A GUIDELINE FOR WORKING WITH

LEAD

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Acknowledgements

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A GUIDELINE FOR WORKING WITH LEAD

Preface

This guideline is intended to serve as a resource for employers and workers to safely perform work activities involving various forms of lead. It is recommended that your workplace create a written prevention plan that includes lead safety. It should promote worker awareness and training, so that workers can know the hazards of lead and take the necessary precautions to reduce or eliminate their exposure to lead. This document may be used to help you with the creation of your lead safety plan.

I. AN INTRODUCTION TO LEAD

Elemental lead is a bluish grey metal with the chemical symbol *Pb*. Because of its unique properties (softness, high density, low melting point), it has widespread use in industry for many applications. Lead can be used in its elemental form, as an alloy with other metals, or as a chemical compound. All lead compounds can be classified as either organic (carbon-containing) or inorganic. These forms differ in their toxicology. Organic lead, in the form of tetraethyl lead, was used in leaded gasoline as an anti-knock agent. Between 1974 and 1990, the addition of lead compounds to gasoline was phased out. As a result, exposure to organic lead has been greatly reduced. Therefore, this guideline will only deal with lead in its inorganic form.

The occupational hazards of lead have been known for over two thousand years. Today, lead exposure can occur in many operations - especially in the recycling of scrap metal, the manufacturing and recycling of car batteries, the ceramics industry, soldering, welding, cutting, smelting, refining, and operations using or disturbing lead-based paints or coatings. Lead in its solid metallic form is considered relatively safe. However, it can become a health hazard if treatments such as heating, spraying, grinding, or burning, generate lead dust and fume.

The families of individuals working in lead-contaminated worksites can also be affected. Lead dust can settle on a worker's clothes and hair. The worker can then bring the dust into his or her car and home, where it can harm the worker's family.

Apart from industrial operations, additional consideration should be given to sources of lead in the home and the general environment. Individuals can be exposed to lead outside of the workplace from sources such as contaminated water (usually due to lead pipes in plumbing fixtures), contaminated soil, and deteriorated lead paint in older homes. While this guideline primarily focuses on occupational exposure, other sources of lead may be present and should be treated seriously as well.

II. HEALTH EFFECTS OF LEAD EXPOSURE

Lead, through natural environmental exposure, is found in the body at very low levels – blood-lead levels between 0 and 0.25 μmol/L (micromoles per litre), also stated as between 0 and 5 μg/dL (micrograms per decilitre). Occupationally, lead is absorbed into the body primarily through the **inhalation** (breathing) of a lead dust, mist or fume. **Ingestion** (eating) is also an important route of entry, as lead can be swallowed if it gets on the hands, face, clothing, food, or beverages. Occupational exposure to lead will raise lead levels in the body, creating a wide variety of health problems. Lead poisoning can be acute (a high exposure over a short period of time) or chronic (cumulative exposure over long periods of time). Both acute and chronic exposures can cause temporary or permanent damage to the body.

LEAD IS A TOXIN. It accumulates in the blood, bones, kidneys, brain, and liver causing various health problems. Furthermore, lead is persistent, staying in the body for long periods of time. High levels of lead can cause diseases of the central and peripheral nervous systems, kidneys, heart, bones, blood, and reproductive systems (causing reduced fertility), as well as high blood pressure. Children and unborn babies are more susceptible to health effects resulting from lead exposure.

Symptoms of lead poisoning may include:

- Headache	- Loss of appetite	- Insomnia
- Hyperactivity	- Dizziness	- Weakness
- Irritability	- Constipation	- "Wrist Drop"
- Nausea	- Pallor	- Fine Tremors
- Metallic taste in mouth	- "Lead line" on gums	- Tiredness
- Muscle and joint pain	- Stomach aches and cramps	- Numbness

Workers should be trained to recognise the symptoms of lead poisoning early, so that they can get prompt medical attention. It is important to know that lead poisoning is not always accompanied by symptoms until significant damage has been done. Regular check-ups with your family doctor, as well as biological monitoring through your employer (see Section VI) will help identify if overexposure to lead has occurred. Prompt medical attention reduces the risk of the long-term health effects of overexposure.

III. ENGINEERING CONTROLS TO REDUCE LEAD EXPOSURE

In accordance with the Manitoba Workplace Health Hazard Regulation (M.R. 53/88), employers are required to maintain a safe working environment for their employees. This includes keeping exposures to hazardous chemicals below their Occupational Exposure Limits (OEL). The OEL for airborne lead is 50 $\mu g/m^3$ (micrograms per cubic metre). This number is a time weighted average for an 8-hour workday and a 40-hour work week to which a worker may be exposed, without experiencing adverse health effects. It is required that exposure be kept below the OEL.

When concentrations of lead are, or are believed to be, above an *action level* of 25 $\mu g/m^3$, an employer is required to implement monitoring of the airborne lead concentration or implement control measures to ensure that an average of 50 $\mu g/m^3$ is not surpassed. Monitoring of lead must comply with Part IV "Monitoring and Controls" of the Manitoba Workplace Health Hazard Regulation. Information about acceptable methods of monitoring can also be obtained from Workplace Safety and Health. In place of monitoring, an employer may implement control measures to keep airborne contaminants from reaching the worker, such as safe work practices, ventilation systems, and respirators. Even with control measures, personal air monitoring should be done at least once to determine an initial level of airborne lead, so that the proper level of protection can be provided.

Airborne Concentration of Lead in monitoring	Action
Above 50 $\mu g/m^3$	Additional controls must be implemented to bring exposure to below 50 $\mu g/m^3$
Between 25 and 50 $\mu g/m^3$	Implement monitoring to ensure exposure does not rise above 50 $\mu g/m^3$ *- or-* Implement controls to ensure exposure is kept below 50 $\mu g/m^3$
Below 25 $\mu g/m^3$	No further action must be taken, unless there is a change in processes or controls

Notes about Air Monitoring

- Monitoring should be repeated whenever there is a change in processes or control measures.
- Air monitoring should be conducted or supervised by a technically qualified person.
- Repeated air samples over long periods of time will allow the fluctuations of airborne lead concentrations to average out and give a more accurate measurement of the airborne lead levels to which the workers are actually exposed.

- Remember that the concentration of lead in air is an indicator of the level to which the workers are exposed. It is NOT a measurement of the levels of lead in workers' bodies – for that, biological monitoring is necessary.
- Monitoring should be performed as often as necessary so that the level of airborne lead can be reliably assessed.

A knowledgeable person should review all operations at your workplace, identify sources of exposure, and assign control measures to reduce worker exposures to lead. Material Safety Data Sheets (MSDS) for all chemicals used at your workplace should be reviewed to check for lead ingredients.

The following are examples of some recommended control measures that may be used to reduce lead exposures:

1. Substitution and Modification

Substituting for a material that doesn't contain lead is the most effective method of reducing lead exposure, and should be considered wherever practical. Work practices and equipment may also be substituted or modified so that less airborne lead is released. Examples of substitution and modification for various operations include:

Painting

- Using non-lead based paints and other coatings. For example, replace lead chromate with zinc. Note: paints, enamels, and other liquid coating materials containing a certain lead content (0.1 or 1 percent lead depending on the lead compound) are controlled under the *Hazardous Products Act* and its regulations.
- Brushing or rolling on lead paints and coatings instead of using sprays will reduce the amount of lead that gets airborne.

Paint Removal

- Using chemical strippers to remove lead paint (note: chemicals used as strippers may be hazardous themselves – appropriate precautions should be taken).

- Other alternative paint removal methods (which create less dusty conditions than abrasive blasting) include: centrifugal blasting (using rotating blades to propel the abrasive, which is then recovered and recycled), wet blasting (high-pressure water with or without an abrasive), vacuum blasting (shrouding the nozzle with local exhaust ventilation), and using needle guns.
- Removing and replacing woodwork, rather than scraping during lead paint abatement. Note: sawing and prying deteriorated painted woodwork may release lead dust and chips.
- Encapsulating lead paint on walls, ceilings, and floors to make it inaccessible, rather than removing the lead paint. This can be done by coating it with a material that

bonds to the surface such as an acrylic or epoxy coating, or covering it with heavy wallpaper, drywall, or panelling. Encapsulation procedures must be documented to reduce exposures when lead surfaces are uncovered in future maintenance, renovations, or demolition.

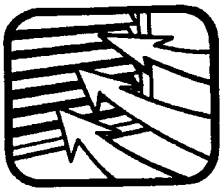
Cutting and Welding

- Using mobile hydraulic shears instead of torch cutting, when possible.
- Using long-handled torches when welding and cutting, which increases the distance between the worker and the source of contamination.
- Stripping lead paint away before cutting or welding (the U.S. Occupational Safety and Health Administration (OSHA) recommends a minimum of 4 inches on either side of the cut or weld line).
- Where possible, use pneumatic air tools or impact wrenches to remove rivets or bolts, instead of torch cutting for demolition operations.

Soldering and Melting

- Using no-lead or low-lead solder for soldering.
- Using a thermostat when working with molten lead, ensuring that temperatures are kept near the melting point of lead (327°C). When heated to temperatures of 500°C or higher, lead will begin to produce a fume.

2. Ventilation



Ventilation is the preferred method (over respirators) for protecting workers against airborne lead (however using *both* an effective ventilation system *and* respirators are encouraged and are often necessary). Two types of exhaust ventilation systems exist: general and local. **General dilution** works by supplying outside air to be mixed in with the contaminated air, thereby diluting the airborne lead to safe levels. **Local exhaust systems** work by capturing the contaminant at its point of release and exhausting it, in some cases, through filters, outdoors. Local exhaust systems are the preferred method of ventilation. For some work areas, a combination of both systems may be necessary.

All ventilation systems should be engineer-designed. The following points should be noted when choosing a new ventilation system, or when determining if current ventilation systems are adequate:

- Local exhaust systems are preferred over general dilution. They allow less contaminant to be released into the work area. General dilution may not be appropriate for controlling lead hazards, as it does not provide effective ventilation to workers near the source of airborne lead. Also, general dilution may disperse lead dust around the workroom, keep it airborne, and transport it to other work areas.
- Ventilation systems used for removing airborne lead (or any other hazardous materials) should be separate from general building ventilation systems.

- Ventilation systems should be evaluated regularly to ensure their effectiveness.
- When working outside, where possible, work upwind from the source of contamination.

General dilution

- Exhaust intakes should be placed near the point of contamination if possible.
- Air supply and exhaust systems should be placed so that airflow goes from the supply, past the worker, through the zone of contamination, and into the exhaust. This orientation will reduce the amount of airborne lead that enters the worker's breathing zone.
- The operator should remain between the air supply and the source of the contaminant.

- Outlets discharging exhaust should be far away from any outside air intakes or windows. Exhaust should be discharged above the roof line to prevent the recirculation of contaminated air.

Local exhaust systems

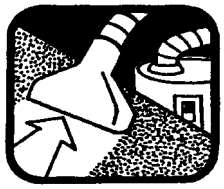
- Where possible, enclose the lead producing process or source of contamination in a ventilated enclosure.
- The hood should be oriented so that contaminated air is removed close to the point of release.
- Contaminated air should be drawn away from the individual, rather than past the individual's breathing area.
- Ventilation air flow should be sufficiently high as to effectively remove the contaminant. This will depend on many factors, including the speed at which the lead fume or vapour is being released and the turbulence of the surrounding air. Your ventilation rate must be sufficiently high to reduce the exposure down below the OEL (50 $\mu g/m^3$ of airborne lead).
- Strong air currents (cross currents) can disrupt the movement of air into the hood, and should therefore be eliminated or minimized. Common sources of cross currents include free-standing fans, open windows and doors, and poorly placed supply air ducts.
- In addition to stationary local exhaust systems, a dust and fume may also be captured by vacuum attachments built into (or attached to) tools such as sanders.
- The recirculation of contaminated air should be prevented. Air contaminated with lead dust should be directed into filters or dust collectors.
- Ensure the ventilation system is working properly before each use.
- Using a fume-extractor gun is an alternative to using an exhaust hood when performing welding operations.

Note: Some work sites may not allow for a ventilation system to be used (e.g. demolition sites). At these sites, the use of other control measures and protective equipment is of greater importance. For more information on controlling lead at demolition sites, read WorkSafe! Bulletin #216: *Lead Exposure in Demolition Workers*.

3. Dust Control

The following are control measures used to reduce the amount of lead dust at the work site:

- Use polyethylene plastic to cover walls, floors and ceilings during lead paint abatement or other dust-producing processes. This will contain dust during operations and cleanup.
- Dust clean-ups should be performed at the end of each day and again after a job is complete. When doing a final clean-up, wait at least one day to let any dust settle. Adequate respiratory protection must be provided to personnel conducting the clean-up.
- Report all leaks and spills of lead-containing material immediately to the appropriate personnel.
- DO NOT use compressed air or a dry broom to clean up lead dust. This will raise any settled dust back into the air.
- Where possible, use methods that continually wet the surface being worked on (particularly during lead paint abatement).
- Dry abrasive blasting for removing lead paint should be avoided. This method generates high lead dust levels. When possible, use alternative paint removal methods, such as those listed in *Substitution and Modification*.
- Use a HEPA-filter vacuum and wet mop contaminated surfaces to remove lead dust. Operators should have appropriate attachments (such as angular tools and brushes) for the HEPA vacuum to effectively remove lead dust. Do not use vacuums that are not equipped with HEPA filtration, as they do not remove fine lead dust effectively.



- Do not create dust clouds by clapping together or shaking out contaminated objects or clothing.
- Place discarded lead dust in sealed plastic bags and dispose of them as hazardous waste. Accumulations of lead dust and debris should be removed from the work site at least daily.

Contact Manitoba Conservation for information on disposal, phone 945-7100.

Testing may be necessary to determine the lead content of old paint, or the effectiveness of dust control measures. You may wipe down surfaces with test pads and bring in pads or paint chips to a qualified analytical laboratory. Most laboratories can give you instructions on how to sample properly, however, they do not interpret the results. Although there is no set legal limit of lead dust on surfaces, high levels of lead dust is a good indicator of airborne lead dust. The U.S. Environmental Protection Agency considers lead dust a hazard if it is in concentrations greater than 40 $\mu g/ft^2$ (micrograms per square foot) on floors and greater than 250 $\mu g/ft^2$ on window sills.

4. Containment Structures and Other Work Areas

Containment structures and separations are often used to prevent environmental contamination of lead particles, as well as to reduce exposure to workers in adjacent worksites. Containment structures, while necessary in many situations, may increase lead exposure to workers inside the structure or work area. Necessary precautions such as a mechanical ventilation system and respirators should be taken to prevent overexposure to these workers.

Signs should be posted and be clearly visible at the entrance of the structure or work area, to warn personnel about the lead-contaminated area. An example of an appropriate warning sign is shown below:

Containment structures should be equipped with dust collecting and air-cleaning devices to prevent the emission of lead dust into the environment.

IV. RESPIRATORS

When ventilation and other engineering controls cannot reduce airborne concentrations of lead to below the OEL of 50 μg/m^3, respirators are required. **Avoid using respirators as the *only* means of preventing or minimizing exposures.** When feasible, respirators may be used in conjunction with exhaust ventilation and other control measures. Selecting a respirator will depend upon many factors, including:

- the nature of the airborne lead that is being given off (whether it is a fume or dust);
- the amount of lead dust/fume in the air;
- the generation of other harmful airborne chemicals in the work process;
- whether the work is being done in an oxygen-deficient atmosphere;
- the duration of the work and whether it is strenuous;
- any added protection required (i.e. eye protection);
- the condition of the worker – respirators can put additional stress on the heart and lungs; if the worker's ability to wear a respirator is in question, a physician should be consulted and a health assessment should be performed;
- proper fit – workers with glasses might not be able to achieve an adequate respirator-to-face seal; as well, workers must be clean shaven to achieve a proper fit.

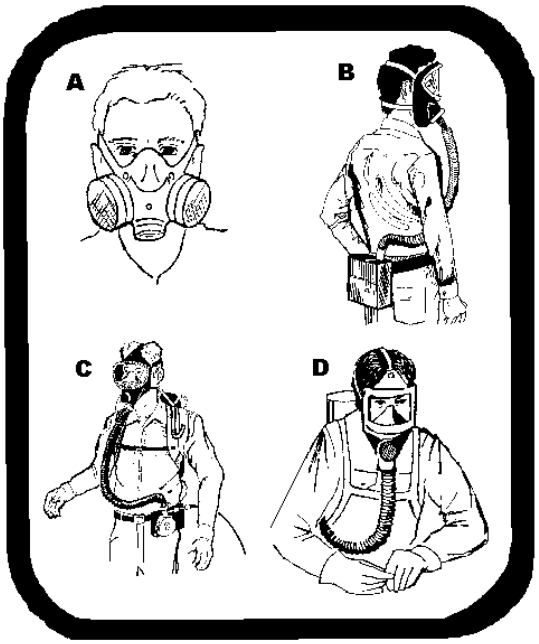
Respirator selection and use must comply with the Canadian Standards Association's (CSA) current CSA Standard Z94.4 *Selection, Use, and Care of Respirators*. Manufacturer's instructions should also be followed.

Choosing a Respirator

There are two main types of respirators:

Air-Purifying Respirators – These respirators purify air by filtering out lead particles through filters and/or chemical cartridges. Generally, filters provide protection against particulates (dust, mist, fume), and sorbent cartridges or canisters provide protection against vapours and gases. Powered air-purifying respirators (PAPRs) provide a greater degree of protection by using a compact fan that draws contaminated air through a series of filters and supplies the filtered air to the respirator facepiece.

Supplied-Air Respirators – these respirators may protect against all airborne forms of contaminant by providing an alternate source of clean air through a compressed air tank or through an air line. A respirator that uses a compressed air tank worn by the user is known as a self-contained breathing apparatus (SCBA).



A) Half-facepiece air-purifying respirator
B) Full-facepiece powered air-purifying respirator
C) Full-facepiece airline supplied air respirator
D) Full-facepiece self-contained breathing apparatus

The appropriate respirator must be chosen based on the degree of hazard. Each type of respirator will provide a degree of protection commonly stated as an Assigned Protection Factor (APF). A respirator with an APF of 10 means that a user, *when properly fitted and trained*, can safely work in an environment that contains 10 times the Occupational Exposure Limit (OEL) for airborne lead ($10 \times 50\mu g/m^3 = 500\mu g/m^3$). Below is a table of various types of respirators, listing their APF and the maximum level of lead they will protect against:

Respirator Type	Assigned Protection Factor (APF)	Maximum Exposure to Lead in $\mu g/m^3$ ($APF \times OEL_{LEAD}$)
Air Purifying (negative pressure)		
Quarter facepiece	5	250
Half facepiece	10	500
Full facepiece	100 (10*)	5000 (500*)
Powered Air Purifying		
Half facepiece	50	2500
Full facepiece	1000	50000
Helmet/hood	1000	50000
Loose-fitting facepiece/visor	25	1250
Supplied-air (demand)		
Half facepiece	10	500
Full facepiece	100 (10*)	5000 (500*)
Supplied-air (pressure demand)		
Half facepiece	50	2500
Full facepiece	1000	50000
Supplied-air (continuos flow)		
Half facepiece	50	2500
Full facepiece	1000	50000
Helmet/hood	1000	50000
Loose-fitting facepiece/visor	25	1250
SCBA (demand)		
Half facepiece	10	500
Full facepiece	100 (10*)	5000 (500*)
SCBA (pressure demand)		
Full facepiece	10000 †	500000 †
Helmet/hood	10000 †	500000 †

* If qualitative fit testing (QLFT; see *Fit Testing*) is used, all demand and non-powered air purifying respirators are assigned a maximum APF of 10.

† Not all users may be able to achieve protection factors of 10000. Because of limited data, no definitive APF could be assigned for pressure demand SCBA.

Notes 1) This table is adapted from Table 2 of CSA Standard Z94.4-93. Refer to the current standard for detailed information.

2) Combination respirators such as airline respirators equipped with an air-purifying filter should have the APF assigned on the basis of the mode of operation. For example, if the combination respirator is to be used in both the supplied air mode as well as the air-purifying mode, then the APF applicable to that respirator in the air-purifying mode applies.

Filters

NIOSH type-100 filters (formerly called HEPA filters) are 99.97 percent efficient against particles of 0.3 micron size or larger. P-100, R-100, or N-100 respiratory filters are recommended for protection against lead.

Fit Testing PROPER FIT OF THE RESPIRATOR IS EXTREMELY IMPORTANT!

Once the appropriate type of respirator and filter has been chosen, each user must select from various sizes and brands to determine which respirator provides an adequate seal to the user's face. This is accomplished through fit testing. Fit testing must comply with the current CSA Standard Z94.4 *Selection, Use, and Care of Respirators.* Also, fit testing must be repeated whenever there is significant change to the user's face (e.g. gain or loss of weight, dental changes). There are two types of fit testing:

Qualitative Fit Testing (QLFT) – this method is a simple and inexpensive way of testing a respirator on a pass/fail basis. A strong smelling or tasting test chemical is released around the respirator-face seal. If the user can smell or taste the chemical, than the respirator has failed the test. Although a QLFT can tell you if a respirator can pass the test, it cannot tell you which respirator fits best.

Quantitative Fit Testing (QNFT) – this method uses electronic equipment to measure exactly how much the respirator leaks. From this information you may select the best fitting respirator.

Using the Respirator

- Respirators must be worn at all times whenever the job you are doing exposes you to levels of airborne lead above the occupational exposure limit (OEL).
- Before removing the respirator, use a HEPA vacuum and damp cloth to remove any lead dust from around the facemask, especially around the face-mask seal.
- ALWAYS wear your own respirator. Respirators have been tested for fit on each individual. Another person's respirator will not fit properly, and therefore will not provide adequate protection.
- Respirators must be fastened to the head properly. For most respirators, one strap below the ear and one above. An additional strap atop the head is required on most full-facepiece respirators. Follow the manufacturer's instructions.
- Users must be clean shaven to achieve an adequate respirator-to-face seal.
- Ensure that the respirator is in good repair.
- Perform a user seal check *every time* you use the respirator:

Negative-pressure sealing check - suitable for testing the seal on most air-purifying and atmosphere-supplying respirators equipped with tight-fitting facepieces;

- block the inlet opening (with the hands, with plastic wrap, or by closing off the air supply hose) so that air cannot be drawn through; be careful not to distort the mask or disrupt the facial seal during the test;
- inhale gently and hold your breath for at least 10 seconds ;

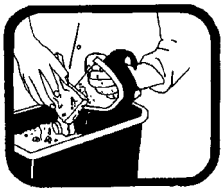
- if the facepiece collapses slightly and no inward leakage can be detected, then the respirator has passed this seal check; if the facepiece does not remain collapsed, then the user must remove the mask, inspect components for damaged or worn parts, readjust the straps and facepiece, and perform the test again; DO NOT use a respirator that cannot pass a user seal check;

Positive-pressure sealing check – suitable for testing the seal on respirators equipped with tight-fitting face-pieces that contain both inhalation and exhalation valves; some respirators require the user to remove the exhalation cover from the respirator and then replace it after completion of the check;
- block the exhalation valve, breathing tube, or both;
- exhale gently and wait a few seconds;
- if a slight positive pressure can be maintained without detection of outward leakage, then the respirator has passed this seal check; if outward leakage can be detected, then the user must remove the mask, inspect components for damaged or worn parts, readjust the straps and facepiece, and perform the test again; DO NOT use a respirator that cannot pass a user seal check.

Respirator Care

Respiratory maintenance should not be ignored – follow the manufacturer's recommendations. In general, the following tips should be used when caring for your respirator:

Cleaning



- Before removing the respirator, use a HEPA vacuum and damp cloth to remove any lead dust from around the facemask, especially around the face-mask seal.
- Wash your hands before cleaning the respirator.
- Remove the filters and wipe them clean. Filters should be changed on a time schedule or as soon as you notice it is slightly harder to breath through them (whichever comes first).
- The mask should be washed with a mild detergent and rinsed well. Do not use a solvent for cleaning.
- Dry the respirator well before storing it.

Storage

- When not in use, store the respirator in a clean, dry location, away from any source of lead particles. Store respirators in a sealed container.
- Masks should not be bent or folded while in storage.

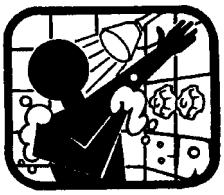
Maintenance

- Keep all parts of the respirator in good shape.

- Inspect the respirator for tears, cracks or holes in all parts of the respirator. Also check for distortion in the mask caused by improper storage.
- A qualified person should repair all damaged or worn parts immediately. Damaged respirators should never be worn. Replacement parts are usually inexpensive and should be stocked on-site. Do not mix parts from different manufacturers.

V. PERSONAL HYGIENE AND PROTECTIVE EQUIPMENT

While working, lead dust can get on the clothes, hands, or hair leaving the opportunity for the dust to be ingested, inhaled, or brought into homes and cars where the dust may harm the workers' family members. For this reason, good hygiene practices are critical in preventing work-related lead poisoning. The following are considered good hygiene practices:



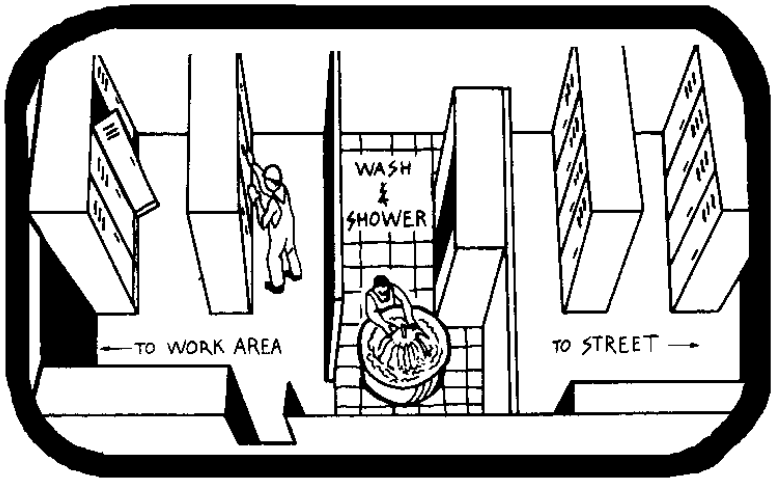
General

Workers must wash their hands and face prior to eating, drinking, smoking, or using washroom facilities.

- When working, avoid putting your hands near your mouth, lips, or nostrils. Avoid rubbing your sleeve against your face.
- Adequate washing facilities must be in close proximity to work areas.
- Never put any object in the mouth.
- Do not eat, drink, smoke, or apply cosmetics anywhere lead materials are being handled or accumulate. Lunch rooms must be completely separated from work areas and must be posted as such. Workers must either clean or remove their protective clothing and wash their hands and face prior to entering designated lunch rooms or smoking areas. HEPA vacuuming can be used to remove loose lead dust from clothing.
- Rinse your mouth before eating or smoking.
- Cars should be parked where they cannot be contaminated with lead.

Change Areas and Showers

- Employers must provide a clean change area equipped with storage facilities for clean, uncontaminated street clothes, and a separate change area for removal and storage of contaminated protective clothing and equipment. Cross-contamination of the employees' street clothes must not be possible.
- When contamination of workers' skin, hair, and clothing is possible, shower facilities must be provided. Employees should change out of work clothes and then shower, before changing into street clothes. Below is an example of a good shower/change room set-up:



Work Clothing

- Appropriate protective clothing should be provided to prevent lead dust from accumulating on the worker's body, as well as to protect against other hazards inherent in the work. Coveralls, gloves, goggles, face shields, and shoe covers may be required.
- Employees may not wear street clothes when working in lead contaminated work sites.
- Wearing full body protective clothing may contribute to heat stress. Employers should implement plans to reduce this risk.
- Work clothing contaminated with lead must not be worn home. When leaving the job site, a HEPA vacuum must be used to remove loose dust off the outer work clothing. Coveralls should be removed.
- Be careful not to disperse lead dust into the work or change area when removing contaminated clothing. Using a HEPA vacuum on work clothes can reduce this hazard. Do not shake, blow, or brush off dust.

Laundering

- Work clothing must be laundered or replaced daily.
- Work clothes must either be washed on site or laundered professionally (the professional laundry company must be aware of, and well-equipped for, the lead hazard). Washing lead contaminated clothing at home is not permitted. Alternatively, employers may provide disposable coveralls (to be used only once, and then disposed of).
- Contaminated disposable clothing and contaminated wash water (with a lead concentration greater than 5 parts per million) must be disposed of as hazardous waste. Contact Manitoba Conservation for more information on proper disposal.
- Contaminated clothing that is to be laundered or disposed of should be placed in closed containers with labelled warnings alerting to the presence of lead dust.

VI. BIOLOGICAL MONITORING AND TREATMENT

Early symptoms of lead toxicity are non-specific, and may be confused with a flu-like condition. For this reason, biological monitoring may be useful. This includes monitoring blood levels for lead. Biological monitoring is **required** when:

i) a worker has been, or is expected to be, exposed to lead above the action limit (25 $\mu g/m^3$) for more than 30 days per year;

or ii) work site lead exposure could result in an elevated body burden of lead through any route of entry.

Workers who are likely to be exposed to lead should have their initial baseline blood-lead level determined.

The blood-lead (PbB) level is an indicator (but not a direct measure) of the worker's body burden from lead exposure. This value must be analysed along with a complete medical evaluation to fully diagnose lead poisoning and prescribe a treatment. **Note:** biological monitoring should not be used as a replacement for workplace air monitoring and controls, but rather as an indicator of exposure. If PbB levels are high but monitoring shows low levels of workplace airborne lead, then other sources and/or routes of exposure, such as ingestion of lead dust or lead-contaminated drinking water, may need to be investigated.

Test Results and Interpretation

The table below is a general guide used by the Chief Occupational Medical Officer to determine the required workplace actions at various levels of lead found in blood during biological monitoring:

Interpretation of Lead Levels		
Blood Lead Level*	**Minimum Frequency of Follow-up****	**Required Actions**
Less than 1.5 µmol/L (<30 µg/dL)	Every 6 months	Identify sources of exposure and reduce exposure to as low as possible.
1.5-1.99 µmol/L (30-39 µg/dL)	every 3 months	Identify source of exposure and discuss with worker. Reduce exposure to as low as possible and ensure safe work practices.
2.0-2.49 µmol/L (40-49 µg/dL)	every 1 month	Review and evaluate work practices and environmental controls. Identify sources of exposure and discuss with worker. Reduce exposure to as low as possible and ensure safe work practices.
2.5 µmol/L and greater (≥50 µg/dL)	As indicated by attending physician	Remove the worker from exposure and place him or her in a job with minimal exposure. Consult a physician for a medical assessment. Corrective action should be taken to ensure no other workers are similarly affected.
Note: women who are pregnant or are planning a pregnancy should check with their physician to ensure protection for the unborn child; the above blood lead levels may not protect an unborn child. * Normal background blood lead levels for unexposed individuals is between 0 - 0.25 µmol/L (0 - 5 µg/dL). ** Newer employees should initially be tested more frequently.		

Employees who have blood lead levels at 2.5 μmol/L or greater must be removed from the lead contaminated work site, and placed in a job with minimal lead exposure (i.e. less than 30 $\mu g/m^3$). In all cases, when high levels of lead are found in workers' blood, sources of exposure must be investigated and reduced using engineering controls and protective equipment. Employees may only return to their job after their blood lead levels have dropped to sufficiently low levels and controls have been implemented to reduce exposure.

Information that is obtained from biological monitoring is considered to be confidential medical information.

Treatment

In most cases, treatment for lead poisoning consists of removal of the affected individual from the lead-contaminated work site. Varying amounts of time, depending on the level of lead in the body, is required to allow the body to naturally remove the lead. Removal from the work site must occur when the employee's blood lead level is at 2.5 μmol/L, or earlier, at the request of the attending physician.

In rare cases, lead poisoning is treated with a process called chelation. In these cases, special drugs are administered to remove lead from the worker's blood. Chelation may only be carried out under the supervision of a physician. It is important to know that medical treatment should never be used as a means of controlling lead exposure, and should *never* be used in place of engineering controls, good workplace practices, good personal hygiene, and personal protective equipment.

For all questions regarding biological monitoring and treatment, contact the Chief Occupational Medical Officer (945-3608) of the Workplace Safety & Health Division. Additional information can be found in the publication, *Lead Exposure in the Workplace: A Physician's Guide.*

VII. EMPLOYER REQUIREMENTS

Employers are expected to comply with all applicable sections of Manitoba's Workplace Health Hazard Regulation (MR 53/88). This includes, but is not limited to:

- installing adequate engineering, ventilation, and other control measures to limit the exposure to lead;
- implementing monitoring of airborne lead concentrations, as necessary, with detailed record keeping of the results;
- making available appropriate hygiene facilities to limit ingestion of lead and its transportation to the workers' homes;
- providing respiratory and other protective equipment, as necessary, at no cost to the employee;
- supervising employees to ensure safe and healthy work practices;
- providing biological monitoring at no cost to the employee, as necessary;
- implementing a training program with the prevention of lead overexposure as the main focus; this includes training on:
  - the health effects of lead and symptoms of exposure;
  - the sources of hazardous levels of lead in your workplace;
  - specific work practices to minimize lead exposure;
  - how to use applicable ventilation systems;
  - proper clean-up procedures;
  - the use, care, and proper fit of respirators;
  - good hygiene practices;
  - information about biological monitoring, and limitations on the access to confidential medical records;

  Training materials, including videos may be obtained from safety equipment suppliers as well as from the Workplace Safety & Health Division.

VIII. CONTACT INFORMATION

WORKPLACE SAFETY AND HEALTH DIVISION
200– 401 York Avenue, Winnipeg, MB. R3C 0P8
TOLL FREE: 1-800-282-8069 (In MB. Only)
INTERNET: http://www.gov.mb.ca/labour/safety

Client Services	Workplace Safety and Health (Wpg.)	(204) 945-6848
	Workplace Safety and Health (Brandon)	(204) 726-6361
	Mines Inspection (Flin Flon)	(204) 687-1618
24-Hour Emergency Line	Workplace Safety and Health	(204) 945-0581
Fax	Workplace Safety and Health (Wpg.)	(204) 945-4556
	Workplace Safety and Health (Brandon)	(204) 726-6749
	Mines Inspection (Flin Flon)	(204) 687-1623

IX. REFERENCES AND ADDITIONAL READING

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Internet

Manitoba Labour, Workplace Safety and Health Division; www.gov.mb.ca/labour/safety
Canadian Centre for Occupational Health and Safety (CCOHS); www.ccohs.ca
Canadian Standards Association (CSA); www.csa.ca
National Institute for Occupational Safety and Health (NIOSH; US); www.cdc.gov/niosh/homepage.html
Occupational Safety and Health Administration (OSHA; US); www.osha.gov