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An American National Standard

# Standard Practice for Selection of Lead Hazard Reduction Methods for Identified Risks in Residential Housing or Child Occupied Facilities[1]

This standard is issued under the fixed designation E 2252; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This practice describes the selection of lead hazard reduction methods for controlling lead hazard risks identified during risk assessments of residential dwellings and child occupied facilities.

1.2 The values stated in SI units are to be regarded as the standard.

1.3 This practice contains notes, which are explanatory and are not part of the mandatory requirements of this standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

[1] This practice is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.23 on Lead Hazards Associated With Buildings.

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## 2. Referenced Documents

2.1 *ASTM Standards:* [2]

E 917 Practice for Measuring Life-Cycle Costs of Buildings and Building Systems
E 1605 Terminology Relating to Abatement of Hazards from Lead-based Paint in Buildings and Related Structures
E 1795 Specification for Non-Reinforced Liquid Coating Encapsulation Products for Leaded Paint in Buildings
E 1796 Guide for Selection and Use of Liquid Coating Encapsulation Products for Leaded Paint in Buildings
E 1797 Specification for Reinforced Liquid Coating Encapsulation Products for Leaded Paint in Buildings
E 2052 Guide for Identification and Management of Lead Hazards in Facilities
E 2115 Guide for Lead-Hazard Assessments of Residential Housing and Other Properties Frequented by Children
E 2239 Practice for Record Keeping and Record Preservation for Lead Hazard Activities

2.2 *HUD:*[3]

Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing—_
24 CFR Part 35 Requirements for Notification, Evaluation and Reduction of Lead-Based Paint Hazards in Federally Owned Residential Property, and Housing Receiving Federal Assistance; Final Rule, September 15, 1999

2.3 *EPA:*[4]

Protect Your Family from Lead in Your Home
40 CFR Part 745, Subpart L, Lead-Based Paint Activities

2.4 *NIBS:*[5]

Lead-Based Paint: Operations and Maintenance Work Practices Manual for Homes and Buildings
Guide Specifications for Reducing Lead-Based Paint Hazards

2.5 *R.S. Means:*[6]

Building Construction Cost Data

## 3. Terminology

3.1 ~~*Definition of Term Specific to This Practice*:~~

~~3.2 *lead hazard activities*, *n*—procedures, measures, and actions including abatement, clearance, control, inspection, maintenance, management, quality systems, reduction, and risk assessment pertaining to lead hazards in buildings.~~

3.3 *Definitions*—For definitions of terms used in this practice refer to Terminology E 1605.

## 4. Significance and Use

4.1 This practice outlines lead hazard reduction methods that have been shown to be effective in preventing lead poisoning in children.

4.2 This practice tabulates advantages, disadvantages, and relative costs of the reduction methods to assist professionals such as certified lead risk assessors, supervisors, or project designers in selecting appropriate cost-effective options for controlling lead hazards identified during a lead risk assessment. Different control methods may be equally effective in controlling a given lead hazard and, consequently, the selection of a specific control method may depend on the needs and economic constraints of the client or building owner.

4.3 This practice is intended to complement other lead hazard activities that are performed in accordance with regulations promulgated by authorities having jurisdiction. For example, in some jurisdictions, a lead hazard risk assessment, by regulation, consists of a visual assessment, a hazard assessment including environmental monitoring for lead, and selection of lead hazard reduction methods.

4.4 This practice is intended to assist homeowners, owners and occupants of rental property, lenders, insurers, and others who have interest in selecting options for controlling hazards associated with leaded paint, dust, or soil.

4.5 This practice complements Practice E 2115. Information and data gathered in accordance with Practice E 2115 and this practice are used in preparing a risk assessment report. Subsequent lead hazards are mitigated through implementation of controls selected in accordance with this present practice.

4.6 This practice addresses the most commonly used lead hazard reduction methods. It is left to users of this practice to identify the advantages, disadvantages, and relative costs associated with emerging control technologies for comparison with these characteristics of established lead hazard control methods.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards*, ~~Vol 04.11.~~ volume information, refer to the standard's Document Summary page on the ASTM website.

~~*Annual Book*~~

[3] U.S. Department of ~~ASTM Standards, Vol 04.12.~~ Housing and Urban Development, Washington DC 20140, Current Edition. http://www.hud.gov/offices/lead/

~~[4] U.S. Department of Housing and Urban Development, Washington, DC 20140, Current Edition. http://www.hud.gov/offices/lead/~~

[4] Environmental Protection Agency, Washington DC, 1999. http://www.epa.gov/

~~[5] Environmental Protection Agency, Washington, DC, 1999. http://www.epa.gov/~~

[5] National Institute of Building Sciences, Washington DC May 1995. http://www.nibs.org/

~~[6] National Institute of Building Sciences, Washington DC, May 1995. http://www.nibs.org/~~

[6] 1998. http://www.rsmeans.com/

4.7 This practice does not address specific historic preservation requirements. The interim control and abatement methods in this practice will work in any structure; however, historic preservation regulations promulgated by authorities having jurisdiction may impose specific interim control or abatement methods.

## 5. Training and Experience Requirements

5.1 Selection of appropriate lead hazard reduction methods performed in response to risk assessments shall be carried out by a risk assessor, supervisor, or project designer as required under regulations promulgated by authorities having jurisdiction. Users of lead hazard control services should review the credentials and experience of the risk assessor, supervisor, or project designer under regulations promulgated by authorities having jurisdiction to determine whether the lead professional is qualified to conduct the work.

5.1.1 Refer to Guide E 2052 and to regulations promulgated by authorities having jurisdiction (see Appendix X1) regarding training and experience of risk assessors, supervisors and project designers.

5.2 The selection of lead hazard reduction methods shall take into consideration the qualifications and experience of persons such as contractors or in-house maintenance personnel who will implement the selected procedures. These persons should be trained regarding the hazards of lead and the proper use of lead hazard reduction methods as required through certification or licensure promulgated by authorities having jurisdiction.

5.2.1 Refer to Guide E 2052 and to regulations promulgated by authorities having jurisdiction (see Appendix X1) for additional information regarding training and experience for workers and supervisors, and for information regarding work practice standards and interim controls.

## 6. Lead Hazard Reduction Methods

6.1 *General*—There are two approaches to reducing lead hazards: interim control and abatement. Most often, a combination of the two approaches will be utilized to maximize the effectiveness of hazard management balanced with the cost.

6.2 *Occupant and Owner Education*—All lead hazard reduction strategies shall include a component on occupant and owner education of lead hazards. In addition, the individual responsible for the lead hazard reduction shall inform owners that, when a property has been identified as containing lead hazards or lead-based paint, they shall disclose this information upon the sale, lease, or rental of the property.

NOTE 1—A document considered to be universally informative for occupant and owner education is the EPA/HUD/CPSC pamphlet entitled *Protect Your Family from Lead in Your Home*. It is available in English and Spanish.

6.2.1 Refer to Guide E 2052 for elements of an occupant education program.

## 7. Interim Controls

7.1 Interim controls are designed to reduce the exposure to lead through relatively low cost procedures that require on-going maintenance. They are almost always an option in every lead hazard reduction situation; however, if interim controls cannot control a lead hazard, abatement (see Section 8) will be the only option. The main question that the owner needs to answer is: Are resources, staff, equipment, budget, and willingness to manage an interim lead hazard control program available over the long term.

7.2 The following are key elements of interim controls:

NOTE 2—Refer to Sections 8 and 9 of Guide E 2052 for developing interim controls.

7.2.1 Educate occupants and owners regarding lead hazards (see 6.2).

7.2.2 Train maintenance personnel concerning the proper maintenance, cleaning, and surface protection requirements to maintain a safe lead-hazard-free environment (see 5.2).

7.2.3 Conduct periodic visual inspections of coated surfaces by qualified personnel to assess paint integrity.

7.2.4 Develop a work permit system to ensure that both in-house personnel and contractors are made aware of surfaces containing lead-based paint.

7.2.5 Perform proper clearance procedures for each interim control treatment.

7.2.6 Perform record keeping of all interim control actions, including but not limited to notification, inspections, actions, and clearance.

7.2.7 Use safe work practices to protect the occupant, workers, and environment while performing interim control actions.

7.2.8 Perform all work with properly trained and certified personnel in accordance regulations promulgated by authorities having jurisdiction.

7.3 The following are standard practices of interim control that may be selected for lead-based paint, lead in dust and lead in soil. Table 1 lists the advantages and disadvantages of using interim controls. See also 24 CFR Part 35.

7.3.1 *Paint Stabilization*—Repair of deteriorated paint through coating repair methods (for example, application of paints, stains, varnishes, shellacs, lacquers, and other coatings). This process is called paint stabilization. Paint stabilization means repairing any physical defect in the substrate of a painted surface that is causing paint deterioration, removing loose paint and other material from the surface to be treated, and applying a new protective coating or paint.

7.3.2 *Smooth and Cleanable Horizontal Surfaces*—All horizontal surfaces that are rough, pitted, or porous shall be covered with a smooth, cleanable covering or coating, such as metal coil stock, plastic, polyurethane, or linoleum.

**TABLE 1 Advantages and Disadvantages of using Interim Controls**

| Advantages | Disadvantages |
|---|---|
| Generally a quick process to repair hazards. | Lead-based paint still remains. |
| Uses commercially available products. | Requires periodic inspections to ensure that interim control practice remains intact. |
| Cost effective in the short term. | May not be a long term cost-effective solution. |
| Products and labor generally lower in cost. | Will not work on severely damaged substrates. |
| Re-occupancy is quicker, and often residents can remain in structure during process. | In most cases, requires that workers take the Lead Safe Work Practice Course. |
| Training is easier and generally does not require certification. | Not appropriate in high wear areas where deterioration will likely recur. |
| | Repairs may create lead contaminated dust which requires containment and thorough cleanup. |

7.3.3 *Correcting Dust-generating Conditions*—Conditions causing friction or impact of painted surfaces shall be corrected. This may be performed by rehanging doors or planing doors so that doors do not rub against door frames, installing window channel guides that reduce or eliminate abrasion of painted surfaces, or by protecting paint on stair treads and/or floors with a durable covering such as carpeting, tile, or sheet flooring. In the case of impact surfaces, include treatments that eliminate impact with the painted surface, such as door stops.

7.3.4 *Bare Residential Soil*—Interim control options for lead in soil include mulching, seeding, sodding, planting obtrusive shrubbery, and fencing or barricading the area from entry by individuals. The important factor is to determine the best approach for eliminating lead exposure to humans from bare soil areas. It is critical to ensure that bare soil and the subsequent treatment is not subject to erosion.

7.4 Documentation for all interim control actions shall be maintained by the owner or owner's designee.

## 8. Abatement

8.1 Abatement is any measure or set of measures designed to permanently eliminate lead-based paint hazards. Abatement includes:

8.1.1 Removal of lead-based paint and lead-containing dust,

8.1.2 Application of an encapsulant or installation of a permanent enclosure

8.1.3 Replacement of surfaces or fixtures coated with lead-based paint, and

8.1.4 Removal or covering of lead-contaminated soil.

8.2 *Lead-Based Paint*—There are four general methods for abatement of lead-based paint hazards: encapsulation, enclosure, replacement and (paint) removal. If encapsulation, or enclosure, or both are used as a hazard reduction option, the lead-based paint remains in place. In these cases, the encapsulated or enclosed areas shall be periodically inspected as part of the lead hazard control program. An overview of the advantages and disadvantages of typical abatement methods for lead-based paint are contained within the tables listed below and discussed in the paragraphs that follow:



8.2.1 *Encapsulation* (see Table 2). Encapsulation is the application of a covering or coating that acts as a barrier between the lead-based paint and the environment. Guidance for selection and use of encapsulants is given in Guide E 1796. Preliminary testing of the lead-based paint and substrate shall be performed by the individual responsible for the lead hazard reduction program to ensure that the encapsulant will adhere to the surface and that the existing paint or substrate will not fail and cause exposure to lead-based paint. Care must be taken to ensure that the surface is prepared according to the encapsulation material manufacturer's specification.

8.2.1.1 The individual responsible for recommending the encapsulant shall document its location(s) and arrange for its periodic inspection. This periodic inspection shall include checking the substrates where the encapsulant has been applied.

8.2.1.2 Apply encapsulants in accordance with the manufacture's requirements and/or in accordance with regulations promulgated by authorities having jurisdiction.

**TABLE 2 Advantages and Disadvantages of Abatement by Encapsulation**

| Advantages | Disadvantages |
|---|---|
| ~~The process is generally quick and easy.~~ | ~~Encapsulants cannot be applied on friction surfaces (for example, window tracks and door jambs).~~ |
| ~~Abatement contractors require little additional training for application.~~ | ~~They do not permanently remove the lead; They only cover the hazard.~~ |
| ~~The amount of hazardous waste generated is minimal.~~ | ~~They generally cannot be applied during adverse environmental conditions (temperature, humidity, wind, etc).~~ |
| ~~Only a limited amount of capital equipment is required.~~ | ~~Their long-term effectiveness is unknown and under study by HUD.~~ |
| ~~Worker protection requirements are minimal (for example, half-face respirators are generally required during surface preparation).~~ | ~~Bonding of encapsulants to lead surface is sometimes poor.~~ |
| ~~A wide variety of encapsulants are available for interior or exterior application, or both.~~ | ~~Pilot testing of encapsulant on the given substrate is often required.~~ |
| ~~Often no additional finish work is required.~~ | ~~Periodic monitoring is required after installation (for damage, cuts, etc.).~~ |
| ~~Encapsulants can be applied to almost any substrate type and material with proper surface preparation.~~ | ~~Waste generated during installation is generally considered hazardous.~~ |
| ~~Encapsulation works well on hard-to-reach areas. The method generates the lowest levels of airborne lead dust during abatement.~~ | |
| The process is generally quick and easy. | Encapsulants cannot be applied on friction surfaces (for example, window tracks and door jambs). |
| Abatement contractors require little additional training for application. | They do not permanently remove the lead; They only cover the hazard. |
| The amount of hazardous waste generated is minimal. | They generally cannot be applied during adverse environmental conditions (temperature, humidity, wind, etc). |
| Only a limited amount of capital equipment is required. | Their long-term effectiveness is unknown and under study by HUD. |
| Worker protection requirements are minimal (for example, half-face respirators are generally required during surface preparation). | Bonding of encapsulants to lead surface is sometimes poor. |
| A wide variety of encapsulants are available for interior or exterior application, or both. | Pilot testing of encapsulant on the given substrate is often required. |
| Often no additional finish work is required. | Periodic monitoring is required after installation (for damage, cuts, and so forth). |
| Encapsulants can be applied to almost any substrate type and material with proper surface preparation. | Waste generated during installation is generally considered hazardous. |
| Encapsulation works well on hard-to-reach areas. The method generates the lowest levels of airborne lead dust during abatement. | |

8.2.1.3 Use only encapsulants for which the manufacturer provides a 20-year warranty.

8.2.1.4 Since the lead-based paint remains, care must be taken to prevent damage to the encapsulant that results in exposure of the underlying paint.

8.2.1.5 *Encapsulation of Surfaces without Reinforcement* —Encapsulants without reinforcements are easy to apply and may immediately improve the aesthetic appeal of the substrate (and housing unit). Only apply non-reinforced encapsulants that are in conformance with Specification E 1795. In applying non-reinforced encapsulants, it is important to repair surface imperfections such as cracks, holes, and chips.

8.2.1.6 *Encapsulation of Surfaces with Reinforcement* —Encapsulation of surfaces can also be performed using a reinforcement system. This reinforcement is typically a fiberglass mesh that is mechanically fastened to the substrate. The encapsulant is then applied over the mesh in several applications until the mesh detail disappears. Only apply reinforced encapsulants that are in conformance with Specification E 1797. This method does not require repair of hairline cracks and small holes prior to the application of the system.

8.2.2 *Enclosure* (see Table 3). An enclosure is a rigid, durable, construction material that is mechanically fastened to a substrate to act as a barrier between the lead hazard and the environment. The construction of an enclosure requires a sealing of all edges to ensure that lead dust is not released into the environment. In addition, adhesives and mechanical fasteners are generally used throughout the enclosure system to prevent a “billowing” effect. The use of enclosures may require the use of additional trim, particularly at baseboards, windows and doors. The following apply to typical enclosure systems.

8.2.2.1 The individual responsible for recommending the enclosure shall document its location(s) and arrange for its periodic inspection.

8.2.2.2 Construct the enclosure in accordance with the manufacture’s requirements and/or in accordance with regulations promulgated by authorities having jurisdiction.

8.2.2.3 Since the lead hazard remains, care must be taken to prevent the unauthorized removal of the enclosure system.

8.2.2.4 *Enclosure with Gypsum Board*—Gypsum board is a common enclosure material used on interior walls and ceilings. Mechanical fasteners (that is, nails or screws) in conjunction with adhesives are required to ensure that a secure, long-lasting

**TABLE 3 Advantages and Disadvantages of Abatement by Enclosure**

| Advantages | Disadvantages |
|---|---|
| Enclosures may enhance the overall appearance of room/unit. | Lead is not removed. |
| They normally generate little hazardous waste during installation. | Their installation requires carpentry and finishing skills; they may also require the extension of electrical and other fixtures from original surfaces. |
| Enclosure materials are readily available. | Sealing of the enclosure is critical and must be carefully examined. |
| Enclosure installation generally does not create large amounts of leaded dust. | There is a potential for buckling and bellowing if not properly installed. |
| Their installation may provide additional thermal insulation. | They can be difficult to install in some instances due to surface irregularities and poor integrity of the existing substrate. They may also conceal rotting wood. |
| They work particularly well on large, flat surfaces such as ceilings, floors, and walls. | Enclosures are uniformly more expensive than encapsulating, (but they may be more durable than encapsulation). |
| Installation is not necessarily weather dependent | Their long term effectiveness is still under study. |
| | Enclosures are typically not accepted on historical structures. |
| | Some waste generated during installation may be hazardous. |
| | Future renovations can result in exposure to surfaces with lead-based paint and create lead-based paint hazards. It is important to label surfaces that have lead-based paint before they are enclosed. |

**TABLE 4 Advantages and Disadvantages of Abatement by Component Replacement**

| Advantages | Disadvantages |
|---|---|
| Component replacement results in new, clean substrates and generally improves the quality of a unit. | Component replacement should not generally be used if architectural significance is required. (See 4.7.) |
| The method completely eliminates the lead hazard for the replaced component. | Costs for replacement of like-type components can be high. |
| New components (for example, windows) may result in energy savings. | Installation requires skilled tradespeople. |
| Component replacement can be used for almost all substrates. | Depending upon hazardous waste characterization analyses, components may require disposal as hazardous wastes.[A] |
| Overall, this is one of the best long-term and most widely applicable abatement methods. | When trim removal reveals an opening, large amounts of dust can be released. |

[A] Pending legislation may permit the disposal of components in a Construction and Demolition (C&D) Landfill. This may lessen disposal costs and make this method more attractive from a cost standpoint. However, States may vary their approach to this regulation and the user is cautioned to verify disposal requirements with State and local jurisdictions where the work is performed.

enclosure is obtained. If gypsum board is used on the exterior of the structure, it must be rated for such application.

8.2.2.5 *Enclosure with Paneling*—Enclosure with paneling generally involves using pre-finished plywood or fiberboard paneling that is attached with mechanical fasteners and bonded to the existing surface or framing by the application of an adhesive.

8.2.2.6 *Enclosure with Sheet Metal, Vinyl, Wood, or Similar Materials*—Enclosure systems of aluminum, vinyl, and wood are available prefabricated, or are fabricated on site. Typical uses include siding, soffits, fascias, window systems, and doorframes. In certain instances, some surface preparation must be undertaken to prevent deteriorated paint from being released from the edges of the enclosure systems. Sometimes, this can be accomplished by applying a synthetic fabric membrane to the substrate. Some window manufacturers have retrofit packages whereby sheet metal is wrapped around the existing window case and a new window is placed into the window opening. Sheet metal (or vinyl) can also be fitted on window impact surfaces on the sill/stool, if these are the only areas that contain lead-based paint. It is important to caulk or seal all seams between the window surfaces and the enclosure, and to ensure tight fits. However, when replacing window systems or parts of window systems, the potential for high leaded dust levels may exist.

8.2.3 *Component Replacement* (see Table 4). This method, which has excellent aesthetic potential, provides for elimination of the lead-based paint. When performed properly, it has minimal risk for lead exposure. Paint applied to replaced components shall not contain greater than 0.06 % lead (by mass).

8.2.4 *Removal by Chemical Strippers* (see Table 5). Chemical removal can be one of the more effective means of permanently removing lead from a variety of substrate types. Painted substrates that are chemically stripped must be washed, and neutralized if a caustic stripper is used, before applying a priming or sealing coat. Chemical removal can be performed at the job site or at off site locations. For off-site chemical stripping, the component(s) are taken to a facility that specializes in removing coatings from components. This is typically performed by “dipping” the component in a tub or vat of the chemical stripper. A drawback of this

**TABLE 5 Advantages and Disadvantages of Removal by Chemical Strippers**

| Advantages | Disadvantages |
|---|---|
| Chemical strippers are effective on a wide variety of substrate types. | Use is labor-intensive and requires time for compounds to react. |
| Lead is removed permanently (except that lead embedded in the substrate may remain). | Strippers do not work well at low temperatures. |
| Application is not difficult and training is moderate. | Use can be messy and clean up extensive; care must be taken to contain the caustic strippers and accompanying neutralizing agents. |
| Various products are readily available. | Use may cause lead to migrate into the substrate. |
| Strippers leave the substrate visually clean when used properly. | Worker protection against stripper exposure is important; eye and dermal protection is mandatory. |
| | Strippers do not work well on plaster or gypsum board substrates. |
| | Waste generated is usually considered hazardous. |
| | There is large potential for damage to materials and components adjacent to those being stripped. |
| | Use may require several applications to be completely effective. |
| | Stripper application can damage substrates if not used properly by experienced personnel. |
| | Cost is consistently higher than the costs of removing lead-based paint by hand-scraping or replacement methods. |
| | On wood surfaces the grain may be raised by the chemical stripper or by the cleaning agent. The surface would have to be sanded, potentially raising lead dust, before it can be repainted. |

**TABLE 6 Advantages and Disadvantages of Removal by Mechanical Abrasion**

| Advantages | Disadvantages |
|---|---|
| Removal by mechanical abrasion leaves substrates clean and in good condition when performed on a flat surface. | Mechanical abrasion methods are very labor-intensive. |
| | Large amounts of dust can be generated, requiring worker protection, the use of a High-Efficiency Particulate Air (HEPA) vacuum (or other specialty equipment), and extensive cleanup. |
| | Application is generally limited to flat surfaces. |
| | Abrasion does not work well on many materials, such as plaster, glass, and gypsum board. |
| | Abrasion is difficult to use in awkward areas (overhead, corners, or other detailed areas). |

process is that the chemical stripper may act on glue joints, if present, and re-gluing may be necessary. One advantage of using the off-site chemical stripping process is that the stripping vendor performs the handling and disposal of any hazardous waste generated.

8.2.4.1 Chemical strippers containing methylene chloride shall not be used because methylene chloride is a suspected carcinogen.

8.2.5 *Removal by Mechanical Abrasion* (see Table 6). Mechanical abrasion generally involves sanding or grinding using abrasive disks and, consequently, requires that the substrate surface be flat, and large enough for the mechanical abrasion device to fit flush. This method is generally not recommended, because it generates a large amount of potentially hazardous dust and is very slow, even under ideal conditions. All mechanical abrasion devices shall be attached to High-Efficiency Particulate Air (HEPA) vacuum equipment.

8.2.6 *Removal by Hand-Scraping after Softening with a Heat Gun* (see Table 7). Heat guns are hand held devices that direct heat onto a painted surface that is, thus, softened. The heat gun operator scraps the softened paint from the surface. The heat gun generally works better on wood than on metal and masonry substrates. The temperature of the heat gun shall be limited to less than 600°C (1,100°F) to prevent excessive fumes containing lead from being liberated.

8.2.7 *Removal by Vacuum Blasting and Needle Guns*—The use of vacuum blasting and needleguns has had limited use for removal of lead-based paint in housing. The use of this specialized equipment requires a large capital outlay. It is recommended that work involving the use of these methodologies be contracted to firms with experience in their use.

8.3 *Soil Abatement*—In the case of soil, abatement generally requires the removal of soil, or the permanent covering of it with such products like asphalt or concrete.

**TABLE 7 Advantages and Disadvantages of Removal by Hand-Scraping after Softening with a Heat Gun**

| Advantages | Disadvantages |
|---|---|
| Experienced workers can do quick and effective, lead-based paint removal using scrapping after heat-gun softening. | The method is very labor-intensive for those with little or no experience. |
| The method can be used on a variety of surfaces. | It creates large amounts of airborne leaded dust and fumes (more than any other abatement method) and it requires strict worker protection in almost all cases. |
| Most of the lead is removed permanently. | |
| Extensive worker training is not required. | Paint residue is hazardous. |
| Equipment is inexpensive and readily available. | The method is generally ineffective on masonry surfaces or on cold metal surfaces. |
| The method is less expensive than replacing windows or doors when only minor interior or exterior surfaces require abatement. | Caution needs to be exercised to prevent over-heating of the substrate that could cause a fire. |
| | The method is more expensive than replacement for most substrates, except windows, and about the same cost for replacement of baseboards, window sills, and exterior door frames. |

8.4 *Emerging Technologies*—There are also emerging technologies in lead abatement that should be considered by the risk assessor and designer. It must be emphasized that the use of any method, either existing or emerging will have advantages and disadvantages. It is the responsibility of the risk assessor or designer to review all the options and then select the most effective control option based on his/her constraints. While for the most part, the following (Section 9) Lead Hazard Reduction Control Strategies should work in most cases and are generally the most effective; the lead hazard control manager should keep abreast of emerging technologies. However, before performing an abatement involving new technology, the lead hazard control manager should research previous applications of the technology, and perform a pilot abatement demonstration before full-scale use.

## 9. Selecting Lead Hazard Reduction Strategies

9.1 For each item or set of items identified as a lead hazard, lead hazard reduction methods shall be determined using a systematic approach consisting of seven general tasks. These tasks are discussed in a step-by-step progression as follows:

Task 1 Review Available Risk Assessment and Lead Inspection Data.
Task 2 Prepare a Constraints List.
Task 3 Identify All Potential Lead Hazard Reduction Options.
Task 4 Select Appropriate Lead Hazard Reduction Options Based on Economic and Other Constraints.
Task 5 Select Appropriate Lead Hazard Reduction Options Based on Practical Considerations.
Task 6 Review Appropriate Lead Hazard Reduction Selections for Shared Attributes.
Task 7 Prepare and Issue a Report.

9.2 Tasks 1–6 are described in 9.3-9.8. Task 7 is discussed in 10.2.

9.3 *Task 1—Review Available Risk Assessment and Lead Inspection Data*. Perform a review of the information that was collected in identifying the lead hazards and order the items from highest to lowest priority. When selecting lead hazard reduction options, the highest priority and greatest allocation of available resources shall be applied to those items, which have the highest lead hazard risk. The highest priority is the protection from lead exposure to children under the age of six, and to women of childbearing age. Actions that protect the greatest numbers of the potentially affected population should also be considered as a high priority.

9.4 *Task 2—Prepare a Constraints List*. Prepare a list of items that are likely to be constraints to selecting and implementing lead hazard controls. Table 8 is intended to assist the user of this standard in asking questions regarding possible constraints. Table 8 is not an exhaustive list of constraints; others may arise for a particular project.

9.5 *Task 3—Identify All Potential Lead Hazard Reduction Options*. For each item, or set of items, identified as a potential or existing lead hazard, select appropriate lead hazard reduction options. At this stage of selection, include all options that can be used to control the lead hazard (suited to the components and substrates involved) while weighing the advantages and disadvantages of each (see Tables 1-7). At this stage of consideration, ignore any cost and practical considerations.

9.6 *Task 4—Select Appropriate Lead Hazard Reduction Options Based on Economic and Other Constraints*:

9.6.1 From the list of lead hazard reduction options identified in Task 3, select those which are potentially more economical as based on estimated materials, installation costs, available project funding and life-cycle cost analysis. Consult Practice E 917 for assistance in determining life cycle cost analysis.

9.6.1.1 Table 9 illustrates approximate relative cost ranges of various lead abatement methods.

9.6.1.2 Table 10 illustrates approximate relative cost ranges of interim control methods.

9.6.2 Remove from consideration any lead hazard reduction option that is not possible due to limits in funding.

**TABLE 8 Practical Constraints to Consider in Selecting a Lead Hazard Control Method**

*Skill Level*—What degree of skill is necessary to employ a method?

*Aesthetics*—How will component/substrate look after employing the method?

*Applicability*—How well suited is the method to the component/substrate?

*Lead Presence*—Will the hazard continue to exist after employing the method?

*Hazardous Waste Generation*—How much hazardous waste is generated by employing the method?

*Weather Limitations*—Is method restricted by weather, and what are the restrictive factors?

*Friction Surfaces*—Can the method be utilized on friction surfaces, for example, sash guides, floors, and door jambs?

*Speed of Methodology*—How quickly can the method be implemented?

*Training Required*—How extensive is the training required to employ the method?

*Capital Required*—How much of expenditure is necessary to employ the method?

*Energy Savings*—What is the effect of the control method on the building's energy consumption?

*Worker Protection Required*—How much dust will be generated and what degree of worker protection is needed to employ the method?

*Finish Work Required*—How much finish work is needed after employing the method?

*Product Availability*—How conveniently accessible is the product to employ?

*Durability*—How lasting is the method?

*Labor Intensive*—What degree of effort is required to employ the method?

*Overall Safety*—Can the method be safely employed?

*Surface Preparation*—How much preparation is needed prior to employing the method?

*Historical*—Does a historical designation apply to the structure? If so, contact the State Historical Protection Office (SHPO)

*Maintenance Support*—Are lead trained maintenance personnel available with proper equipment?

*Occupancy*—Is the property occupied?

*Occupant Protection*—What types and duration of occupant protection measures are needed when employing the method?

**TABLE 9 Approximate Cost Ranges of Various Lead Abatement Methods[A]**

| Method | Direct Materials | Direct Labor |
|---|---|---|
| Encapsulation | \$5.90 - \$12.90/ $m^2$ (0.55 - \$1.20/ $ft^2$) | \$15.55- \$37.65/ $m^2$ (\$1.35 - \$3.50/ $ft^2$) |
| Enclosure | \$7.00 - \$21.50/ $m^2$ (\$.65 - \$2.00/ $ft^2$) | \$12.90 - \$73.15/ $m^2$ (\$1.20 - \$6.80/ $ft^2$) |
| Chemical Removal | \$17.75 - \$61.85/ $m^2$ (\$1.65 - \$5.75/ $ft^2$) | \$30.15 - \$83.95/$m^2$ (\$2.80 - \$7.80/ $ft^2$) |
| Hand-Scraping Removal | \$2.70 - \$53.80/ $m^2$ (\$.25 - \$5.00/ $ft^2$) | \$8.60 - \$301.30/ $m^2$ (\$0.80 - \$28.00/ $ft^2$) |
| Replacement Trim | \$53.80 - \$139.90/ $m^2$ (\$5.00 - \$13.00/ $ft^2$) | \$26.90 - \$37.65/ $m^2$ (\$2.50 - \$3.50/ $ft^2$) |
| Replacement Windows | \$92.00 - \$325.00/ window | \$26.00 - \$118.00/ window |
| Replacement Doors (interior) | \$40.00 - \$200.00/ door | \$25.00 - \$88.50/ door |
| Replacement Doors (exterior) | \$90.00 - \$400.00/ door | \$32.00 - \$88.50/ door |
| Soil Removal | \$383.25 -\$448.64/ $m^3$ (\$293.00 - \$343.00/ $yd^3$) | \$1.65 - \$2.30/ $m^3$ (\$1.25 - \$1.75/ $yd^3$) |

[A] 1998 dollars, Source—Means and E06.23 member data, rounded to nearest \$0.05. This table is intended to provide the user of this Standard Practice relative costs of lead hazard control methods. The user is responsible for providing correct cost estimates that provide local labor and other direct cost estimates.

9.6.3 It is important to review the costs of managing an interim control program for lead-based paint versus the cost of removing the lead-based paint.

9.7 *Task 5—Select Appropriate Lead Hazard Reduction Methods Based on Practical Constraints*:

9.7.1 From one list of lead hazard reduction options prepared on the basis of economic considerations, select those options that are most appropriate when evaluated in relation to the list of practical constraints given in Table 8. In addition, consider the advantages and disadvantages of the various lead hazard reduction options given in Tables 1-7.

9.7.2 Remove from consideration, any lead hazard reduction methods that are not at all possible due to constraints.

9.8 *Task 6—Select the Appropriate Lead Hazard Reduction Option*:

9.8.1 After executing Tasks 4 and 5, consider the remaining lead hazard reduction options with respect to their use for the specific abatement project.

9.8.2 Select the options of choice on the basis of their appropriate alternatives for the project.

9.8.3 If two or more options are found to be appropriate, select the most cost effective.

**TABLE 10 Approximate Cost Ranges of Interim Control Methods[A]**

| Interior Item | Unit Cost | |
|---|---|---|
| | Low | High |
| Surface Preparation/Dust Removal | $1.10/ $m^2$ ($0.10/ $ft^2$) | $13.45/ $m^2$ ($1.25/ $ft^2$) |
| Paint Stabilization | $1.60/ $m^2$ ($0.15/ $ft^2$) | $13.45/ $m^2$ ($1.25/ $ft^2$) |
| Friction/Impact Surface Treatment | $41.95/ $m^2$ ($3.90/ $ft^2$) | $61.85/ $m^2$ ($5.75/ $ft^2$) |
| **Exterior Item** | **Unit Cost** | |
| | Low | High |
| Surface Preparation/Dust Removal | $3.75/ $m^2$ ($0.35/ $ft^2$) | $31.75/ $m^2$ ($2.95/ $ft^2$) |
| Paint Stabilization | $2.15/ $m^2$ ($0.20/ $ft^2$) | $43.05/ $m^2$ ($4.00/ $ft^2$) |
| Friction/Impact Surface Treatment | $41.95/ $m^2$ ($3.90/ $ft^2$) | $61.85/ $m^2$ ($5.75/ $ft^2$) |
| Bare Soil Treatment | $0.55/ $m^2$ ($0.05/ $ft^2$) | $4.30/ $m^2$ ($0.40/ $ft^2$) |

[A] 1998 dollars, Source—Means and E06.23 member data, rounded to nearest $0.05. This table is intended to provide the user of this Standard Practice relative costs of lead hazard control methods. The user is responsible for providing correct cost estimates that provide local labor and other direct cost estimates.

## 10. Reporting (Task 7)

10.1 The report describing the selection process for the lead hazard control methods shall be prepared in accordance with federal, state and local regulations.

10.2 As a minimum, the following information shall be included in a dated report describing the selection of the lead hazard reduction methods for the project:

10.2.1 Project or client name, name and address of owner, and mailing addresses of the client or owner or both.

10.2.2 A description of the project, including location or address.

10.2.3 Name of risk assessor or project designer making the selection of the lead hazard control methods, a summary of this individual's credentials, including certifications and training, and the name and address of the firm employing this individual.

10.2.4 A listing of all lead hazards along with recommendations for all potential lead hazard reduction options for each, as identified in Task 3.

10.2.5 A listing of estimated cost options for each recommended lead hazard control reduction strategy.

10.2.6 A listing of the selected options for each lead hazard including a discussion of the constraints and assumptions used to make the selections as identified in Task 2.

10.2.7 For selected interim control options, the following shall also be included.

10.2.7.1 A listing of the required procedures for repair (if damage occurs), and periodic inspections.

10.2.7.2 A listing of the training requirements for individuals responsible for maintenance, repair, and inspection of the interim controls.

10.2.8 For selected abatement options, the following shall also be included:

10.2.8.1 A listing of the requirements for periodic inspections, if any.

10.2.8.2 A listing of the training requirements for individuals responsible for conducting abatement activities and for periodic inspection of the abatement options.

## 11. Record Keeping

11.1 All records shall be preserved in accordance with Practice E 2239.

11.2 As a minimum, the following information shall be preserved as a record of the lead hazard reduction selection process.

11.2.1 The report,

11.2.2 Notes and data assembled during the selection processes that are not included in the report, and

11.2.3 All correspondence with the client, or owner, or both.

## 12. Keywords

12.1 abatement; building; lead; lead hazard control; risk assessment

## APPENDIX

### X1. DOCUMENTS THAT ADDRESS SELECTION OF LEAD HAZARD REDUCTION METHODS FOR IDENTIFIED RISKS IN RESIDENTIAL HOUSING OR CHILD OCCUPIED FACILITIES

X1.1 This Appendix lists documents that provide information that assists practitioners such as certified lead risk assessors, supervisors, or project designers in selecting appropriate cost-effective options for controlling lead hazards identified during a lead risk assessment.

X1.1.1 The information in these documents complements the requirements given in this Practice and, in some cases, makes reference to lead hazard reduction regulations that are promulgated by authorities having jurisdiction.

**X1.2 Listing of Documents The documents listed in this Appendix are pertinent to:**

X1.2.1 *Training*:

X1.2.1.1 24 CFR Part 35: Requirements for Notification, Evaluation and Reduction of Lead-Based Paint Hazards in Federally Owned Residential Property, and Housing Receiving Federal Assistance.

X1.2.1.2 40 CFR 745.226: Lead-Based Paint Activities.

X1.2.1.3 40 CFR 745.227: Lead-Based Paint Activities.

X1.2.2 *Interim Control Methods*:

X1.2.2.1 HUD Guidelines: *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing*

X1.2.2.2

X1.2.3 *Abatement Methods*:

X1.2.3.1 HUD Guidelines: *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing*

X1.2.3.2 NIBS Guidelines: *Lead-Based Paint: Operations and Maintenance Work Practices Manual for Homes and Buildings*

X1.2.4 *Owner Notification of Lead Hazards*:

X1.2.4.1 EPA Pamphlet: *Protect Your Family from Lead in Your Home*

X1.2.5 *Historic Preservation*:

X1.2.5.1 24 CFR Part 35, 115 (a)(13): Requirements for Notification, Evaluation and Reduction of Lead-Based Paint Hazards in Federally Owned Residential Property, and Housing Receiving Federal Assistance.

X1.2.5.2 U.S State Historic Preservation Officer (SHPO) Documents; contact at http://www.sso.org/ncshpo/shpolist.htm.