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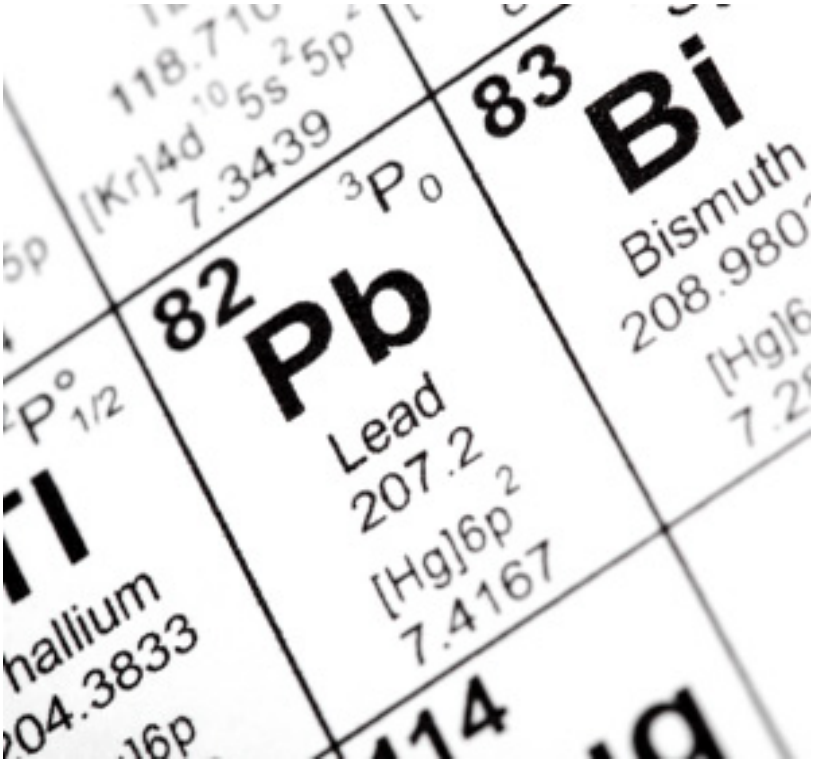
Occupational Health and Safety

Bulletin

Lead at The Work Site



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Introduction

Lead is a bluish-grey metal that is naturally present in the earth's crust. It has a low melting point, is pliable, corrosion resistant and is often combined with other elements such as zinc, silver and copper; the most common lead ore is lead sulphide (galena). Since lead is easily re-melted and refined, it has the highest recycling rate of all metals worldwide. Lead is used in the manufacture of many consumer and industrial products and can be found in a variety of workplaces.

The largest single use of lead today is in the manufacture of the lead-acid storage battery, which is a vital part of every automobile. The average car battery contains about 10 kg of lead. Lead-acid batteries for automotive, industrial and consumer purposes account for about 75% of world lead usage. In the communications industry, lead is still used extensively as protective sheathing for underground and underwater cables, including transoceanic cable systems. Certain lead compounds are used as paint pigments. Red lead (lead oxide) is the basic paint primer for iron and steel. Lead compounds are used as stabilizers in plastic (PVC) piping and in decorative glass. Lead's corrosion-resistant nature also makes it suitable for applications in sheeting for roofing purposes, while its high density imparts radiation attenuation properties that prevent the emission of harmful radiation from television, video, and computer screens.[1] Lead alloys such as lead-antimony are used in batteries and in the chemicals industry for pumps and valves. Lead-tin solders are used for welding metal parts together.[2]

In this bulletin, information is provided on workplaces that may use lead, health effects due to lead exposure, options for the control of exposure as well as the requirements in Alberta's occupational health and safety (OHS) legislation for lead.

Exposure to Lead

Everyone is exposed to trace amounts of lead through air, soil, household dust, food, drinking water and various consumer products.[1] Traces of lead can be found in almost all food. Airborne lead falls onto crops or soil and is absorbed by plants and even cigarette smoke may contain small amounts. These trace amounts are excreted through normal body processes and do not normally pose a health risk. The following sections discuss the types of work sites and work activities that can increase lead exposure to workers.

Lead in the Workplace

The most common way that workers may be exposed to lead at the work site is when tasks are done that produce airborne lead dust, fume or vapour. Table 1 summarizes some examples of occupations and tasks in Alberta where exposure to lead may occur.[3,4]

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[1] Government of Manitoba. Environmental Health: Lead. Located at: http://www.gov.mb.ca/health/publichealth/environmentalhealth/lead.html

[2] Government of Canada (Natural Resources Canada). Canadian Minerals Yearbook – 2008. Located at: http://www.nrcan.gc.ca/minerals-metals/business-market/canadian-minerals-yearbook/2008-review/commodity-reviews/4186

[3] Government of the United Kingdom (Health and Safety Executive). Lead and You. Located at: http://www.hse.gov.uk/pubns/indg305.pdf

Table 1 - Occupations and Tasks where Exposure to Lead may Occur in Alberta

Occupation/Industry	Where Lead May be Found	Tasks That May Involve Lead Exposure
artists, jewelers and potters	* lead solder * glaze * leaded glass	* handling * manufacturing
battery or metal recycling workers	* battery cells * raw lead sheet * lead in alloys	* handling * sorting * packaging
chrome plating workers	* lead anodes	* use of anodes * cleaning of anodes
demolition and renovation workers	* building materials * paint * tile * roofing materials * plumbing materials * lead sheet	* manual demolition/disposal * equipment operation
electronic manufacturing workers	* solder	* manual and wave soldering * circuit board handling
electronic recycling workers	* solder * the rear part of cathode ray tubes known as funnel glass contain around 20% lead and the glass frit contains up to 90% lead	* receiving * handling * processing * melting * dismantling * packaging
foundry workers	* zinc lead content in raw material	* production * handling * packaging
galvanizing or galvanized metal processing workers	*lead in molten zinc bath	* dipping * handling * processing * packaging * maintenance of equipment
glass manufacturer and recycling workers	* lead oxide may be added to specialty and technical glass * CRT tubes * leaded glass * stained glass	* handling * manufacturing/processing
lead abatement workers	* lead paint * wall panels * tile glaze * solder from piping	* removal * handling/disposal of lead containing waste
lead manufacturers, miners,	* processing lead ore	* mining

[4] United States Centers for Disease Control and Prevention. Lead Information for Workers. Located at: http://www.cdc.gov/niosh/topics/lead/wi01.html

Occupation/Industry	Where Lead May be Found	Tasks That May Involve Lead Exposure
refiners and smelters	* manufacturing of products	* equipment operation * processing * packaging
painters that apply industrial coatings	* lead paint	* sanding * handling * application * cleaning
plastics manufacturing, processing workers	* lead stabilizers such as lead sulfate or lead stearate are common additives in the formulation of polyvinyl chloride (PVC) plastic used to coat or insulate wire and cables * lead pigments such as lead chromate to color plastics	* handling of raw materials * manufacturing/processing
plumbers and pipe fitters	* solder * piping * fixtures * fittings and valves	* soldering * handling
police officers	* ammunition	* cleaning of firearms * shooting * range maintenance
radiator & automotive repair technicians	* radiator manufacturing	* handling of radiators * melting existing or applying new lead containing solder * cleaning by abrasive blasting * compressed air/sweeping
shooting range workers	* ammunition	* monitoring shooters * cleaning * reloading ammunition * range maintenance
solid waste incinerator operators	* plastic items * lined paper packing material	* contact with surfaces * cleaning/maintenance of incinerator/other equipment
type press printing and stamp production workers	* lead forms * lead type	* producing stamps * manufacturing of type * printing process * operating linotype machine
welders	* lead paint * alloys * galvanized metals	* grinding * buffing/polishing * welding * cutting * gouging

Worker Exposure

If lead exposure is a possibility in your job, it is important that you understand how exposure occurs to minimize the chances of harm from contact with lead. When lead and items containing lead are processed, worked, or recovered from scrap or waste they can create lead dust, fume or vapour. There are three main routes for exposure.[5,6,7]

1. Inhalation:
   - breathing in lead dust, fume or vapour. These substances may not have an odour, so you may not know you are being exposed
   - lead fumes are produced during processing, when metal is being heated, cut, welded or soldered
   - lead dust is produced when metal containing lead is cut, ground or when lead paint or coatings are disturbed

2. Ingestion:
   - eating, drinking or smoking in areas where lead contamination exists
   - hand to mouth transfer of lead for example biting one's nails, licking one's fingers, touching one's face or other poor hygiene practices

3. Skin Absorption:
   - organic forms of lead, such as pesticides, may be absorbed through skin

Health Effects

The health effects from lead are the same regardless of the lead source or route of exposure. Most of the lead entering the body will leave via the urine with smaller amounts discarded in the feces, sweat and dead skin cells. Lead remaining in the body accumulates in bone where it can be stored for decades and released at a later time back in to the blood. Aging and pregnancy may result in larger releases of lead from bone.

Lead exposure from high exposure over a short time causes acute effects. Long-term exposure to lower doses of lead may cause chronic adverse effects. Both types of exposure may result in effects on multiple organ systems including the nervous, renal, cardiovascular, gastrointestinal, hematological, and reproductive systems.[8]

Lead is considered a hematological, neurological, renal and reproductive toxin. Inorganic lead exerts a wide spectrum of multi-systemic adverse effects ranging from subtle, subclinical changes in function to symptomatic effects, and in rare acute instances, lead intoxication.

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[5] Government of the United Kingdom (Health and Safety Executive). Lead and You. Located at: http://www.hse.gov.uk/pubns/indg305.pdf

[6] United States Centers for Disease Control and Prevention. Lead Information for Workers. Located at: http://www.cdc.gov/niosh/topics/lead/wi01.html

[7] Government of Manitoba. Environmental Health: Lead. Located at: http://www.gov.mb.ca/health/publichealth/environmentalhealth/lead.html

[8] Government of Canada (Health Canada). Risk Management Strategy for Lead. Located at: http://www.hc-sc.gc.ca/ewh-semt/alt_formats/pdf/pubs/contaminants/prms_lead-psgr_plomb/prms_lead-psgr_plomb-eng.pdf

A variety of health problems commonly identified with lead exposure include anemia, gastrointestinal dysfunction, peripheral neuropathy, central nervous system dysfunction (ranging from mental function disturbances, mood changes, hearing loss, impaired balance to hallucinations and coma), musculoskeletal pains, and negative effects on male reproduction.

In general, the number and severity of overt symptoms worsens with increasing blood lead levels. Mild symptoms included mild fatigue, emotional irritability, difficulty concentrating, and sleep disturbances. Moderate symptoms include headache, general fatigue or drowsiness, myalgia, arthralgia, tremor, nausea, decreased appetite, abdominal cramps, constipation or diarrhea, and decreased libido. Severe symptoms would include colicky abdominal pain, peripheral neuropathy, encephalopathy with seizures, delirium and coma.

Early symptoms are often subtle and nonspecific, involving the nervous system, gastrointestinal tract or the musculoskeletal system. Symptoms may lag physiological changes.

In addition to symptoms associated with acute, high dose exposures, more recent research has increased concern with regard to subclinical effects linked to chronic lower exposures including hypertension, effects on renal function, cognitive dysfunction and adverse female reproductive outcomes.[9]

New Findings

Recent research has documented adverse health effects at blood lead levels below the American Conference of Governmental Industrial Hygienists (ACGIH) Biological Exposure Limit (BEI).[10] Mounting evidence is accumulating that lead can cause effects at very low levels, well below those at which clinical symptoms occur. A definitive threshold below which no adverse effects will occur has not yet been established.

Sufficient evidence has accumulated for a causal relationship between lead and hypertension (with risk for heart disease, stroke, and renal insufficiency). There is an association of decreasing renal function with increasing blood lead level. There is also an association between increased blood lead levels and decreased mental function in adults.[11]

Subclinical slowing of nerve conduction velocity has been shown at the level of the BEI. Lead exposure during pregnancy resulting in minimally elevated blood lead levels has been associated with increased risk of spontaneous abortion and adverse effects on infant physical, mental and

[9] California Department of Public Health. Medical Guidelines for the Lead-Exposed Worker. Located at http://www.cdph.ca.gov/programs/olppp/Documents/medgdln.pdf

[10] Government of Canada (Health Canada). Final Human Health State of the Science Report on Lead. Located at: http://www.hc-sc.gc.ca/ewh-semt/alt_formats/pdf/pubs/contaminants/dhhssrl-rpecscepsh/dhhssrl-rpecscepsh-eng.pdf

[11] Government of Canada (Health Canada). Final Human Health State of the Science Report on Lead. Located at: http://www.hc-sc.gc.ca/ewh-semt/alt_formats/pdf/pubs/contaminants/dhhssrl-rpecscepsh/dhhssrl-rpecscepsh-eng.pdf

neurobehavioral development.[9] In addition, the International Agency for Research on Cancer (IARC) has also deemed lead a probable carcinogen to humans (Group 2A).[12]

Medical Monitoring

Medical monitoring provides valuable information to protect workers from developing adverse health effects from workplace exposure to lead by early identification of biological indicators or blood lead levels in addition to health symptoms and physical examination findings. Action can then be taken to prevent, reduce severity or arrest the progression of adverse health effects.
Results of medical monitoring are also useful in evaluating the effectiveness of controls, when exposure cannot be evaluated by air and/or surface monitoring alone, where oral and/or gastrointestinal intake may be a significant route exposure, and when exposure control is dependent on the use of respiratory protective equipment.

Where a worker may receive significant exposure to lead, the employer should routinely require workers to have a medical assessment. It is recommended that employers have new workers and those newly assigned to work in an area with lead exposure undergo a medical assessment prior to lead exposure. This provides a baseline measure of the worker's health. A medical assessment should ideally include a health history, physical examination, blood count, test of kidney function and blood lead level testing. Periodic examination findings can subsequently be compared to baseline results with frequency dependent upon specific circumstances and previous test results.

Blood lead levels provide good information on recent exposures. They do not necessarily reflect the level of lead in body stores as a result of chronic exposure. Blood lead levels will rise rapidly within hours of exposure. With removal from lead exposure, blood lead levels will decline at a variable rate dependent upon intensity, duration of exposure and level of blood lead stores. Blood lead levels assess the intake of lead into the body from all routes and from all sources, both occupational and non-occupational.

In Alberta, an employer must ensure blood lead level testing is available to a worker if the worker at a work site could reasonably be expected to have an elevated body burden of lead.

The minimum recommended frequency of testing is included in Table 2. Blood lead results should be reported in units of micromoles per litre of whole blood (µmol/L whole blood). The employer is responsible for paying the cost of blood lead level testing. The physician ordering the testing and reviewing the results should explain the results and their significance to the worker and should indicate when additional medical assessment is indicated.

Blood lead levels in workers exposed to lead should at a minimum be kept below 1.5 µmol/L, (approximately the ACGIH BEI). This represents the level most likely to be observed in specimens collected from healthy workers who have been exposed to the same extent as workers with inhalation exposure at the Threshold Limit Value (TLV) for lead of 0.05 mg/m3

[12] World Health Organization (International Agency for Research on Cancer). IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Located at: http://monographs.iarc.fr/ENG/Classification/ClassificationsAlphaOrder.pdf

which is also the Alberta occupational exposure limit (OEL).[13] However, while symptoms in workplace lead-exposed workers will not likely appear at this level, in view of recent mounting evidence that adverse effects from lead exposure can occur at blood lead levels well below those at which clinical symptoms appear, it is strongly recommended the goal of blood lead monitoring is to keep worker blood lead levels as low as possible and close to the reference non-occupational population upper limit of 0.5 µmol/L

As a result of recent changes to the OHS legislation, an elevated blood lead level in a worker above 0.5 µmol/L is classified as a notifiable disease and the Director of Medical Services must be notified.

In view if the noted potential adverse effect on pregnancy outcome, female workers of childbearing age who are lead exposed and pregnant (or may become pregnant) should have blood lead levels maintained below 0.5 µmol/L.

Table 2 - Minimum Requirements for Blood Lead Level Testing Frequency and Follow-up

Blood Lead Level (µmol/L)	Frequency of Follow-up	Required Actions
BLL o.49 or less	Monthly x 3 months then every 6 months	Acceptable level – no action required
BLL >= 0.5 - 1.49	Monthly x 3 months; then every 3 months	Evaluate exposure, controls and work practices. If pregnant (or may become pregnant) remove from lead exposure
BLL >= 1.5 - 1.99	Monthly until <1.5	**CAUTION RANGE** Worker must be informed of blood lead level. Evaluate sources of excessive exposure, lack of effectiveness or controls and ineffective work practices. Implement changes to reduce exposure.
BLL >= 2.0 - 2.49	Monthly until <1.5	**DANGER RANGE** Worker must be informed of blood lead level. Exposure to lead must be significantly reduced by engineering/administrative controls/work practices.

[13] ACGIH. Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices – 2013.

BLL >= 2.5	Blood testing every month until 2 consecutive tests less than 1.5	**LEAD TOXICITY** Worker must be informed of blood lead level. Worker must be removed from the lead-containing workplace until his or her blood lead level returns to acceptable levels Medical assessment Notify the Director of Medical Services, Alberta Human Services. Source of exposure must be identified and corrective actions taken to eliminate or reduce exposure potential. Hazard of worker exposure to lead must be assessed and effectiveness of worksite controls evaluated. Controls must be implemented to reduce exposure.

Assessing Exposure and Control

To determine if lead poses a hazard in the workplace, it is important to find out where and how lead is used. Lead may be found in places that are not immediately obvious. Tools, weights and old paint may contain lead. Ask the following:

- where may lead be present?
- do the workers' tasks involve materials containing lead?
- do workers potentially come into contact with lead?

Once these questions are answered, an exposure control plan must be developed. The purpose of the plan is to minimize worker exposure to lead. The plan must have the following elements:

- statement of purpose and responsibilities
- worker education about the hazards of lead and safe work procedures
- written safe work procedures to control exposure
- health monitoring
- documentation and record keeping
- follow up procedures to evaluate how well the program is working and determine if changes are needed

In addition, employers must establish procedures to minimize workers' exposure to lead, ensure the worker is trained in the procedures, applies the training and is informed of the health hazards associated with lead.

Air sampling and surface testing are an important part of assessing lead exposure and are part of an exposure control plan. Three types of sampling can be done; air sampling, bulk sampling, and surface wipe sampling.

Air Sampling

When doing air sampling to evaluate worker exposure to airborne lead for the purposes of complying with the occupational exposure limit (OEL), methods specified in section 20 of the OHS Code must be used. National Institute for Occupational Safety and Health (NIOSH) lists multiple methods for determining exposure to lead in air.[14] The range, accuracy, interferences and cost of the methodology should be assessed in the context of the sampling environment to ensure the most applicable method is chosen. The Occupational Health and Safety Code Explanation Guide[15] section 20, provides more information on how to assess these methods and other points to address when conducting worker exposure monitoring.

Surface and Bulk Sampling

NIOSH provides three methods for collecting lead surface wipe samples, there are also a variety of lead test kits available that can be used to check dust or chip samples.[13] Some substances can interfere with the results such as barium and chromate. The kits can also give false positive or negative results, so they should be used as screening tools only. Analysis of the sample by a laboratory may still be needed to confirm the presence/absence of lead and the actual lead concentrations. The US Occupational Safety and Health Administration (OSHA) has evaluated some test kits for lead.[16] OSHA also provides guidance on lead surface sampling to evaluate skin exposure in the OSHA Technical Manual.[15] Another resource for wipe sampling of lead contaminated dust is the document "Indoor Firing Ranges Industrial Hygiene Technical Guide" developed by the US Navy Environmental Health Centre.[17]

Portable x-ray fluorescence analyzers are available to measure the amount of lead in surface coatings without damaging the paint.[13] Readings from these instruments are affected by the base material under the paint (wood, plaster, metal). For curved surfaces or paint that is in poor condition, the instruments may not read accurately. In these cases a paint chip sample may be needed. These instruments provide a reading of mass per unit of area (mg/cm^2). This is not the same as the concentration of lead in the paint itself which is measured in percentage or parts per million (ppm). One cannot convert from ppm or percentage by weight to an area concentration in mg/cm^2 in a predictable way unless the total mass per unit area of the sample is known.

Once samples have been collected, the results must be compared to an appropriate standard or guideline to assess the potential hazard.

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[14] United States Centers for Disease Control and Prevention. NIOSH Manual of Analytical Methods. Located at: http://www.cdc.gov/niosh/docs/2003-154/

[15] Government of Alberta. Occupational Health and Safety Explanation Guide, 2009 located at: http://humanservices.alberta.ca/documents/WHS-LEG_ohsc_p04.pdf

[16] Occupational Health and Safety Administration. Lead Test Kit Product Evaluation. Located at: www.osha.gov/SLTC/leadtest

[17] United States Navy. Indoor Firing Ranges Industrial Hygiene Technical Guide. Located at: http://www.deq.state.ok.us/lpdnew/scap/SCAP%20Webpage/IFR%20Industrial%20Hygiene%20guide/tm6290.99-10Rev1%5B1%5D.pdf

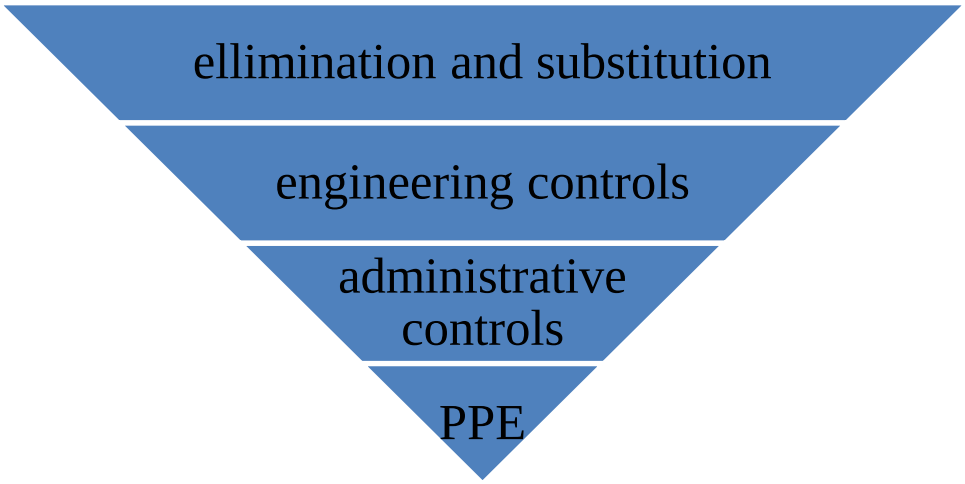
- for air samples, the results should be compared to the OEL for lead in the Alberta OHS legislation
- paints containing less than 90 ppm (0.009%) lead are not considered to be lead-containing paints under the Canadian federal law

No regulatory limits have been established for surface contamination by lead. However the US Environmental Protection Agency and US Department of Housing and Urban development have developed lead dust clearance standards of 40 µg/ft^2 (0.04 µg/cm^2) for floors, 250 µg/ft^2 (0.27 µg/cm^2) for interior window sills and 400 µg/ft^2 (0.43 µg/cm^2) for window troughs.[18] Occupational Safety and Health Administration (OSHA) recommends an acceptable surface dust level for non-lead work areas (such as lunchrooms) of 200 µg/ft^2 (21.5 µg/100 cm^2).[19] These guidelines or an equivalent standard developed by a reputable and credible organization would be considered appropriate surface clearance criteria in Alberta.

Controlling Exposure

Preventing exposure to lead is the best way to protect health. In addition to the health of the worker, the health of a workers' family may be at risk if lead dust is taken from the workplace to the family vehicle or home on clothing, footwear or in the hair. Children are much more susceptible to the health effects from lead exposure than adults.

Options that should be considered include the following, listed in preference based on the hierarchy of control:



[18] US Department of Housing and Urban Development, Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing, 2012 Edition. Located at: http://portal.hud.gov/hudportal/HUD?src=/program_offices/healthy_homes/lbp/hudguidelines

[19] Occupational Safety and Health Administration. Lead Exposure in Construction: Interim Final Rule – Inspection and Compliance Procedures. Located at: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=1570&p_table=DIRECTIVES

Elimination and Substitution

When able less hazardous substances should be substituted when lead elimination is not possible. This can be done with paints and glazes, batteries and solder materials or reduce amounts of lead such as by using lead-free materials.

Engineering Controls

These are mechanical processes used to eliminate exposure to a contaminant like lead. Engineering controls remove the contaminant from the air or provide a barrier between the worker and the contaminant. Examples of engineering controls that can be used to prevent exposure to lead include:

- installation of local ventilation hoods for fumes from soldering operations;
- use of ultrasonic wet cleaning device for cleaning firearms;
- installation of dust collection systems onto machines or equipment;
- enclosures around the work process;
- shear cutting instead of torch cutting;

For ventilation and other controls related specifically to firing ranges, the document "Indoor Firing Ranges Industrial Hygiene Technical Guide" developed by the US Navy[20] provides some guidance.

When operating properly, engineering controls can eliminate or greatly reduce the potential hazard. They only need to be installed once and unlike personal protective equipment, do not place a physical burden on workers. However, an initial investment is required and the systems must be properly operated and maintained once installed.

Administrative Controls

Work practices that can be implemented to reduce potential exposure to lead include:

- educating workers so that they understand the hazards associated with lead - workers must participate in training and monitoring programs (i.e. blood lead monitoring) in the workplace
- developing and using work procedures that reduce the potential for worker exposure (e.g. housekeeping practices, keeping workers further from the source of exposure by changing positioning or tools, grinding back on galvanized prior to welding)
- ensuring that proper worker decontamination and workplace housekeeping practices are followed. Since ingestion is one of the main exposure routes for lead, the importance of personal hygiene needs to be emphasized in the workplace
- use of soaps and cleaners developed specifically for lead decontamination should be considered
- training to ensure that controls and other equipment used to reduce exposure are used and maintained properly

[20] United States Navy. Indoor Firing Ranges Industrial Hygiene Technical Guide. Located at: http://www.deq.state.ok.us/lpdnew/scap/SCAP%20Webpage/IFR%20Industrial%20Hygiene%20guide/tm6290.99-10Rev1%5B1%5D.pdf

- managing of work practices including shift length and work rotation can reduce the amount of time workers are exposed to lead

Both British Columbia and Ontario have published helpful guidance documents for work procedures to control lead exposure on construction projects.[21,22]

Implementing work practices to reduce exposure is often less expensive than engineering controls. However, workers must be properly trained, use the practices correctly and the employer must also ensure that the practices are followed.

Personal Protective Equipment (PPE)

If it is not practicable or feasible to eliminate, use substitutes, engineering controls or change work practices to reduce the potential for exposure, or if they do not reduce the hazard sufficiently, protective equipment is required.

Respiratory Protection

Respiratory protective equipment is used to remove contaminants from the air that is breathed by the worker. There are many types of respirators available and it is important to select the correct one for the work being done. The type of respirator will be dependent on the airborne concentrations of lead. Where air filtering respirators are used for airborne lead particulate, they must be equipped with a particulate filter that is suitable for the environment. For example an "N" class particulate filter is not appropriate for industrial settings where oil may be present. When respiratory protective equipment is used in a worksite, an employer must prepare a code of practice.

- Guideline for the Development of a Code of Practice for Respiratory Protective Equipment[23]
- Respiratory Protective Equipment: An Employers' Guide[24]

Clothing

Protective clothing is used to prevent skin contact with a contaminant or contaminated surfaces. The type of protective clothing chosen depends on the type of work being done, work conditions, and the presence of other contaminants in the workplace. NIOSH recommends that any appropriate personal protective clothing that will prevent skin contact and contamination from dust is suitable. The employer should take into account other hazards that may be present in the workplace (both chemical and physical) that may require protective clothing and confirm that the product is suitable for the needs of the workplace with the clothing manufacturer.

[21] Government of British Columbia (WorksafeBC). Lead-Containing Paints and Coatings, Preventing Exposure in the Construction Industry. Located at: http://www.worksafebc.com/publications/health_and_safety/by_topic/assets/pdf/LeadContainingPaintCoatings.pdf

[22] Government of Ontario (Ontario Ministry of Labour). Lead on Construction Projects. Located at: http://www.labour.gov.on.ca/english/hs/pubs/lead/index.php

[23] Government of Alberta. Guideline for the Development of a Code of Practice for Respiratory Protective Equipment. Located at: http://humanservices.alberta.ca/documents/WHS-PUB_ppe004.pdf

[24] Government of Alberta. Respiratory Protective Equipment: An Employer's Guide. Located at: http://humanservices.alberta.ca/documents/WHS-PUB_ppe001.pdf

Protective clothing used in a lead contaminated environment must be removed before the worker leaves the workplace. The employer must ensure that only properly decontaminated clothing and articles are taken from the work site.[25] Lead contaminated clothes should not be laundered at home.

Although the use of personal protective equipment may initially seem less costly, workers need to be trained about the protective equipment they are using. Employers need to monitor how the protective equipment is used and ensure that it is properly maintained. In some cases, personal protective equipment can create a hazard to workers such as heat stress, limited vision, and allergic reactions to the equipment material. These issues need to be evaluated when personal protective equipment is selected.

Legislation

Legislation under Alberta's *Occupational Health and Safety Code*[25] has general and specific requirements related to lead. Occupational exposure limits (OELs) are provided for lead compounds. These limits apply to workers directly or indirectly involved with tasks using lead.

- if a worker may be exposed to lead at the work site an employer must identify the health hazards associated with the exposure and assess the workers exposure
- procedures must be established to minimize worker exposure to lead and workers must be trained in these procedures
- suitable showers, change rooms or other facilities must be provided to allow workers to remove contamination before leaving the work site. Only articles and clothing that have been properly decontaminated or cleaned can be taken from the work site by workers
- no worker may eat, drink or smoke in an area of the workplace contaminated with lead
- the employer must ensure that release of airborne dust containing lead is kept as low as reasonably practicable and prevent unnecessary accumulations of lead (such as the build-up of lead dust) at the work site
- a lead exposure control plan must be developed if workers may be exposed to lead[26]
- regular air and surface testing are required to ensure the controls in place are effective
- medical monitoring (blood lead testing) must be made available to workers exposed to lead. The employer must pay the cost of a blood lead level test
- a "Code of Practice" must be developed if there is more than a small amount (10 kg) of lead at the work site
- personal protective equipment must be properly selected, used and maintained

[25] Government of Alberta. Occupational Health and Safety Act, Regulation and Code. Located at: http://humanservices.alberta.ca/documents/WHS-LEG_ohsc_2009.pdf

[26] Government of Alberta. OHS Code Explanation Guide. Part 4 Chemical Hazards, Biological Hazards and Harmful Substances - Section 41 Lead exposure control plan. Located at: http://humanservices.alberta.ca/SearchAARC/964.html

Special Cases

Lead Paints and Coatings

Some paints used before 1950 could contain as much as 50% lead by weight. Lead was often used as a pigment in white and pastel shades. It made the paint dry faster, last longer and gave the colours a more vibrant look. While suppliers have been moving away from the use of lead in paints generally, for coatings and pigments intended for industrial applications, lead is still used. Examples include red and blue coloured paints used for corrosion protection, coatings used on wire, yellow products used for highway markings, products used in aerospace applications and marine paints. Common additives include lead flake in exterior primers and lead oleate to promote drying.

The content of lead in paints is regulated at the federal level in Canada. Starting in the 1950s, the amount of lead in paint began to decrease as other pigments were substituted. In 1976, federal legislation in Canada limited the amount of lead in interior paints to 0.5% by weight (or 5000 ppm), although paint containing lead in higher concentrations could still be used for exterior and industrial applications. This was subsequently reduced to 600 ppm (0.06%) by weight in 2005. In June 2009, the *Canada Consumer Product Safety Act (CCPSA)* was passed and the definition of lead paint changed again. In the Surface Coating Materials Regulations (SCMR) made under the *CCPSA*, the concentration of total lead in a surface coating material may not exceed 90 mg/kg (ppm or about 0.009%) when a dried sample is tested in accordance with a method that conforms to good laboratory practices. This does not apply to:

- anti-corrosive or anti-weathering products applied to the interior or exterior of buildings or equipment used for agricultural or industrial purposes
- anti-corrosive or anti-weathering products applied on any structure (other than a building) used for agricultural, industrial or public purposes
- touch up coatings for metal surfaces
- traffic signs
- graphic art on billboards or similar displays
- identification marks in industrial buildings
- material used in arts, crafts or hobbies other than those intended for use by children

Any liquid product that contains more than 90 ppm lead must have labeling on the container that includes the information specified in the SCMR. This does not apply to a dry product that has already been applied to a surface. So, equipment or other products may be imported into Canada for use in workplaces that contain lead in excess of the federal standard, but are not required to have labeling to this effect. Since these products would likely also be exempt from WHMIS requirements as “manufactured articles”, there is also no requirement for a material safety data sheet or WHMIS label on the product.

Lead based coatings do not normally pose a hazard if they remain in good condition. The hazard begins when the coating or paint deteriorates or is disturbed during renovation or industrial activities such as sanding, grinding, cutting or welding. Removing lead paint can sometimes create a greater hazard than just leaving it as is.

For example, sanding will increase lead dust levels in the air, heat guns, blow lamps or flame torches can produce lead fume. If proper precautions are taken, lead paint can be more safely removed using a chemical stripper. However, paint stripping in this way creates a second hazard—chemical solvents—which must be controlled by proper ventilation, equipment and procedures.

Resources

ACGIH. Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices – 2013.

California Department of Public Health. Medical Guidelines for the Lead-Exposed Worker. Located at http://www.cdph.ca.gov/programs/olppp/Documents/medgdln.pdf

Government of Alberta. Occupational Health and Safety Act, Regulation and Code. Located at: http://humanservices.alberta.ca/documents/WHS-LEG_ohsc_2009.pdf

Government of Alberta. Guideline for the Development of a Code of Practice for Respiratory Protective Equipment. Located at: http://humanservices.alberta.ca/documents/WHS-PUB_ppe004.pdf

Government of Alberta. OHS Code Explanation Guide. Part 4 Chemical Hazards, Biological Hazards and Harmful Substances - Section 41 Lead exposure control plan. Located at: http://humanservices.alberta.ca/SearchAARC/964.html

Government of Alberta. Respiratory Protective Equipment: An Employer's Guide. Located at: http://humanservices.alberta.ca/documents/WHS-PUB_ppe001.pdf

Government of British Columbia (WorksafeBC), Lead-Containing Paints and Coatings, Preventing Exposure in the Construction Industry. Located at: http://www.worksafebc.com/publications/health_and_safety/by_topic/assets/pdf/LeadContainingPaintCoatings.pdf

Government of Canada (Health Canada). Risk Management Strategy for Lead. Located at: http://www.hc-sc.gc.ca/ewh-semt/pubs/contaminants/prms_lead-psgr_plomb/index-eng.php

Government of Canada (Health Canada). Final Human Health State of the Science Report on Lead. Located at: http://www.hc-sc.gc.ca/ewh-semt/alt_formats/pdf/pubs/contaminants/dhhssrl-rpecscepsh/dhhssrl-rpecscepsh-eng.pdf

Government of Canada (Natural Resources Canada). Canadian Minerals Yearbook – 2008 (archived). Located at: http://www.nrcan.gc.ca/minerals-metals/business-market/canadian-minerals-yearbook/2008-review/commodity-reviews/4186

Government of Manitoba. Environmental Health: Lead. Located at: http://www.gov.mb.ca/health/publichealth/environmentalhealth/lead.html

Government of Ontario (Ontario Ministry of Labour). Lead on Construction Projects. Located at: http://www.labour.gov.on.ca/english/hs/pubs/lead/index.php

Government of the United Kingdom (Health and Safety Executive). Lead and You. Located at: http://www.hse.gov.uk/pubns/indg305.pdf

Occupational Health and Safety Administration. Lead Test Kit Product Evaluation. Located at: www.osha.gov/SLTC/leadtest

Occupational Safety and Health Administration. Lead Exposure in Construction: Interim Final Rule – Inspection and Compliance Procedures. Located at: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=1570&p_table=DIRECTIVES

United States Centers for Disease Control and Prevention. Lead Information for Workers. Located at: http://www.cdc.gov/niosh/topics/lead/wi03.html

United States Centers for Disease Control and Prevention. NIOSH Manual of Analytical Methods. Located at: http://www.cdc.gov/niosh/docs/2003-154/

United States Navy. Indoor Firing Ranges Industrial Hygiene Technical Guide. Located at: http://www.deq.state.ok.us/lpdnew/scap/SCAP%20Webpage/IFR%20Industrial%20Hygiene%20guide/tm6290.99-10Rev1%5B1%5D.pdf

US Department of Housing and Urban Development, Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing, 2012 Edition. Located at: http://portal.hud.gov/hudportal/HUD?src=/program_offices/healthy_homes/lbp/hudguidelines

World Health Organization (International Agency for Research on Cancer). IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Located at: http://monographs.iarc.fr/ENG/Classification/ClassificationsAlphaOrder.pdf

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(Toll Free)

Web Site

www.worksafe.alberta.ca

Getting copies of *OHS Act*, Regulation & Code:

Queen's Printer

www.qp.alberta.ca

Edmonton 780-427-4952

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http://humanservices.alberta.ca/ohs-legislation

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Dial 310-0000, then the area code and telephone number you want to reach