# RESEARCH REPORT

## Lead Precautionary Measures

Canada

CMHC SCHL
HOME TO CANADIANS

# CMHC—HOME TO CANADIANS

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**Morrison Hershfield Limited**
Consulting Engineers

REPORT

# LEAD PRECAUTIONARY MEASURES

Presented to:

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*This publication is one of the many items of information published by CMHC with the assistance of federal funds.*

*This study was conducted by Morrison Hershfield Limited for Canada Mortgage and Housing Corporation under Part IX of the National Housing Act. The analysis, interpretations, and recommendations are those of the consultants and do not necessarily reflect the views of Canada Mortgage and Housing Corporation or those divisions of the Corporation that assisted in the study and its publications.*

NOTE: Disponible aussi en français sous le titre:
Précautions concernant le plomb.

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# *1. Introduction*

Home renovation is a positive action which can bring out the best of an older home's original character, and provide the occupant with modern comfort and efficiency. Renovation work can, however, uncover unpleasant surprises in the existing construction which require special precautions to avoid health hazards.

One such unpleasant surprise is the presence of lead-based paint. Lead-based paint was used in virtually all older houses. The renovation of painted surfaces by most conventional means can create a distinct health hazard to both the renovator and the occupants of the home. The renovator may ingest or inhale fine lead particles which are liberated during the renovation process. The occupants of the dwelling can be exposed to the hazard at a lower level but for a longer-term, persisting long after the renovation if lead containing particles become part of the house dust. These may be inhaled or ingested through normal occupant activity. Children and pregnant women are particularly at risk.

This guide provides information to help those considering or undertaking renovation to choose methods which can minimize their exposure to lead-based paint at each step of the renovation process.

*This guide is not intended as a detailed manual for the complete removal of lead containing material from a building. This process of "Lead Abatement" can be a major operation which should be undertaken by specially trained professionals.*

# *2. Lead-Based Paints*

## History

The use of lead in paints and coatings probably dates to biblical times. "White lead" became the dominant white base for paint in the early 1900's and paint with high proportions of lead was widely used on both exterior and interior surfaces of homes well into the 1940's. Formulations with 50% lead by weight were not uncommon. In the 40's a new white pigment, titanium dioxide, slowly began to replace "white lead" in paints, partially because it was recognized to be less hazardous to health.

Between 1950 and 1976, legislation was passed which repeatedly reduced the allowable lead concentrations in interior paint, finally down to 0.5% by weight. Lead in interior paint currently serves as a minor pigmenting element and to assist in drying. Exterior paints for the professional market are still produced which contain lead in quantities greater than 0.5% but are subject to stringent labeling requirements. Member companies of the Canadian Paint and Coatings Association (virtually the entire Canadian paint industry) voluntarily stopped using any lead compounds in all consumer paints by December, 1990.

## Health Concerns

Lead has been known to be a health hazard for hundreds of years. Throughout the 20th century the medical community has shown an increased concern in its toxicity by reducing the level of lead exposure that it considers harmful to humans.

Since the 1920's, deaths due to lead poisoning have become rare as industrial use of lead has become controlled. However, most humans have experienced increased blood-lead levels from environmental sources due to industrialization especially due to the recent history of leaded gasoline.

Lead affects most of the body's biological systems. It is absorbed into the bloodstream and deposited in organs and in bones. It interferes with the body's ability to manufacture hemoglobin and so reduces oxygen supply to tissues. It interferes with the kidney's filtering of wastes from the bloodstream, can cause nerve damage, and can affect the gastrointestinal tract. Relatively low exposures to lead have been linked to a reduction in the IQ of children.

The lead in paint is by no means the only, or even major, source of lead in our environment. Exposure to lead, in either inorganic or organic form, can come from several sources. Food is the predominant source of everyday inorganic lead intake in

rural settings. The ingestion or inhalation of lead dust rivals food as the largest everyday source of environmental inorganic lead in urban settings. Inorganic lead may also be present in drinking water from lead water pipes.

The primary source of organic lead is leaded gasoline. The exposure of Canadians to organic lead has diminished significantly over recent years as the level of lead in gasoline has been restricted. This has led to reduced average blood lead levels in Canadians.

Lead in house dust, which can come from deteriorating lead-based paint inside the home (it can also come from lead-containing soil which has been tracked into the home by the occupants) is, therefore, one of the most important locally controllable sources of lead in urban settings. It has also been noted that in those cases where children have been found to have elevated levels of lead in their blood, the most common major source is from lead based paint.

Concern about lead-based paints rose in the 1960's and 1970's as cases of childhood lead poisoning were reported. In most of the severe cases, it was found that the children had ingested chips or dust from lead paint from deteriorated surfaces. Less obviously, random blood-lead testing of young children showed a widespread problem of elevated blood-lead levels in some urban communities, particularly when they lived in older deteriorating accommodations. The existence of leaded house paints was shown to be a significant factor in the elevation of blood lead levels, even without the direct ingestion of paint chips. Further studies have shown that ingestion of house dust is a very significant contributor to lead intake. This is of particular concern with small children. The high level of hand to mouth activities leads to ingestion of house dust and they absorb lead into growing bone and tissues.

Lead-containing dust can be generated during normal building operation, for example the rubbing of painted surfaces on sliding windows. Renovation work can generate large quantities of lead-containing dust. This dust is particularly difficult to remove due to the small particle sizes and its electrostatic nature. The uncontrolled generation of contaminated dust without adequate clean up leaves a hazard to the future occupants of the building.

Renovators are particularly at risk. Badly handled renovation or repainting work has resulted in many known cases of trades people with severe lead poisoning. Many unreported cases of less severe yet harmful exposure have probably occurred.

Removing paint by mechanical sanding or heat guns can generate large quantities of lead particles. Sanding creates airborne particles which are easily inhaled. Removal by heat gun can create dust particles and "fume" whose vapours also contain lead. Without proper protective measures the proximity of the renovator to these high concentrations of airborne lead, combined with repeated events of exposure, can quickly result in the elevation of blood lead to harmful levels.

# *3. Controlling Exposure to Lead During Home Renovation Work*

Home renovation work has the potential to create excessive exposure to lead for the renovator, the occupants of the home and the surrounding outdoor environment if care is not taken to reduce the hazard.

The key principles of controlling lead exposure hazards during renovation can be summarized as:

- Reduce the amount lead dust and fume created;
- Contain lead contaminated particles within the work area;
- Where possible, remove the workpiece and do the most hazardous work outside the living environment;
- Use protective equipment to minimize worker exposure;
- Thoroughly clean the work area after the renovation to minimize future exposure of the occupants.

Choosing the specific measures suited for an individual case requires some evaluation. Figure 1 is a flow chart that illustrates the decisions and activities involved in planning home renovations which disturb surfaces covered with lead-based paints. Sections 4 through 8 of this document address the questions in the decision boxes of the flow chart.

Suggested safe working practices are outlined in section 9. Two levels of hazard control measures are provided for three different scopes of renovation work. Which level of hazard control to use depends on the risk category of the occupants, and the renovation techniques used.

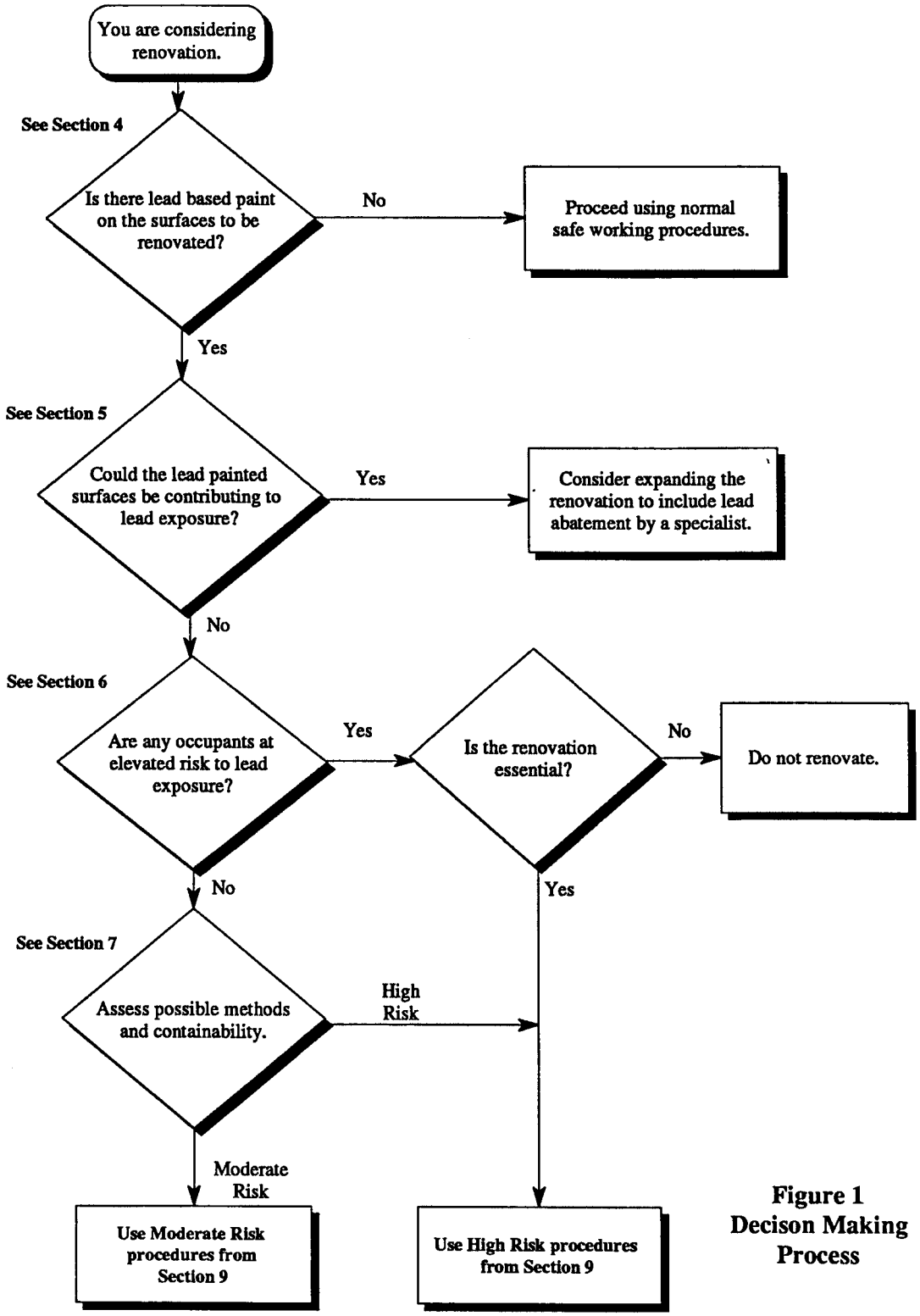


**Figure 1**
**Decison Making Process**

# *4. Measuring Lead in Paint*

| KEY POINTS | ⇒ Pre-1950 homes probably have high levels of lead paint on both the interior and exterior surfaces.<br><br>⇒ Exterior paints in pre-1980 houses probably contain lead.<br><br>⇒ Post-1980 homes probably have a negligible lead hazard on interior surfaces but exterior paints may contain lead.<br><br>⇒ Chemical and analytical tests are available to test for lead in paints. They include "Do-it-yourself" spot tests, X-ray fluorescence and laboratory analysis. The latter two are recommended. |
|---|---|

Several methods are currently available for testing for lead content in house paint. Testing should be done on all painted areas to be renovated, including ceilings, walls, floors, windows and window trim, doors and door trim, moldings, baseboards, stairs, painted furniture, radiators, and exterior siding. Lead is often measured in parts per million, which is also written as μg/g (micrograms per gram). Any measurement over 5000 mg/g (5,000 ppm, or 0.5%) can be considered a significant lead level in the paint.

CMHC has a publication, *Testing of Canadian Sources for Lead Analysis*, which reports the findings of a study on test methods for lead and their availability in Canada.

**"Spot Test" Solutions**

Do-it-yourself spot tests use a solution of sodium sulfide or sodium rhodizonate. A spot is placed on the surface to be tested. The presence of lead causes a reaction, darkening the spot. Usually a threshold lead concentration is given with the test kit information. The cost of the kits is generally $25 to $50 or enough for 50 - 100 tests, and the kit is easily available by mail order.

Unfortunately the kits can only detect lead in concentrations down to 1% by weight (10,000 ppm), and are not very accurate. Since the reagents act on the surface it is important to make sure that all layers of paint down to the substrate are exposed for testing. The kits can be difficult to use on dark surfaces, which can mask the color change. It has also been found that they are not lead-specific, other metals in the paint

may cause the darkening as well. The end result is that use of the kits generate a significant number of false positive and false negative results.

**X-ray Fluorescence**

X-ray fluorescence (XRF) is non destructive analytical method which determines the lead content of paints on all surfaces. A portable electronic device "x-rays" the surface in question and monitors the pattern of emitted rays. XRF testing provides immediate results making it good for surveying a building.

There are two types of XRF equipment: the spectrum analyzer type and the direct reading (lead-specific) type. The precision of these devices is reasonable down to about 400 ppm, which is accurate enough for most uses in initial detection of lead-based paint. The spectrum analyzer type is generally more accurate. Large-scale sampling procedures (for example, for an entire house) usually are accompanied by some atomic absorption spectroscopy analysis (see below) for verification.

This service, which requires the special equipment and a skilled operator, is not widely available in Canada. The cost of an analysis of all surfaces in house is estimated at $300 to $800.

**Laboratory Methods**

Atomic Absorption Spectroscopy (AAS) is one of several laboratory analysis method which uses physical samples of paint and determines the constituent compounds. With these methods, a chip of paint must be removed from each surface to be renovated, and sent to a laboratory. The cost varies from $7-$40 per sample depending on the laboratory used. This is the most accurate testing method (to about 20 parts per million or 20 μg/g), but results are not immediately available. Typical turnaround times are from a few days to a few weeks.

The table below summarizes the advantages and disadvantages of each method.

| Method | Accuracy | Cost | Completeness of Coverage | Immediate Results |
|---|---|---|---|---|
| **Spot Tests** | marginal | inexpensive | only where sampled | yes |
| **XRF** | good | expensive | complete | yes |
| **Laboratory** | excellent | moderate | only where sampled | no |

# *5. Determining Lead Exposure From Paint*

| KEY POINTS | |
|---|---|
| | ⇒ Blood lead testing, done at a doctor's office, is a simple and reliable gauge of the body's total exposure to lead. |
| | ⇒ Signs of deteriorated paint and/or elevated blood lead levels indicate that paint may be a significant source of lead to the occupant. |
| | ⇒ House dust can be analyzed for lead content. If it contains a significant amount of lead traceable to lead-based paint, lead abatement measures should be considered. |

Severe lead poisoning from domestic exposure is very rare in Canada today. Where it has occurred it has usually been attributed to improper use of equipment by home renovators, or from young children ingesting lead-contaminated material.. Symptoms of even severe lead exposure are difficult to spot, but may include headaches, fatigue, irritability, pains in joints and muscles, stomach cramps, and constipation. Tolerance levels differ greatly among individuals. Excessive lead exposure without readily noticeable symptoms is not uncommon and is best diagnosed with a blood test in a doctor's office.

If exposure to lead from lead-based paint in a house is considered a possibility two steps are recommended. The occupants, particularly the children, should have their blood lead level tested, and a detailed examination of the house for signs of deteriorated or abraded (worn by rubbing) paint surfaces should be made. The inspection should obviously look for any areas where interior or exterior painted surfaces are lifting, peeling or chipping into fragments that a child might put into their mouth. Less obvious, but as important, is looking for areas where paint is being abraded or rubbed into a fine dust. Important areas to examine are operating elements such as tracks and frames for windows and doors.

If blood lead levels of the occupants are normal and there are no noted areas of deterioration it is unlikely that paint is a significant current source of lead.

Signs of deteriorated paint, with or without elevated blood lead levels should be taken as a strong indicator that the house paint could be a significant source of lead to the occupant.

If some occupants have elevated blood lead levels, but there are no signs of deteriorated paint, the source could be, but may not necessarily be, lead paint. As mentioned earlier, exposure to lead can come from several sources including food, water, and lead from exterior sources that has been tracked into the home by the occupants. One can determine the lead concentration of household dust by having a sample of dust collected in a vacuum cleaner sent to a laboratory and analyzed for lead content but this still does not determine where the lead containing dust originally came from. In this case a detailed survey of possible sources, carried out by an expert, is called for.

If it is determined that lead-based paint in the home is a significant source of lead exposure, then consideration should be given to lead paint abatement measures. These measures, which are beyond the scope of this document, address all lead-containing surfaces within a home and render the completed work almost lead-free. Lead abatement is expensive and onerous, usually requiring that the occupants move out during the renovation.

Canada does yet not have specific regulations or requirements for training and qualification of contractors doing lead abatement. There is however a pool of contractors who have the equipment and training to deal with a material that is more hazardous than lead. These are contractors who are qualified to deal with asbestos.

## *6. Determining Exposure Risk of the Occupants*

| KEY POINTS | |
|---|---|
| | ⇒ Children under 6 years of age, women who are pregnant, or planning on becoming so, and people already exposed to lead through other sources are at elevated risk. |
| | ⇒ The presence of elevated risk individuals in a house requires questioning the need for the planned renovation or use of the most stringent control measures. |

Undertaking a renovation can increase the potential exposure to lead, at least over the short term. If there are people in the house to whom any additional exposure is of particular concern, the option of canceling or deferring renovation plans should be considered **but only if** it has been shown that the building in its current condition is not a significant source of lead

If deferring is not an option, people with an elevated risk should move out during the renovation and stringent dust containment and clean up procedures should be employed.

Children under six years of age are at elevated risk for several reasons. Their metabolisms absorb more minerals, including lead, as they grow. Young children have more hand-to-mouth activity and thus may ingest more lead-containing dust. Even moderately high blood lead levels have been linked to slowed mental development, which is especially important in a child's early years (six months to three years) as his/her brain matures.

Women of child-bearing age are at elevated risk. Any lead that has been absorbed into the mothers bones can be activated as the mother's body draws on its mineral reserves during pregnancy. Lead can also be transferred into the fetus.

People who already have a high exposure to lead from their workplace or other environmental sources are at an elevated risk. The effects of lead are cumulative, and the higher the blood lead level, the more serious and permanent the consequences.

# *7. Renovation Methods to Control Exposure*

| | |
|---|---|
| KEY POINTS | **Doing Nothing:**<br>• can be considered when it is known that surfaces are not contributing to a lead dust problem.<br>**Encapsulation (or Enclosure):**<br>• generates a relatively minor amount of lead dust.<br>• does not permanently remove the lead hazard from the home.<br>**Component Removal and Replacement:**<br>• generates a relatively minor amount of lead dust<br>• comparatively expensive and limited in scope.<br>• permanently abates the lead hazard.<br>**Off-site Chemical Stripping:**<br>• creates a minimal lead hazard in the home.<br>• permanently abates the lead hazard.<br>• has physical limitations to applicability, and is time consuming.<br>**On-site Removal:**<br>• includes removal by chemical stripper, heat gun and scraping, sanding, and sandblasting.<br>• is relatively inexpensive and requires low skill levels.<br>• has a broad range of applicability.<br>• is potentially the most hazardous of renovation methods. Respiratory protection is mandatory in most cases. **Sanding and sandblasting are not recommended under any circumstances** due to high exposure to the renovator and the difficulty of containment. |

The following descriptions refer to hazard control procedures described in section 9. These have been classified into two "risk levels". **Moderate risk** procedures are considered the minimum prudent measures to take when lead painted surfaces are to be disturbed. If the work requires major disturbance of lead painted surfaces or if the occupants or renovator are at elevated risk from lead exposure the **high risk** procedures are recommended.

## Doing Nothing

Doing nothing is an option when considering a renovation which will disturb surface finished with lead-based paints. It is only appropriate if it has been determined that the surfaces are not contributing to an elevation of lead levels in house dust, and if the painted surface is in a completely intact state. Doing nothing may be advisable if the undertaking renovation risks exposure of a high risk individual.

## Encapsulation and Enclosure

Encapsulation is the process of sealing off the lead painted surface from the living space with a new one. Materials used to encapsulate lead-based paint surfaces must be durable, must not be toxic themselves, and must be safe to install.

Examples of encapsulation methods include: gypsum board overlays on walls, plywood overlays on floors, cementitious coatings (such as plaster and stucco) on interior and exterior walls, vinyl wallpaper, elastic acrylic coatings on painted surfaces, and exterior vinyl siding.

*A new coat of latex paint, paper wallpaper, or contact paper* ***are not*** *considered satisfactory encapsulating procedures because they are not durable enough.*

The primary advantage of encapsulation or enclosure is that a minimum of potentially hazardous dust is generated. This reduces the immediate exposure to the renovator and to the occupants. **Moderate risk** renovation procedures described in the section 9 are considered appropriate. Encapsulation is not as labour-intensive as some other measures of abatement and thus may be less expensive on large areas.

The main disadvantage is that the lead is still there. A future renovator will have less chance of discovering it before starting renovations. There may also be a resurgence of concern if the encapsulating material starts to deteriorate.

## Component Removal and Replacement

In this process components with lead paint on them are removed, in large pieces, and replaced with new materials. Current regulation in most provinces would allow disposal of these as regular construction waste.

Removal in large pieces minimizes lead dust generation so removal and replacement is also considered a **moderate-risk** procedure. Other advantages are that labour requirements are reasonable and work can often been completed quickly.

The biggest disadvantage is the cost of supplying replacement materials and components, especially if they are high cost items such as doors and windows. The care and skill level

of the renovator must be higher or other components may be damaged during removal processes. The cost can sometimes be partially offset by labour savings and in many cases replacement of items, such as windows, is an intended part of the renovation anyway.

In other cases, such as when dealing with historic items, replacement components may not be available.

### Off-Site Chemical Stripping

Off-site chemical stripping involves removing components and shipping them to a paint stripping shop where they are stripped, usually chemically. The residue is retained and disposed of at the shop. The hazardous chemicals generated in this process are stored and disposed of by trained professionals, away from the renovation site. The stripped components are then returned to the site for re-use.

The advantage of this process is that removal of hazardous materials is nearly complete and neither the renovator nor the occupants will be exposed to chemical by-products. Some dust may be generated by the component removal process, but this would be much less than for other paint removal methods. Removal can be considered a **moderate risk** renovation procedure.

The disadvantages of this method are that it is generally limited to easily removable components such as windows, doors and trim, the potential for damage to components during the removal and re-installation procedures, and the need for additional skills during re-installation. There may also be some time delay between the removal and re-installation which causes inconvenience to the renovator and the occupants. Size of components is also an issue. Both the logistics of removal and the physical limits of the facilities at the stripping shop may limit the size of the components which can be handled.

### On-Site Paint Removal

On-site paint removal encompasses the most traditional and well-known removal techniques, as well as some newer methods. These include sanding, sandblasting, burning, use of a heat gun with a hand scraper, and use of chemical strippers. Generally, these methods require the least skill and are the most flexible paint removal methods in terms of applicability to varying surfaces. They also conserve the original materials, and remove the hazardous material.

Generally, however, these methods have serious drawbacks. In most cases a hazardous by-product is created, some of which are very difficult to contain. Components are more susceptible to physical damage because of the physical effort required. Removal of lead-based paint cannot always be made complete with most of these methods.

### Sanding and Sandblasting

These are the most labour intensive, and probably the most hazardous methods of removing lead-based paint from surfaces. Sandblasting and sanding create large amounts of lead dust, which is difficult to contain and protect against. This dust can range in particle size down below 1 μm (micrometer) and is very tenacious, often having an electrostatic charge. There are special equipment and procedures, such as sanders with high efficiency particulate accumulation (HEPA) filtered vacuum attachments and wet sanding that reduce dust generation, but even these are not fully effective. The renovator requires full personal protection and extensive containment and clean up measures are required to protect the occupants. These risks are severe enough that, in most cases, another method should be chosen.

### Removal by Heat Gun and Scraper

This method of removal has gained popularity because of its relative ease, apparent safety, and availability of equipment. The application of heat to paint softens it and allows removal by scraping. Scraping the paint off generates and disperses less dust than sandblasting or sanding, but is much slower and not as feasible for large areas. Special high efficiency particulate accumulation (HEPA) filtered vacuums can be attached to scrapers to reduce exposure.

However, the renovator is still in intimate contact with some airborne lead particles and requires a high degree of protection. An unseen danger is present with all heat removal techniques: at high temperatures, some of the components of the paint vapourizes, carrying lead particles and other hazardous products with them into the air. Lead melts at approximately 320°C and organic lead vapours can be formed at temperatures in the 400°C to 500°C range. When cooled these form particles that end up as house dust. Prolonged use of heat guns without proper protection and containment measures will result in excessive exposure to both the renovator and occupants of the home. This removal method should employ **high-risk precautionary measures**. Lead-based paint scrapings are often classed as hazardous waste and require special disposal methods.

### On-Site Chemical Stripping

Chemical stripping is recommended over sanding or heat methods for on-site paint removal. The strippers are applied to paint surfaces, where a chemical dissolution of the paint takes place. The chemical stripper and paint are then scraped off and disposed of.

CMHC has issued a research report entitled *Advice on the Use Chemical Strippers to Remove Leaded Paint* which provides details of the available materials and suggested work practices.

There are some hot stripping processes which use caustic chemicals such as lye or caustic soda, to soften paint for removal. These are not normally used for on-site stripping operations.

The application type chemical paint strippers most often used in residential applications contain methylene chloride (also known as dichloromethane). Methylene chloride is very effective and works quickly, but must be considered a hazardous material to use. It is a suspected carcinogen and its use is banned in some U.S. states. Exposure can burn skin and cause blindness. Good workspace ventilation, respirators with an organic vapour cartridge for all personnel in the workspace and skin and eye protection is the minimum recommended protection to avoid inhaling the hazardous vapours. Suitable respirators, safety glasses, and gloves are available from safety equipment outlets.

Other volatile organic solvent mixtures are also available. Most are less effective and slower but less dangerous than methylene chloride. Organic vapour cartridge equipped respirators should still be used to provide respiratory protection and gloves and goggles are still necessary.

Dibasic Esters and NMP's (N-methyl-2-Pyrrolidones) are the bases of another type of chemical paint stripper. These non volatile organic are much safer but slower. No respiratory protection is required, but the paint may require up to 24 hours to soften.

The major advantages of on-site chemical stripping are that little dust is generated during paint removal and the reduced physical effort need to remove paint minimizes the chance of damage.

The largest disadvantage is the hazardous nature of the more aggressive stripping chemicals themselves. This hazard must be weighed against the reduction in hazardous lead dust generated. Any indoor work area must be very well ventilated. Products of the chemical stripping process may be considered as hazardous waste and may have to be disposed of accordingly. The length of time required for "safe" strippers to completely soften the paint may also restrict the feasibility of their use.

Because lead dust production is limited, **moderate risk** precautions in the next section can be applied. However, the special precautions outlined above and detailed in the CMHC research report entitled *Advice on the Use Chemical Strippers to Remove Leaded Paint* should be followed.

# *8. Special Terms and Regulations Associated with Removal of Lead-Based Paint*

## Special Terms

In the detailed recommendations in section 9 it has proven necessary to use special terms to describe isolation and clean-up procedures. The term defined below have been printed in italics in the section 9.

### *Changing Area*

Large scale renovation procedures require a *changing area* where *protective clothing* is donned and removed. This area is located at the entrance to the work area but physically isolated from both the work area and the surrounding environment using 0.15 mm (6 mil) polyethylene sheets sealed securely and in an airtight manner with duct tape. The entry to a *changing area* should consist of overlapping polyethylene sheets. This area should undergo *HEPA vacuuming* and *phosphate washing* following the removal and bagging of the *protective clothing*. Ideally it should also allow the renovator to shower and wash his or her hair, but this is not always feasible

### *Clearance Testing*

*Clearance testing* confirms that the clean-up following the renovation has reduced the lead dust concentration to values specified for the project. Suggested limits used in the United States are:

| | |
|---|---|
| Floors | 2 $mg/m^2$ |
| Window sills | 5 $mg/m^2$ |
| Window wells | 8 $mg/m^2$ |

Testing is usually done using *dust wipe samples*

### *Dust Wipe Samples*

A commercial wipe is moistened with a non-alcohol wetting agent. It is wiped over a known area (best done with a template) of the surface to be tested and placed in an isolating tube. The tube is then sent to a laboratory, where the lead quantity, and thus the concentration, are determined.

### *Hazardous Waste*

The definition of *hazardous waste* is governed by provincial legislation. It cannot be disposed of at normal landfill sites. Lead paint left intact on removed components is not generally considered *hazardous waste.* Lead paint flakes, residue from chemical stripping, and vacuum filters and wash water used in clean-up usually are.

A special toxicity extraction test procedure is required to determine with certainty whether or not a specific waste product is considered hazardous. This testing can usually be done through the provincial Ministry of Health.

*Hazardous waste* requires special disposal. Several provinces, however have household *hazardous waste* depositories for this purpose.

### *HEPA Vacuums*

HEPA is an acronym for High Efficiency Particle Accumulation. A *HEPA vacuum* is one which will trap particles of 0.3 μm and greater in size with an efficiency of 99.97% or more. These vacuums have been widely used in the asbestos removal industry and are available from safety equipment outlets. Special attachments and tools are available to ease the removal of lead dust..

*HEPA vacuum* procedures stress that *all* surfaces be vacuumed. A top-to-bottom order achieves best results.

### *Isolating Sheets*

Isolating or masking sheets are used to cover surfaces and contain objects within the renovation area which are not to be affected by the renovation procedure. Examples include large immovable furniture, floor coverings and carpets. Floor *isolating sheets* are a double layer of 0.15 mm (6 mil) polyethylene installed continuously over the whole surface. Joints and terminations are sealed with waterproof tape. These same types of sheets are often used to compartmentalize the renovation area to contain the lead dust which will be generated during the renovation.

### *Negative Pressurization*

*Negative pressurization* is a method of containing lead dust and fume so that it doesn't spread outside the renovation area. The idea is to pump air from the renovation area to outdoors in a controlled fashion. With this, air (and dust) movement inside the building will be into the work area, not outward. This can be achieved by running exterior exhausted *HEPA vacuum* to remove air from inside the renovation area. Another method is mount a strong fan blowing out an open window.

### *On-Site Storage*

During most renovations waste is generated which is not immediately transferable to a disposal facility. Because of the mobile nature of lead dust, measures should be taken to provide a method of *on-site storage* which maximizes the chances for containment.

This is best accomplished by choosing a location outside the renovation area, but separate from other living spaces, to store waste temporarily until it is shipped to the disposal site.

Lead contaminated but non-hazardous materials (such as components with lead-based painted surfaces) should be wrapped and sealed with *isolating sheets* or sealed in polyethylene bags. *Hazardous waste* should be stored in the work area until it is time to be transported to the *hazardous waste* site.

### *Phosphate Washing*

*Phosphate washing* refers to the wet scrubbing of surfaces with a water/detergent solution. The suggested detergent is trisodium phosphate (TSP), diluted to the manufacturer's directions, which has been found effective on lead dust, which is particularly tenacious. TSP is available from most hardware stores.

Gloves should be worn during *Phosphate washing*. It is normally done after vacuuming, in the same top-to-bottom pattern. The wash water usually must be treated as *hazardous waste*. Washing sponges and brushes should be discarded with other contaminated waste at the end of the project.

### *Protective clothing*

*Protective clothing* should be worn during renovation work whenever high levels of lead dust are present. This should include full length coveralls which are close fitting at the neck and arms, hair covering, gloves, and eye protection. Shoe coverings or a change of footwear are also suggested. Nylon fibre garments have shown a particular resistance to lead dust. Before removal of *protective clothing*, if it is not of the disposable type, it should be *vacuumed* while being worn and then sealed in a plastic bag. *Respirators* should be left on until after *protective clothing* is removed. Ideally this clothing should be washed at a laundry equipped to handle lead contamination. Never wash it with regular clothing

### *Respirators*

*Respirators* should be used at all times when there is any possibility creating lead dust. Several types of *respirators* are available. Industrial safety equipment suppliers are the best source since they have detailed information on the capability of their products. One of the most important factors in respirator selection is the fit so a visit to a safety equipment supplier is warranted.

Many encapsulation and replacement procedures generate little enough lead dust than no *respirator* is required. Other procedures generate a some amount of lead dust and fume. A replaceable filter-type air purifying *respirator* or a single use *respirator* suitable for "lead (/toxic) dust, fumes, and mists" should be worn.

For chemical stripping procedures the concern is less with lead dust than protection against the chemical solvents. With some of the "safe strippers" good ventilation precludes the need for a *respirator* but for the methylene-chloride based strippers most commonly used a *respirator* with an "organic vapour" cartridge must be used.

### *Safe Passage*

A *safe passage* is built as an isolated walkway thorough a renovation area. Usually, a wood frame is built and covered with 0.15 mm (6 mil) polyethylene and sealed at all joints with waterproof tape.

### *Vacuum*

The effectiveness of lead clean-up techniques is governed by two factors, how well the method picks up lead dust and how little dust it disperses into the air. A CMHC research report entitled *Effectiveness of Clean-up Techniques for Leaded Paint Dust* looked at a variety of cleaning methods including vacuuming with a good quality portable domestic vacuum cleaner, an outdoor exhausted central vacuum system, a *HEPA vacuum* and both wet and dry sweeping methods. This study found that on a vinyl floor virtually all methods were capable of very high collection efficiencies. On carpet samples a key factor was the use of an agitator head on the vacuum. The portable vacuum with agitator head had collection efficiencies very similar to the more powerful *HEPA vacuum* and central systems. The *HEPA vacuum* greatly reduced the number of air borne particles over the portable unit with a new bag but if the bag was 10% full (and the agitator was used on carpet) the differences were far less. This indicates that use of domestic type vacuum cleaners is appropriate for moderate risk applications.

*Wet Sweeping*

Dry sweeping of debris from renovation of surfaces containing lead paint is not recommended because it is not complete and small lead particles can become airborne and cause further exposure to the renovator and occupants. A recommended method is be *wet sweeping* were the surface is wetted with a fine water mist to reduce the scattering of the lead dust. This same procedure should be applied to dusting.

**Regulations Associated with the Disposal of Lead**

Most provinces have acts which define *hazardous wastes* and specify more stringent disposal procedures for these wastes. "*Hazardous wastes*" are ones that are either toxic, ignitable, corrosive, or reactive. Lead paint chips, sludge from chemical stripping, *HEPA vacuum* filters, and cleaning wash water may all exceed toxicity regulations.

Toxicity is determined by either the Extraction Procedure Toxicity ( EP Tox) test or the Toxicity Characteristic Leaching Procedure (TCLP). In Ontario, for example, a lead level greater than 5 ppm in the test leachate indicates that the waste is "hazardous" and must be handled and disposed of appropriately. Many municipalities now have household *hazardous waste* depositories or collection programs, which would simplify the disposal problem for the homeowner. Most commercial firms creating *hazardous waste*, however, must be licensed provincially, and are monitored in their handling and disposal procedures.

Renovators must become familiar with their local requirements.

**Regulations Governing Worker Exposure to Lead**

Occupational exposure to lead is governed in most provinces by an act pertaining to occupational health and safety. Occupational exposure to lead is most often monitored in terms of time-weighted average concentration levels (TWA). The Ontario regulation, for example, specifies that the TWA be less than 0.15 $mg/m^3$ for inorganic lead, during a working week of 5 days at 8 hours/day. The maximum exposure at any time is 0.45 $mg/m^3$ and cannot be experienced more than 15 minutes at a time, more than 4 times per working day, and must be spaced at least 60 minutes apart.

The allowable blood lead level of workers is also regulated in most provinces. In several provinces, a male worker must be removed from exposure to lead if his blood lead level is continually above 70 µg/dL. The corresponding level for a woman of child-bearing age is 40 µg/dL.

Renovators must become familiar with their local requirements.

# *9. Hazard Control Procedures*

The primary focus of this document is dealing with the potential hazards of carrying out interior renovations which disturb surfaces covered in lead-based paints. This section contains suggested procedures four three scales of renovation and two different levels of risk. they are presented in the following order

9.1. Minor Repairs to a Localized Area

- **A)** Moderate Risk
- **B)** High Risk

9.2. Renovations to a Single Enclosable Room

- **A)** Moderate Risk
- **B)** High Risk

9.3. Renovations to an Essential Non Enclosable Space

- **A)** Moderate Risk
- **B)** High Risk

Section 9.4 provides some advise on exterior renovations

Procedures for the first scale of renovation, Minor Repairs to a Localized Area, can be used for localized work where lead dust generation can be expected to be minimal (such as replacing a window) and the work can be completed in one day.

Procedures for Renovations to a Single Enclosable Room are widely applicable, even in areas of the house that are not enclosed by permanent partitions walls. In many cases procedures for enclosable rooms can be applied by isolated the area using temporarily enclosures.

Kitchens and bathrooms can be special cases. No household activity, particularly food preparation should be allowed in areas under renovation. Living in the house with this restriction can be difficult. Finding alternate accommodation for the renovation period may be necessary

The type of space dealt with in the third scale of renovation are those which cannot be enclosed, even temporary, because they must be traveled through. Examples are entrance foyers, hallways, and stairwells. For these areas two approaches can be taken.

The first, which should only be applied to moderate risk situations, is to allow non working people (occupants) the minimum required level of passage through the space

and provide them the necessary equipment and procedures to protect themselves and limit dust migration through the house.

The second is to create a *safe passage* through the work area. This is done by isolating the work area from the remaining areas of the home, using the same procedures as for isolating an individual room. Then, a passageway must be constructed through the work area, usually with a wood frame, waterproof tape and polyethylene sheets which is isolated from the work area and connected to the other living spaces. This type of set-up may be impractical due to space considerations. If so, or **if the entire house is being renovated, the occupants should temporarily move out, until renovations and clean-up are complete.**

Sections 6 and 7 of this document provided information to help make decisions about what **risk level** to assume. In general, the presence of occupants with an elevated risk to lead exposure or the use of a methods which can generate high levels of lead contaminated dust call for the high risk procedures (B).

Another important question is who will do the work. Controlling the potential hazards of renovating houses with lead-based paints takes knowledge of the concerns and control principles, training on how to carry out the required control procedures, practice in carrying them out and the right equipment. The use of a professional contractor with specific training and experience in dealing with lead paint removal projects is obviously preferable. This is not to say that a renovator without special training cannot understand and successfully follow the control procedure described in this section, if they take the necessary care and time to understand and apply them.

## *9.1 A) Minor Repairs to a Localized Area Moderate Risk Procedures*

*Suitable for localized work where lead dust generation can be expected to be minimal (such as replacing a window) and none of the occupants of the house are at an elevated risk. Only work which can be completed in one day should be undertaken with these procedures.*

**In planning and preparing for the work:**

- Collect the personal protective equipment required for the type of work. A respirator with filter (not a dust mask), full length coveralls, gloves, hair protection, safety boots and suitable eye protection should always be worn, regardless of the type of renovation. Most chemical stripping method require a respirator with an organic filter.
- Remove all furniture, drapes and rugs well back from the work area or, preferably, from the room.
- Lay a drop sheet of 0.15 mm (6 mil) polyethylene over any carpet or furniture which could not be moved.
- Seal off nearby vents and return grilles with polyethylene sheet and waterproof tape.
- Provide active ventilation for the work area if using chemical strippers. Fans should be placed in windows, blowing out.

**Before starting a work session:**

- Bring all required materials, tools, and cleaning equipment including bags for contaminated waste to the work area.
- Put on *respirators* and *protective clothing* as required. If shoe coverings are not going to be used in the work space bring a clean pair of shoes in a sealed bag to change into when leaving the work area.

**During removal work:**

- Do not eat, drink, smoke, or chew gum while inside the renovation area.
- Remove and isolate any items to be replaced or treated off-site by bagging or wrapping and taping.

**Upon final completion of demolition and rough in work, but before any new finishes are applied:**

- Treat all refuse as lead contaminated waste by sealing in plastic bags and removing to storage area.
- *Wet sweep* or *vacuum* and *phosphate wash* all surfaces around the work area working from the top down.
- Fold up the drop cloth working from the top down, and from the corners in, to avoid spilling any contaminated material. Bag and seal for disposal.
- Remove and bag *protective clothing*.

**At completion of work**

- *Vacuum* all surfaces, *Phosphate wash* all possible surfaces and re*vacuum* after drying.
- Remove the vacuum bag and treat it as lead-contaminated, non *hazardous waste*.

## *9.1 B) Minor Repairs to a Localized Area High Risk Procedures*

*Suitable where a very small amount of lead-based paint is required to be disturbed or where lead dust generation can be expected to be minimal (such as replacing a window) but one of the occupants of the house are at an elevated risk. Only work which can be completed in one day should be undertaken with these procedures.*

**In planning and preparing for the work:**

- Collect the personal protective equipment required for the type of work. A respirator with filter (not a dust mask), full length coveralls, gloves, hair protection, shoe covers over safety boots and suitable eye protection should always be worn. Most chemical stripping method require a respirator with an organic filter.
- Establish a negative pressure ventilation system, either with a fan blowing out through a window or with a remote-exhausting *HEPA vacuum* system. Verify that air is moving from the rest of the house, through the renovation area to outside.
- Remove all furniture, drapes and rugs at least 5 m from the work area and upstream of the repair area relative to the air current in the room or, if possible, out of the room.
- Mask the surfaces around and under the work area with 0.15 mm (6 mil) polyethylene sheets and waterproof tape for a minimum distance of 3 m.
- Seal off nearby vents and return grilles with polyethylene sheet and waterproof tape.
- Provide active ventilation for the work area if using chemical strippers. Fans should be placed in windows, blowing out.

**Before starting a work session:**

- Bring all required materials, tools, and cleaning equipment including bags for contaminated waste to the work area.
- Put on *respirators* and *protective clothing* as required.

**During removal work:**

- Do not eat, drink, smoke, or chew gum while inside the renovation area.
- Remove and isolate any items to be replaced or treated off-site by bagging or wrapping and taping.
- Collect, bag and seal all waste which could be contaminated as it is generated.
- Remove shoe coverings any time it is necessary to leave masked area.

**Upon final completion of demolition and rough in work, but before any new finishes are applied:**

- Treat all refuse as lead contaminated waste by sealing in plastic bags and removing to storage area.
- *Wet sweep* or *HEPA vacuum* and *phosphate wash* all surfaces around the work area working from the top down
- Fold up the polyethylene masking sheets working from the top down, and from the corners towards the repair area. Bag and seal for disposal.
- Remove and bag *protective clothing*

**During the application of new finishes:**

- Refrain from using positive pressure equipment such as spray guns.

**At completion of work**

- *Wet sweep* or *HEPA vacuum* all surfaces, *Phosphate wash* all possible surfaces and re*vacuum* after drying
- Remove the vacuum bag and treat it as lead-contaminated, non hazardous waste.
- At least 24 h after removal work has ended, obtain two *dust wipe samples*, preferably on bare horizontal surfaces, one from inside and one from outside but nearby the repair area. This will verify that cleaning and containment work has controlled the spread of lead dust.
- Lab analysis of these samples can verify what levels of lead the house dust contains after the renovation. If levels exceed the following U.S. standards, you may wish to reclean and retest.

| | |
|---|---|
| Floors | 2 $mg/m^2$ |
| Window sills | 5 $mg/m^2$ |
| Window wells | 8 $mg/m^2$ |

## *9.2 A) Renovations to a Single Enclosable Room Moderate Risk Procedures*

*Suitable only if none of the occupants of the house are at an elevated risk and none of the high risk methods identified in the previous section are to be used. It is recommended that work of this scale be undertaken by qualified contractors. Regardless of who does the work the following precautions should be taken.*

**In planning and preparing for the work:**

- Establish that it is feasible to deny access to the room for the renovation period. Continued occupancy of the house may not be possible if kitchen and bathroom renovations are to be carried out over several days.
- Establish an *on-site storage* area for those waste materials which will be contaminated with lead. This area should be on the property but located to reduce possible exposure.
- Collect the personal protective equipment required for the type of work. A respirator with filter (not a dust mask), full length coveralls, gloves, hair protection, safety boots and suitable eye protection should always be worn, regardless of the type of renovation. Most chemical stripping method require a respirator with an organic filter.
- Remove all furniture, drapes and rugs from the room.
- Isolate the floor or carpet using at least 2 layers of 0.15 mm (6 mil) polyethylene sheet, taped and sealed at joints and edges with waterproof tape.
- Isolate any immovable objects by wrapping them with 0.15 mm (6 mil) polyethylene and sealing in an airtight fashion.
- Seal off all vents return grilles and all doors except the one used for access with polyethylene sheet and waterproof tape.
- Provide active ventilation for the work area, particularly if using chemical strippers. Fans should be placed in windows, blowing out, to minimize the spread of airborne dust and solvents inside the house.

**Before starting a work session:**

- Bring all required materials, tools, and cleaning equipment including bags and isolation sheets for removing contaminated materials.
- Seal the entry door behind you with polyethylene and tape after you enter for a work session.
- Put on *respirators* and *protective clothing* as required. If shoe coverings are not going to be used in the work space bring a clean pair of shoes in a sealed bag to change into when leaving the work area.

**During removal work:**

- Perform work as continuously as possible. Do everything possible to minimize entry and exit to the isolated room.
- Do not eat, drink, smoke, or chew gum while inside the renovation area.
- Remove and isolate any items to be replaced or treated off-site by bagging or wrapping and taping.

**At the end of a work session or day:**

- clean up by sweeping up, bagging and sealing all paint chips and dust and cleaning every surface in the room , starting from the top and working downwards either by *vacuum*ing or damp mopping.
- *Vacuum* dust off all surfaces of items to be removed from the room and place them near the entry door.
- *Protective clothing* should not be taken out of the isolated work space. When exiting the space keep your respirator on, *vacuum* the worst of the dust off the *protective clothing*, remove *protective clothing,* including shoe coverings or work boots, and bag and seal them in polyethylene bags. At this point you can remove *respirators* and leave the area, carrying isolated contaminated materials to the temporary storage area.

**Upon final completion of demolition and rough in work, but before any new finishes are applied:**

- Treat all refuse as lead contaminated waste by sealing in plastic bags and removing to storage area.
- *Wet sweep* or *vacuum* and *phosphate wash* all surfaces inside the enclosure, including isolated items to be removed.
- Take down the isolating polyethylene sheets and floor protection by wetting them down to control dust and folding them into themselves. Work from the top down, and from the corners in, to avoid spilling any damp contaminated material. Bag and seal the *isolating sheets*.
- *Wet sweep* or *vacuum* all floors, and after they have dried *vacuum* them until no visible residue remains.

**During finishing:**

- Avoid using positive pressure devices such as paint guns which could spread fugitive dust.

**At completion of work:**

- *Vacuum* all surfaces, *Phosphate wash* all possible surfaces and re*vacuum* after drying.
- Remove the *vacuum* bag and treat it as lead-contaminated, non hazardous waste.

## *9.2 B) Renovations to a Single Enclosable Room High Risk Procedures*

*Should be applied if any of the occupants of the house are at an elevated risk or any of the high risk methods identified in the previous section are to be used. Work of this scale should be undertaken by qualified contractors.*

**In planning and preparing for the work:**

- Arrange for alternate accommodation for occupants who are at an elevated risk for the period of the renovation.
- Establish that it is feasible to deny access to the room for the renovation period. Continued occupancy of the house may not be possible if kitchen and bathroom renovations are to be carried out over several days.
- Establish an *on-site storage* area for those waste materials which will be contaminated with lead. This area should be on the property but located to reduce possible exposure.
- Determine whether any *hazardous waste* will be created (based on the renovation methods chosen) and , if so, obtain a storage container to be placed in the renovation area.
- Collect the personal protective equipment required for the type of work. A respirator with filter (not a dust mask), full length coveralls, gloves, hair protection, safety boots and suitable eye protection should always be worn, regardless of the type of renovation. Most chemical stripping method require a respirator with an organic filter.
- Remove all furniture, drapes and rugs from the room.
- Isolate the floor or carpet using at least 2 layers of 0.15 mm (6 mil) polyethylene sheet, taped and sealed at joints and edges with waterproof tape.
- Isolate any immovable objects by wrapping them with 0.15 mm (6 mil) polyethylene and sealing in an airtight fashion.
- Seal off all vents return grilles and all doors except the one used for access with polyethylene sheet and waterproof tape.
- Create a *changing area* just outside the entrance to the room using two layers of 0.15 mm (6 mil) polyethylene sheet and waterproof tape. This space is to be used as an "intermediate space" where workers can don and take off *protective clothing.*
- Provide a negative pressure in the work area with the ventilation system to minimize the spread of airborne dust and solvents inside the house. This can be done by using window fans, blowing out, of an outside exhausted *HEPA vacuum.*

**Before starting a work session:**

- Bring all required materials, tools, and cleaning equipment including bags and isolation sheets for removing contaminated materials.
- Seal the entry door behind you with polyethylene and tape after you enter for a work session.
- Put on *respirators* and *protective clothing* as required. If shoe coverings are not going to be used in the work space bring a clean pair of shoes in a sealed bag to change into when leaving the work area.

**During Work:**

- Perform work as continuously as possible. Do everything possible to minimize entry and exit to the isolated room.
- Do not eat, drink, smoke, or chew gum while inside the renovation area.
- Remove and isolate any items to be replaced or treated off-site by bagging or wrapping and taping.
- Gather any items of *hazardous waste* and put them promptly into the container.

**At the end of a work session/day:**

- Clean up by sweeping up, bagging and sealing all paint chips and dust and cleaning every surface in the room , starting from the top and working downwards either by *HEPA vacuuming* or damp mopping.
- *HEPA vacuum* dust off all surfaces of items to be removed from the room and place them near the entry door or in the change area.
- *Protective clothing* should not be taken out of the isolated work space. When exiting the space keep your respirator on, *HEPA vacuum* the worst of the dust off the *protective clothing*, Move to the *changing area* and remove *protective clothing*, including shoe coverings or work boots, and bag and seal them in polyethylene bags. At this point you can remove *respirators* and leave the area, carrying isolated contaminated materials to the temporary storage area.

**Upon final completion of demolition and rough in work, but before any new finishes are applied:**

- treat all refuse as lead contaminated waste by sealing in plastic bags and removing to storage area.
- *Wet sweep* or *HEPA vacuum* and *phosphate wash* all surfaces inside the enclosure, including isolated items to be removed and the *hazardous waste* container, at final completion of removal work. Move it and other isolated items to the *changing area.*
- Take down the isolating polyethylene sheets and floor protection by wetting them down to control dust and folding them into themselves. Work from the top down, and from the corners in, to avoid spilling any damp contaminated material. Bag and seal the *isolating sheets.*
- Move waste to the *on site storage area*
- Take down the walls of the *changing area* in the same fashion as *isolating sheets.*
- *Wet sweep* or *HEPA vacuum* and *phosphate wash* all surfaces, and after they have dried *HEPA vacuum* them again until no visible residue remains.

**During finishing:**

- Avoid using positive pressure devices such as paint guns which could spread fugitive dust.

**At completion of work:**

- *HEPA vacuum* all surfaces, *Phosphate wash* all possible surfaces and *HEPA vacuum* again after drying.
- Remove the vacuum bag and treat it as lead-contaminated, non hazardous waste.
- At least 24 h after work has ended, obtain at least two *dust wipe samples*, preferably on bare horizontal surfaces, one inside the renovation area and one outside but nearby. Window wells, window sills, and floors are suggested as the most critical areas.
- Lab analysis of these samples can verify what levels of lead the house dust contains after the renovation. If levels exceed the following U.S. standards, you may wish to reclean and retest.

| | |
|---|---|
| Floors | 2 $mg/m^2$ |
| Window sills | 5 $mg/m^2$ |
| Window wells | 8 $mg/m^2$ |

## *9.3 A) Renovations to an Essential, Non-enclosable Space*
## *Moderate Risk Procedures*

*Suitable only if none of the occupants of the house are at an elevated risk and none of the high risk methods identified in section 7 are to be used. It is strongly recommended that work of this scale be undertaken by qualified contractors.*

**In planning and preparing for the work:**

- Establish an *on-site storage* area for those waste materials which will be contaminated with lead. This area should be on the property but located to reduce possible exposure.
- Collect the personal protective equipment required for the type of work. Workers will need a *respirator* with filter (not a dust mask), full length coveralls, gloves, hair protection, safety boots and suitable eye protection. Most chemical stripping method require a respirator with an organic filter. Occupants should wear disposable shoe covers and hair protection when passing through the area where work is in progress.
- Remove all furniture, drapes and rugs from the room.
- Create a temporary enclosure around the area to be renovated using a wood frame with at least two layers of 0.15 mm (6 mil) polyethylene sheet, taped and sealed at joints and edges with waterproof tape. Create a *changing area* outside of each necessary entrance.
- Isolate the floor or carpet using at least 2 layers of 0.15 mm (6 mil) polyethylene sheet, taped and sealed at joints and edges with waterproof tape.
- Isolate any immovable objects by wrapping them with 0.15 mm (6 mil) polyethylene and sealing in an airtight fashion.
- Seal off all vents return grilles with polyethylene sheet and waterproof tape.
- Provide a negative pressure, active ventilation scheme for the work area to minimize the spread of airborne dust and solvents inside the house, particularly if using chemical strippers. Fans could be placed in windows, blowing out or an outside exhausted *HEPA vacuum* could be used.

**Before starting a work session:**

- Bring all required materials, tools, and cleaning equipment including bags and isolation sheets for removing contaminated materials.
- Put on *respirators* and *protective clothing* as required. If shoe coverings are not going to be used by workers they should bring a clean pair of shoes in a sealed bag to change into when leaving the work area.

**During removal work:**

- Perform work as continuously as possible. Do everything possible to minimize entry and exit to the isolated room.
- Do not eat, drink, smoke, or chew gum while inside the renovation area.
- Collect bag and seal waste as it is generated.
- Remove and isolate any items to be replaced or treated off-site by bagging or wrapping and taping.
- Occupant entry to the work space should be limited to the absolute minimum and should not be allowed at times of high dust generation. Before entering the space the occupant should put on disposable shoe coverings and hair protection. When leaving the work area these should be disposed of, and the occupant should immediately wash their hands.

**At the end of every work session or day:**

- *Wet sweep* or *HEPA vacuum* and *phosphate wash* all surfaces inside the enclosure, including isolated items to be removed.
- *Vacuum* dust off all surfaces of items to be removed from the room and place them near the entry door.
- *Protective clothing* should not be taken out of the isolated work space. When exiting the space keep your respirator on, *vacuum* the worst of the dust off the *protective clothing*, remove *protective clothing*, including shoe coverings or work boots, and bag and seal them in polyethylene bags. At this point you can remove *respirators* and leave the area, carrying isolated contaminated materials to the temporary storage area.
- Remove waste to storage area.

**Upon final completion of demolition and rough in work, but before any new finishes are applied:**

- Treat all refuse as lead contaminated waste by sealing in plastic bags and removing to storage area.
- *Wet sweep* or *vacuum* and *phosphate wash* all surfaces inside the enclosure, including isolated items to be removed.
- Take down the isolating and enclosing polyethylene sheets and floor protection by wetting them down to control dust and folding them into themselves. Work from the top down, and from the corners in, to avoid spilling any damp contaminated material. Bag and seal the *isolating sheets*.
- *Wet sweep* or *vacuum* all surfaces, and after they have dried *vacuum* them until no visible residue remains.

**During finishing:**

- Avoid using positive pressure devices such as paint guns which could spread fugitive dust.

**At completion of work:**

- *Vacuum* all surfaces, *Phosphate wash* all possible surfaces and re*vacuum* after drying.
- Remove the vacuum bag and treat it as lead-contaminated, non hazardous waste.
- If renovation has included the kitchen obtain at least two *dust wipe samples* from bare horizontal surfaces at least 24 h after work has ended. One should be from inside the renovation area and one outside but nearby. Window wells, window sills, and floors are suggested as the most critical areas.
- Lab analysis of these samples can verify what levels of lead the house dust contains after the renovation. If levels exceed the following U.S. standards, you may wish to reclean and retest.

| | |
|---|---|
| Floors | 2 $mg/m^2$ |
| Window sills | 5 $mg/m^2$ |
| Window wells | 8 $mg/m^2$ |

## *9.3 B) Renovations to an Essential, Non-enclosable Space*
## *High Risk Procedures*

*Should be applied if any of the high risk methods identified in section 7 are to be used. Work of this scale should be undertaken by qualified contractors.*

**In planning and preparing for the work:**

- Arrange for alternate accommodation for occupants who are at an elevated risk for the period of the renovation.
- Establish an *on-site storage* area for those waste materials which will be contaminated with lead. This area should be on the property but located to reduce possible exposure.
- Determine whether any *hazardous waste* will be created (based on the renovation methods chosen) and , if so, obtain a storage container to be placed in the renovation area.
- Collect the personal protective equipment required for the type of work. A respirator with filter (not a dust mask), full length coveralls, gloves, hair protection, safety boots and suitable eye protection should always be worn, regardless of the type of renovation. Most chemical stripping method require a respirator with an organic filter.
- Remove all furniture, drapes and rugs from the work area.
- Create a temporary enclosure and *safe passage* around and through the area to be renovated using a wood frame with at least two layers of 0.15 mm (6 mil) polyethylene sheet, taped and sealed at joints and edges with waterproof tape. Create a *changing area* outside the entrance to the work area.
- Isolate the floor or carpet using at least 2 layers of 0.15 mm (6 mil) polyethylene sheet, taped and sealed at joints and edges with waterproof tape.
- Isolate any immovable objects by wrapping them with 0.15 mm (6 mil) polyethylene and sealing in an airtight fashion.
- Seal off all vents return grilles and all doors except the one used for access with polyethylene sheet and waterproof tape.
- Provide a negative pressure in the work area with the ventilation system to minimize the spread of airborne dust and solvents inside the house. This can be done by using window fans, blowing out, of an outside exhausted *HEPA vacuum.*

**Before starting a work session:**

- Bring all required materials, tools, and cleaning equipment including bags and isolation sheets for removing contaminated materials.
- Seal the entry door behind you with polyethylene and tape after you enter for a work session.
- Put on *respirators* and *protective clothing* as required. If shoe coverings are not going to be used in the work space bring a clean pair of shoes in a sealed bag to change into when leaving the work area.

**During Work:**

- Perform work as continuously as possible. Do everything possible to minimize entry and exit to the isolated room.
- Do not eat, drink, smoke, or chew gum while inside the renovation area.
- Remove and isolate any items to be replaced or treated off-site by bagging or wrapping and taping.
- Gather any items of *hazardous waste* and put them promptly into the container.

**At the end of a work session/day:**

- Clean up by sweeping up, bagging and sealing all paint chips and dust and cleaning every surface in the room , starting from the top and working downwards either by *HEPA vacuuming* or damp mopping.
- *HEPA vacuum* dust off all surfaces of items to be removed from the room and place them near the entry door or in the change area.
- *Protective clothing* should not be taken out of the isolated work space. When exiting the space keep your respirator on, *HEPA vacuum* the worst of the dust off the *protective clothing*, Move to the *changing area* and remove *protective clothing*, including shoe coverings or work boots, and bag and seal them in polyethylene bags. At this point you can remove *respirators* and leave the area, carrying isolated contaminated materials to the temporary storage area.

**Upon final completion of demolition and rough in work, but before any new finishes are applied:**

- treat all refuse as lead contaminated waste by sealing in plastic bags and removing to storage area.
- *Wet sweep* or *HEPA vacuum* and *phosphate wash* all surfaces inside the enclosure, including isolated items to be removed and the *hazardous waste* container, at final completion of removal work. Move it and other isolated items to the *changing area.*
- Take down the isolating polyethylene sheets and floor protection by wetting them down to control dust and folding them into themselves. Work from the top down, and from the corners in, to avoid spilling any damp contaminated material. Bag and seal the *isolating sheets*. During dismantling of the enclosure, the side of the *safe passage* polyethylene sheets facing the work area should be treated as *isolating sheets*, and should be misted, swept, *vacuum*ed, washed, and folded accordingly.
- Move waste to the *on site storage area.*
- Take down the walls of the *changing area* in the same fashion as *isolating sheets*.
- *Wet sweep* or *HEPA vacuum* and *phosphate wash* all surfaces, and after they have dried *HEPA vacuum* them again until no visible residue remains.

**During finishing:**

- Avoid using positive pressure devices such as paint guns which could spread fugitive dust.

**At completion of work:**

- *HEPA vacuum* all surfaces, *Phosphate wash* all possible surfaces and *HEPA vacuum* again after drying.
- Remove the vacuum bag and treat it as lead-contaminated, non hazardous waste.
- At least 24 h after work has ended, obtain at least two *dust wipe samples*, preferably on bare horizontal surfaces, one inside the renovation area and one outside but nearby. Window wells, window sills, and floors are suggested as the most critical areas.
- Lab analysis of these samples can verify what levels of lead the house dust contains after the renovation. If levels exceed the following U.S. standards, you may wish to reclean and retest.

| | |
|---|---|
| Floors | 2 $mg/m^2$ |
| Window sills | 5 $mg/m^2$ |
| Window wells | 8 $mg/m^2$ |

## *9.4 Exterior Renovations*

Exterior renovations on painted surfaces of homes, such as wood siding and trim, wooden porches, verandahs, and rails, may also create exposure to lead. Lead-based paint has been more common in exterior applications and is available even today. While direct airborne exposure to the occupants will be less likely than in interior renovations, the tracking in of lead contaminated soil can be a significant exposure route. The renovator must take full personal protection measures and must protect the general public as much as possible from any exposure. The general principles and some procedures for controlling lead hazards in exterior renovations are similar to interior renovations. Since there are many factors in exterior renovations which cannot be controlled, such as the wind and even access to the site, only a single level of containment and isolation procedures is presented.

### Methods

#### Encapsulation or Enclosure

Many options exist for the encapsulation of exterior cladding systems to relieve concerns about lead-based paint. Examples include covering with metal or vinyl cladding or stucco. No special personal protection or procedures should be required for encapsulation work, unless attachment methods create dust or there is a substantial amount of peeling paint. If peeling paint is a problem one should consider placing a water permeable, weather barrier membrane over the old paint to limit future shedding of paint from under the new cladding.

#### Removal and Replacement

Removal and replacement, and off-site paint removal of exterior components with lead-based paint, should be done similarly to interior components, by wrapping in 0.15 mm polyethylene sheets and sealing with duct tape before transporting them. Gloves should be worn during these procedures, and increased protection should be used if flaking paint is present. Windows in the home and in any adjacent home should be shut during the work. Normal site safety and access measures should also apply to this type of renovation.

## On-Site Removal

Sandblasting, water blasting and sanding are not recommended because control of the residue is difficult and exposure of the renovator to hazardous lead dust is high. The preferred choices for paint removal are scraping and heat gun, or else removal by chemical strippers. Both of these methods pose less hazard for the renovator in an exterior setting, due to improved ventilation and dilution of the lead dust and chemical fumes. *Respirators* are still required and gloves, hair protection, and foot protection should be used. Environmental protection is also important, given the amount of *hazardous waste* which may be generated. The use of chemical strippers will result in a heavy and somewhat liquid waste product which collects at the base of walls which are being renovated. Wind does not usually pose a large problem in containing waste materials from this method, although care must be taken with regard to fumes from the stripping chemicals

## Using Chemical Strippers

- First, inform neighbors in advance and plan to control access to the work area. Consideration should be given to the type and scope of removal in order to determine the area of work which should be closed off.

- Obtain *hazardous waste* containers if required.

- Post signs outside the limits of the work area, which indicate the potential danger and erect barricades and fences as the situation requires to control access.

- Cover all openings on the face of the building being renovated, including vents, and soffits windows and doors (where possible), with polyethylene sheet and seal with water proof tape.

- Place 0.15 mm (6 mil) polyethylene sheeting over the ground from the building foundation to a distance at least 2 m out. Weight it down at perimeters to prevent billowing. Tape joints between sheets, and raise the outside perimeters of sheets with wood blocking to prevent spillage outside the covered area.

- After stripping, consider the polyethylene sheeting and contents as *hazardous waste* for disposal purposes. When rolling it up for disposal, make sure that no spillage of the contaminated waste occurs. Consideration should be given to special methods of transferring the stripped material into the into the *hazardous waste* container, such as a vacuum or bailer, to reduce the exposure of the individual in handling the contaminated materials.

### Using Heat Gun and Scraping

Softening paint with a heat gun, followed by scraping, requires more attention to the effects of the wind in spreading contaminated waste materials. This method should not be used on windy days. Wind breaks can help expand the range of application.

- Cover all openings on the face of the building being renovated, including vents, and soffits windows and doors (where possible), with polyethylene sheet and seal with water proof tape.

- Place 0.15 mm (6 mil) polyethylene sheeting over the ground from the building foundation to a distance at least of 1 m per storey being renovated, with a minimum of 1.5 m and a maximum of 6 m out. Weight it down at perimeters to prevent billowing. Seal the seams if *wet sweeping* is to be done to collect debris.

- Advise neighbors to shut all windows tightly.

- If the horizontal area to be covered extends onto adjacent property or roadways, it may be necessary to enclose the building face, to ensure that paint chips do not escape the work area.

- If possible, collect paint residue at the base of the building by dry sweeping, or *wet sweeping* if the particle size of the residue is small.

- Treat this residue as *hazardous waste* and store and dispose of it accordingly.

- Roll up and bag the polyethylene sheeting up and as contaminated waste, although it probably will not require classification as hazardous.

# *Bibliography*

Renovation, Lead in Your Home, CMHC/Health and Welfare Canada; NHA/LNH 6624, 1992.

Renovating, Old Paint, Lead and Your Family's Health, CMHC/Health and Welfare Canada/Consumer and Corporate Affairs Canada/Canadian Paint and Coatings Association; NHA 6625, 1992.

Testing of Canadian Sources for Lead Analysis, CMHC/Proctor & Redfern Ltd.; EO 92639, September, 1992.

Effectiveness of Clean-Up Techniques for Leaded Paint Dust, CMHC/Saskatchewan Research Council, Building Science Division; 1-4800-38-C-92, September, 1992.

Advice on the Use of Chemical Strippers to Remove Leaded Paint, CMHC/Buchan, Lawton, Parent Ltd.; CR No. 6790-10, August, 1992.

Home Renovations - Removing Lead-Based Paint, Health and Welfare Canada, Health Protection Branch.

Amendment to Designated Substances in the Workplace: A Guide to the Lead Regulation; ISBN 0-7729-4285-4, 6/88 Rev.

Lead in Paint: It's History and Removal, Health and Safety Committee of the Canadian Paint and Coatings Association; April, 1989.

Lead-Based Paint in Both the Home and Work Environments, Gore & Storrie Limited Information Seminar, April, 1992.

The Lead Paint Hazard; U.S. Army Construction Engineering Research Laboratory.

Lead-Based Paint: Interim Guidelines for Hazard Identification and Abatement in Public and Indian Housing, September, 1990.

Lead Paint: A Renovator's Hazard, The Journal of Light Construction; 48/JLC, September, 1989.

Lead-Based Paint in Dwellings: The Potential for Contamination of the Home Environment During Renovation; Environmental Geochemistry and Health, 1987.

Reducing Lead Exposure from Remodeling and Soil Track-in in Older Homes, Air & Waste Management Association; 84th Annual Meeting & Exhibition, June, 1991.

Potential Systems for Lead Hazard Elimination: Evaluations and Recommendations for Use, NBS 098, 1973.

South Riverdale Lead Reduction Program: Housedust Cleaning Demonstration, Final Report.

Lead Based Paint in Housing, NIBS, TP 935N37, February, 1988.