

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 dwellings built before 1978 where paint is sanded, scraped, or otherwise disturbed, a lead dust hazard may be created if protective measures and special cleanup procedures are not used.

Three federal agencies have regulations that cover renovation work in housing. These are discussed at greater length in Appendix 6.

- ◆ The Occupational Safety and Health Administration's (OSHA's) *Lead in Construction standard* (29 CFR 1926.62) requires certain procedures for construction work (which includes construction, alteration, repair, painting, and/or decorating) that may expose a worker to lead.
- ◆ EPA's *Renovation, Repair, and Painting (RRP) Rule* (40 CFR 745, especially subpart E) requires that firms performing these activities in target housing (which is most pre-1978 housing) or in pre-1978 child-occupied facilities be certified, use trained and certified renovators, and use lead-safe work practices. EPA can authorize states, tribes or territories to administer and enforce an RRP program in lieu of the EPA program. As of the publication of this edition of these *Guidelines*, EPA has authorized over a dozen of these programs.
- ◆ HUD's *Lead Safe Housing Rule* (LSHR; 24 CFR 35, especially subpart J) requires specific lead evaluation and hazard control activities for renovations in HUD-assisted target housing based on the amount of HUD rehabilitation assistance (on a dollars-per-unit basis).

The EPA and HUD rules, but not the OSHA standard, exempt renovations when the paint to be disturbed has been determined to be below the EPA-HUD standard for lead-based paint of 1 mg/cm² or 5000 mg/g (0.5%) of lead. (This was the standard as of the publication of this edition of these *Guidelines*; at that time, in response to a petition received by the EPA on August 10, 2009, the agencies were reviewing the standard. (See <http://www.epa.gov/oppt/chemtest/pubs/petitions.html#petition5> for links to the petition and EPA's response.)

HUD recommends that clearance testing be performed whenever a job creates leaded dust, while EPA's RRP rule allows for cleaning verification with optional clearance testing when required by contract or regulation. For more information on clearance, see Chapter 15.

Contractors who perform most renovation, repairs, and painting jobs in pre-1978 target housing or pre-1978 child-occupied facilities are also required by EPA's renovation regulations to provide owners and tenants of target housing, owners and adult representatives of child occupied facilities, and the parents and guardians of children under age six who use child occupied facilities with a copy of the EPA lead hazard information pamphlet, *Renovate Right: Important Lead Hazard Information for Families, Child Care Providers, and Schools* or *Remodelar Correctamente: Guía de Prácticas Acreditadas Seguras para Trabajar con el Plomo para Remodelar Correctamente*. (EPA, 2011) See Appendix 6 for more information, including how to obtain the pamphlets.

If an activity meets the EPA's definition of abatement (40 CFR 745.223), whether or not the abatement activity is performed as part of a larger renovation project, it must be conducted by a certified abatement contractor in accordance with EPA's abatement regulations (40 CFR 745, subpart L) or, if the work is being done in an EPA-authorized state or tribal area, that jurisdiction's abatement regulation (issued under 40 CFR 745, subpart Q). Abatement is generally defined as any measure or set of measures designed to permanently eliminate lead-based paint hazards. For renovations in housing receiving HUD assistance, see the April 19, 2001, "HUD/EPA abatement letter," which clarified the requirements for rehabilitation and lead hazard reduction in property receiving up to \$25,000 per unit in Federal rehabilitation assistance under HUD's LSHR, and the definition of "abatement" under EPA and HUD regulations. (http://portal.hud.gov/hudportal/documents/huddoc?id=DOC_25480.pdf).

Housing renovation work that is performed for pay is regulated by OSHA, whose standard for lead in the construction industry requires protection for renovation workers. For example, if the work includes manual demolition, scraping, sanding, and/or the use of heat guns, needle guns, and power sanders on surfaces coated with paint that has lead in it, there are worker protection requirements involving air monitoring, respirators, medical surveillance, training, "engineering controls," and other protective measures (depending on the employee's potential for exposure). See Chapter 9 and Appendix 6 for more information.

A. Evidence of Lead Poisoning Caused by Improper 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) (see Figure 4.1). Another study of 370 lead poisoned children found a statistically significant association between household renovation activity and young children's blood lead levels at or above 10 µg/dL ($p < 0.0001$) (Shannon, 1992). Other researchers have also reported cases where renovation activity has resulted in EBLs (Fischbein, 1981; Marino, 1990). The costs of cleaning up a house contaminated by paint removal using uncontained power sanding can run as high as \$195,000 (Jacobs, 2003). EPA announced the availability of two new studies in its Renovation, Repair, and Painting (RRP) rulemaking docket on March 16, 2007 (<http://www.epa.gov/lead/pubs/rrp.htm>) Based on this data, the Agency concluded that renovation, repair, and painting activities that disturb lead-based paint create lead-based paint hazards.

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, that is, activities conducted for the purpose of reducing



FIGURE 4.1 Sanding wooden floors can generate significant amounts of dust.

current or anticipated lead hazards, and renovation activities. Many activities are common to lead hazard control and renovation work because they disturb known or presumed lead-based paint. For example, window replacement can be performed as part of a home renovation, but also could be done as an abatement project to address lead hazards. Whether a project is a renovation or lead hazard control often depends on the intent of the work. Lead hazard control jobs are intended to reduce or eliminate a specific lead hazard(s), while renovation work is not, even though it may coincidentally address lead hazards.

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	On-site paint removal
New wall installation	Enclosure

B. Dust Containing Lead

It does not take much leaded dust to create a hazard. Almost any activity that involves disturbing a lead-containing surface will increase the amount of microscopic leaded dust in the surrounding environment, and may create a lead dust hazard when the dust settles on horizontal surfaces

To understand how easily a lead dust hazard can be created when 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/cm² of lead in it (the lowest lead concentration covered by EPA and HUD regulation) and if the dust is spread out over a 100 square foot area (the size of a 10 foot by 10 foot room), there will be about 9,300 µg/ft² of leaded dust present, which is over 200 times greater than the allowable level. HUD does not permit more than 40 µg/ft² of leaded dust to be left on

floors following lead hazard control work in HUD-assisted housing. 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 the lead will vaporize. These small particles (fumes) are extremely dangerous because they can be inhaled and rapidly absorbed into the body. When these particles settle, they increase the amount of lead dust in the work area. 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 (see Figure 4.2).

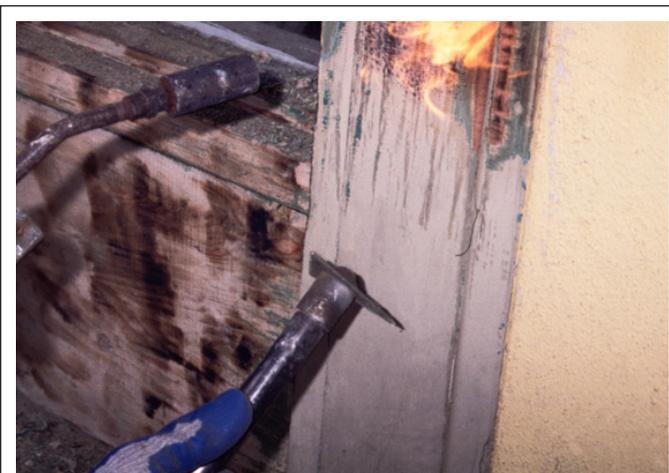


FIGURE 4.2 Torching and burning old paint is a prohibited work practice that can generate lead fumes.

D. Paint Chips

Metal brushing, dry scraping, or water blasting any lead-containing surface creates many poisonous chips that will contaminate the floor, window sills and troughs, and/or the ground, where they are accessible to children. These methods should not be used except in limited circumstances with appropriate controls (see Chapters 11 and 12). Waste and debris from a renovation should be handled properly (see Chapter 10).

E. Exposed Surfaces

Wooden 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 repainting, they can cause lead poisoning if dust is generated, or if they are touched, mouthed, or chewed by small children. Repainting should always be completed before children are allowed back into the area.

F. Soil

For many years automobile gasoline exhaust contained lead that was deposited onto soil (Mielke, 2011). In 1973, 1985 and 1996, EPA issued standards that cut and then completed the phase-out of lead in gasoline (see the EPA press releases linked from <http://www.epa.gov/aboutepa/history/topics/lead/02.html>). Also, paint chips from previous paint scraping jobs and normal weathering of paint can contaminate the top few inches of soil around older dwellings. Excavation, landscaping, concrete flatwork, and re-grading that disturb lead-contaminated soil 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. Coordinating Renovation and Lead Hazard Control

Coordinating lead hazard control 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 a number of years with considerable success and cost savings. Subpart J of HUD's Lead Safe Housing Rule requires evaluation and lead hazard control by qualified workers in properties constructed before 1978 as a condition of Federal rehabilitation assistance; the type of evaluation and control measures depend on the amount of assistance per housing unit (see Appendix 6). State and local governments have conducted lead hazard controls during restoration of privately-owned housing with the assistance from HUD's Lead Hazard Control Programs. As a result, a significant number of housing units have been treated with interim controls or abated.

A. Phasing projects

One way of coordinating lead hazard control and renovation is phasing. To do a project in phases, determine which parts of the job will disturb lead-based paint or produce contaminated dust, and which parts will not do so, such as work that is done after the lead-disturbing parts of the project are complete. A firm certified under EPA's (or an EPA-authorized state's or tribe's) RRP Rule must be used for performing paint-disturbing work unless the paint has been tested and found not to be lead-based paint. As noted above, if the work is abatement, only a firm certified by EPA (or an EPA-authorized state or tribe) can perform lead abatement activities. Once the lead disturbing work is complete and the area is cleared for reoccupancy, then the remainder of the job can be performed using traditional methods. In many cases, this means that the lead hazard control phase of the work will be completed before traditional renovation work during the initial demolition phase of the project. In other cases, a more complicated phasing process is necessary where abatement activities alternate with traditional construction work.

All cuts or penetrations into surfaces with lead-based paint (or paint that is presumed to be 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 certified RRP firm should do the cutting and cleaning. Alternatively, the plumber could do this work if appropriately certified.

Separate contractors are not always necessary when combining renovation and lead hazard control work. If the project does not involve abatement, all work could be completed by a renovation contractor certified by EPA (or the state), but where abatement is involved, the project would likely require both EPA certified abatement and renovation contractors. Chapter 3 contains additional information on how to plan lead-based paint abatement projects.

B. Concurrent renovation and lead hazard control

As seen in Table 4.1, Similarities between Lead Hazard Control and Renovation, above, many activities conducted for lead hazard control are the same as those conducted for renovations in general in pre-1978 housing, with addition of lead safety measures. As a result, planning for renovations for purposes other than lead safety, such as weatherization or rearrangements of rooms, may be done concurrently with lead hazard control work.

Window replacement done for the purpose of lead hazard control is abatement, but when a window is replaced as part of a renovation project (a project not designed to address lead hazards), it is an example how a renovation project can also reduce lead hazards. Common findings in risk assessments are old windows having deteriorated lead-based paint and high levels of leaded dust on window sills and window troughs. When the intent is renovation, a firm certified under EPA's (or a state's) RRP Rule prepares the work area for dust containment, removes the old window, disposes of it properly, and conducts cleaning and cleaning verification. The new window can then be installed in the traditional fashion as long as no other surfaces with lead-based paint will need to be disturbed during installation. See Chapter 11 for additional examples and discussion.

IV. Safe Renovation Procedures for Pre-1978 Homes

There are certain practices that are required as part of the standard operating procedure of most renovation or remodeling project in pre-1978 housing. These practices also apply to most pre-1978 child-occupied facilities. (See Appendix 6 for discussion of the exceptions.)

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

- ◆ Resident protection (see Chapter 8).
- ◆ Worker protection (see Chapter 9).
- ◆ Proper management of waste (see Chapter 10).
- ◆ Lead-safe work practices (see Chapter 11).
- ◆ Final cleaning techniques (see Chapter 14).
- ◆ Final clearance (see Chapter 15).

These are discussed in sequence in the following sections:

A. Pre-Work Planning

Renovation projects in pre-1978 housing should be planned in a manner that considers existing lead hazards and lead hazards that could be created by the renovation if the work is not done properly.

Testing can be done for paint, dust, and soil to determine if its lead content exceeds applicable standards. The tests can define the building components that can be handled in a traditional way and the building components that must be treated using lead-safe work practices. Field testing methods for lead in paint (paint testing) include portable X-ray fluorescence (XRF) lead paint analyzer, laboratory analysis of paint chips, or chemical test kits. For characterizing paint in federally-owned or -assisted housing, HUD requires use of an XRF or paint testing (paint chip sampling by a certified LBP inspector or risk assessor followed by analysis by an EPA-recognized paint lead laboratory), or presumption that lead-based paint is present.

Planning should also include decisions on how the project will be determined to be completed and the residents allowed to reoccupy the work area. The two main approaches for all but the smallest interior projects are cleaning verification and clearance. EPA permits the use of some spot tests kits

for certain characterizations of paint to be disturbed during RRP projects as part of its cleaning verification method. See EPA's website www.epa.gov/lead for information on the Agency's research activities on spot test kits, and on their use under the RRP Rule.

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

Exterior projects are determined to be completed based on visual inspection of the work area for the absence dust and debris.

B. Occupant Protection

1. Education

Residents who are not educated about the dangers of lead poisoning may revisit the home unexpectedly and compromise the containment measures, 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 must include in their general requirements when dealing with lead-based paint.

Before starting any renovation job in a home built before 1978, affected entities the owner and resident(s) must be informed of the dangers of lead-based paint. Similarly, before starting any renovation job in a child-occupied facility built before 1978, the property owner or facility owner, and the parents and guardians of children using the child-occupied facility must be informed of the dangers of lead-based paint.

Specifically, an EPA regulation requires contractors who perform renovation, repairs, and painting jobs in pre-1978 housing and child-occupied facilities, before beginning work, to provide housing owners and tenants, owners of child-care facilities, adult representatives of child care facilities, and the parents or guardians of children under age six who use the child-care facilities with a copy of the EPA lead hazard information pamphlet *Renovate Right* or *Remodelar Correctamente*. The electronic version of the pamphlet, in English and Spanish, is available on the EPA's and HUD's websites. (EPA, 2011) See Appendix 6 for more information.

2. Containment

EPA's RRP rule requires work area containment, as does HUD's LSHR for federally-assisted projects. For interior projects containment must be adequate to contain and prevent the spread of dust and debris beyond the work area. The following containment is required for interior projects:

- ◆ Post signs defining the work area
- ◆ Remove or cover all objects from/in the work area.
- ◆ Close and cover all ducts in the work area.
- ◆ Close all windows, and cover all doors in the work area.

- ◆ Cover the floor surface of the work area with plastic sheeting a minimum of 6 feet in all directions from where paint is disturbed.

For exterior projects, EPA’s RRP rule requires containment be adequate to prevent dust and debris from leaving the work area; HUD’s LSHR incorporates this requirement for federally-assisted projects. The following containment is required for exterior projects:

- ◆ Close all doors and windows within 20 feet of the renovation.
- ◆ Cover doors within the work area used for access with plastic sheeting in a manner that allows workers to pass through while confining dust and debris to the work area.
- ◆ Cover the ground with plastic sheeting extending 10 feet beyond the perimeter of surfaces undergoing renovation or a sufficient distance to collect falling paint debris.
- ◆ In certain situations, the renovation firm must take extra precautions in containing the work area to ensure that dust and debris from the renovation does not contaminate other buildings or other areas of the property or migrate to adjacent properties.

3. Relocation

One of the safest ways to prevent lead poisoning is temporary 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 (see Figure 4.4). Occupants should not return to the work area until cleanup and final painting or finishing have been completed and clearance has been achieved, or cleaning verification performed on renovations where clearance is not otherwise required prior to reoccupancy. For small jobs, relocation may not be necessary. For federally-assisted renovations, relocation is required for longer and more extensive projects. See Chapter 8 for further discussion of relocation techniques, and Appendix 6 for regulatory information.



FIGURE 4.3 This worksite was not properly prepared for lead-disturbing work by removing the occupant’s belongings.



FIGURE 4.4 HEPA vacuuming is an important step in the specialized cleaning process.

C. Worker protection

Project planning must cover worker protection, whether the work is to be done by the property owner's or manager's staff or by outside contractors. The workers' employer is responsible for ensuring that workers doing the work are doing so in a safe and healthful manner. See Chapter 9 and Appendix 6 for further information.

The property owner or manager should include a requirement in staff standard operating procedures and in renovation contracts that OSHA (and other applicable) worker protection requirements are implemented.

D. Waste Disposal

EPA's RRP rule requires the following waste disposal requirements, as does HUD's LSHR for federally-assisted projects:

- ◆ Waste from renovation activities must be contained to prevent releases of dust and debris. If a chute is used to remove waste from the work area, it must be covered.
- ◆ Waste that has been collected from renovation activities must be contained.
- ◆ When transporting waste the firm must contain waste and prevent release of dust and debris.
- ◆ Note: The disposal of household waste is generally exempt from EPA regulation, but such waste should be carefully managed and disposed of in accordance with the recommendations in Chapter 10.

E. Cleaning Techniques

EPA's RRP rule requires the following cleaning procedure:

- ◆ Pick up paint chips and debris.
- ◆ Remove all protective sheeting.
- ◆ Clean all objects and surfaces in and around the work area.
 - Clean walls with a HEPA-equipped vacuum or with a damp cloth.
 - HEPA vacuum all remaining surfaces and objects in the work area.
 - Wipe all remaining surfaces in the work area with a damp cloth.
 - Mop uncarpeted floors.

To be most effective, vacuums should be used in combination with wet cleaning with detergents and clean rinse. The cleaning process starts with a vacuuming, followed by wet cleaning and a final vacuuming. Research on methods for removing lead-contaminated dust from wood surfaces found that vacuuming and wet wiping, the traditional method, was somewhat more effective than two newer (electrostatic dry cloth, and wet Swiffer-brand mop) methods (Lewis, 2012). The wipe product industry continues to develop products; future cloths may have higher dust reduction efficiencies. See Chapter 14 for more details about cleaning techniques.

F. Clearance Testing

If work is being done in federally assisted pre-1978 housing, dust wipe clearance testing is required instead of cleaning verification. Clearance testing may also be required under the renovation contract. When clearance testing is used, the area is ready for reoccupancy only after visual inspection of the project and laboratory analysis of dust wipe samples show that no lead hazards remain. See Chapter 15 and Appendix 6.

V. Prohibited Activities

Many traditional methods of preparing a painted surface for repainting, refinishing, or re-staining are prohibited if the old paint contains lead, since these methods are known to poison both children and workers. Chapter 11 discusses safe ways of removing lead-based paint.

Methods of paint removal prohibited by EPA's RRP and abatement regulations:

- ◆ Open-flame burning or torching of painted surfaces.
- ◆ The use of machines (such as abrasive blasters and sandblasters) designed to remove paint or other surface coatings is prohibited unless the machine has a shroud or containment systems and is equipped with a HEPA vacuum attachment to collect dust and debris at the point of generation.
- ◆ Operating a heat gun on painted surfaces above 1,100 degrees Fahrenheit.

Additional methods of paint removal prohibited by HUD's Lead Safe Housing Rule:

- ◆ Manual dry sanding (except within 1 foot of electrical outlets).
- ◆ Heat guns that char paint.
- ◆ Paint stripping in a poorly ventilated space when using a volatile stripper.

OSHA's Lead in Construction standard prohibits the use of compressed air to remove lead from any surface unless used in conjunction with a ventilation system designed to capture the airborne dust created by the compressed air.

These *Guidelines* recommend strongly against the use of uncontained hydroblasting. Removal of paint using this method can spread paint chips, dust, and debris beyond the work area containment. Contained pressure washing can be done within a protective enclosure to prevent the spread of paint chips, dust, and debris. Water runoff should also be contained (see Chapter 8). (See Chapters 11 and 12).

VI. Housing Receiving Federal Rehabilitation Assistance

The HUD Lead Safe Housing Rule established procedures for federally funded rehabilitation activities (24 CFR Part 35, Subpart J; <http://www.hud.gov/offices/lead/enforcement/lshr.cfm>). Additional information on lead-safe rehabilitation is available in the training curriculum, "Making It Work: Implementing the Lead Safe Housing Rule in CPD-Funded Programs" on HUD's website at: http://www.hud.gov/offices/lead/training/training_curricula.cfm (see Modules 3 and 4). Contractors are not always familiar with the funding source of their projects. It is important for all parties involved to become familiar with

the funding source in order to ensure proper lead-based paint regulatory compliance. Multiple laws and regulations can apply, and not all have the same requirements. In general, where there are overlapping requirements, the most protective apply.

A. Options

When undertaking federally assisted rehabilitation, the property owner may either presume that all painted surfaces are coated with lead-based paint or arrange for paint testing of surfaces to be disturbed during rehabilitation by a licensed lead-based paint inspector or risk assessor using either XRF instrumentation or by a licensed lead-based paint inspector or risk assessor submitting paint samples to an NLLAP-recognized laboratory, as noted above. **HUD does not allow certified renovators to perform paint testing on surfaces to be disturbed to meet the paint testing or presumption requirement for a federally funded rehabilitation project unless they are also certified inspectors or risk assessors (LSHR, at 24 CFR 35.1320(a)).**

B. Notices and Pamphlets

In cases where evaluation or hazard reduction or both are undertaken, the property owner shall provide notices of evaluation and of hazard reduction activity to occupants in accordance with the Lead Safe Housing Rule. The property owner must also provide to each occupied dwelling unit a copy of the EPA lead hazard information pamphlet, [Renovate Right](#) or [Remodelar Correctamente](#), in accordance with HUD's Lead Safe Housing Rule and EPA's Renovation, Repair, and Painting (RRP) Rule.

C. Evaluation and Hazard Reduction Requirements for Rehabilitation Activities covered under the Lead Safe Housing Rule

The requirements for rehabilitation (and the associated level of lead hazard control) depend on the hard costs of the rehabilitation project, as calculated on a per-housing unit basis in accordance with the provisions of Section 35.915, and the amount of Federal assistance per unit. For projects receiving Federal rehabilitation assistance:

- ◆ Using lead-safe work practices is required for projects with hard costs up to \$5,000 per unit;
- ◆ Interim controls, for projects with hard costs above \$5,000 and up to \$25,000 per unit; and
- ◆ Abatement, for projects with hard costs above \$25,000 per unit.

See Appendix 6 for more information on subpart J, Rehabilitation, of HUD's Lead Safe Housing Rule.

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