



CHAPTER 4: LEAD-BASED PAINT AND HOUSING RENOVATION

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Chapter 4: Lead-Based Paint and Housing Renovation

I. Introduction

This chapter provides general information on the hazards of lead-based paint in various kinds of housing renovation work, including demolition, remodeling, repainting, rehabilitation, weatherization, and other forms of home improvement. If these activities are performed in older dwellings where lead-based paint is sanded, scraped, or otherwise disturbed, workers and residents may become lead poisoned if protective measures and special cleanup procedures are not used. Occupational Safety and Health Administration (OSHA) regulations require certain procedures for any paint that contains lead, even if it is below the HUD standard of 1 mg/cm² or 5,000 µg/g (0.5%). Clearance testing should be performed whenever a job creates lead dust.

The Environmental Protection Agency (EPA) is currently studying the extent of lead hazards produced during this kind of work and will issue detailed guidelines on how to do renovation work involving lead-based paint safely. Starting in October 1995, Title X requires all renovation contractors to provide an EPA pamphlet to owners before beginning work in older dwellings. The pamphlet will describe the hazards of lead poisoning that could be caused by renovation work. Title X also sets certain lead-based paint hazard control requirements for housing rehabilitation assisted by the Federal Government. Future HUD regulations will provide details.

Additionally, some aspects of housing renovation work are regulated by OSHA, which recently issued a new rule covering lead in the construction industry. If the work includes manual demolition, scraping, sanding, and the use of heat guns, needle guns, and power sanders on surfaces that are coated with lead-based paint, there are worker protection requirements involving air monitoring, respirators, medical surveillance, training, and other protective measures. Further information on the OSHA standard can be found in Chapter 9.

A. Evidence of Lead Poisoning Caused by Renovation

There is substantial evidence that uncontrolled housing renovation work can cause lead poisoning. One study found that refinishing activity performed in dwellings with lead-based paint was associated with an average 69-percent increase in the blood lead level of the 249 infants living there (Rabinowitz, 1985a). Another study of 370 recently lead-poisoned children found a statistically significant association between household renovation activity and elevated blood lead level (EBL) ($p < 0.0001$)¹ (Shannon, 1992). Other researchers have also reported cases where renovation activity has resulted in EBLs (Fischbein, 1981; Marino, 1990). The Marino case report (named after the physician who treated the family) is summarized in Figure 4.1.

II. Lead-Based Paint Hazards in Housing Renovation

A. Similarities Between Lead Hazard Control Work and Housing Renovation

Table 4.1 shows the similarity between lead hazard control work and renovation activity. Depending on the intent of the repair work, some of the same activities could be considered to be either lead hazard control work or renovation work. Because of these similarities, HUD recommends that all renovation workers and contractors become knowledgeable about how to conduct their work safely by reviewing the controlled work practices described throughout these *Guidelines*.

¹ A p value of less than 0.0001 means that there was less than 1 chance in 10,000 that the association observed was due to chance.



Figure 4.1 A Case Report: Renovation and Lead Poisoning.

The Marino case report (Marino, 1990) is an example of how uncontrolled renovation work can cause lead poisoning in both adults and children. The dwelling involved was a 2-story, 19th century Victorian farmhouse with 10 rooms. Most of the wooden floors, moldings, walls, ceilings, and door frames had been painted with lead-based paint.

The renovation work included restoration of surfaces by removing the paint down to the bare surface on floors and woodwork and recoating with new varnish. Ceilings were repaired, and wallpaper and paint were removed from a number of walls. Two workers used rotary power sanders, hand sanders, scrapers, torches, heat guns, and chemical paint strippers. The family left the house during most of the renovation work, but returned after it was only partially completed. There was dust throughout the dwelling.

After one of the family's dogs started to have seizures, a veterinarian determined that the dog was lead poisoned. The mother and two children were subsequently tested. The children had blood lead levels of 104 $\mu\text{g}/\text{dL}$ and 67 $\mu\text{g}/\text{dL}$, which is 5 to 10 times above the level of concern established by the Centers for Disease Control and Prevention (CDC) (10 $\mu\text{g}/\text{dL}$). The mother had a blood lead level of 56 $\mu\text{g}/\text{dL}$. All three were admitted to a local hospital where they were treated for severe lead poisoning. The mother was 8 weeks pregnant and opted for a therapeutic abortion. A babysitter who had two children of her own sometimes cared for all four children in the home. The babysitter's two children were also tested and found to have blood lead levels of 80 $\mu\text{g}/\text{dL}$ and 68 $\mu\text{g}/\text{dL}$. These two children were also hospitalized and treated for severe lead poisoning.

During the 1980s, at least \$100 billion was spent on residential repairs and improvements. When working on houses that were constructed prior to 1978 (and especially before 1960), it is very likely that normal renovation and remodeling practices will expose surfaces that are covered with lead-based paint. Table 3.2 in Chapter 3 shows that the older the dwelling, the more lead-based paint is likely to be present.

B. Leaded Dust

It does not take much leaded dust to create a hazard. The use of palm sanders, belt sanders, and sandpaper can increase the amount of hazardous leaded dust by a great deal. Almost any activity that involves disturbing a lead-containing surface will temporarily increase the amount of microscopic leaded dust in the surrounding environment.

To understand how easily leaded dust hazards can be created from jobs disturbing lead-based paint, consider the following example. Suppose renovation work is done on only 1 square foot of painted surface and all the paint inside that square foot is turned into dust by sanding or some other work. If the paint has 1 mg/cm^2 of lead in it (the lowest level covered by HUD

regulation) and if the dust is spread out over a 100-square-foot area, there will be about 9,300 $\mu\text{g}/\text{ft}^2$ of leaded dust present, which is nearly 100 times greater than the allowable level. HUD does not permit more than 100 $\mu\text{g}/\text{ft}^2$ of leaded dust to be left on floors following lead hazard control work. In short, dust-generating work performed on even a small area can cause a serious problem if not controlled and cleaned up. Of course working on a small area requires only modest cleaning and control measures, as described in Chapters 8 and 11.

C. Fumes

Whenever lead-based paint is heated above 1,100 °F, some of it may vaporize and later settle on the surrounding walls and floors. These small particles (fumes) are extremely dangerous because they can be inhaled by the lungs and rapidly absorbed into the body. These fumes are present whenever high-temperature heat guns or open flames heat the paint film excessively. Lead fumes can also be a problem when debris coated with lead-based paint is burned or metal coated with lead-based paint is welded.



Table 4.1 Similarities Between Lead Hazard Control and Renovation

Renovation Technique	Lead Hazard Control Technique
Repainting	Paint film stabilization
Window and door repair	Friction and impact surface treatments
Landscaping	Soil treatment
Installation of new building components (e.g., cabinet replacement)	Building component replacement
Paint stripping	Onsite paint removal
New wall installation	Enclosure

D. Paint Chips

Metal brushing, dry scraping, or water blasting any lead-containing surface creates many poisonous chips that will contaminate the ground, where they are accessible to children.

E. Exposed Surfaces

Surfaces that have had all lead-based paint removed may still have leaded particles trapped in the pores of the wood. While these surfaces are drying out and being prepared for recoating, they can cause lead poisoning if touched, mouthed, or chewed by small children. Recoating should always be completed before children are allowed back into the area.

F. Soil

For many years automobile gasoline contained lead that was deposited onto soil. Also, paint chips from previous paint-scraping jobs, and normal weathering of paint, may contaminate the top few inches of soil around older dwellings. Excavation, landscaping, concrete flatwork, and regrading that disturbs lead-contaminated soil into the dwelling may also cause lead poisoning by increasing the accessibility of the soil to children and by making the soil more easily tracked into the dwelling.

III. Combining Renovation and Abatement

While renovation work can pose certain dangers, it also provides the most cost-effective op-

portunity to permanently address lead-based paint hazards. Combining lead-based paint abatement with renovation work will result in substantial savings when compared to the cost of conducting each activity independently. HUD's public housing program has been combining lead-based paint abatement with housing renovation for several years with considerable success and cost savings. As a result a significant number of public housing units have been fully abated and a number of renovation contractors now possess the special skills required to perform lead-based paint abatement.

The best way of combining abatement and renovation is to determine which parts of the job will disturb lead-based paint or produce leaded dust hazards is best performed by a contractor certified in lead-based paint abatement (who may or may not also be the renovation contractor). The remainder of the job can be performed in the traditional fashion. In many cases this means that the abatement phase of the work will be completed first during the initial demolition work. In other cases a more complicated phasing process is necessary where abatement activities alternate with traditional construction work.

Window replacement is an example of renovation work that can also achieve abatement at the same time. A common finding of risk assessments is that old windows have deteriorated lead-based paint and very high levels of leaded dust on the window trough. A certified



abatement contractor is best suited to prepare the work area for dust containment, remove the old window, dispose of it properly, and conduct cleaning. The new window can be installed in the traditional fashion without worker protection, as long as no other surfaces with lead-based paint will need to be disturbed during installation.

All cuts or penetrations into surfaces with lead-based paint that are needed to complete the job should be identified ahead of time so that they will be performed by the appropriate contractor (if multiple contractors are used) and so that cleanup, worker protection, and containment are employed at the appropriate times. For example, if new plumbing will require cutting into an existing wall containing lead-based paint, the abatement contractor should do the cutting and cleaning. Alternatively, the plumber can become certified as an abatement contractor and specialize in plumbing work on leaded surfaces. Of course, work that disturbs only a small amount of lead-based paint does not necessarily require a specialized, certified contractor. Nevertheless, the precautions recommended in these *Guidelines* should always be observed.

Separate contractors are not necessarily required when combining renovation and abatement work. All work can be completed by a single contractor, but only if the renovation contractor is also certified to conduct lead-based paint abatement. In many respects the ideal abatement/renovation project is performed by a contractor with good construction skills and abatement skills. Chapter 3 contains additional information on how to plan lead-based paint abatement projects.

IV. Safe Older Home Renovation Procedures

The information in these *Guidelines* can be used to ensure that renovation work does not cause lead poisoning in either children or adults or create lead hazards. There are certain basic precautions that should become part of the standard operating procedure of any renovation or remodeling project.

If lead-based paint or contaminated dust or soil is present, there are five basic precautions that should be taken:

- ◆ Resident protection (see Chapter 8).
- ◆ Adherence to OSHA regulations (see Chapter 9).
- ◆ Proper management of waste (see Chapter 10).
- ◆ Final cleaning techniques (see Chapter 14).
- ◆ Final clearance (see Chapter 15).

A. Testing

Testing can be done for paint, dust, and soil to determine if it is contaminated with lead. The tests can define the building components that can be handled in a traditional way and the building components that must be treated with extra care. The best field testing method for lead in paint usually involves a portable x-ray fluorescence (XRF) lead paint analyzer backed up by laboratory analysis of paint chips, especially if many surfaces need to be tested. When properly used (see Chapter 7) this method has an adequate detection limit and an acceptable rate of false positives and negatives, and is relatively easy to use at a modest cost per test.

Dust testing shows how much leaded surface dust is on various horizontal building components. Usually the floors and the interior window sill and exterior window troughs will be tested as part of a risk assessment (see Chapter 5) and as part of clearance to determine if cleaning was adequate (see Chapters 14 and 15).

There is insufficient evidence to fully endorse the use of chemical spot-test kits at this time. Research efforts on these kits indicate that they may hold promise for the future. The National Lead Information Center should be contacted to determine the current status of the kits. If for some reason, XRF or laboratory paint-chip testing cannot be performed, the chemical spot-test kits should be used. Because there is some evidence that these kits erroneously report the presence of lead, they are not recommended by HUD at this time.



B. Occupant Protection

1. Education

Before starting any renovation job that is likely to disturb suspected lead-containing surfaces, the owner and/or resident should be informed of the dangers of lead-based paint—its dust, chips, and the increased exposure that most construction work will generate. A brochure about this topic may be obtained by calling the National Lead Information Center (1-800-LEAD-FYI). Residents who are not educated about the dangers of lead poisoning may compromise the containment measures and revisit the home unexpectedly or allow their children to play in the worksite. Owners and residents who are educated about the potential dangers will become aware of the special protection and cleaning procedures that all renovation contractors and subcontractors should now include in their general requirements when dealing with lead-based paint.

2. Containment

Rooms or areas where surfaces suspected of containing lead are being penetrated, removed, or prepared should be isolated from the other sections of the dwelling that will not be cleaned or renovated. This is usually done with sheets of 6-mil plastic, masking tape, and preformed or field-built containments. Only adequately protected individuals should be allowed to enter the contained area before it has been cleaned.

Exterior containment involves covering the soil or pavement around the building to a distance of 10 to 20 feet (possibly less in some situations). The soil must be covered in order to capture dust and chips and to prevent the soil around the home from becoming more contaminated with lead. See Chapter 8 for a description of various worksite preparation practices.

3. Relocation

One of the safest ways to prevent lead poisoning is relocation of the residents and their “portable” belongings. With all of the small possessions out of the dwelling, there is relatively little to clean prior to reoccupancy. Occupants should not return to the work area until

cleanup and final painting or finishing have been completed.

C. Cleaning Techniques

It is absolutely essential to clean the work area and any adjacent contaminated areas so that leaded dust levels are acceptable. All renovation contractors doing work on surfaces with lead-based paint must do more than simply clean up any visible dust. There are also small dust particles that cannot be seen by the naked eye. Cleaning should be done by using vacuums equipped with high-efficiency particulate air (HEPA) filters. HEPA filters trap very small particles from the vacuum exhaust so they do not recontaminate the work area or cause excessive exposures to workers. OSHA requires vacuums to have HEPA filters when working with lead. Ordinary vacuums release a cloud of small dust particles that cannot be seen with the naked eye.

To be most effective, HEPA vacuums should be used in combination with lead-specific detergents, high-phosphate detergents, or other suitable wet cleaning agents. The cleaning process starts with a HEPA vacuuming, followed by a wet wash, and a final HEPA vacuuming (see Chapter 14 for more details). If clearance can be established using only wet cleaning, the HEPA vacuuming step may not be needed. Carpeting and other dust traps may also have to be cleaned, discarded, or replaced before the family can reoccupy the dwelling. Renovation contractors working for owners who do not allow or wish to pay for this extensive cleaning should make it clear (in writing) that the contractor cannot be held responsible for lead contamination or lead poisoning.

D. Clearance Testing

Clearance testing should be completed after any renovation job that disturbs lead-based paint or creates leaded dust to ensure that the dwelling is safe for occupancy (see Chapter 15).

E. Waste Disposal

For some types of renovation work involving lead-based paint, the waste will have to be sorted into various categories (see Chapter 10).



Some of this waste may need to be tested to determine whether it is hazardous. Even if the waste is “nonhazardous,” lead-containing construction debris is still potentially dangerous and should not be placed directly on the ground. Debris piles should be placed on two layers of 6-mil plastic. The debris should be covered and clearly identified as containing lead. If the waste must be left onsite overnight, it must be stored in a secure area inaccessible to children or scavengers. Chapter 10 contains more specific information on waste disposal requirements.

For rolloff containers being used during extensive demolition jobs, debris should be handled in ways that minimize dust generation. Drop chutes cause too much dust and should not be used for lead-based paint construction debris unless proper precautions are taken to control dust. Loose plaster and dust should be thoroughly wetted down and/or covered prior to open transportation to the container.

V. Prohibited Activities

Many traditional methods of preparing a painted surface for repainting, refinishing, or restaining are prohibited if the old paint contains lead, since these methods are known to poison both children and workers. Chapters 11 and 12 discuss safe ways of removing lead-based paint. Prohibited methods of paint removal include:

- ◆ Open-flame burning or torching.
- ◆ Machine sanding or grinding without a HEPA vacuum exhaust tool.
- ◆ Uncontained hydroblasting or high-pressure washing.
- ◆ Abrasive blasting or sandblasting without a HEPA vacuum exhaust tool.
- ◆ Heat guns operating above 1,100 °F.

Dry scraping (except for limited areas) and methylene chloride paint strippers are also not recommended.

A. Flame Treatment

The use of open torches, infrared scorers, electric irons, or high-temperature heat guns are all

prohibited when the surface has a lead content equal to or greater than 1 mg/cm² or 5,000 µg/g (0.5 percent). Traditionally, these methods are used to remove a number of layers of paint prior to repainting; however, they release very large amounts of lead fume, which can poison workers and be very difficult to clean up. They should be avoided even if the lead concentration is below the HUD standards.

B. Dry Sanding

Ordinary circular, reciprocating, belt, and palm sanding of lead-containing surfaces generates a great deal of dust. These methods should be done on a wet surface or by using a HEPA vacuum exhaust tool (see Chapter 12).

C. Dry Scraping

Dry scraping was the traditional method of surface preparation. Dry scraping has been replaced by wet scraping for work on lead-based paint surfaces. Wet scraping should not be done near electrical circuits, even if they have been de-energized.

D. Abrasive Blasting

All forms of blasting are prohibited on lead-containing surfaces unless a HEPA-filtered local exhaust tool is used (see Chapter 12).

E. Power Washing

High-pressure washing is often used prior to starting an exterior paint job. However, uncontrollable power washing or water blasting on lead-based painted surfaces is a prohibited practice. The alternative practice involves exterior containment, collection of all water, filtration of the water, and proper disposal of the filter and debris.

F. Welding on Painted Surfaces

Welding on surfaces coated with lead-based paint is prohibited by OSHA regulations. The high temperatures will produce leaded fumes and high exposures.



VI. General Guidance for Selected Renovation Activities

Certain activities are very likely to generate hazardous leaded dust and chips during

renovation activities. Table 4.2 provides a summary of measures for protecting residents, providing containment, selecting safer alternate methods, and conducting cleanup for a few types of renovation.

Table 4.2 Selected Renovation Jobs and Work Practices

	Containment (see Chapter 8)	Relocation (see Chapter 8)	Recommended Practices (see Chapters 11 and 12)	Cleanup (see Chapter 14)
Demolition	Use plastic sheeting to prevent airborne dust migration. Interior Worksite Prep. Level 4; Exterior Worksite Prep. Level 3	No residents in dwelling during any work.	Wet surfaces, use covered containers to move debris; best subcontracted to abatement contractor, or a demolition contractor certified for abatement.	HEPA vacuum, wet mop, and HEPA vacuum.
Repainting	Floors and ground covered with 6-mil plastic. Interior Worksite Prep. Level 4; Exterior Worksite Prep. Level 3	No entry into work area during interior work.	Wet scrape, wet sanding, HEPA-filtered vacuum power tools.	Daily cleanup with HEPA vacuum, wet wash, HEPA vacuum.
Floor Sanding	Full containment of rooms, negative air recommended if leaded dust hazard identified.	No entry into work area during work.	Sanding lead-containing floors should be completed by abatement contractor, or other contractor certified for abatement.	HEPA vacuum of entire house may be needed.
Plaster Repairs	Localized containment for walls, entire room for ceiling. Usually Interior Worksite Prep. Level 1 or 2 for small jobs	No entry into work area.	Wet prior to removing.	HEPA final cleanup.
Window Replacement	Localized containment around each opening. See Table 8.3.	No occupancy during removal and initial cleaning and sealing.	Seal interior with plastic. Remove window from exterior if possible.	HEPA vacuum all areas with replaced windows.
Carpet Removal	Do dust sampling to determine contamination level. Usually Interior Worksite Prep. Level 3 or 4.	No occupancy during removal and initial cleaning.	Carefully remove and package carpet and pad in 6-mil plastic with taped seams. Wet down carpet before removal or disturbance.	HEPA vacuum floor after carpet bagged and prior to removal.