to the New Jersey Department of Health and Senior Services' Occupational Health Service by clinical laboratories and physicians/advanced practice nurses (See *Appendix 7* for reporting form). The ACGIH BEI is 1.5 micrograms of mercury per deciliter of blood and is roughly equivalent to the level that would be expected if exposure occurred at the ACGIH TLV (ACGIH, 2003). Any worker exceeding this level should be placed in a non-exposed job until dietary and workplace exposures have been evaluated and blood levels have returned to baseline.

(ACGIH) American Conference of Governmental Industrial Hygienists. (2003) TLVs and BEIs, Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices. ACGIH. Cincinnati, OH: ISBN#: 1-882417-49-6

Laboratory Analysis

Urine or blood samples should be submitted to a laboratory that is proficient in mercury analyses. Not all labs are proficient in these analyses. The best indication of such proficiency is successful participation in the interlaboratory comparison program for mercury urine and/or blood samples sponsored by the Quebec Toxicology Center. Questions on laboratory proficiency should be directed to the clinical lab's quality control department.

Removing Employees from Exposure

Individuals should be removed from mercury exposure if signs or symptoms of intoxication are detected on physical exam or if their biologic levels equal or exceed the ACGIH BEI value for urine mercury, which currently are:

- **35 μg Hg/g creatinine in urine**
- **15 μg Hg/L in blood (i.e., 1.5 μg Hg/dL)**

Note: as stated previously, urine tests are preferred for occupational metallic mercury exposure.

An individual who must be removed from mercury exposure because of elevated blood or urine mercury levels or physical examination results suggesting mercury intoxication should be given alternative work with no exposure. His or her wages, benefits and seniority should be maintained. No employee should be terminated or otherwise punished because of overexposure to mercury.

Employees should be returned to work only after they are free of symptoms of mercury intoxication and mercury urine levels have fallen below 35 μg Hg/g creatinine.

Appendix C
Selecting and Using a Health and Safety Consultant

At times, employee exposures and safety problems will defy your best efforts to find a solution. At those times, many businesses seek the advice of experts who specialize in industrial health and safety. Often companies that do not have full time health and safety staff will hire outside consultants. *It is important to obtain the services of a qualified consultant*. The scientific discipline that deals with occupational health and safety is called **Industrial Hygiene**. Industrial hygienists are those individuals who practice and specialize in industrial health and safety and are trained to visit industrial sites and anticipate, evaluate, control, and prevent occupational exposures and hazards.

Industrial hygiene consultants are hired primarily to accomplish two major objectives:
(1) to identify and evaluate potential health and safety hazards to workers in the occupational environment, and/or (2) to design effective controls to protect the workers. Competent industrial hygiene consultants should be able to perform both of these tasks because of their training and experience. Consultants can also be used to keep management aware of both current and proposed federal and state regulations in the area of occupational health and safety. There is a Board Certification for Industrial Hygiene, typically referred to as the C.I.H. (certified industrial hygienist), which is administered by the American Board of Industrial Hygiene. This certification is designed to provide some assurance that a professional is qualified in the science and art of industrial hygiene.

Industrial hygiene consultants can recommend whether or not control measures are required and whether alternatives are available. They can evaluate the effectiveness of control measures, determine when medical examinations of employees may be recommended or required by regulation, and design employee training programs, and they should be able to recommend appropriate physicians or clinics specializing in occupational medicine. An industrial hygiene consultant can also play a valuable role in providing the examining physician with information on the occupational exposures of employees.

There are several sources one can go to for information on the names of consultants. One source of information is from professional associations and public-service organizations involved in occupational safety and health. Three national groups are the American Industrial Hygiene Association (AIHA), the American Society of Safety Engineers (ASSE), and the National Safety Council (NSC). These groups have local chapters, sections, or offices in major cities that can provide information and assistance. The AIHA publishes a nationwide list of industrial hygiene consultants in the January and July issues of the AIHA Journal. The Web addresses for these organizations are:

- AIHA: www.aiha.org or www.njaiha.org (NJ section)
- ASSE: www.asse.org
- NSC: www.nsc.org

Many insurance companies have loss prevention programs that employ industrial hygienists. Inquiries should be made of your present insurer; you may want to compare the services they offer with those of other insurance companies. Finally, there may be a university or college in your area that has an environmental or occupational health program.

Anyone can advertise and sell occupational and environmental health and safety services. Therefore, it is extremely important to obtain the services of a qualified consultant due to the complexity of many occupational health and safety issues. It is important to assess the qualifications of the consultant by asking questions about their experience, if they are Board Certified in Industrial Hygiene (C.I.H.), and the resolution of problems for other clients they have worked for. Direct inquires and critical judgments can help you find a qualified consultant.

Appendix D
Example Worksheet for Gathering Information About Work Involving Metallic Mercury

Location/building/floor/department:

Operation/process/machines/work stations:

Overview of how mercury is used in this location and operation:

Hours of shifts on which mercury is used:

Frequency of mercury use in days per week, month, or year:

Amount of mercury (give units of weight or volume) used per week, month, or year:

Employees working with mercury (list names and job titles):

Job Title	**Number of Employees in Title per Shift**		
	1st shift	***2nd shift***	***3rd shift***
1.			
2.			
3.			
etc.			

<u>Tasks involving potential exposure</u>:

Job Title	**Task Description**	**Frequency days/week**	**Duration hours/day**	**Exposure Potential***
1.	1.			
	2.			
	3.			
2.	1.			
	etc.			

*** Exposure potential** = rate the potential for exposure via inhalation of vapors, skin contact, or accidental or incidental ingestion (e.g., eating on surface where mercury is handled). Use a scale that denotes high, medium, and low potential.

Appendix E
Example Worksheet for Gathering Information About Controls for Metallic Mercury

Job Title and Task Description	**List Controls to Prevent Exposure**		
	Control #1	***Control #2***	***Control #3***
Operator - pours mercury	Local exhaust ventilation	Wears respirator	Wears proper chemical gloves and protective clothes
Maintenance - cleans areas	Checks area with mercury vapor meter, notifies EH&S staff if spill detected	Wears chemical protective clothing and chemical protective gloves	

Checklist of Recommended Written Procedures

- ❑ Written Hazard Communication Program; required by OSHA at 29 CFR 1910.1200
- ❑ Written Respiratory Protection Program, required by OSHA 29 CFR 1910.134
- ❑ Written certification that a workplace hazard assessment has been performed to determine if hazards are present that require the use of personal protective equipment, required by OSHA 29 CFR 1910.132
- ❑ Written mercury spill clean-up procedures
- ❑ Written mercury exposure and control assessment
- ❑ Written mercury handling and control procedures
- ❑ Written mercury medical surveillance and medical removal procedures

Appendix F
Guidelines for the Safe Clean-up of Mercury Spilled in the Workplace

Importance of Safe Clean-up

Mercury is a very toxic silver-gray liquid metal. When mercury metal is spilled, it forms droplets that can accumulate in the tiniest of spaces and in small pools and droplets which then emit vapor into the air. Spilled mercury that is not cleaned up properly creates potential mercury exposure for employees and visitors in the area of the spill. Liquid mercury gives off vapor which is odorless and colorless; the warmer it is the more vapor is emitted. Even a small amount of spilled mercury is enough to create a health hazard, especially if it is vaporized by heat or vacuuming with an ordinary vacuum cleaner. Mercury can also be inadvertently ingested or absorbed through contact with contaminated objects.

Spill Prevention is Preferable to Spill Clean-up

It is much better to prevent a mercury spill than to be forced to clean it up. It is important to have established, written work procedures for processes involving the handling of mercury or equipment containing mercury. Workers should receive thorough training in safe handling practices. All handling of mercury should be done over an appropriate container capable of catching any drips or spills. Where possible, substitutes should be found for mercury, e.g., alcohol-filled or electronic digital thermometers rather than ones filled with mercury. Where it is known that mercury spills are likely, floors should be sealed so they are free of cracks and crevices.

Planning is Needed

The following issues should be addressed in advance in every workplace that uses mercury, preferably by establishing written mercury spill clean-up procedures.

1. ***Lines of authority*** **-** Determine to whom in management spills should be reported and who is responsible for taking charge of the spill area.

2. ***Site control measures*** **-** Spill containment, area protection procedures, limiting the spread of mercury until clean-up begins, and decontamination of employees if contaminated during the spill, are essential planning items.

3. ***Criteria for assessing*** the size and difficulty of cleaning up the spill is important to accurately decide whether the spill will be cleaned up by:
    a. employees in the immediate area of the spill
    b. employees on the Hazardous Materials team
    c. an outside contractor

    If the spill is very large and hazardous, contact you local emergency response team or call the New Jersey Department of Environmental Protection at their toll-free 24-hour hotline at 1-877-927-6337.

4. ***Step-by-step procedures*** for conducting the clean-up under various probable scenarios of size and difficulty are valuable and highly recommended.

5. ***Equipment available*** for use in spill clean-up must be readily available and spill responders must know how to use the equipment.

6. ***Training*** of personnel that will be involved in the clean-up is crucial.

7. ***Personal protective equipment*** to be used during the clean-up must be readily available and personnel must know how to use personal protective equipment properly.

8. ***Protective reoccupancy criteria*** for deciding that enough clean-up has been done and the area can be re-occupied is important to determine when the clean-up process is complete. Sampling should be performed to confirm that the area is clean enough for re-entry.

9. ***Disposal*** procedures for the mercury and mercury-contaminated waste must be established.

10. ***Legal requirements*** include compliance with OSHA and PEOSH regulations and compliance with regulations on mercury disposal required by the United States Environmental Protection Agency and the NJ Department of Environmental Protection.

11. ***Medical surveillance*** is recommended to be certain that employees are not getting sick from mercury exposure (see *Appendix B*)

What NEVER to do when responding to a Mercury Spill

Never use an ordinary shop vacuum cleaner to clean up mercury. The vacuum will put mercury vapor into the air and increase exposure. The vacuum cleaner will be contaminated and have to be thrown away. Special mercury vacuums, however, are commercially available and can safely be used. ***See Appendix 2 for a list of commercially available mercury vacuums.***

Never use a broom to clean up mercury. It will break the mercury into smaller beads and spread them around.

Never use an ordinary vacuum pump to clean up mercury. The pump exhaust will put mercury vapor into the air and increase exposure.

Never pour or allow mercury to go down a drain. Not only is this a violation of environmental regulations, but the mercury may lodge in the plumbing and cause future problems during plumbing repairs. Dumping mercury onto the ground or into waterways is also illegal. Information on recycling mercury is provided later in this document.

Never allow people whose shoes or clothing may be contaminated with mercury to walk around. They may spread the mercury contamination.

VERY IMPORTANT NOTE: **A discussion of some of the issues outlined above under Planning (pages F1-F2) is provided below along with some NJDHSS recommendations.** ***However, it is the employer's responsibility to properly utilize this information and write a complete spill clean-up protocol appropriate for the specific workplace.***

Spill Containment and Area Protection

Use dikes or other appropriate barriers to prevent the mercury from rolling on sloped surfaces. Divert mercury away from floor drains and cracks and crevices.

Keep away all persons not involved in the clean-up. Close doors to other areas. Post warning signs and barriers to prevent entry to the spill area by unauthorized persons.

Turn off any heating, ventilating or air conditioning system that circulates air from the spill area to other parts of the workplace. Turn off or lower any type of heat as far as possible since mercury vaporization increases significantly with temperature.

Decontaminate Employees

Employees involved in the spill should be visually examined for evidence of mercury on their skin, hair, shoes, and/or clothing. They should stay in the area designated for them until they are decontaminated so that they do not spread the mercury elsewhere. Have them put their contaminated shoes/clothing into a trash bag, wipe any visible mercury off their skin into the bag and dispose properly. Have employees shower and shampoo well before putting on clean clothing.

Employees involved in the spill clean-up should wear appropriate chemical protective clothing and make sure that this clothing is removed upon exiting the spill containment area. This will prevent mercury from being spread to other areas of the workplace on clothing, shoes, etc.

Assess the Size and Difficulty of Cleaning Up the Spill

Estimate the amount of mercury that was spilled and the size of the area affected. Note what types of surfaces mercury was spilled onto in terms of whether they are hard or porous, accessible or difficult to reach, contain cracks or crevices. Note whether these surfaces are disposable or permanent.

A small spill on a hard surface, free of cracks and crevices, in a limited and easy to reach area, can probably be handled by properly trained and equipped employees in the immediate area of the spill.

A larger spill on a hard surface with some cracks and crevices, in a limited area with some difficult to reach places, or on a disposable porous item such as clothing, can probably be handled by a properly trained and equipped Hazardous Materials team. Contact information for HazMat teams and their emergency phone numbers must be specified in your emergency response plan.

For very large, more difficult spills, or spills on permanent porous surfaces such as wall-to-wall carpeting, we recommend employing a contractor skilled in mercury clean-up. ***See Appendix 1 for a list of mercury clean-up firms in the New Jersey area***. When choosing a contractor, be sure to check references.

Equipment Available for Use in a Mercury Spill Clean-up

Mercury spill clean-up kits are commercially available and convenient. In addition to devices designed to pick up the mercury, they usually contain equipment to roughly measure mercury in the air, and chemicals to help visualize the mercury, amalgamate the mercury, and/or convert the mercury to a form which will not vaporize (solutions of 20 percent calcium sulfide or 20 percent sodium thiosulfate). ***See Appendix 4 for a list of commercially available mercury clean-up/control products.***

Special mercury vacuums are commercially available and useful. However, they can be expensive. If, one is already available in the workplace, it will probably be useful in a clean-up. ***See Appendix 2 for a list of commercially available mercury vacuums.***

Many of the items useful in cleaning up a mercury spill are readily available and can be assembled in advance into a spill kit to be available if needed. Everything used in a clean-up should be disposed of properly. Useful items are:

- rubber squeegee
- dust pan
- plastic trash bags
- plastic bags which zipper shut

- flashlight
- wide mouth container
- large tray or box
- paper towels or napkins
- powdered zinc (amalgamates mercury)
- syringe with blunt needle (optional)
- eye dropper (optional)

In addition, a mercury vapor meter will be needed both to assess airborne exposure and to decide whether the area has been cleaned-up well enough to allow re-occupancy. For both of these purposes, a mercury vapor meter is better than other ways of measuring mercury in air for two reasons. First, a meter gives an immediate reading so that decisions concerning the level of respiratory protection required and whether more clean-up is necessary can be made at once. Second, a meter is the only direct reading method that is sensitive enough to read down to the recommended clearance level. Meters must be calibrated regularly at the factory and used according to the manufacturer's directions. ***See Appendix 3 for a list of commercially available mercury vapor meters***.

It is important to realize that over time, mercury will oxidize to form an oxide that is not as volatile as metallic mercury and therefore the ability to detect metallic mercury surface contamination with a mercury vapor meter will diminish over time. Therefore, it is also recommended that wipe samples be collected and analyzed to assure that spilled mercury has been removed adequately from the surface. Many certified industrial hygiene analytical laboratories can analyze wipe samples accurately.

Clean-up Methods

Mercury is a very dense, non-wetting liquid that has a great affinity for itself. Beads of mercury can be pushed together with a squeegee to form larger droplets. These can be collected in a dust pan and poured into a plastic bag or container. Alternatively, a disposable syringe with a blunt needle or eye dropper may be able to be used to draw up the mercury. Work from the outside of the spill area towards the center. It is safest to work over a large tray or box when pouring mercury. Mercury's high density and smoothness cause it to roll fast. A flashlight can be used to look all around in the area of the spill. The flashlight will reflect off the shiny silver mercury beads and make it easier to see them.

If using a commercially available spill clean-up kit, follow the instructions provided. Contact a professional as necessary.

Use the mercury vapor meter to determine if mercury is still present and more clean-up is needed. Sprinkle powdered zinc to suppress vaporization of any small amounts of mercury that remain and to amalgamate the remaining mercury, which should make it easier to remove from the surface.

Take a wipe sample to assure that the surface has been cleaned adequately.

Training of Personnel to be Involved in the Clean-Up

Employees should be trained and competent at the level at which they will be expected to function in case of a mercury spill. All employees should be trained to report spills to the proper person. Under the OSHA and PEOSH Hazard Communication and Personal Protective Equipment (PPE) standards, all employees must be trained in the following topics:

- Operations in their work area where mercury is present
- Methods to detect the presence or release of mercury

- Health hazards of mercury
- Protective work practices and emergency procedures
- When PPE is necessary
- What PPE is necessary
- How to properly put on, remove, adjust, and wear PPE
- Proper care, maintenance, useful life, and disposal methods for PPE
- Limitations of PPE

Under 29 CFR 1910.120(q), OSHA and PEOSH require the employer to identify in advance and provide an appropriate level of training for employees that will be involved in the clean-up of an uncontrolled mercury spill outside of their immediate work area. Annual re-training or demonstrated competence of employees is required.

Personal Protective Equipment to be Used During the Clean-up

OSHA/PEOSH standard 29 CFR 1910.132 requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment. OSHA 29 CFR 1910.134, respiratory protection program, states the requirements for using respirators, including the requirement to assure that employees using respirators are medically capable of using them safely.

Air monitoring should be done using a mercury vapor meter to permit correct respirator selection. Be aware that air levels of mercury vapor will probably increase 10-20 times during the clean-up due to disturbance of the mercury. The NJDHSS recommends that the ACGIH Threshold Limit Value (TLV) of 0.025 mg/m^3 be utilized in selecting the appropriate respirator for protection against mercury vapor because it is the most protective published occupational exposure limit. If airborne exposure to mercury vapor does not exceed 0.25 mg/m^3 (10 times the TLV), a half-mask cartridge respirator approved for protection against mercury vapor can be selected. If airborne exposure does not exceed 1.25 mg/m^3 (50 times the TLV), a full-face cartridge respirator can be selected. If airborne exposures exceed 1.25 mg/m^3, a self-contained breathing apparatus should be used. ***Appendix 5 contains information on cartridge respirators approved for protection against mercury vapor***. Please note that if respirators are used, it must be assured that employees are medically able to wear and use a respirator safely as per the OSHA respiratory protection standard. Consult a physician as certain medical conditions could exclude some employees.

Other personal protective equipment that may be necessary include chemical resistant clothing, gloves, boots or shoe covers, and eye and face protection. There is almost no qualitative information available at the present time on what type of gloves and clothing materials offer protection from breakthrough, permeation, or degradation by metallic mercury. Glove manufacturers have recommended Viton Neoprene, Neoprene, PVC, and Butyl Neoprene for protection against mercury. However, vendor recommendations may be based on factors other than impermeability such as resistance to being cut by glass. DuPont has found their proprietary chemical protective clothing materials, 2-Ply Tyvek®/Saranex® and Barricade®, to have mercury breakthrough times greater than 480 minutes and no detected permeation. In general, gloves and protective clothing are not necessarily resistant to all chemicals and you should check the current manufacturers' recommendations to assure the material is resistant to penetration and permeation by metallic mercury.

Criteria for Reoccupancy

Before it is reoccupied for normal use, the area of the spill should be cleaned enough so that an employee working in the area would not be exposed to a level of mercury vapor greater then the ACGIH TLV (8-hour time-weighted-average) of 0.025 mg/m^3 (25 $\mu g/m^3$). To determine if this standard is being met, mercury in air readings should be taken throughout the area of the spill at the breathing zone level (five feet from the floor) using a mercury vapor meter. As noted earlier, metallic mercury's vapor pressure is

temperature dependent and metallic mercury can form lower volatility oxides over time and hence exist on surfaces for a period of time.

Wipe samples of cleaned surfaces should also be taken to determine if any mercury is left on the surface. ***See Appendix 3 for the wipe sampling method for mercury.*** Additional information about wipe samples can be found in our Industrial Hygiene Fact Sheet on this topic in *Controlling Chemical Exposure*, available online at www.state.nj.us/health/eoh/survweb/ odispubs.htm or ordered by calling the Occupational Health Surveillance Program at (609) 984-1863.

There is no current standard or guideline available for acceptable levels of mercury on surfaces. Therefore, professional judgment must be used in consultation with an environmental and occupational safety professional. One method that can be used is to determine the background mercury levels in "clean" areas of the facility with mercury levels in the spill area via wipe samples and clean up to a level as close to the "clean background" level as possible. Wipe samples taken in "clean" areas of facilities inspected by our agency have often shown levels around or below 1 μg per 100 square centimeters of surface area. ATSDR has suggested that normal background mercury levels in soil can range between 0.02 to 0.6 μg of mercury per gram of soil (ATSDR, Tox Profile Mercury, 1993, see page 6 for citation). The key is to reference your facility's own "clean" background levels for comparison and assure that no employee in the area is exposed beyond the ACGIH TLV for airborne exposures and that employees are not above the ACGIH BEI urine levels.

A detailed and informative example of a facility that experienced mercury contamination that required remedial activities to clean up the work site for employees is cited below:

> National Institute for Occupational Safety and Health (NIOSH). (1998) Hall-RM; Page-E; Mattorano-D; Roegner-K. Health Hazard Evaluation Report HETA # 97-0292-2678, General Electric, Bridgeville Glass Plant, Bridgeville, Pennsylvania. Report by the Health Hazard Evaluation Program. Cincinnati, OH. Can be downloaded from the NIOSH Web site at: www.cdc.gov/niosh/hhe/reports/pdfs/1997-0292-2678.pdf

Disposal

Under New Jersey Department of Environmental Protection (NJDEP) regulations, if mercury that is a commercial chemical product is spilled, it is a hazardous waste with the code U151. When the spilled mercury is cleaned up, the clean-up material is a hazardous waste according to the "mixture rule" at N.J.A.C. 7:26-8.1(a)2iii and would also have the waste code U151. This determination is not concentration dependent.

However, if the spilled mercury was not a commercial chemical product or was from an unknown source, the generator would have to determine if the mixture contained mercury at or above the appropriate threshold according to the Toxicity Characteristic Leaching Procedure (TCLP) at N.J.A.C. 7:26-8.12. If the threshold is exceeded, the waste must be disposed of as containing mercury.

In both cases described above, waste must be manifested and shipped to a facility licensed to accept mercury-containing waste. Such facilities require the waste generator to obtain prior approval based on a review of the waste profile before the waste can be sent to them. Disposal prices are based on the amount and type of waste and can be obtained only after the waste is tested and profiled. ***A list of facilities which accept mercury-containing waste is given in Appendix 6.***

APPENDIX 1

MERCURY CLEAN-UP CONTRACTORS IN THE NEW JERSEY AREA✳

Acton Technology
P.O. Box 726
101 Thompson St
Pittston, PA 18640
570-654-0612
www.actontech.com

Onyx Environmental Services
3100 Hedley Street
Philadelphia, PA 19137
215-289-3700
and
One Eden Lane
Flanders, NJ 07836
201-347-7111
1-800-426-2382
www.onyxes.com

Clean Harbors
2301 Pennsylvania Avenue
Deptford, NJ 08096
1-800-544-3128
609-589-5000
and
3 Sutton Place
Edison, NJ 08817
1-800-782-8805
908-248-1997
www.cleanharbors.com

Guardian Environmental Services
1280 Porter Road
Bear, DE 19701-1347
302-834-1000
1-800-345-4395

LFR (Recon) Environmental
35 Columbia Road
Branchburg, NJ 08876
908-526-1000

Clean Venture
600 Cenco Blvd
Clayton, NJ 08312
856-863-8778
and
201 South First Street
Elizabeth, NJ 07206
908-354-0210
www.cyclechem.com

Insurance Restoration Specialist
26 Kennedy Blvd
East Brunswick, NJ 08816
1-800-634-0261
www.irs-restoration.com

✳ Disclaimer: No assessment of quality of services has been made. The New Jersey Department of Health and Senior Services neither recommends nor endorses these or any other providers of mercury clean-up services.

APPENDIX 2

MERCURY VACUUMS

Hg Vacupick
Bethlehem Apparatus Co., Inc.
890 Front Street
P.O. Box Y
Hellertown, PA 18055
610-838-7034
www.bethapp.com

Mercury Vacuum
Nilfisk of America
300 Technology Drive
Malvern, PA 19355
610-647-6420
1-800-645-3475
www.pa.nilfisk-advance.com

Mercury Hand Vacuum
Lab Safety Supply, Inc.
401 S. Wright Rd.
Janesville, WI 53546
608-754-2345
1-800-356-0783
www.labsafety.com

MRS 1, MRS 2, MRS 3, MRS 4, MRS 6
Minuteman International, Inc.
111 South Rohlwing Road
Addison, Illinois 60101
630-627-6900
1-800-323-9420
www.minutemanintl.com

Mercury Recovery Vacuum

- Nikro Industries, Inc.
  638 N. Iowa Street
  Villa Park, Illinois, 60181
  630-530-0558
  www.nikro.com

- American Vacuum Company
  7301 N. Monticello Ave
  Skokie, IL 60076
  1-800-321-2849
  www.americanvacuum.com

Wet/Dry Mercury Vacuum
Mercury Floor Machines, Inc.
110 South Van Brunt Street
Englewood, NJ 07631
201-568-4606
www.mercuryfloormachines.com

✳Disclaimer: No assessment of quality of these products has been made. The New Jersey Department of Health and Senior Services neither recommends nor endorses these or any other manufacturers and vendors of mercury vacuums.

APPENDIX 3

MERCURY INDUSTRIAL HYGIENE MONITORING METHODS

DIRECT READING METHODS

UNIT NAME	MODEL CATALOG	AVAILABLE FROM	PRINCIPAL OF OPERATION	RANGE mg/m^3	ADVANTAGES	DISADVANTAGES
Gold Coil Dosimeter For Mercury Vapor Only	X-990-0175	Arizona Inst. Corp. 1912 W. 4th Street Tempe, AZ 85281 Phone 1-800-528-7411 Fax 480-804-0656 www.azic.com	Collects mercury vapor on gold film and desorbs when connected with Jerome Monitor. (See next entry).	Variable Range; Sensitivity: $< 0.5 \times 10^{-9}$ g Capacity: $> 1000 \times 10^{-9}$ g Accuracy: $\pm$ 15% @ 0.107 mg/m^3	Provides 8-hour TWA for personal exposure. In-house analysis provides fast results. Economical, reusable. Weight: 1-5 ounces.	Not accepted by OSHA for 8-hour TWA. Analysis requires connection with Jerome mercury meter.
Jerome Mercury Vapor Analyzer For Mercury Vapor Only	431-X	Arizona Inst. Corp. Jerome Division 1912 W. 4th St. Tempe, AZ 85281 Phone 1-800-528-7411 Fax 480-804-0656 www.azic.com	Change in resistance of gold film as function of mercury vapor	0.000 to 0.999 mg/m^3 Hg Sensitivity: 0.003 mg/m^3	Portable/7 lbs. 6-hour battery life. Accuracy; 5% at 0.1mg/m^3 Hg. Complete monitoring package includes base station, data logger and reusable personal gold coil dosimeters (gold coil dosimeters, used in conjunction with a flow pump and the Jerome 431-X, can provide in-house time-weighted-average for personal mercury exposure). (See previous entry). Selective to mercury; no interferences from particulates, hydro-carbons and magnetic fields.	In a heavily contaminated atmosphere, if the instrument pegs, it must be taken out of the contaminated area and allowed to re-zero which takes a few minutes.

MERCURY INDUSTRIAL HYGIENE MONITORING METHODS (Continued)

DIRECT READING METHODS

UNIT NAME	MODEL CATALOG	AVAILABLE FROM	PRINCIPAL OF OPERATION	RANGE mg/m^3	ADVANTAGES	DISADVANTAGES
MSA Mercury Detector Tube and Kwik-Draw Pump For Mercury Vapor Only	497663	Mine Safety Appliances Co. P.O. Box 426 Pittsburgh, PA 15230 1-800-MSA-2222 412-967-3000 www.msanet.com	Reaction of mercury with copper iodide	0.1 - 0.8 mg/m^3	Easy to use. Operating range 30 to 120 ^oF and relative humidity 10 to 90%. Inexpensive. Results available immediately.	Limited accuracy 25%. 20 - 30 seconds per pump stroke. 20 pump strokes required.
Draeger Mercury Vapor Detector Tube and Pump For Mercury Vapor Only	CH 23101 6400000	Draeger Safety, Inc. 101 Technology Drive Pittsburgh, PA 15275 1-800-922-5518 Fax 1-800-922-5519 www.draeger.net	Reaction of mercury with copper iodide	0.05 - 2 mg/m^3 (1 to 40 pump strokes, max. time 10 minutes)	Easy to use. Inexpensive. Results available imme-diately. Arsine, phosphine, hydrogen sulfide, ammonia, nitrogen dioxide, sulfur dioxide, and hydrazine in the TLV range do not interfere.	Limited accuracy 30%, Chlorine and other free halogens give low readings. Up to 40 pump squeezes required.
Sensidyne Mercury Vapor Detector Tube and Pump For Mercury Vapor Only	1425 830-0001-01	Sensidyne 16333 Bay Vista Drive Clearwater, FL 34620 1-800-451-9444 Fax (813) 539-0550 www.sensidyne.com	Mercury vapor reacts with copper iodide to form Cu-Hg complex	0.5-10 mg/m^3 (1 pump stroke) 0.1 – 2 mg/m^3 (5 pump strokes)	Easy to use. Inexpensive. Results available immediately.	Limited accuracy 25%, accuracy further limited in presence of hydrogen sulfide, nitrogen dioxide and chlorine.
Chromair Passive Badge For Mercury Vapor Only	380018-10	K & M Environmental 2557 Production Road Virginia Beach, VA 23454 757-431-2260 www.kandmenvironmental.com	Proprietary	0.125-1.6 mg/m^3 x hours minimum (15 minutes) Detectable conc.: 0.15 mg/m^3 Rel. Humidity Range: 10 - 85%	Easy to use. Cost effective screening tool. Inexpensive. Results available immediately.	Limited accuracy 20%. Interferences from chlorine and bromine. Requires refrigeration at 4^oC.
Safeair Passive Badge For Mercury Vapor Only	382005	K & M Environmental 2557 Production Road Virginia Beach, VA 23454 757-431-2260 www.kandmenvironmental.com	Proprietary	0.25 mg/m^3 x hours (front) 0.08 mg/m^3 x hours (back) min. detection limit: 0.031 mg/m^3 (front) min. detection limit: 0.01 mg/m^3(back)	Easy to use. Screening layers filter out potential interferences. Dual threshold badge. Enhanced sensitivity. Results available immediately.	Limited accuracy 20%. Interferences from chlorine, bromine, and strong oxidizers. Require refrigeration at 4^oC.

MERCURY INDUSTRIAL HYGIENE MONITORING METHODS (Continued)

DIRECT READING METHODS

UNIT NAME	MODEL CATALOG	AVAILABLE FROM	PRINCIPAL OF OPERATION	RANGE mg/m^3	ADVANTAGES	DISADVANTAGES
Mercury Vapor Badge For Mercury Vapor Only	47275	Lab Safety Supply P.O. Box 1368 Janesville, WI 53547-1368 1-800-356-0783 www.labsafety.com	Deposition of mercury on gold film.	0.002 - 0.2 mg/m^3 (8 hours).	Easy to use. Designed to measure time-weighted-average.	Limited accuracy 20%. Mail away for analysis.
SKC Sorbent Badge Capsule (For Mercury Vapor) SKC Sorbent Tube with Mixed Cellulose ester filter and pump (For Mercury Particulate)	520-02A 226-17-1A	SKC, Inc. 863 Valley View Road Eighty Four, PA 15330-9614 412-941-9701 1-800-SKC-84PA Fax 412-941-1369 www.skcinc.com	Absorption of mercury by solid hopcalite sorbent and analysis by cold atomic absorption.	Validation Range: 0.061 - 0.2 mg/m^3	Greater sample stability due to irreversible affinity of mercury with hopcalite; not affected by chlorine, moisture. Analysis done by any qualified lab. Badge holder may be cleaned and reused. Analysed OSHA method ID-140.	Particulate compounds cannot be collected with the passive capsule. Its sampling rate is dependent on face velocity. Sorbent tube depends on a calibrated pump to take the sample. Mail away for analysis.
Mercury Vapor Monitor For Mercury Vapor Only	HG-10	Advanced Chemical Sensors Co. 3201 N. Dixie Hwy Boca Raton, FL 33431 561-338-3116 www.acsbadges.com	Deposition of mercury on gold film.	0.001 - 2 mg/m^3 (8 hours)	Analysis is by OSHA method ID-140.	At .05 $mg/m^3 \pm 10\%$ Mail away for analysis.

MERCURY INDUSTRIAL HYGIENE MONITORING METHODS (Continued)

METHODS REQUIRING ANALYSIS

METHODS #	SAMPLING MEDIA	VOLUME min-max(L)	FLOW RATE L/min.	ANALYTICAL TECHNIQUE	RANGE µg/ SAMPLE	ADVANTAGES	DISADVANTAGES
NIOSH 6009 issued on 5/15/89 for Mercury Vapor and Particulate	Hydrar in single section (200 mg) tube	Min: 2L Max: 100L	0.15 to 0.25 L/min.	Cold vapor atomic absorption	0.1 to 1.2 µg	Not affected by high humidity. A prefilter can be used to exclude particulate mercury species from the sample. The prefilter may be analyzed for particulate Hg by similar methodology.	Inorganic and organic mercury compounds may cause positive interference. Oxidizing gases including chlorine do not interfere. A significant loss of mercury vapor due to the prefilter has been noted. This would give a false high for particulate and a false low for vapor.

Available from:

Paula O'Connor
Chemist
NIOSH, R-3
4676 Columbia Parkway
Cincinnati, OH 45226
513-841-4302
www.cdc.gov/niosh/nmam/nmampub.html

MERCURY INDUSTRIAL HYGIENE MONITORING METHODS (Continued)

METHODS REQUIRING ANALYSIS

METHODS #	SAMPLING MEDIA	VOLUME min-max(L)	FLOW RATE L/min.	ANALYTICAL TECHNIQUE	RANGE µg/ SAMPLE	ADVANTAGES	DISADVANTAGES
OSHA Method ID-140 Revised Dec. 1989 For Mercury Vapor Only (P) For Total Vapor and particulate (A)	Hopcalite as the solid sorbent. May be done using a pump	(P) 4.8 to 9.6L (A) 3 to 100L	(P) 0.02 L/min. (A) 0.2 L/min.	Cold vapor atomic absorption	0.1 to 2 µg	Adequate sensitivity. Passive dosimeter requires no sampling pump. Dosimeter housing reusable. Chlorine in the air does not interfere.	Passive Dosimeter (P). Particulate compounds cannot be collected with this device. Sample rate dependent on face velocity; should not be used in areas where air velocity is > 229 m/min (750 ft/min). Active Sampler (A). Dependence on a calibrated pump to take sample. Cannot distinguish between mercury vapor and particulate; both are measured.
OSHA Method ID-145 Revised Dec. 1989 For Mercury Particulate Only	0.8 µm mixed cellulose ester (MCE) filter	10 liters recommended for measuring compliance with the ceiling PEL. Full shift for evaluation of entire workday.	2 L/min. recommended	Cold vapor atomic absorption spectro-photometry	0.1 to 2 µg	Wipe or bulk samples can also be collected and analyzed using this method. Adequate sensitivity. Particulate organo-mercury compounds will also be collected, if present, using 0.8 µm mixed cellulose ester (MCE) filter.	Elemental mercury vapor can not be collected on the 0.8 µm MCE filters. Some volatile organic compounds (i.e. benzene, toluene, acetone, carbon tetrachloride) may cause positive inferences (occurring as contaminants in the reagents used during sample preparation). These interferences can be rendered insignificant by using organic-free deionized water and at least reagent grade chemicals or by blank subtraction.

Available From:

Steve Edwards, Team Leader
OSHA SLC Analytical Laboratory
1781 South 300 West
Salt Lake City, UT 84115
801-524-7900

www.osha.gov

APPENDIX 4

COMMERCIAL MERCURY CLEAN-UP/CONTROL PRODUCTS*

Lab Safety Supply
P.O. Box 1368
Janesville, WI 53547-1368
1-800-356-0783
www.labsafety.com

Signs and Labels
- ✓ Graphic warning self-adhesive labels

Mercury Indicator Powder
- ✓ Color change from yellow to brown overnight

Mercury Vacuum Cleaner by Hako Minutemen
- ✓ Compact Mini-Merc Mercury Vacuum by Nilfisk

Mercury Vapor Absorbent
- ✓ Reduces concentrations of mercury vapor remaining after clean-up of spills

Mercury Spill Control Station
Mercury Absorb Powder
Mercury Sponges
- ✓ Decontaminates an area after a mercury spill

Mercury Vapor Detector
- ✓ Passive dosimeters detect the presence of mercury vapor

Mercury Spill Kits
Mercury Check Swabs by Lead Check
- ✓ Detects mercury ions on surfaces and in liquids

Mercury Absorb Jar
Mercury Hand Vacuum

Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865
1-800-582-2537
www.jtbaker.com

Cinnasorb to pick-up spills
Resisorb for adsorption and disposal
Mercury Indicator to detect mercury
Mercury sponge to clean mercury
Cinnasorb mercury absorbent activator
Mercury safety clean-up kit

✳ Disclaimer: No assessment of quality of these products has been made. The New Jersey Department of Health and Senior Services neither recommends nor endorses these or any other manufacturers and vendors of mercury clean-up/control products.

APPENDIX 5

NIOSH-APPROVED CARTRIDGE RESPIRATORS FOR PROTECTION AGAINST MERCURY VAPOR

3M Occupational Health and Safety Products
3M Center Building, 235-2E-90
St. Paul, MN 55144-1000
1-800-243-4630
www.3mrespirators.com

- 6009 mercury vapor or chlorine gas cartridge. For use up to 10 X PEL when used with 6000 Series half mask or 50 X PEL with 7800 Series full- facepiece respirator.
- End-of-service-life indicator for mercury vapor changes color from orange to brown when the cartridge is to be discarded or 30 days whichever comes first. All cartridges are face-mounted, but color change is visible to the wearers.
- NIOSH Approval # TC-23C-1424 to TC-23C-1440 and TC-23C-1557 to TC-23C-1561
- Cartridge filter combination, multi gas plus organic vapors with P-100 filter attached. NIOSH approved # TC-84A-0196

Aearo Safety Corporation
90 Mechanic Street
Southbridge, MA 01550
1-800-444-4774
www.aearo.com

- R59A mercury cartridge to be used on half-mask or full-facepiece for use up to 10 X PEL.
- NIOSH Approval # TC-23C-1031
- End-of-service-life indicator changes from orange to dark gray when the cartridge is to be discarded.

Survivair
3001 South Susan Street
Santa Ana, CA 92704
1-800-821-7236
www.survivair.com

- 100600 metallic mercury vapor and chlorine gas cartridge for use with either belt or face-mounted respirators for up to 10 X PEL.
- End-of-service-life indicator changes color from yellow to gray when the cartridge is to be discarded.
- NIOSH Approval # TC-23C-1483.

Bacou Dalloz Safety
7828 Waterville Road
San Diego, CA 92154
1-800-327-1110
www.bacou-dalloz.com

- T07 mercury vapor/chlorine gas cartridge. For use with 6100 half mask, and 6400/6500, and 8000 series (full facepiece) up to 10 X PEL.
- Use in face-mounted position is acceptable under certain conditions (mirror or buddy system)
- End-of-service-life-indicator changes color from orange-pink to dark gray when cartridge is to be discarded.
- NIOSH Approval # TC-23C-1356 (half-mask) and # TC-23C-1357 (full- facepiece). For 8000 series full facepiece, TC-23C-1935

MSA
P.O. Box 426
Pittsburgh, PA 15230
1-800-672-2222
www.msanet.com

- MSA twin-cartridge respirator with Mersorb (NIOSH Approval # TC-23C-629) and comfoMersorb P100 (NIOSH Approval # TC-84A-0169) cartridge. Affords protection up to 10 X PEL.
- Advantage 1000 Series with Mersorb P100 (TC-23C-84A-0180).
- Mersorb P100 Cartridge also offer protection against dusts, fumes, asbestos containing dusts and mists, and radionuclides.
- End-of-service-life-indicator changes color from orange to brown when cartridge is to be discarded.

APPENDIX 6

FACILITIES WHICH ACCEPT MERCURY-CONTAINING WASTE

Advanced Environmental Recycling Corp.
2591 Mitchell Avenue
Allentown, PA 18103
610-797-7608
1-800-554-2372
www.aerc-mti.com

Onyx Environmental Services
3100 Hedley Street
Philadelphia, PA 19137
215-289-3700
and
One Eden Lane
Flanders, NJ 07836
201-347-7111
1-800-426-2382
www.onyxes.com

Bethlehem Apparatus Company, Inc.
890 Front Street
P.O. Box Y
Hellertown, PA 18055
610-838-7034
www.bethapp.com

Mercury Refining Company*
26 Railroad Avenue
Albany, NY 12205
518-459-0846
1-800-833-3505
www.mercuryrefining.com

NSSI/ Recovery Services, Inc.
P.O. Box 34042
Houston, TX 77234
713-641-0391
www.nssihouston.com

Stablex Canada Incorporated**
760 Industrial Blvd.
Blainville, Quebec J7C-3V4
Canada
1-800-782-2539 U.S.
215-836-4933
www.stablex.com

* Accepts only dental amalgam waste
** No longer accepts elemental mercury unless it is in contaminated soil

APPENDIX 7

REPORTING FORMS

New Jersey Department of Health and Senior Services
Occupational Health Service
PO Box 360
Trenton, NJ 08625-0360
(609) 984-1863

CLINICAL LABORATORY REPORT OF ELEVATED LEVELS OF HEAVY METALS:
LEAD: IN ADULTS (Greater than 16 Years of Age)
ARSENIC, CADMIUM, MERCURY: IN PERSONS OF ANY AGE

Instructions to Lab:
Complete report, as required by N.J.A.C. 8:44-2.11, should be forwarded immediately to the New Jersey Department of Health and Senior Services (NJDHSS) at the above address or fax to (609) 292-5677. Laboratory must obtain all information from physician before submitting report to NJDHSS.

REPORTED INDIVIDUAL

1. Last Name	First Name	M.I.

2. Address of Individual	City	State	Zip Code

3. Sex	4. Date of Birth (DOB)	5. Age in Years (If DOB unavailable)	6. Telephone No. of Reported Individual
☐ Male ☐ Female	/ / Mo./Day/Yr.		( )

7. Name of Employer	8. Telephone No. of Employer
	( )

9. Address of Employer	City	State	Zip Code

10. Occupation

PHYSICIAN

11. Last Name of Requesting Physician	First Name	M.I.	12. Telephone No. of Physician
			( )

13. Address of Physician	City	State	Zip Code

14. Name of Medical Facility of Requesting Physician

LABORATORY

15. Name of Testing Laboratory	16. Telephone No. of Laboratory
	( )

17. Address of Laboratory	City	State	Zip Code

18. Date Sample Taken	19. Date Sample Analyzed
/ / Month/Day/Year	/ / Month/Day/Year

LABORATORY RESULTS

Sample Type	ARSENIC		CADMIUM		LEAD		MERCURY	
	Reportable Level	Value (With Unit)	Reportable Level	Value (With Unit)	Reportable Level	Value (With Unit)	Reportable Level	Value (With Unit)
BLOOD	≥ .07 µg/ml		≥ 5 µg/LWB		All Blood Test Results		≥ 2.8 µg/dl	
URINE	≥ 100 µg/L		≥ 3 µg/gram creatinine		≥ 80 µg/L		≥ 20 µg/L	

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REPORTING FORMS (continued)

New Jersey Department of Health and Senior Services
Occupational Health Service
P.O. Box 360
Trenton, NJ 08625-0360

OCCUPATIONAL DISEASE, INJURY, OR POISONING REPORT FOR PHYSICIANS AND ADVANCED PRACTICE NURSES

*INSTRUCTIONS: In accordance with N.J.A.C. 8:57-3.2, physicians and advanced practice nurses must report any patient who is ill or diagnosed with any disease, injury, or poisoning listed below within 30 days after the disease, injury, or poisoning has been diagnosed or treated. In addition, suspect cases or patients with other occupational diseases may be reported. All information **MUST** be completed. Mail **complete** report to above address or fax to (609) 292-5677. Additional information, report forms, or business reply envelopes may be obtained from the above address, or by calling (609) 984-1863. This form is also available online in Microsoft Word and in PDF format at www.state.nj.us/health/eoh/survweb.*

Date

PATIENT INFORMATION

Name of Patient (Print) _____ (First) _____ (MI) _____ (Last)

Date of Birth

Street Address

Age (If DOB Unavailable)

City State Zip Code

Home Telephone Number ( )

Sex ☐Male ☐Female

Race ☐White ☐Black ☐Am. Ind./ Alaskan Native ☐Asian/Pacific Islander ☐Other

Hispanic Origin ☐Yes ☐No ☐Unknown

DIAGNOSTIC INFORMATION

Date of Onset of Disease, Injury, or Poisoning
_____ / _____ / _____

Diagnosis:

☐Work-Related Asthma
- ☐Possible
- ☐Probable
- ☐Confirmed

☐Extrinsic Allergic Alveolitis
☐Silicosis
☐Asbestosis
☐Pneumoconiosis, Other and Unspecific
☐Occupational Dermatitis
☐Other Occupational Disease - Specify:

_____

☐Work-Related Fatal Injury
☐Work-Related Injury in Children (Under Age 18)
☐Work-Related Carpal Tunnel Syndrome
☐Poisoning Caused by Known or Suspected Occupational Exposure
☐Pesticide Toxicity

☐Lead Toxicity, Adult
(Blood ≥ 25 µg/dl; Urine ≥ 80 µg/L)
Blood = _____ µg/dL
Urine = _____ µg/L

☐Arsenic Toxicity, Adult
(Blood ≥ .07 µg/mL; Urine ≥ 100 µg/L)
Blood = _____ µg /mL
Urine = _____ µg /L

☐Mercury Toxicity, Adult
(Blood ≥ 2.8 µg/dL; Urine ≥ 20 µg/L)
Blood = _____ µg/dL
Urine = _____ µg/L

☐Cadmium Toxicity, Adult
(Blood ≥ 5 µg/L whole blood;
Urine ≥ 3 µg/gram creatinine)
Blood = _____ µg/L whole blood
Urine = _____ µg/gram creatinine

Name and Address of Laboratory Which Performed the Testing, If Applicable
Laboratory Name _____
Street Address _____
City _____ State _____ Zip _____

PLACE OF EXPOSURE / INJURY

Company Where Exposure/Injury Occurred
Name _____
Street Address _____ Phone No. _____
City _____ State _____ Zip _____

Patient's Department or Work Location

Job Title or Type of Work Performed by Patient

PHYSICIAN/ADVANCED PRACTICE NURSE INFORMATION

Name of Physician or Advanced Practice Nurse (Print)

Telephone Number ( )

Address
Facility Name _____
Street Address _____
City _____ State _____ Zip _____

Indicate Any Reasons Why The Patient Should NOT be Contacted

Comments by Physician/Advanced Practice Nurse, If Any

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