Lead Risk Assessor Training Handout Booklet

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LEAD-BASED PAINT HANDOUTS

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1. **Determine scope.** Determine if the client is requesting a risk assessment, a lead-based paint inspection, or a combination of the two. Reach an agreement on costs and scope of effort. If the cause of a child having an elevated blood lead level is being investigated, use the protocol in Chapter 16 and coordinate with the local health agency. If the dwelling is in good condition (as defined by Form 5.1 in this chapter), a lead hazard screen may be conducted to determine if a full risk assessment is needed. If a previous risk assessment has been conducted, determine if the owner is requesting a reevaluation or a risk assessment. (If the housing is receiving HUD assistance, determine if the previous risk assessment is still current (i.e., conducted within the past 12 months) or has expired.) In all other cases, conduct a full risk assessment, a lead-based paint inspection, or a combination of the two. Neither air nor water samples are part of routine lead-based paint risk assessments or lead hazard screens.

2. **Interview residents and/or owners.** For individual residences, interview residents about use patterns of young children (if any) and the family. For multi-family rental properties, the risk assessor asks the owner (or owner's agent) to submit information on the type and condition of the buildings to the risk assessor on forms provided by the risk assessor, or the risk assessor completes forms based on an interview of the owner (or owner's agent).

3. **Survey building condition.** Perform a brief building condition survey to identify any major deficiencies that may affect the success of lead hazard controls and/or to determine whether a lead hazard screen may be an acceptable alternative to a full risk assessment.

4. **Determine whether units will be sampled and, if so, select units.** Visual assessments and environmental sampling should be conducted in *each* dwelling if assessing individual dwelling units, fewer than five rental units, or multiple rental units where the units are not similar. If there are five or more similar dwellings, select the targeted, worst-case or randomly selected dwellings for sampling using the criteria in this chapter (see Section III.B and table 5.9) and then evaluation.

5. **Conduct visual assessment.** Perform a visual assessment of the building and paint condition, using the forms and protocols in this chapter, and select dust sampling and paint testing locations based on use patterns and visual observations. Also identify bare soil in play areas and other parts of the yard and select locations for soil sampling.

6. **Conduct dust sampling.**

    - In individual dwelling units, dust samples are typically collected in the entryway (if the dwelling unit has direct access to the outdoors) and at least four living areas where children under age 6 are most likely to come into contact with dust (such as the kitchen, the children's principal playroom, and children's bedrooms). One floor sample and one interior window sill sample (if a window is present) should be collected in each of the rooms or areas selected for dust sampling in dwelling units. Collect a floor sample at the entryway with immediate access to the outdoors.

- In multi-family properties, dust samples are also collected from the common areas, including main entryway, stairways and hallways, and other common areas frequented by a young child. In each selected common-area room or space, a floor sample should be collected and an interior window sill sample should be collected as well if there is a frequently used window present.
- Submit dust samples to a laboratory recognized for the analysis of lead in dust by the U.S. Environmental Protection Agency (EPA) through the National Lead Laboratory Accreditation Program (NLLAP) (***http://www.epa.gov/lead/pubs/nllap.htm***) (See Appendix 6).

7. **Conduct soil sampling.** Collect a composite soil sample from bare soil in each of the three following area types: (a) each play area with bare soil, (b) non-play areas in the dripline/foundation area, and (c) non-play areas in the rest of the yard, (including gardens). Collect one composite sample from each distinguishable play area with bare soil, up to at least the number of sampled recommended in Section II.G of this chapter. Select the play areas used by young children, i.e., those under 6 years old. For non-play areas, collect a composite sample from bare soil (if present) in both the dripline/foundation area and the rest of the yard, following guidance in Section II.G. If the total surface area of bare spots in non-play areas is no more than 1 square yard (9 sq. ft.) for each property, the risk assessor may conclude that a lead-based paint hazard does not exist in non-play areas, and soil samples are not necessary (unless the soil sampling is required by State or local regulations). Bare soil of any size in play areas should always be sampled. Submit samples to an laboratory recognized by NLLAP for analysis of lead in soil.

8. **Conduct paint testing as needed**. Conduct testing of deteriorated paint and intact paint on friction surfaces. Lead in deteriorated paint can be measured with a portable x-ray fluorescence (XRF) analyzer if there is a large enough flat surface with all layers present. If not, it is necessary to collect a paint sample by collecting all layers of paint (not just the peeling layers) and to submit the sample to a laboratory recognized by NLLAP for analysis of lead in paint.

9. **Sample tap water (optional).** At the client's request, collect optional water samples to evaluate lead exposures that can be corrected by the owner (leaded service lines, fixtures). Water sampling is not recommended for routine risk assessments of lead-based paint hazards, since drinking water hazards are outside the scope of lead-based paint hazards and EPA has another program in this area. EPA has a protocol, including specific sample collection procedures and when to collect the samples, which should be followed; see Section II.H.) If a lead-contaminated water problem exists beyond the owner's service line, the local water supplier should be notified.

10. **Interpret the laboratory results.** Interpret the results of the environmental testing in accordance with applicable regulations. (See Section V.A.)

11. **Analyze data and discuss with client.** Integrate the laboratory results with the visual assessment results, any XRF measurements, and other maintenance and management data to determine the presence or absence of lead-based paint hazards, as defined under applicable statutes or regulations.

12. **Prepare report.** Prepare a report listing any hazards identified and acceptable control measures, including interim control and abatement options.

13. **Discuss** all the various safe and effective lead hazard control options, and provide recommendations, for specific lead hazards with the owner. If the risk assessment is being conducted in anticipation of an abatement, rehabilitation, renovation, repair or other project to be conducted, discuss how lead safety, including addressing the lead-based paint hazards identified in the risk assessment report, should be integrated into the project design and execution. (See chapters 10 through 15.)

I. Introduction

This chapter describes a procedure, known as a risk assessment, for determining the existence, nature, severity and location of lead-based paint hazards in or on a residential property and for reporting the findings of the assessment and the options for controlling or abating the hazards that are found. A risk assessment may be conducted in any residential property, regardless of occupancy. However, in the case of an environmental investigation of the home of a child with an elevated blood-lead level (EBL), the standard risk assessment described in this chapter should be supplemented with additional questions and activities. Please refer to Chapter 16 for guidance on additional information to be collected during an EBL investigation.

Activities that are required by EPA or HUD regulations are identified in this chapter as being "required" or as actions that "must" be done. Activities that are not required by EPA or HUD regulations but are recommended by these *Guidelines* are identified as being "recommended" or as actions that "should" be done. Note that there may be State, Tribal or local laws and regulations that have to be followed, especially if they are more stringent or protective than the federal requirements. Activities that may be done at the discretion of the owner or manager are identified as "optional."

A. Evaluation Options

While most of this chapter is devoted to risk assessment protocols, this section offers owners, planners, and risk assessors guidance on choosing the most appropriate evaluation method for specific housing situations. Except where regulations specifically require a risk assessment or a lead-based paint inspection, there are no simple rules for choosing an evaluation method.

A property owner has a choice of the following evaluation options, except where regulations limit or determine the choice:

1. A risk assessment, which identifies lead-based paint *hazards*, as defined by EPA regulations.
2. A lead hazard screen (for properties in good physical condition).
3. A lead-based paint inspection, which identifies all lead-based paint, whether hazardous or not.
4. A combination risk assessment/paint inspection, which provides complete information on lead-based paint and lead-based paint hazards.
5. Testing of selected paint surfaces that may be lead-based paint hazards or that may be disturbed by repainting or other maintenance, renovation or rehabilitation activity.
6. Presumption; no hazard evaluation is performed. Proceed directly to control of presumed hazards, e.g., presume all deteriorated paint is a lead-based paint hazard.
7. Investigation of a home with an EBL child.

Table 5.1 provides an overview comparing these evaluation options.

Table 5.1 Comparison of Risk Assessment, Lead Hazard Screen, Lead-Based Paint Inspection, and Combination Inspection/Risk Assessment.

Analysis, Content, or Use	Risk Assessment	Lead Hazard Screen	Lead-Based Paint Inspection	Combination Inspection/ Risk Assessment
Paint	Deteriorated paint and intact paint on friction and impact surfaces only*	Deteriorated paint only	Surface-by-surface (all paint surfaces, including deteriorated paint)	Surface-by-surface (all paint surfaces, including deteriorated paint)
Dust	Yes	Yes	No	Yes
Soil	Yes	No	No	Yes
Water	Optional	No	No	Optional
Air	No	No	No	No
Maintenance status	Optional	No	No	Optional
Management plan	Optional	No	No	Optional
Status of any current child lead-poisoning cases	If information is available	If information is available	No	If information is available
Review of previous paint testing	Yes	Yes	Yes	Yes
Typical applications	1. Interim controls 2. Building nearing the end of expected life 3. Sale of property or turnover 4. Insurance (documentation of lead-safe status) 5. Remodeling and Repainting 6. Lead Safe Housing Rule compliance	Post-1960 housing in good condition for which a risk assessment is required or recommended	1. Abatement 2. Renovation work 3. Weatherization 4. Sale of property or turnover	Renovation work
Final Report	Location of lead-based paint hazards and options for acceptable hazard control methods, or certification that no lead-based paint hazards were found.	Probable existence of lead-based paint hazards (based on more stringent standards used for screen), or the absence of lead-based paint hazards.	Lead concentrations for each painted building component or certification that no lead-based paint was found.	Combination of risk assessment and inspection report content.

* For pre-rehabilitation risk assessments in housing not receiving HUD rehabilitation assistance, assess the paint to be disturbed. If the target housing is receiving HUD rehabilitation assistance up to $5,000 per unit, conduct paint testing of the paint to be disturbed. If the assistance is over $5,000 per unit, conduct a risk assessment of the entire property.

1. Risk Assessment

Risk assessments are on-site investigations to determine the existence, nature, severity, and location of lead-based paint hazards accompanied by a report explaining the results and options for reducing lead-based paint hazards (40 CFR 745.227(d)(11)) (see Appendix 6). A lead-based paint hazard is any condition that causes exposure to lead from dust-lead hazards, soil-lead hazards, or lead-based paint that is deteriorated, or present in chewable surfaces, friction surfaces, or impact surfaces that would result in adverse human health effects. Risk assessments can be performed only by risk assessors certified or licensed by EPA or an EPA-authorized State, Tribe or Territory.

A risk assessment report must cover the following, at a minimum:

- Identification of the existence, nature, severity, source, and location of lead-based paint hazards, including soil and dust hazards as well as paint (or documentation that no such hazards have been identified).
- Description of the options for controlling lead hazards in the event that hazards are found, including interim controls and abatement measures.

In addition, a risk assessor may provide other information, such as:

- Suggestions on how to keep in a non-hazardous condition lead-based paint that will remain in a dwelling after present hazards are corrected.
- Recommended changes to the management and maintenance systems. By considering all hazards and examining resident and owner practices, a risk assessor can determine appropriate ways to control hazards and modify management practices so that the chance of hazards recurring is reduced.
- If the housing is HUD-assisted, that HUD considers a risk assessment of the housing to be valid for 12 months (see 24 CFR 35.165(b)(1)).

These and other practices are described in this chapter.

2. Lead Hazard Screen

A second type of lead-based paint evaluation is the lead hazard screen. This evaluation method identifies lead-based paint hazards; it also identifies other potential lead hazards. It is an abbreviated form of evaluation and generally is available at a lower cost than a full risk assessment. However, this method should be used only in dwellings in good condition where the probability of finding lead-based paint hazards is low. A screen employs limited sampling (soil sampling is usually not conducted) and, as a trade-off, more sensitive hazard identification criteria. The protocol for a lead hazard screen is described later in this chapter. If a screen indicates that lead hazards may be present, the owner should have a full risk assessment performed. All lead hazard screens must be performed by risk assessors certified or licensed by EPA or an EPA-authorized state, tribe, or territory. If an owner is being charged travel time by the risk assessor, the lead

hazard screen may not be cost-effective if the property condition or date of construction indicates a full risk assessment is likely to have to be performed ultimately.

A lead hazard screen is likely to be less costly than a full risk assessment in housing in good condition built after 1960. As shown in Table 5.2, only 11 percent of the U.S. housing built between 1960 and 1977 is estimated to have "significant" lead-based paint hazards (any dust, soil and paint lead hazard, except deteriorated lead-based paint in amounts less than the "de minimis" amount described in Section II.D.3, below). This is compared to 39 percent for housing built in the period 1940-1959 and 67 percent for units built before 1940. It should be noted, however, that these statistics are based on the EPA dust-lead hazard standards of 40 μg/ft² for floors and 250 μg/ft² for interior window sills as of the publication of this edition of these *Guidelines*. The dust-lead standards are approximately *one-half* these values for a lead hazard screen (a more stringent evaluation criteria to act as a "negative screen"). Therefore, the probability that a home from the 1960-1977 period will be positive with a screen (i.e., that it will "fail" the screen) is greater than 11 percent. For example, while about 2.0% of housing units in this period have floor dust-lead hazards, i.e., lead levels of at least 40 μg/ft², about 2.4%, a higher percentage, would fail the lower floor dust-lead screen criterion of lead levels of at least 25 μg/ft². (HUD, 2011, based on table 6-4.) Similarly, for housing of all years, while about 4.9% of housing has floor dust-lead hazards, about 6.5%, also a higher percentage, would fail the floor dust-lead screen criterion. (HUD, 2011, based on table 6-2). The impact of the more stringent screen standards on screen failure rates may be small if the housing is in good condition.

Lead hazard screens should not be used in buildings in poor condition, since a full risk assessment will usually be needed. This is especially true of structures built before 1960. A suggested decision-making process to determine whether the lead hazard screen option is appropriate is outlined in Figure 5.1.

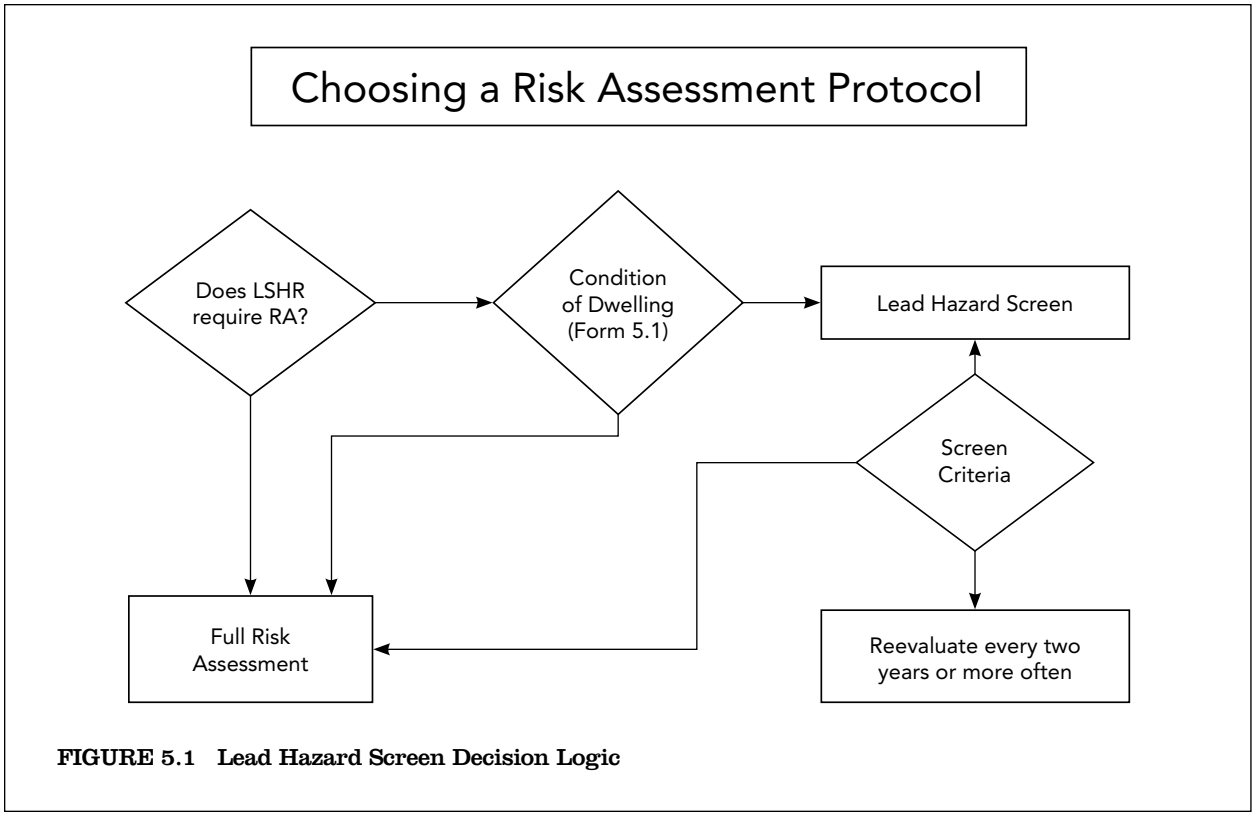


FIGURE 5.1 Lead Hazard Screen Decision Logic

3. Lead-Based Paint Inspection

Lead-based paint inspections measure the concentration of lead in paint on a surface-by-surface basis. Inspection results enable the owner to manage *all* lead-based paint, since the exact locations of the lead-based paint have been identified. A lead-based paint inspection (covered in Chapter 7) must be performed by a lead-based paint inspector certified or licensed by EPA or an EPA-authorized state, tribe or Territory. In many states, a certified risk assessor is also qualified to perform a lead-based paint inspection. (Note that the paint testing described below in Section I.A.5 is a technique involving only a limited number of surfaces for use in planning maintenance or similar projects, and is not a comprehensive lead-based paint inspection.)

A lead-based paint inspection identifies only the presence of lead-based paint; it does not determine whether the paint presents an immediate hazard. Also, the collection of dust and soil samples is not part of a lead-based paint inspection. Thus, if a risk assessment is not performed along with the paint inspection, a full determination of the location and nature of all lead-based paint hazards (including dust and soil hazards) cannot be made.

Without data about hazards, a lead-based paint inspector cannot offer guidance on lead hazard control, including appropriate lead hazard control measures. A lead-based paint inspector does not necessarily have the training to identify all hazard control options, while a risk assessor does.

Nevertheless, a lead-based paint inspection is the preferred evaluation method when an owner has decided to abate all lead-based paint. Because abatement activities can be costly, it is usually cost effective to complete a lead-based paint inspection before using resources to abate presumed hazards. Inspections are also appropriate when extensive renovation that is about to occur will disturb painted surfaces. An owner may also choose to have a lead-based paint inspection performed to obtain a regulatory exemption that would apply if the property is found to have no lead-based paint. Table 5.1 provides a summary comparison of evaluation methods.

4. Combination Risk Assessment and Lead-Based Paint Inspection

It is sometimes advisable to conduct *both* a lead-based paint inspection and a risk assessment. Both inspection and risk assessment may be required by regulation. By combining measurements of dust and soil with surface-by-surface paint analysis, and by collecting maintenance and management data, lead-based paint hazards can be identified and addressed in a comprehensive fashion, employing the best mix of interim control and abatement strategies. If a lead-based paint inspection has been completed before the start of a risk assessment, the risk assessor will often be able to reduce the time spent on the assessment, yet offer much more comprehensive advice. However, the risk assessor should ensure that the paint inspection was conducted properly before relying on its results. The evaluation of previously conducted paint testing is discussed later in this chapter, in Section II.F.1.

5. Selective Testing

a. **Paint Testing.** Testing the paint of only certain surfaces for lead is often used before rehabilitation or other renovation or maintenance activities. If only certain paint surfaces are to be disturbed, it may make sense to test them in order to know whether the paint is lead-based paint and thus whether full lead-safe work practices are needed during the work. Paint testing is allowed by the Lead Safe Housing Rule before rehabilitation or other

renovation or maintenance activities in HUD-assisted target housing (see Appendix 6). If only certain paint surfaces are to be disturbed, those surfaces can be tested in order to know whether the paint is lead-based paint and thus whether lead-safe work practices are needed during the work.

b. **Taking Additional Samples.** A risk assessor, in order to provide the client with some additional useful information, may want to test a few more paint surfaces or take a few more soil samples in the course of a risk assessment than are normally required. This is especially appropriate if the client is a family with very young children. For example, EPA regulations do not require that chewable surfaces be tested unless there is evidence of teeth marks, but the parents may want to know which chewable surfaces have lead-based paint, if any, so they can temporarily cover such surfaces with vinyl or heavy plastic. Similarly, with regard to soil, if there is a possibility of lead contamination, as in old urban neighborhoods, a young family may want soil to be tested even if it is currently not bare. (See Table 5.2 for information on how prevalent soil-lead hazards are.) Then they can protect against future exposure if hazardous levels of lead are present.

Table 5.2 Percentage of Housing Units with Significant Lead-Based Paint Hazards, and Percentage with Bare Soil Lead Levels in Yard ≥ 1200 ppm, United States, 2005-2006*.

Hazard	Year of Construction			
	1978-2005	1960-1977	1940-1959	Before 1940
Significant Lead-Based Paint Hazards *	3%	11%	39%	67%
Bare Soil in Yard Equal to or Exceeding 1,200 ppm **	0.3%	0.3%	4%	14%

Source: HUD, 2011. See also Jacobs, 2002, for which the construction-year percentages for a similar survey conducted in 1998-1999 were 3% (for 1978-1998), 8%, 43%, and 68%, respectively, for significant hazards, and 0% (for 1978-1998), 0%, 14% and 19% for bare soil ≥ 1200 ppm.

** A "significant" lead-based paint hazard is any paint-lead, dust-lead or soil-lead hazard above* de minimis *levels in HUD's Lead Safe Housing Rule (24 CFR 35.1320(b)(2)(ii)(B) or 35.1350(d), as applicable).*

*** Measured when total amount of bare soil in yard exceeded 9 square feet.*

6. Bypassing Evaluation, and the Option to Presume

These *Guidelines* generally discourage owners from skipping the evaluation process. However, property owners have the option of not conducting a risk assessment or other evaluation and, instead, presuming that all painted surfaces are coated with lead-based paint and all possible lead hazards exist in the unit, including hazardous paint, dust and soil. If the presumption option is taken, the owner should conduct all work that disturbs paint (and soil, if applicable) using lead-safe work practices above the de minimis amounts as described in Chapter 8 and obtain a

clearance examination. Some owners may be required by the HUD Lead Safe Housing Rule, or by state, tribal or local regulation, to control or abate all presumed hazards (i.e., all deteriorated paint and all bare soil). If the owner presumes the presence of lead-based paint and lead-based paint hazards, where interim controls are required, the owner should perform the standard set of interim control treatments ("standard treatments") in the unit. Standard treatments require treatment of all possible lead hazards associated with the unit, including soil. Chapter 6 describes procedures for lead-safe maintenance that can be performed without an evaluation.

Important factors in deciding whether to evaluate or presume are typically based on which option is likely to be safest and most cost-effective. This calculation depends to a large extent on the probability of lead-based paint or lead-based paint hazards being present in a given property. The lower the probability of lead, the more likely it is that evaluation will be more cost-effective than presumption, because the costs of hazard control and/or lead-safe work practices are likely to be much lower if the evaluation finds few lead hazards than they would be if all surfaces, dust or soil were presumed to be lead-based, or have dust-lead hazards or soil lead hazards, respectively. If, as a result of a complete lead-based paint inspection, it is determined that there is no lead-based paint on the property, it is exempt from the HUD Lead Safe Housing Rule, the HUD-EPA Lead-Based Paint Disclosure Rule, the EPA Pre-Renovation Education (PRE) Rule, and the EPA Renovation, Repair, and Painting (RRP) Rule, (and, potentially, state, tribal or local regulations). On the other hand, if the likelihood of lead is high, the owner may calculate that it would be less expensive to presume its presence, and proceed on that basis when interim controls, abatement, renovation or maintenance are being conducted.

The likelihood of lead-based paint hazards or lead-based paint (whether hazardous or not) being present in a dwelling is closely associated with the age of the structure. Only 8 percent of housing units built between 1960 and 1977 in the United States are estimated to have "significant" lead-based paint hazards, compared to 68 percent for units built before 1940 (Table 5.1). Table 5.3 shows that for most building components, the presence of lead-based paint is not likely, especially in housing built after 1960 when lead-based paint was used infrequently. These data are from a national survey conducted primarily in 1999 and may not reflect the presence of lead in paint in a given dwelling or jurisdiction.

Table 5.3 Percentage of Component Types Coated with Lead-Based Paint, by Year of Construction, and by Interior or Exterior Location, United States, 2000.

Component Type	Year of Construction			
	1978-1998	1960-1977	1940-1959	Before 1940
Interior:	(%)	(%)	(%)	(%)
Walls, Floors, Ceilings	0	1	2	7
Windows	1	2	6	21
Doors	0	1	7	22
Trim	0	2	4	15
Other	0	1	2	12
Exterior:				
Walls	0	9	18	34
Windows	0	12	30	41
Doors	2	5	29	33
Trim	3	8	16	24
Porch	1	7	25	28
Other	0	8	37	37

Source: Jacobs, 2002. (Lead-based paint is defined as 1.0 mg/cm² or 5,000 ppm lead, in accordance with the Federal standard.)

B. The Risk Assessment Process

The risk assessor is a trained professional certified by EPA or an EPA-authorized State, Tribe or Territory as being capable of objectively analyzing lead-based paint hazards. Property owners may choose to have a member of their management staff trained and certified to aid in the decision making process, but such an assessor may not be perceived as being able to provide an unbiased evaluation of the property. Therefore, the owner may want to consider contracting with an independent, certified risk assessor to minimize the perception of bias (which might be important in the event of litigation). For similar reasons, the owner may want to consider whether it is prudent to employ the risk assessment firm to perform the actual lead hazard control work, since this would create a conflict of interest by providing an incentive to identify nonexistent lead hazards or to suggest controls that are not necessary or cost effective.

The risk assessment process begins with the collection of information about the property from the owner or resident (if the property is occupied). This information can often be collected by telephone. For individual dwelling units, Form 5.0 (can be found at the end of the chapter) is used and the information includes resident use patterns, such as where young children who are in residence play, both inside and outside. For multiple units in multi-family properties, the information is recorded on Form 5.6 (can be found at the end of the chapter) or a similar form, and it includes details about management and maintenance practices and the occupancy status of buildings. The risk assessor will use this information to make decisions about the location of the limited environmental testing within the dwelling or the property. If the risk assessment involves the evaluation of five or more similar dwellings, the risk assessor will select a limited number for sampling using specific criteria. The risk assessment entails both: 1) a visual assessment of the selected dwelling units and common areas and 2) environmental testing, which includes testing of deteriorated paint and (if needed) other painted surfaces and collection of dust and soil samples. Usually, paint is tested with a portable X-ray fluorescence (XRF) analyzer but sometimes by collecting paint chip samples. The environmental samples are then sent to a laboratory recognized by NLLAP for analysis of lead in paint, dust or soil, as applicable.

When the lab results or XRF measurements are received, the risk assessor reviews and analyzes all data, including visual assessment results, environmental sampling results, and management and maintenance information. The risk assessor then drafts a report identifying lead-based paint hazards and acceptable lead hazard control options. Options should include a spectrum of treatments ranging from interim controls to abatement of all identified lead hazards. The control options should take into account the condition of the property and the location and severity of lead-based paint hazards, based on criteria established in these *Guidelines* and federal or other regulations. The owner must decide which hazard control option is most appropriate for the property and develop a plan to implement that option. To the extent possible, risk assessors should provide a range of options for all cases. EPA has also published information about the risk assessment process in owner-occupied, single-family dwellings (EPA, 1994). EPA regulations on risk assessments can be found at 40 CFR 745.227(d).

C. Limitations of This Risk Assessment Protocol

1. Risk Assessments of Dwellings Housing Children with Elevated Blood Lead Levels

The risk assessment protocol contained in this chapter may not be sufficient for an investigation of a dwelling presently housing a child with an elevated blood lead level (EBL). As of

the publication of these *Guidelines*, HUD regulations, at 24 CFR 35.110, define an "environmental intervention blood lead level" as a confirmed concentration of lead in whole blood equal to or greater than 20 µg/dL for a single test or 15-19 µg/dL in two tests taken at least 3 months apart. This definition is based on guidance from the Centers for Disease Control and Prevention (CDC, 2002, Chapter 2). A more comprehensive investigation of all sources of lead is necessary when there is a child with an EBL, because it is possible that the exposure is unrelated to the residential property (e.g., it may be related to personal property, such as glazed pottery or leaded toys) or that another site is the source of the poisoning. For more information about investigations involving children with EBLs, refer to Chapter 16, consult with state and local health departments and childhood lead poisoning prevention programs, and review the protocols and recommendations issued by the CDC. In particular, because CDC issued recommendations shortly before the publication of this edition of these *Guidelines*, HUD and EPA had not completed their reviews of the implications of the CDC recommendations by the publication date. These *Guidelines* may be revised once these reviews are completed.

2. Assessment of Less Common Sources of Lead Exposure

In order to evaluate the largest number of dwellings in the shortest period of time, these *Guidelines* do not recommend assessing *all* potential sources of lead at each property. Instead, these *Guidelines* recommend assessing the *most likely* sources of lead hazards that are within the control of the property owner. Private risk assessors have an obligation only to investigate those lead exposures that are directly related to the residential property, although other obvious sources should be noted. For example, if it is known that the use of folk remedies containing lead is widespread in a given neighborhood, risk assessors should not try to analyze these remedies but should mention the potential source in their final report. EPA has published information on additional sources of lead and how they should be addressed (EPA, 1994). Additional information on lead in consumer products is available from the Consumer Product Safety Commission's website at: ***www.cpsc.gov***.

Many risk assessors routinely test non-paint items for lead content when they conduct risk assessments. Ceramic tile, and ceramic bath fixtures are sometimes tested because they may be a source of lead exposure during demolition or renovation. Lead-containing ceramic tile or bath fixtures are not a common cause for childhood lead poisoning. However, demolition activities such as breaking or crushing them may release lead. Similarly, some risk assessors test vertical miniblinds because some models have been found to release lead when exposed to sunlight (***http://www.cpsc.gov/CPSCPUB/PREREL/PRHTML96/96150.html***). For this reason, some risk assessors test these items when they conduct pre-rehabilitation risk assessments and reference the OSHA lead in construction standard (29 CFR 1926.62) in their reports (see Appendix 6). Project specifications should require that construction or/demolition contractors comply with the applicable provisions of the OSHA standard when employees have potential lead exposure from any source.

Air sampling is not recommended for routine risk assessments of housing. The levels of airborne lead in a residence are expected to be low unless there is an identifiable lead air emission source nearby. If a source is identified, it should be noted in the final report, but the responsibility for action rests with public agencies. Significant airborne emissions are likely to be reflected in settled dust-lead levels.

Water sampling is also optional for routine risk assessments. If a client is concerned about plumbing within the building and specifically requests water testing, the risk assessor should have the water analyzed or refer the owner to the local water authority, which may conduct such tests at no charge. Information on municipal water quality can be obtained from the EPA Drinking Water Hotline (800-426-4791). (Hearing- or speech-challenged individuals may access this number through TTY by calling the toll-free Federal Relay Service at 800-877-8339.) In communities where water contamination appears to be especially prevalent, EPA requires public water suppliers to evaluate and correct the problem. Additional guidance on water sampling is provided at Section II.H, below.

D. Non-Federal Standards

Standards and procedures described in this chapter are those established by EPA and HUD. Some States, Tribes, and local governments have different requirements. If such a requirement is more stringent or more protective than a federal standard, the local, not the federal, requirement applies. This is true even if the housing is federally assisted. If a local standard is less stringent, the federal standard applies if the housing is federally assisted. Therefore, risk assessors, local program administrators and property owners and managers should become familiar with the lead-based paint requirements of their jurisdictions.

II. Data Collection

The data collection phase of the risk assessment includes the administration of a questionnaire, an assessment of the condition of the building, a visual assessment of the buildings, other structures and common areas on the property being evaluated, and a limited amount of paint, dust, and soil testing. Forms for the questionnaires, condition survey, visual assessment, and on-site testing and sampling are provided at the end of this chapter.

A. Questionnaires

1. Individual Occupied Units (Form 5.0)

Before conducting the visual assessment and environmental testing of individual occupied units, the risk assessor should administer the questionnaire provided at Form 5.0 (or a similar questionnaire) to an owner-occupant or, if the unit is rented, to an adult resident and the owner. If the family includes young children, it is preferable that the resident respondent be a parent or guardian. The purpose of the questionnaire is to obtain information on family use patterns (e.g., where young children, if any, sleep, play and eat; use of entrances and windows; house cleaning; gardening) and recent renovations. This information is used to determine where to collect dust and soil samples. Some of the information may also be useful in educating the owner and residents about risks of possible future lead exposure.

This questionnaire should be administered with all risk assessments of occupied individual units regardless of the type of structure in which the unit is located. If the unit is not occupied, a questionnaire such as Form 5.0 should not be administered. In unoccupied units, the risk assessor decides which rooms to sample based on general assumptions about the probable use patterns of a family with a young child that might live there, as explained below in Section

II.E. Also, this questionnaire is not necessary if a lead hazard screen is performed instead of a full risk assessment.

The risk assessor may administer the questionnaire by telephone or in person. However, before administering it, the risk assessor should prepare a sketch of the floor plan of the unit, with each room named, or obtain such a plan from the owner, and attach it to the questionnaire. This will help clarify room names used in the questionnaire, and will also be used during the risk assessment to document sample locations and other information. Also, a floor plan will be essential during the visual assessment and environmental testing. An explanation of the questions on Form 5.0 accompanies the form at the end of this chapter.

FIGURE 5.2 Risk Assessor interviewing a resident.

2. Multi-family Rental Properties (Form 5.6)

If the risk assessment encompasses five or more rental dwelling units under the same ownership, the questionnaire at Form 5.6 (or a similar questionnaire) should be completed by the owner. Instructions are provided with the form. Generally it is not easy or useful to administer the questionnaire for individual units (Form 5.0) (or a similar questionnaire) to residents in multi-family risk assessments.

B. Floor Plan and Site Plan Sketches

As stated above, the risk assessor should prepare or obtain from the owner a sketch of the floor plan (or equivalent) of each dwelling unit and common area to be visually assessed. Rooms, other spaces and walls should be labeled, and the same designations should be used in Forms 5.2, 5.3, 5.4 and 5.5, or similar forms. Windows and doors should also be shown on the sketch and identified on the forms.

The risk assessor should also prepare or obtain a site plan sketch (or equivalent, such as a plat) showing the approximate outline of the property, buildings, other structures (including fences), driveways, and adjacent streets. The sketch should have an arrow to indicate the direction north. This sketch has the purpose of clarifying locations of exterior deteriorated paint (Form 5.2) and bare soil (Form 5.5) and the locations of testing and sampling of both paint and soil.

C. Building Condition Inspection (Form 5.1)

The risk assessor should conduct a visual assessment of the condition of the building(s) and record all findings on Form 5.1 or a similar form. This has three purposes: (1) meets EPA's requirements (40 CFR 745.227(c) and (d)) that information on the physical characteristics of the dwelling be obtained during lead hazard screen and risk assessment; (2) to assist in determining whether to perform a lead hazard screen; and, (3) to gain insights into possible causes of existing or future paint or substrate deterioration. For example, a roof in disrepair should be noted since moisture could cause paint deterioration. In addition, a poorly maintained building may indicate that an owner is also unlikely to maintain interim controls.

FIGURE 5.3 Record of sampling locations and floor plan sketch.

If the risk assessor believes the likelihood of finding lead-based paint hazards in a property is low and therefore proposes to perform a lead hazard screen instead of a full risk assessment, he or she should document the condition of the building and complete Form 5.1 or similar form. This building condition inspection should be performed before the visual assessment and environmental testing in order to assure that a lead hazard screen is appropriate for the property. If a full risk assessment is to be performed, the risk assessor can conduct the visual assessment of building condition at the same time as the visual assessment.

Form 5.1 lists a selected number of physical problems that indicate structural or water damage. This is not an exhaustive list of possible problems. Most risk assessors could suggest other conditions that may cause paint deterioration and/or indicate poor maintenance practices. It is, however, an adequate list for the purposes of determining whether a building is in good enough condition to make a lead hazard screen appropriate. If two or more of these listed conditions are present and a lead hazard screen is performed, the risk assessor should explain on the form the extenuating circumstances for that property that make a lead hazard screen appropriate. If a full risk assessment is performed, the risk assessor can use the space at the bottom of the form to note additional conditions that he or she thinks could cause lead hazard control problems. Having this information will be useful in preparing recommendations in the final report on acceptable options for controlling lead-based paint hazards and in recommending to the client any additional repairs or changes in maintenance practices that will help protect the dwelling from developing hazards in the future.

D. Visual Assessment

1. Overall Scope and Purpose

The purpose of the visual assessment element of the risk assessment is to locate potential lead-based paint hazards, both exterior and interior. Within a dwelling unit, the visual assessment should be conducted in all rooms. In multi-family buildings, the visual assessment should include examination of common areas adjacent to sampled dwelling units (see Section III.B, below, regarding unit sampling) and other common areas in which one or more children under age 6 are likely to come in contact with dust. The risk assessor should also examine exterior painted surfaces, including fences and outbuildings that are part of the residential property (such as garages, fences and storage sheds) as well as buildings with living spaces. Also, the risk assessor should examine the grounds to identify bare soil. The result should be a complete inventory of the location and approximate size of each instance of:

- Deteriorated paint that may be lead-based paint,
- Friction surfaces coated with paint that may be lead-based paint,
- Impact surfaces coated with paint that may be lead-based paint,
- Chewed surfaces coated with paint that may be lead-based paint,
- Deteriorated substrate conditions, and
- Bare soil.

The risk assessor will use these data, in conjunction with results of the questionnaire, to select locations for dust sampling, paint testing, and soil sampling. Then, in conjunction with the environmental testing results and the building condition inspection, the visual assessment data are used in preparing a report that includes the following information for the property in question:

- The location and approximate size of all paint-lead hazards, including deteriorated lead-based paint, friction-surface hazards, impact-surface hazards, and chewable-surface hazards,
- The specific location of all dust-lead hazards,
- The location and approximate size of all soil-lead hazards,
- Acceptable options for interim control or abatement of each paint-lead, dust-lead, and soil-lead hazard, and whether each option is considered an interim control or abatement in that state,
- Recommendations for ongoing lead-safe maintenance and repairs (optional), and
- Other general educational information (optional).

If a lead-based paint inspection has already been conducted, the risk assessor should review it to determine if the findings are reliable (see Section II.F.1, below, and Chapter 7). If the data are useable, the assessor should focus on the painted surfaces that are known to contain lead-based paint. In dwellings where no inspection has been conducted, any painted surface that has not been replaced after 1977 must be presumed to contain lead-based paint.. However, in properties covered by the Lead Safe Housing Rule, all components, even if they were replaced after 1977, are presumed to contain lead-based paint unless they are tested and the inspection proves they do not contain lead-based paint. Risk assessors should never presume that replacement components do not contain lead-based paint and should test all deteriorated painted surfaces. This practice is very important given the recent popularity of reinstalling salvaged building components.

2. Documentation of Locations

Risk assessors should carefully document the location of each potential hazard in order to accurately and efficiently combine information from the visual assessment with environmental sampling results and thus to be able to evaluate findings, determine acceptable options for hazard control, and clearly describe this information in a report to the client, often without returning to the site. The information in the report should be in a format and level of detail that can be easily used by the client or the client's contractor in preparing a work write-up.

There are several ways to document precise locations, but a floor plan sketch is always recommended. A site plan sketch is necessary if the locations of exterior painted surfaces or bare soil are to be identified. For a small single dwelling unit with few instances of deteriorated paint, the risk assessor may describe the location of each potential hazard on a floor plan sketch and number each item with a corresponding number on Form 5.2 or similar form. For buildings that are larger or have a large number of potential hazards, a combination of a floor plan sketch with a standard numbering system is recommended. One numbering system is as follows:

a) *Side and wall identification*. Identify sides of the structure with letters. For example, Side A is usually the street side for a single-family house. For an apartment in a multi-family building, Side A is the side of the main entry to the unit. Sides B, C, and D are identified clockwise from Side A. Show the building side designations on a site plan sketch (which shows the outline of the building and the principle features of the grounds).

b) *Room equivalent identification*. Room equivalents should be identified by both a number and a use designation, such as "Room 5, Kitchen." Room 1 may be the first room, at the entryway, or it may be the exterior room equivalent. A floor plan sketch is recommended for documenting room identification. If there are several bedrooms, for example, the plan will identify which room has which number.

c) *Sides in a room*. Some risk assessors and lead-based paint inspectors prefer to designate the sides of each room or room equivalent using the same designation system as for the sides of the structure or apartment, as explained above. They do not base room side designations on the location of the door to the room, because some rooms have more than one door. Other risk assessors and inspectors have found that room sides should be based on a reference door, because it is easy to get confused and lose orientation to the street side or the apartment entrance, especially when windows are nonexistent or boarded up. Under the reference door system, it is essential that the reference door be properly identified when there is more than one door to a room (e.g., wooden door from hallway, or stained door from bathroom). In either case, sides are designated clockwise. If facing Side C, Side A should be at your back, and Side B should be on your left, except in odd shaped rooms, which may require a special identification (another reason for a floor plan sketch). If there is more than one closet in a room, use the side designation; for example, "Room 3, Master Bedroom, Side C, Closet."

d) *Component identification*. Individual building components are identified by their room number and side allocation; for example, "Radiator, Room 1, Side C." If there is more than one of a component type on a room side, they are numbered from left to right when facing the wall with the components. For example, "Window, Room 1, Side C, Number 1," which could be abbreviated as "Window, 1,C,1."

Whatever numbering or identification system is adopted to designate walls, rooms and components, the system used should be understandable from records included in the risk assessment report, and the descriptions as to the locations of identified hazards must be unambiguous. Definitions or codes used in the numbering or identification system should be defined and reported.

If the risk assessor is unable to gain access to a portion of the property that was to be evaluated for the risk assessment, she or he should contact the owner or owner's agent to gain that access. If this is ultimately unsuccessful, the risk assessor should annotate the site sketch and/or location listing, and mention this inability in the risk assessment report.

3. Identification of Deteriorated Paint (Form 5.2)

Hazard Definition

EPA regulations define deteriorated paint as "any interior or exterior paint or other coating that is peeling, chipping, chalking or cracking, or any paint or coating located on an interior or exterior surface or fixture that is otherwise damaged or separated from the substrate" (40 CFR 745.63).

What to Look For

Every risk assessment must include a thorough visual assessment to identify any and all interior or exterior surfaces with deteriorated paint that may be lead-based paint. The risk assessor should inspect painted surfaces in every room and every exterior painted surface. Remember to examine the exterior as well as interior of windows, including frames and sills as well as sashes. Ignore such minor instances hairline cracks and nail holes, which are not considered to be deterioration with respect to designating the paint as deteriorated.

Figure 5.4a through 5.4c illustrates paint conditions that can be grouped into two general categories: bulk deterioration and layered deterioration (NDPA, 1990). While it is not necessary to record the type of paint deterioration, different types of paint deterioration will require different hazard control solutions. For example, if paint is "alligatoring" on a surface, and the cause appears to be too many layers of paint, a risk assessor should recommend component replacement or paint removal before paint film stabilization. Applying additional layers of new paint to an alligatored paint film will be ineffective.

EPA regulations include chalking as a form of paint deterioration. Therefore, risk assessors must identify chalking paint. These *Guidelines*, however, no longer consider chalking to be a form of paint deterioration that must be corrected to prevent childhood lead poisoning. The reason is that it is the top, or exterior layer of paint that chalks, and thus a painted surface must have gone without repainting for some 30 years (at the time of this writing) for lead-based paint to be the outside layer. (Very little lead-based paint was used in the 1970s, even for exterior surfaces.) If paint has existed that long, other forms of deterioration will be present.

Also, these *Guidelines* no longer consider mildew on paint to be deteriorated paint. Mildew is a *cause,* not a form, of paint deterioration, and perhaps of other potential health problems as well. Removal of mildew is not required unless the paint is in fact deteriorated and is lead-based paint. Otherwise, the risk assessor may wish to call the client's attention to mildew and suggest that it be removed as a preventive measure.

Definitions and causes of paint deterioration are described in the following paragraphs. The first three types of deterioration — checking, cracking, flaking and alligatoring — are referred to as "*bulk deterioration.*"

1. **Checking –** A pattern of short, narrow breaks in the top layer of paint that is usually caused by a loss of elasticity. Plywood substrates can often cause checking. The deteriorated paint should be removed if a new coating is to be applied.

2. **Cracking and Flaking –** An advanced form of checking that usually occurs on surfaces with multiple layers of paint and includes breaks in the film that extend to the base substrate.

The cracks usually form parallel to the grain of the wood. The damaged coating should be removed if a new coating is to be applied.

3. **Alligatoring –** Reptilian scale patterns on dried paint films that are often caused by the inability of the topcoat to bond smoothly to a glossy coat underneath. The old paint should be completely removed and the surface should be primed and repainted. Alligatoring is usually associated with paint films that are too thick, or the application of a brittle coating over a more flexible one. In some cases it may be necessary to remove all of the paint before recoating, since the existing paint film is already too thick. Enclosure or component replacement will probably be the most effective and safe hazard control methods in this circumstance.

FIGURE 5.4 Forms of Paint Deterioration

FIGURE 5.4a Peeling paint

FIGURE 5.4b Alligatoring paint

FIGURE 5.4c Blistering paint

The following six types of paint deterioration are referred to as "layered deterioration."

1. **Blistering –** The formation of bubbles in the paint film caused by either heat or moisture. The risk assessor should break open one of the bubbles; if bare substrate shows, then the likely cause is moisture. However, if another layer of paint shows instead of substrate, heat probably caused the blister (not moisture). The risk assessor should endeavor to locate the moisture source if moisture is suspected. Control of the moisture source will lengthen the effective life span of many forms of lead-based paint hazard control, especially paint film stabilization.

2. **Scaling or Flaking (peeling) –** A form of paint separation often found in those exterior areas of the building susceptible to condensation, such as under eaves. Salt deposits drawn to the paint film surface can cause scaling. The deteriorated paint should be removed, and the salts should be washed off if the surface is to be recoated. Enclosure may be the most effective and safe hazard control method for this type of deterioration.

3. **Peeling From Metal –** A form of paint separation usually caused by improper priming of bare, galvanized metal, or by rusting (often seen on garage doors). The loose paint should be removed by wet scraping and the metal should be primed with a galvanizing primer or other primer made for metal before paint film stabilization. Industrial paints containing lead should not be used to prime metal surfaces. Component replacement and enclosure are likely to be most effective.

4. **Peeling From Exterior Wood –** A type of paint deterioration usually resulting from wet wood swelling under paint, causing the paint film to loosen, crack, and dislodge. The water may be present because of either moisture passing through the substrate from the interior (poor ventilation) or exterior sources of moisture penetrating the paint film. The risk assessor should recommend that the cause of the moisture problem be discovered and addressed before attempting paint film stabilization or any form of recoating.

5. **Peeling From Plaster Walls –** Peeling from plaster walls could be the result of insufficient wet troweling of the white coat when the plaster was applied, causing chalking of the surface. Both the use of glue size, which absorbs water, and use of a primer with poor alkali resistance can also cause deterioration.

6. **Peeling From Masonry Surfaces –** Peeling from masonry surfaces is often caused by the alkaline condition of the surface. A coating system that is appropriate for alkaline surfaces should be used.

Field Report

Form 5.2, at the end of this chapter, can be used to identify the location of each occurrence of deteriorated paint, exterior as well as interior. Under the "Location" column, the risk assessor should document the location in a manner described in Section II.D.2, above. (Note that Forms 5.2 and 6.0 both cover visual assessments, the former for risk assessments, and the latter for visual assessments; intentionally, they are identical, which is why the forms have double titles.)

Record the room (or side of the building if exterior), the building component – see the illustrative but not exhaustive list of components in Table 5.4 below – and any other information necessary to clarify the location. It is important to provide the precise location and amounts of deteriorated paint to the owner so the proper building components and areas can be repaired.

The risk assessor should estimate and record the approximate area of all identified deteriorated paint surfaces, by room-side and component. If there are several occurrences of deteriorated paint on the same room-side/component combination, enter an estimate of the total area of deterioration. This estimate does not have to be precisely measured; it is an approximation. Its purpose is to facilitate preparation of the risk assessment report and the subsequent work write-up by or for the client. In the United States, the estimate should be expressed in square feet, because these are the units generally used by the construction industry. If an area is less than one square foot, enter an approximate fraction or decimal of a square foot. For example, an area of about 4 in. x 4 in. would be

"1/10," or "0.1," because 4 times 4 equals 16, and 16 is about one-tenth of 144, which is the number of square inches in a square foot. Similarly, an area of about 6 in. x 10 in. would be "4/10" or "0.4."

The risk assessor must determine, to the extent practicable, and record on Form 5.2, or similar form, whether the paint deterioration has been caused by a moisture problem, friction or abrasion, impact, deteriorated or damaged substrate, severe heat, or some other existing building deficiency. These conditions should be corrected before repainting. The type of deterioration (i.e., blistering, flaking, etc.) may yield information about necessary hazard control treatments. For example, if the type of deterioration is commonly caused by moisture in the substrate, the moisture problem will need to be addressed before the paint can be stabilized.

Table 5.4 Illustrative List of Painted Components.*

Interior:	Exterior:
Balustrades	Air conditioners
Baseboards	Balustrades
Bathroom vanities	Beams
Beams	Chimneys
Cabinets	Columns
Ceilings	Corner boards
Chair rails	Doors and trim
Columns	Fascias
Counters	Fences
Crown molding	Garages and garage doors
Doors and trim	Gutters and downspouts
Fireplace mantels or surrounds	Handrails
Floors	Lattice work
Handrails	Painted roofing
Interior window sills (stools) and aprons	Porches and balconies
Newel posts	Railings and railing caps
Radiators	Rake boards
Shelves	Sashes
Stair stringers	Siding
Stair treads and risers	Soffits
Walls	Stair risers and treads
Window sashes and trim	Stair stringers
Window jambs and channels	Windows and trim

* This is not an exhaustive list. Also see Table 7.1.

Small Amount Designations

For each area of deteriorated paint, the risk assessor should also note whether its size falls within the "*de minimis*" amounts. The "*de minimis* amounts" refer to specific thresholds in HUD and EPA regulations that dictate how control or repair must be performed. All deteriorated lead-based paint must be controlled or abated, regardless of the amount of paint present. Lead hazard control or repair work on amounts of paint below the *de minimis* do not require the use of trained or certified workers, lead-safe work practices, including occupant protection, clearance and notice to residents (if required), although HUD recommends such activities any time known or presumed lead-based paint is disturbed. Therefore, the risk assessor must identify all areas of deteriorated paint and their size/amounts. (The term "*de minimis*" is shorthand for the phrase "*de minimis non curat lex*," Latin for "the law takes no account of trifles" (Merriam-Webster Dictionary; ***http://www.merriam-webster.com***).)

Specifically, the *de minimis* amounts of paint are amounts that do not exceed: (a) 20 square feet on exterior surfaces, (b) 2 square feet in any one interior room or space, or (c) 10 percent of the total surface area on an interior or exterior component type with a small surface area (such as window sills, baseboards, or trim; see Figure 5.5). The *de minimis* threshold applies to abatement activities regulated by EPA as well as to interim controls and maintenance activities regulated by HUD. For EPA policy, see 40 CFR 745.65(d); for HUD policy, see 24 CFR 35.1350(d) and the Interpretative Guidance to HUD's Lead Safe Housing Rule posted on HUD's website at: ***http://portal.hud.gov/hudportal/HUD?src=/program_offices/healthy_homes/enforcement/lshr***.

Note that the HUD *de minimis* thresholds are different from the EPA's *minor repair and maintenance activities* thresholds (40 CFR 745.83) under its RRP Rule for work that that disrupts:

(1) 6 square feet or less of painted surface per room for interior activities; or

(2) 20 square feet or less of painted surface for exterior activities;provided that none of the work practices prohibited or restricted by 40 CFR 745.85(a)(3) were used and where the work does not involve window replacement or demolition of painted surface areas (see Appendix 6 for details).

FIGURE 5.5 Baseboard showing a de minimis amount of deteriorated paint.

4. Identification of Friction Surfaces (Form 5.2)

Hazard Definition

Risk assessors are required to identify and test deteriorated paint on "friction surfaces." EPA regulations define a friction surface as a surface that is subject to abrasion or friction (40 CFR 745.63). Friction surfaces are given special attention because lead-based paint that is subject to friction or abrasion is likely to generate lead-contaminated dust. Research confirms this to be the case (Tohn, 1997).

EPA regulations state that "any lead-based paint on a friction surface" is a lead-based paint hazard if the surface "is subject to abrasion and where the lead-dust on the nearest horizontal surface underneath the friction surface (e.g., the window sill, or floor)" equals or exceeds applicable dust-lead standards (40 CFR 745.65(a)(1)). Therefore, to determine that a friction-surface hazard is present, it is necessary to find that:

- The surface is a friction surface coated with lead-based paint, **and**
- The lead in dust underneath the friction surface equals or exceeds dust-lead standards.

If a surface is determined to be a friction-surface hazard, the risk assessor should recommend hazard controls that eliminate the friction or abrasion.

If the paint on any friction surface is *deteriorated* and the paint is lead-based paint, the deteriorated paint is a *deteriorated-paint hazard*. However, the same surface may also be a friction-surface hazard, and it is necessary to determine if that is the case. If the paint on a friction surface is *intact*, i.e., not deteriorated, it is also necessary to determine if the surface is a friction-surface hazard so the owner can monitor the paint's condition.

What to Look For

Surfaces subject to friction or abrasion are surfaces that are being worn down due to rubbing or surface scratching. The most common examples of painted friction surfaces are: (1) a double-hung window sash rubbing against a window channel, with one or both of the surfaces painted; (2) painted floors and painted stair treads; and (3) painted kitchen counters and shelves on which there is abrasive contact by objects used for cooking or eating, and similar surfaces such as painted drawers and slides. These are friction-surface hazards only if the paint is lead-based paint and the dust underneath the surface (or *on* it, in the case of floors and stair treads) is a dust-lead hazard.

To determine whether there is a possible lead-based paint hazard on a friction surface on a double-hung window or a door, risk assessors should, during the visual assessment:

- **Examine the windows to determine whether they are operable.** If a window is not operable, that is, if the sash does not go up and down, there is not likely to be any friction, and therefore a friction-surface hazard is improbable. (Building codes typically require that there be means of egress from each bedroom. If there are no operable windows in a bedroom, there may be a code violation. Although this subject is not within the scope of a lead hazard risk assessment, the risk assessor may want to mention this problem to the owner.)
- **For each operable window, determine whether there is paint on surfaces subject to friction or abrasion.** A common friction surface is where channels and sashes rub against each other. Most double-hung windows, even those that operate smoothly and easily, have some contact between sash and channel. If there is no paint on these contact surfaces, there can be no friction-surface paint hazard. If there is paint, determine whether it is deteriorated or intact and record same on Form 5.2, or similar form. Also look to see whether the interior side of the bottom of the sash is rubbing against the back of the interior window sill (the stool) and record the findings if paint is being affected.
- **Doors**: **Examine the doors to determine whether any door rubs against its jamb or header and, if so, whether any of those friction surfaces are painted.** Also examine the hinges.

They are sometimes sloppily painted and have ongoing deterioration of paint. If there are no friction surfaces or if there is no paint on friction surfaces, there can be no friction-surface paint hazard. If there is paint on a friction surface, determine whether it is deteriorated or intact and record same on Form 5.2, or similar.

The visual assessment field report (Form 5.2 or similar form) should record positive visual findings for each window or door that may have friction-surface hazards, pending dust-lead sample results. Examine at least one operable window and one door in each room that is likely to be frequented by young children.

Floors and stair treads. To determine whether there is a possible lead-based paint hazard on a painted floor or stair tread, risk assessors should, during the visual assessment, identify all painted floors or stair treads that are not protected from abrasion by foot traffic by rugs or other coverings, determine whether paint on each of these surfaces is or is not deteriorated, and record the location and condition of paint for each surface on Form 5.2 or similar form.

Kitchen counters and shelves (optional). To determine whether there is a possible lead-based paint hazard on painted kitchen counters and shelves and similar surfaces, risk assessors should, during the visual assessment, identify all painted counters and shelves that may be subject to abrasive contact by objects used for cooking or eating, determine whether paint on each of these surfaces is or is not deteriorated, and record the location and paint condition for each surface on Form 5.2 or similar form. This is an optional activity with regard to identification of friction surfaces. However, all deteriorated paint on these built-in surfaces must be identified and recorded. It should be noted that there is no EPA lead hazard standard for dust on counters, shelves, drawers

FIGURE 5.6a **Friction hazard on stairs pre-treatment.**

FIGURE 5.6b **Friction hazard on stairs post-treatment.**

or similar surfaces. These *Guidelines* recommend using the floor dust standard, because it is more stringent than the interior window sill standard, and it is reasonable to use a stringent standard for dust that may contaminate food.

Field Report

Form 5.2 is designed to be used in the following manner: As described above, if there is *deteriorated* paint on a friction surface and it appears that friction or abrasion is at least one of the causes of the deterioration, enter "Friction" under the column heading, "Probable Cause of Deterioration, if Known." If there is *intact* paint on a friction surface, enter 'Y" or "Yes" under the column heading, "Intact Paint on Friction Surface?"

5. Identification of Impact Surfaces (Form 5.2)

Hazard Definition

EPA regulations (at 40 CFR 745.63) defines an impact surface as "an interior or exterior surface that is subject to damage by repeated sudden force, such as certain parts of door frames." EPA has determined that an impact surface is a lead-based paint hazard if there is "damaged or otherwise deteriorated lead-based paint on an impact surface that is caused by impact from a related building component (such as a door knob that knocks into a wall or a door that knocks against its door frame" (40 CFR 745.65(a)(2)).

In contrast to a friction surface, for which lead dust on the nearest horizontal surface underneath the friction surface must equal or exceed the applicable dust-lead standards (see the discussion of friction surfaces in section II.D.4 above) for the surface to be a friction-surface lead-based paint hazard. It is not necessary for a dust-lead measurement to be taken to establish that the impact surface is a lead-based paint hazard, only a measurement to determine that the paint on the surface is lead-based paint.

FIGURE 5.7 **Impact surface on door and frame.**

Damage caused solely by resident misuse (e.g., a child banging toys against a wall, a vacuum cleaner routinely being banged into baseboards) is not considered an impact surface under EPA regulations. Of course, if the paint is deteriorated lead-based paint, it *is* a lead-based paint hazard, and if the cause appears to be impact due to misuse, the risk assessor should note the fact and inform the client. Note that EPA does not require that there be a dust-lead hazard present below an impact surface for there to be a paint-lead hazard.

What to Look For

Risk assessors should operate doors to determine whether they are hung and stopped properly and, if not, whether there are impact surfaces with damaged paint. Risk assessors may exercise judgment in selecting doors for examination. The doors examined for impact may be the same as those examined for friction surfaces. If impact surfaces are found on the examined doors, all doors in the dwelling unit or common area should be examined for impact.

Field Report

Record "impact" as a cause of paint deterioration on Form 5.2 (or similar form).

6. Identification of Chewable Surfaces (Form 5.2)

Hazard Definition

EPA regulations define a chewable surface as "an interior or exterior surface painted with lead-based paint that a young child can mouth or chew. A chewable surface is the same as an 'accessible surface' as defined in U.S Code 42 U.S.C. 4851b(2) (see Appendix 6). Hard metal substrates and other materials that cannot be dented by the bite of a young child are not considered chewable" (40 CFR 745.63).

FIGURE 5.8 Chewable surface: teeth marks on window sill.

What to Look For

The most common chewable surfaces are protruding interior window sills, but children have been known to chew also on baseboards, doors, balusters and other surfaces. Look for teeth marks on these surfaces. The risk assessor may wish to identify chewable surfaces that do *not* have teeth marks in evidence if the resident questionnaire reveals that young children currently in residence have a tendency to chew on painted surfaces. This is an optional activity that, combined with the results of paint testing of such surfaces, would give the parents or guardians information they can use to protect their children.

The risk assessor must identify chewable surfaces in accordance with the EPA hazard definition in order to be in compliance with EPA work practices requirements for risk assessments. However, these *Guidelines* hold that it is not necessary to require *treatment* of a chewable surface if a child of less than 6 years of age does not reside in the home or frequent the common area. A child is not poisoned by chewing that was done by someone else.

FIGURE 5.9 Soil lead hazard at dripline

Field Report

If chewable surfaces with teeth marks are found, record the location in the "Location" column of Form 5.2 or similar form and enter "Yes," or a "Y" or a check in the column entitled "Visible Teeth Marks?" If the risk assessor wishes to identify chewable surfaces without teeth marks, record the location and enter "chewable, no teeth marks" or similar note in the "Notes" column.

7. Identification of Bare Soil (Form 5.5)

Hazard Definition

EPA regulations define a soil-lead hazard as "bare soil on residential real property or on the property of a child-occupied facility that contains total lead equal to or exceeding 400 parts per million (µg/g) in a play area or average of 1200 parts per million of bare soil in the rest of the yard based on soil samples" (40 CFR 745.65(c)).

What to Look For

The visual assessment should include an examination of the grounds of the property to identify areas of *bare* soil in four types of areas: play areas, non-play areas in the dripline/foundation area, non-play areas in the rest of the yard, and vegetable gardens. While EPA regulations require only two categories (play areas, and the rest of the yard), these *Guidelines* recommend an additional focus on the dripline/foundation area because research has found that the average concentration of lead in soil is significantly higher there than in other parts of the yard (NCHH, 2004). Without a separate sample from the dripline / foundation area, one might perform needless hazard control or abatement of the rest of the yard when only the dripline/foundation area has soil lead in excess of hazard standards. As explained in Section V.A.1, below, and Table 5.11, below, these *Guidelines* recommend the use of the same standard of 1,200 ppm for non-play areas in the dripline/foundation area as for non-play areas in the rest of the yard. HUD also recommends that vegetable garden soil be sampled separately. Leafy vegetables and herbs can concentrate significant amounts of lead and gardens should be considered a high contact area (Finster, 2004).

HUD regulations define bare soil as "soil or sand not covered by grass, sod, other live ground covers, wood chips, gravel, artificial turf, or similar covering" (24 CFR 35.110). (EPA regulations do not have a definition of bare soil.) Covered soil is not considered a possible soil-lead hazard.

EPA defines dripline as "the area within 3 feet surrounding the perimeter of a building" (40 CFR 745.63), i.e., within 3 feet from the building wall. This definition applies as well to the term "dripline/foundation area," which is used in these *Guidelines*.

EPA regulations define a play area as "an area of frequent soil contact by children of less than 6 years of age as indicated by, but not limited to, such factors as the following: the presence of play equipment (e.g., sandboxes, swing sets, and sliding boards), toys, or other children's possessions, observations of play patterns, or information provided by parents, residents, care givers, or property owners" (40 CFR 745.63).

If one or more children under age 6 live in or regularly visit the home or building, or if the home or property is a child-occupied facility as defined by EPA (40 CFR 745.223), the risk assessor should base this identification on the questionnaires (Form 5.0 or Form 5.6), other discussions with people on the property, and visual evidence of toys, play equipment, etc.

In searching the dripline/foundation area and the rest of the yard for areas of bare soil, the risk assessor should examine gardens and pet sleeping areas, as wells as paths and other areas. If there is a total of no more than one square yard (9 sq. ft.) of bare soil spots in *non-play areas* of the yard of each property, HUD regulations (at 24 CFR 35.1320(b)(2)(ii)(B)) allow the risk assessor to consider such bare soil to be too small to constitute a hazard.

It is recommended that the risk assessor identify bare soil in the dripline/foundation area of nonresidential outbuildings as well as residential buildings if the following conditions are present:

- the building is a substantial permanent structure, such as a garage;
- it was built before 1978;
- there is evidence that the walls or the roof are or have been painted;
- it is free-standing and not structurally connected to or part of a residential building; **and**
- the bare soil is accessible to young children (i.e., access is not effectively blocked by a fence, wall, thorny bushes, etc.).

FIGURE 5.10 Soil lead hazard at dripline of garage.

If these conditions do not apply, any bare soil in the dripline/foundation area of an out-building should be considered as part of the soil represented by the rest-of-the-yard sample.

For large properties and mixed-use properties, risk assessors must determine what part of the grounds are "residential," that is, those grounds that are intended for the service or use of the residents.

Field Report

The field report of the visual assessment of soil should consist of a site plan sketch and Form 5.5, or similar form. These *Guidelines* do not include a separate form for recording the results of the visual assessment of soil. Rather it is recommended that Form 5.5, or similar form, be used to record the findings of the visual assessment as well as the results of soil sampling. As explained in Section II.G.4, below, risk assessors should assign a number to each area to be sampled and enter the numbers on the site-plan sketch and Form 5.5, or similar form.

Identify on the site plan sketch the location of each distinguishable play area with bare soil that is used or may be used by a child of less than six years of age. If the risk assessment covers a property with up to five residential buildings, it is recommended that the risk assessor identify play areas associated with each residential building. For risk assessments of properties with more than five residential buildings, select up to five residential buildings and identify play areas associated with each selected building. To the extent possible, select buildings based on:

(1) young children in residence, and

(2) the presence of play areas with bare soil.

If more than five buildings have these characteristics, select five among them randomly.

Identify on the site plan sketch the general locations of bare soil in non-play areas of the dripline/ foundation area(s). If the risk assessment covers a property with up to five residential buildings, it is recommended that the dripline / foundation area of each residential building be examined and associated nonresidential buildings meeting the conditions stated above also. For risk assessments of properties with more than five buildings, identify bare soil in the non-play areas of dripline / foundation areas of five residential buildings. Select five buildings based on the following conditions:

(1) occupancy by young children, if known;

(2) presence of bare soil in the dripline/foundation area;

(3) evidence that the walls or roof are or were painted; and

(4) accessibility of the bare soil to young children. If these conditions are not present, select buildings randomly.

Identify on the site-plan sketch the general locations of bare soil in non-play areas of the rest of the yard.

If the risk assessment covers a property with one-to-five residential buildings, it is recommended that the rest of the yard of each building be examined. If more than five residential buildings are covered by the risk assessment, select five residential buildings based on the following conditions: (1) presence of bare soil in the rest of the yard, and (2) presence nearby of a possible source of lead contamination, such as a recently painted building. If the residential buildings do not vary significantly by these conditions, select five buildings at random.

E. Dust Sampling

Dust sampling should be conducted before paint chip sampling to preclude contamination of dust that might occur during the collection of paint samples. However, XRF readings may be taken on intact paint before dust sampling, so long as no deteriorated paint is disturbed.

1. Method of Sample Collection

Dust samples must be collected using wet wipes. EPA regulations issued in January 2001 define a wipe sample as "a sample collected by wiping a representative surface of known area, as determined by ASTM E 1728, 'Standard Practice for Field Collection of Settled Dust Samples Using Wipe Sampling Methods for Lead Determination by Atomic Spectrometry Techniques,' or equivalent method, with an acceptable wipe material as defined in ASTM E 1792 (see below), 'Standard Specification for Wipe Sampling Materials for Lead in Surface Dust'" (40 CFR 745.63). In March 2002, EPA issued interpretive guidance stating that the Agency considers wipe sampling materials "equivalent" in performance to ASTM E 1792 acceptable, and that EPA considered to be acceptable wipe materials described in Appendix 13.1 of these *Guidelines* and in the EPA document, "Residential Sampling for Lead: Protocols for Dust and Soil Sampling;" (March 1995, EPA 747-R-95-001 at ***http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=20012QUZ.txt***).

Thus the recommended protocol for sample collection is either Appendix 13.1 of these *Guidelines,* ASTM Standard Practice E 1728, "Standard Practice for Field Collection of Settled

Dust Samples Using Wipe Sampling Methods for Lead Determination by Atomic Spectrometry Techniques," or the EPA report, "Residential Sampling for Lead: Protocols for Dust and Soil Sampling," March 1995, (EPA 747-R-95-001). Figures 5-11a through 5-11f illustrate dust sampling.

Neither EPA nor HUD currently recognizes a standard for collecting and evaluating vacuum samples of dust as a part of a lead-based paint hazard risk assessment. Wipe sampling yields a measure of dust lead loading (in micrograms of lead per square foot or square meter), whereas vacuum sampling can provide a measure of the concentration of lead in the dust (in parts per million or micrograms per gram) as well as loading. Wipe sampling, however, is the required method of dust collection because it is simple, inexpensive, and has been used successfully for a number of years. Research has indicated that wipe-sampling results correlate well with blood lead levels in children (Lanphear, 1996). The protocols in Appendix 13.1 and ASTM Standard Practice E 1728 are comparable to that used in the Lanphear study.

The following considerations should be observed when collecting dust samples:

- **Disposable, moistened, individual (not bulk-packaged) towelettes are used to collect samples and to clean sampling equipment**. Risk assessors should use a brand of wipes acceptable to the laboratory that will analyze the samples (see Section IV, below, for information on laboratory accreditation). Many laboratories supply wipes to the risk assessor. Important factors to consider in wipe material are as follows:

- **Background lead.** Wipes must not contain significant background levels of lead. Those that contain aloe should be avoided due to increased potential for background lead.

  — **Durability and size**. Wipes must be of adequate length, width and thickness to perform the collection procedure. A thin wipe of approximately 15 cm x 15 cm is recommended. Wipes must be rugged enough to not tear easily. Whatman™ filters are not recommended for that reason.

  — **Moisture content**. Wipes must be moist to the touch across the entire wipe. If the wipes have dried out (e.g., from a torn wrapped), they should not be used.

  — **Digestibility.** Wipes should not be so thick that they cannot be digested in routine laboratory analysis.

  — **ASTM standard**. The American Society for Testing and Materials International (ASTM) has issued a Standard E 1793, "Standard Specification for Wipe Sampling Materials for Lead in Surface Dust." The version of the standard current as of the publication of this edition of these *Guidelines* is ASTM E1792 - 03(2011), per ***http://www.astm.org/Standards/E1792.htm***. (Check the ASTM website for updates.) The standard includes, among other things, requirements pertaining to thickness, ruggedness, and packaging. Some wipes may be too thick to meet the ASTM standard and may not be packaged according to the standard. If a wipe material has been found to meet the ASTM standard, there is assurance of uniform quality, especially of wetness. The ASTM specifications apply to a specific lot or batch of wipes. Therefore anyone, from manufacturer to user, can conduct the testing needed to verify conformance to the standard.

- **Field blank samples.** For quality assurance, risk assessors should submit field blank samples to the laboratory at a frequency of at least one blank for each property. For multi-family risk

FIGURE 5.11a Dust sampling equipment.

FIGURE 5.11b Use individually-packaged wipes.

FIGURE 5.11c Making a first (horizontal) pass.

FIGURE 5.11d Folding wipe over for second pass.

FIGURE 5.11e The second (vertical) pass.

FIGURE 5.11f Placing the wipe into a hard sample container.

assessments, one blank should be submitted for every 20 samples collected. Generally, a maximum of ten blanks per property is adequate, but more may be necessary for very large multi-family properties, such as those with more than 500 units.

- **Spikes** (i.e., wipes with a lead loading known to the risk assessor but not the laboratory) are not required. Laboratories recognized by EPA for lead analysis must participate in a proficiency testing program that includes analysis of single-towelette spiked wipes (see Section IV, below, for information on laboratory accreditation). However, some risk assessors opt to use spikes because they provide additional verification of results.
- **Hard, resealable containers** (such as screw-top plastic centrifuge tubes, not plastic bags) should be used to transport wipe samples from the sampling site to the lab, since the container will be rinsed to recover all lead in the sample.
- **Other required equipment including non-powdered, disposable plastic gloves; masking tape; steel or plastic measuring tape or ruler; container labels and permanent marker; and trash bags.** (Non-powdered gloves are recommended because powder on gloves may contaminate the sample.)
- **Optional equipment includes disposable shoe coverings and reusable templates**. Reusable templates are recommended for ease in obtaining samples of equal area.

2. Selection of Rooms within a Dwelling Unit

Regulatory Requirement

Dust samples must be collected "in all living areas where" young children "are most likely to come into contact with dust" (40 CFR 745.227(d)(5)).

Basic Sampling Plan

These *Guidelines* recommend that risk assessors select a minimum of four rooms for dust sampling (except, of course, when the dwelling unit has less than four rooms).

Note that, for the purposes of risk assessment sampling (as well as lead hazard screen, lead-based paint inspection and clearance sampling), hallways, stairways, entry rooms/lobbies and other significant definable spaces are considered "rooms" as well as spaces normally considered as rooms, such as bedrooms, bathrooms, living rooms, kitchens, dining rooms, family rooms. Similarly, for these sampling purposes, a hallway, lobby or other space within a multi-family building is considered a "unit" or a "room," as applicable.

This recommendation is based on research on variability in dust-lead loading and error associated with number and location of samples (Dixon, 2004). Risk assessors may, at their discretion, collect samples in more than four rooms. In addition, risk assessors should always collect a floor sample from inside the principal entryway of a dwelling unit that has direct access to the outside. (For units accessed via a common hallway or stair landing, the principal common entryway should be sampled.) Entryways generally had floor dust-lead levels that averaged about 30 percent higher than those of other rooms in the HUD Evaluation of the Lead Hazard Control Grant Program (NCHH, 2004).

The rooms generally recommended for sampling, in approximate order of importance, are:

- the principal play area of young children,
- the kitchen,
- the bedroom of the youngest child,
- the bedroom of the next oldest child,
- the bathroom used by the youngest child, and
- the living room.

Aside from the entryway, these recommendations are only general guidance (see Figure 5.12). Risk assessors should select the rooms in which they think young children are most likely to be exposed to dust-lead hazards. Of course, if a dwelling unit has only four rooms or fewer, all rooms should be sampled, and if a dwelling has only one bedroom, another room must be substituted for the second bedroom. A porch or balcony may be considered a living area if: it is used as a living area, it is not a common area but is for the private use of the residents of the dwelling unit, and it is reasonably protected from the exterior environment.

If young children reside in the dwelling, the risk assessor should be guided in choice of rooms by the information on the locations of high child activity recorded on Form 5.0, or similar form. If no children under age six are in residence, one can presume that the smaller bedrooms are those that would be used by young children and that the living room or family room would be the principal play area (see figure 5.15). In dwellings where locations of childhood activity must be presumed, greater emphasis should be given to selection of rooms that are likely to have lead contamination, as evidenced by deteriorated paint or recent repainting (research indicates that repainting generates leaded dust if the work is not done in a lead-safe manner). Even in dwellings occupied by young children, if a room is likely to be highly contaminated (as evidenced, perhaps, by an unusual amount of deteriorated paint on windows and trim) but has only moderate contact by young children, the risk assessor may be justified in choosing it instead of perhaps a bedroom that appears to be in good condition.

FIGURE 5.12 **Floor sampling in high traffic area near entry.**

Dust Sampling for Friction-Surface Hazard Determination

Dust testing in rooms other than the rooms selected for the basic sampling procedure described above is necessary only if there is, in one or more of the other rooms, deteriorated or intact paint on a surface that is determined visually to be a friction surface and the paint is known or presumed to be lead-based paint. If this is the situation, dust sampling locations should be selected based on the guidance in Section II.E.3, below, pertaining to dust sampling for friction-surface hazard determination.

3. Selection of Locations within Rooms

Regulatory Requirements

Dust samples must be collected from the interior window sill(s) and floor in all living areas where young children are most likely to come into contact with dust (40 CFR 745.227(d)(5)). For friction-surface hazard determination, dust-lead levels on the nearest horizontal surface underneath the friction surface must be equal to or greater than dust hazard levels (40 CFR 745.227(h)(2)(i)).

Basic Sampling Plan

Building Components. Wipe samples must be collected from floors and interior window sills in each of the rooms selected for basic dust sampling, except only a floor sample is needed in the entryway. The interior window sill is the portion of the horizontal window ledge that is in the interior of the room, adjacent to the window sash when closed; it is technically called the window "stool" (shown in Figure 5.13, and as Area C in Figure 5.14).

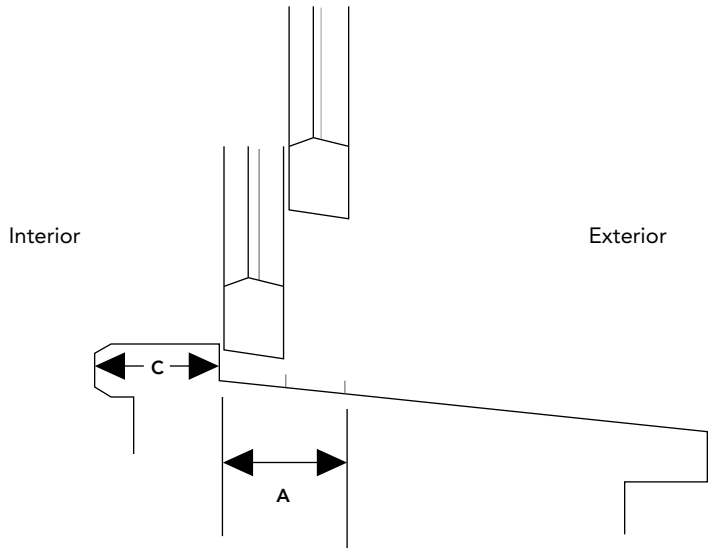
The window trough, sometimes called the window well, is the portion of the horizontal window sill that, in the case of a double hung window, receives both the upper and lower window sashes when they are lowered (Area A in Figure 5.14), or, if there is a storm window, the area between the storm window and the interior window sill (Area A plus B in Figure 5.14). Sampling of window troughs is not required by EPA or HUD as part of a risk assessment, and there is no EPA hazard standard for dust-lead in troughs. There is a *clearance* standard for troughs, but not a hazard standard. The reason for this is that while data analyses indicate that dust-lead measurements in both interior window sills and window troughs are significant in predicting children's blood lead levels, dust-lead levels on sills and troughs are highly correlated. EPA concluded that sampling both sills and troughs instead of just one of the surfaces would not improve a risk assessor's ability to characterize risk enough to justify the additional cost. The EPA chose interior sills because they are usually easier to sample than troughs and because dust-lead in troughs may result from exterior sources and thus may be less representative of interior conditions than dust-lead on interior window sills. Dust-lead levels in troughs are sometimes extremely high, however, so it is important to include them in a cleanup protocol after hazard controls, maintenance or renovation. Some States, Indian Tribes, or local governments may require that window troughs be sampled as a part of a risk assessment.

FIGURE 5.13 **Window sill (at arrow); trough is behind sill, under sash and in front of storm window tracks.**

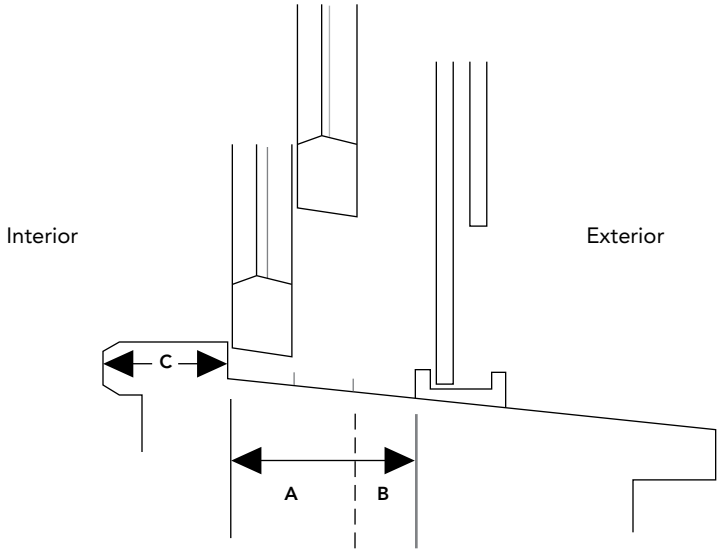
Dust samples may also be collected, at the option of the risk assessor and the client, from other horizontal components, such as window troughs or built-in shelves or cabinets (housing food, dishes, toothbrushes, eating utensils, etc.), but there is no EPA or HUD dust-lead hazard standard for these components.

Choosing Exact Locations on Components. Only general guidance can be offered on exactly where samples should be collected on building components. Factors to be considered in selecting exactly where on floors and interior window sills dust samples should be taken are as follows:

Figure 5.14 Illustrations of Window Trough and Interior Window Sill



1. Sectional view of window (with no storm window) showing window trough area, A, to be tested. Trough is the surface where both window sashes can touch the sill when lowered. The interior window sill (Stool) is sown as area C. Interior window sills and window troughs should be sampled separately.



2. Sectional view of window (including storm window) showing window trough area, A and B, to be tested. Trough extends out to storm window frame. The interior window still (stool) is shown as area C. Interior window sills and window troughs should be sampled separately.

Courtesy: Warren Fredman

(1) **Contact by children.** Floor dust samples should be collected from areas that are likely to be contacted by young children, such as play areas within rooms, high-traffic walkways, room midpoints, or areas immediately underneath windows. Interior window sill dust samples in a given room should be collected from the window that is most frequently contacted by children, if known. For example, if toys are located on one window sill but not the other, the one with the toys should be sampled.

(2) **Operable windows.** For interior window sill samples, a window that can be opened and closed should be selected, if possible, and windows that are opened frequently are preferable to windows that are seldom operated.

(3) **Friction surfaces.** If there is a painted friction surface on a window or door, should be collected from the sill or floor sample from the sill or door under that surface.

Risk assessors should combine this general guidance with the data from the visual inspection and any information gathered about the residents' use patterns to determine the exact number and location of dust samples to be collected. For a risk assessment in multi-family housing in which more than one unit is being assessed (vs. a risk assessment of one unit only), these suggestions may be used to assist the risk assessor in developing a sampling plan for each dwelling. An example of a dust sampling plan is shown in Figure 5.15 below.

Dust Sampling for Friction-Surface Hazard Determination

As mentioned above, friction-surface hazard determination is necessary if: (1) there is paint (deteriorated or intact) on a friction surface and (2) the paint is known or presumed to be lead-based paint. A friction-surface hazard in which the paint is known or presumed to be lead-based paint is known or presumed to be a paint-lead hazard, which is a type of lead-based paint hazard. (40 CFR 745. 65(a)(1).)

The risk assessor determines whether the paint is lead-based paint by: (1) reference to a prior lead-based paint inspection or prior paint testing that is considered reliable, or (2) paint testing. If paint testing is necessary, a non-destructive XRF measurement should be taken, if practicable, on the surface in question or elsewhere on the same component in the same room equivalent, in accordance with principles set forth in Chapter 7, *before* deciding whether dust sampling results are needed. Destructive paint chip sampling should not be conducted before dust sampling. If the XRF measurement is positive, or if non-destructive paint testing cannot be performed, or if the owner agrees that paint that is not known to be lead-based paint by previous inspection or testing shall be presumed to be lead-based paint lead-based paint without measurement or testing, the risk assessor should proceed as follows:

Within Rooms That Are Part of the Basic Sampling Plan. Within the rooms selected for floor and interior-window-sill sampling, the risk assessor should proceed as follows in most circumstances:

- For friction surfaces on windows, use the results of the interior-window-sill dust sample collected in the room in which the subject friction surface is located, provided the dust sample was collected from the sill of an operable window.
- For friction surfaces associated with doors, use the results of the floor dust sample collected in the room, provided the sample was taken within approximately 3 feet of the subject door. If a floor sample was not taken at that location, collect a floor dust sample within approximately 3 feet of the door.

Figure 5.15 Example of a Basic Dust Sampling Plan

Dust samples should be collected from each of the following locations:

- One from the floor of the youngest child's principal play area, which is the living room in this example.
- One from the interior window sill of the most frequently opened window in the living room (the child's principal play area).
- One from the floor of the kitchen.
- One from an interior window sill in the kitchen.
- One from the floor of the bedroom of the youngest child (older than 6 months).
- One from the interior window sill of the bedroom of the youngest child (older than 6 months).
- One from the floor of the bedroom of the next oldest child, if any.
- One from the interior window sill of the bedroom of the next oldest child.
- One from the floor and window sill of every other room selected by the risk assessor.
- One from the floor inside the most frequently used door that provides direct access to the outdoors.

If no playroom can be identified, the living room should be sampled. If the youngest child's bedroom cannot be identified, the smallest bedroom should be sampled.

Under this plan, two composite samples plus one single sample from the entryway or nine single-surface samples would be collected. The risk assessor should use professional judgment to determine which method is most appropriate.

In some dwellings, it may be appropriate to add a sample location if, for example, an additional location is identified that displays both a visible accumulation of dust and childhood exposure. A dusty counter or shelf in a child's play area, a dirty window trough containing children's toys, and dish cabinets with deteriorated paint are other possible examples. However, there is no Federal hazard standard for these surfaces.

- For painted floors or stair treads, use the results of the floor dust sample collected in the room or stairway, provided the sample was taken directly from a painted surface of a like component (i.e., floor or stair tread). If no such sample was taken, collect a dust sample directly from the subject floor or stair-tread surface.
- For friction surfaces on painted counters and shelves (optional), collect a dust sample directly from the subject surface.

Within Rooms That Are Not Part of the Basic Sampling Plan. Within rooms that were not selected for floor and interior-window-sill sampling as part of the basic sampling plan, the risk assessor should proceed as follows in most circumstances:

- For friction surfaces on windows, the risk assessor should choose one of the following options:

  (1) collect a dust sample from the interior window sill of the window with the subject friction surface (only one sill dust sample is needed per room, provided it is from an operable window), or

  (2) presume the dust is a dust-lead hazard.

FIGURE 5.16 **Dust testing a window sill to determine the presence of a friction hazard.**

- For friction surfaces associated with doors, the risk assessor should choose one of the following options:

  (1) collect a dust sample from within 3 feet of the subject door, or

  (2) presume the dust is a dust-lead hazard, and that the friction surface is a lead-based paint hazard.

- For painted floors or stair treads, either

  (1) collect a dust sample directly from the subject surface, or

  (2) presume the dust is a dust-lead hazard, and that the friction surface is a lead-based paint hazard.

- For friction surfaces on painted counters and shelves (optional), either

  (1) collect a dust sample directly from the subject surface, or

  (2) presume the dust is a dust-lead hazard.

If the dust is known (by analysis for lead by a laboratory recognized by NLLAP for analysis of lead in dust) to be a dust-lead hazard or is presumed to be a dust-lead hazard in the absence of dust-lead analysis, and if the paint is known (by XRF measurement or by analysis for lead by a laboratory recognized by NLLAP for analysis of lead in paint) to be lead-based paint or is presumed to be lead-based paint, the friction surface is known or presumed to be a paint-lead hazard, which is a type of lead-based paint hazard. (40 CFR 745.65(a)(1).)

4. Composite Dust Sampling

Under EPA and HUD regulations, dust wipe samples may be either single surface or composite. Each single-surface sample is a separate wipe from a specific location. It is placed in a separate container and is analyzed separately. A composite sample can contain up to four wipes from four different locations, but the locations must be from the same type of component, e.g., hard floors from four different rooms, or interior window sills from four different rooms. Wipe samples are composited in the field, not in the laboratory, by inserting up to four wipes from four surfaces into the same container. The laboratory analyzes all four wipes as one sample using a modified analytical procedure. The individual wipes in each composite are called "subsamples."

Background: Acceptable recovery rates (i.e., within the range of 80 to 120 percent of the "true" value) have been found when no more than four wipes are analyzed as a single sample (EPA, 2001b; Jacobs, 1993c). Testing reported in 2011 among multiple NLLAP-recognized laboratories identified two sample preparation methods for four-wipe composite dust wipe samples that are capable of meeting NLLAP requirements for accuracy (recovery) and precision. (White, 2011)

Research has shown the benefit of composite dust wipe testing for the case of high-dust jobs involving lead-based paint. (Cox, 2011) For such jobs, lead in dust next to the walls was three times more difficult to clean than lead in dust nearer the center of the rooms; clearance using single-wipe samples collected next to the walls was much more likely to fail; and "four-wipe composite sampling within each room (two randomly selected from the perimeter and two randomly selected from the interior) provided a very reliable method for detecting clearance failure (99% or greater) versus a randomly selected single wipe sample per room (50% or less)."

In 2011, the American Industrial Hygiene Association Laboratory Accreditation Programs, LLC revised the "Specific Additional Requirements" in Policy Module 2C for its Environmental Lead Laboratory Accreditation Program (ELLAP). Laboratories accredited by ELLAP for lead analysis of dust wipes are recognized by NLLAP (and similarly for lead in paint chips and soil). As of the publication of these *Guidelines, the ELLAP policy covers accreditation (and, hence NLLAP recognition) of laboratories analyzing composited wipes, for which "all requirements for wipes listed in Policy Module 2C apply, but with the additional requirement that each batch of samples and associated QC samples shall contain the same number of wipes, i.e. composited samples that contain two wipes are to be analyzed in a batch containing QC samples to which two wipes were added as matrix." (ELLAP policy 2C.4.12, which is linked from* ***http://www.aihaaccreditedlabs.org/PolicyModules/Pages/2011%20Policy%20Modules.aspx***. Additional composite-specific requirements are found in the ELLAP application form linked from ***http://www.aihaaccreditedlabs.org/programfees-guidelines-forms/Pages/default.aspx***.)

Single-surface sampling should be used on surfaces that are unique in some way. When they are used, composite samples should be taken on surfaces all of which are fairly similar. For example, if there is a single interior window sill in a child's play area that serves as a storage space for toys, then it should not be sampled by a composite sample, since information is needed about that specific location. Samples collected for the purpose of determining whether a specific friction surface is a hazard must be single-surface samples. The selection of composite or single-surface sampling is a professional judgment that should be made only by a certified risk assessor.

Recommendations: While these *Guidelines recognize the use of composite sampling of dust, they generally do not encourage it for the following reasons:*

- Most laboratories that are recognized by EPA (i.e., NLLAP accredited laboratories) for analysis of lead in dust discourage clients from submitting composite dust-wipe samples,
  - — There is no program to confirm the proficiency of laboratories in analyzing composites The lack of a proficiency program for composites may make the data less convincing in case of a dispute.
  - — Compositing offers only limited information about individual rooms. Single-surface sampling provides specific information that may help focus hazard control efforts on particular surfaces and make hazard control more cost effective by limiting its scope to specific rooms. **Composite sampling does not identify the specific room or location but instead represents a series of rooms/locations; accordingly, it could be more costly to clean such larger areas than the fewer, smaller areas represented by having collected single surface samples.**
  - — Laboratories often separate composite samples and analyze each wipe separately because their equipment and sample preparation procedures are set up for individual wipes, rather than analyzing the composited samples together. As a result, the cost of the composite analysis may well be at least as high as for analyzing the wipes submitted as separate samples.
  - — The cost of single-surface sampling has declined since the 1990s, so the money spent in single-surface samples is more than made up by having good data.

If composite sampling is used, a minimum of two separate composite dust samples should be collected: one for floors and one for interior window sills. A third sample would be needed if carpets are sampled as well as hard floors. In addition, a wipe sample should be collected from the floor of the entry inside the most frequently used door to the exterior. This sample is usually collected as a single-surface sample, but it may be included as a fourth subsample in the floor composite sample if the dwelling unit has no more than three rooms (composites should contain no more than four subsamples). If the risk assessor wishes to sample window troughs, counters, shelves and other horizontal surfaces; additional composite or single-surface samples must be taken for these components. However, the risk assessor should recall that no Federal hazard standard exists for components other than floors and interior window sills.

The following recommendations should be observed if composite dust wipe sampling is conducted:

- Risk assessors should follow either Appendix 13.1 of these *Guidelines, or ASTM Standard Practice E 1728 for collection of wipe subsamples.*
- Wipes used for composite dust wipe samples should meet the requirements of ASTM Standard E 1792 or Appendix 13.1 of these *Guidelines.*
- Whenever composite sampling is contemplated, risk assessors should check with the analytical laboratory to determine whether it analyzes composite samples and, if so, whether special quality assurance practices are needed. Laboratories should be able to

analyze composite samples with wipes that meet ASTM Standard E 1792 (Battelle, 2002).

- Separate composite samples are required from each different component sampled (e.g., a single composite sample should not contain subsamples from both floors and interior window sills, or bare floors and carpeted floors). One reason for this is that methods of controlling dust-lead hazards in carpets are different than for hard floors, so information is needed for each type of floor surface.
- Separate composite samples are required for each dwelling.
- The surface areas of subsamples within a composite sample must be approximately the same size in order to avoid over sampling a room. If both composite and single-surface samples are used to represent a component type in the same dwelling unit or common area, the area of each single-surface sample must be approximately the same as that of the subsamples. This is because the determination of whether a dust-lead hazard is present is based on the weighted arithmetic mean of all single-surface and composite samples (see Section V.A.1, below, on interpreting the results of dust sampling). Floor surface areas sampled in each room should be approximately 1 square foot. Interior window sill sample areas are dependent on window characteristics but must be similar from room to room.
- All the wipe areas for a composite sample should be outlined (with painter's tape or a measured square or rectangular template) before starting to perform the wiping for any of the subsamples. After preparing the container for a composite sample (usually a screw-top centrifuge tube), put on the glove(s) and complete the wiping procedures for all subsamples.
- A new wipe should always be used for each spot sampled.
- Carefully insert each wipe subsample into separately identified containers to be composited by the laboratory, or into a properly identified single container.
- No more than four different wipes should be inserted into a single container for a composite sample.
- Record a separate measurement for each area that is subsampled on the field collection form (see Form 5.4a). Ensure that the container is properly labeled.
- Composite samples should not be taken from rooms that have dramatically different conditions. For example, if the clearance examiner has some reason to believe that cleanup was not performed adequately in a room, a single-surface sample should be collected there. In some cases both single-surface samples and composite samples may be needed for the same component.

5. Common Areas (Multi-family Housing Only)

Common areas may include entryways, lobby areas, hallways, stairways, mail rooms, office waiting rooms, common laundry rooms, multi-purpose rooms, childcare facilities, and other spaces intended for use by residents. EPA regulations require a dust sample from the floor and an interior window sill (if present) in: (1) each common area adjacent to each sampled

dwelling unit (usually a hallway or a stairway landing) and (2) other common areas in which the risk assessor thinks a child under six will "come in contact with dust" (40 CFR 745.227(d)(6)). In addition, these *Guidelines* specifically recommend collecting a floor sample inside the main entryway of each building.

It is generally not necessary to collect samples from hallways or stairways other than those adjacent to sampled dwellings. (When owners of multi-family target housing that is *not* receiving federal housing assistance want to characterize lead-based paint hazards in common areas, such as for developing portions of their ongoing maintenance plan or lead hazard control plan specific to those common areas, they may collect samples from all hallways, stairways or other common areas, use the targeted or worst-case methods described in Section III.B.1 of this chapter, or the random sampling protocol in Chapter 7, treating each type of common area as if it were a set of dwelling units for purposes of using Table 7.3. Owners of multi-family target housing receiving federal housing assistance must comply with the risk assessment requirements for the work given by HUD's Lead Safe Housing Rule, specifically, 24 CFR 35, subpart J, even if all of the work is to be done in common areas.) With regard to identifying other common areas for sampling, risk assessors should, before beginning the visual assessment, obtain from the owner a list of all common areas and the owner's opinion regarding the frequency with which children under age six visit such areas. Form 5.6 provides space to record this information. In addition, the risk assessor should observe all the common areas during the visual assessment, determine whether there is any evidence of childhood use of each area, and, based on the owner's opinion and the risk assessor's observation, decide whether to include the area in the risk assessment.

Friction surfaces in common areas should be assessed in a manner similar to that for dwelling units.

Dust samples may be either single-surface or composite, but, as explained above in Section II.E.4, compositing is not encouraged.

6. On-site Dust Analysis

EPA and HUD allow on-site analysis of dust samples as long as the laboratory analyzing the samples is recognized for on-site ("mobile") analysis of lead in dust by EPA under the National Lead Laboratory Accreditation Program (NLLAP). Methods exist for reliably screening wipe samples on-site rather than in a fixed laboratory; note that this preliminary screening is not the same as clearance, but may be used by the owner, contractor or clearance examiner as part of determining whether to proceed to clearance testing. These include portable X-ray fluorescence (XRF) analysis and anodic stripping voltammetry (ASV) (Ashley 2001; EPA, 2002b; Clark, 2002). These methods may provide testing results much more quickly than fixed laboratory analysis, and so they may save time and money, reduce relocation difficulties, facilitate cooperation by both landlords and tenants, and accelerate environmental investigations in cases of children with elevated blood-lead levels.

In states and tribal lands where EPA is operating a lead program, wipe samples for a risk assessment must be analyzed by a laboratory or testing firm recognized by EPA under the National Lead Laboratory Accreditation Program (NLLAP) for analysis of lead in dust. If, in these states, an NLLAP-recognized laboratory wishes to perform on-site analyses of dust wipe samples, it may do so if its NLLAP recognition includes the type of laboratory operation to be used, whether a

mobile laboratory, or a field sampling and measurement organization. See the NLLAP Laboratory Quality System Requirements (LQSR). (As of the publication of this edition of these Guidelines, NLLAP was using Revision 3.0 of the LSQR, dated November 5, 2007. ***http://www.epa.gov/lead/pubs/lqsr3.pdf***, especially pages 1-2, 7, 12, and 18-19.) In states or tribal lands where the state or tribe is operating an EPA-authorized lead program, the same requirements generally apply, although there may be some differences. While EPA clearance regulations and program procedures apply only to abatement activities (and the option for clearance in projects covered by the RRP Rule), HUD regulations and many State regulations apply the same procedures to non-abatement activities. On-site analysis (just like fixed-site laboratory analysis) of dust for lead for risk assessment or lead hazard screening of target housing may only be done by an NLLAP-recognized laboratory. Thus a certified risk assessor, lead-based paint inspector, or sampling technician who wishes to conduct on-site dust testing as part of a risk assessment must conduct the analysis as part of working for an NLLAP-recognized laboratory, whether as an employee or a subcontractor of the laboratory.

F. Paint Testing in Risk Assessment

The risk assessor must determine whether the following surfaces contain lead-based paint: all surfaces with deteriorated paint (both interior and exterior), surfaces with intact paint on friction surfaces, and chewable surfaces with evidence of teeth marks. All of these surfaces should be identified on the visual assessment field report (Form 5.2, or similar form).

The risk assessor may make the lead-based paint determination from the results of a complete lead-based paint inspection, as described in Chapter 7, or from the testing of specific surfaces, following the principles of Chapter 7. Nondestructive paint testing (as with an XRF) may be performed before dust sampling, but destructive paint testing (as with paint chip sampling) must be performed after dust sampling in order not to disturb the dust on the surface before it is sampled.

1. Evaluating Previous Paint Testing

If previous testing of lead-based paint has been completed, the risk assessor should review the testing report to determine if the results are reliable. Past inspections, especially those conducted before lead-based paint inspectors were required to be certified, may not conform to current standards of care and may not have accounted for important sources of error, possibly resulting in an incorrect determination of the location of lead-based paint.

The risk assessor should review the previous report using the checklist shown in Table 5.5. Chapter 7 contains detailed instructions on how repeated paint inspections can be completed.

If the answer to any of the Table 5.5 questions is negative, the past inspection or a portion of that inspection may not be reliable. (Note that older inspections may have been conducted before EPA issued its rule requiring that lead-based paint inspectors inspecting target housing be certified (61 *Federal Register* 45777, August 29, 1996), or before EPA established the NLLAP (59 *Federal Register,* September 28, 1994).) All surfaces with questionable readings should be treated as though they were never tested. If the inspection report will be used to make decisions in the future, the owner should be encouraged to retest all of the surfaces where the results are questionable.

If Table 5.5 indicates that paint testing was adequate, the risk assessor can use the previous results without additional testing.

Table 5.5 Review of Previous Lead-Based Paint Inspections.

	Question	Yes	No
1	Did the report clearly explain the entire testing program and include an executive summary in narrative form?		
2	Was the inspection conducted by an EPA- or State-/Tribal-certified lead-based paint inspector?		
3	Was any laboratory that analyzed paint samples for lead recognized by the EPA's National Lead Laboratory Accreditation Program (NLLAP) for analysis of lead in paint?		
4	Did the report provide an itemized list of similar building components (testing combinations) and, if the inspection was of a multi-family property, the percentage of each component that tested positive, negative, and inconclusive using XRF? (Percentages are not applicable for single-family dwellings.)		
5	Did the report include test results for the common areas and building exteriors as well as the interior of the dwelling units?		
6	Were all of the painted surfaces that are known to exist in the dwelling units, common areas, and building exteriors included in the itemized list of components that were tested?		
7	If confirmation testing (laboratory paint chip testing) was necessary, did the testing or inspection firm amend the final report and revise the list of surfaces that tested positive, negative, and inconclusive?		
8	Was the unit selection process performed randomly in multi-family properties, and was the correct minimum number of dwelling units sampled and inspected?		
9	Is the name of the XRF manufacturer and the model, serial numbers of the XRF that was used in each unit recorded in the report?		
10	Did the report record the XRF calibration checks for each day that testing was performed?		
11	Did the XRF calibration checks indicate that the instrument was operating within the Quality Control Value? (see Chapter 7)		
12	Were the required number of XRF readings collected for each surface?		
13	Were XRF substrate corrections performed (if necessary)?		
14	Were confirmatory paint chip samples collected if XRF readings were in the inconclusive range for the instrument and mode used?		
15	Was the procedure that was used to collect the paint chip samples described?		
16	Was the laboratory that analyzed the paint chip samples identified?		

2. Paint Testing Methods

Paint testing can be performed with either a portable XRF lead-based paint analyzer or by laboratory analysis of paint chip samples, and, in certain cases, chemical test kits (also known as spot test kits). Whichever method is used, the paint surface tested should not be worn, since some of the lead-containing layer(s) may have worn away. Usually, thicker sections of paint film, as determined visually, should be analyzed to determine the presence of lead-based paint.

Portable XRF Analysis

Portable XRF analyzers should be used on surfaces with intact paint areas large enough to completely cover the active emission/detector window on the XRF face. Furthermore, the surface against the emission/detector window on the XRF face should be flat or nearly flat so that little curvature of the paint surface exists against this window. These are the conditions under which XRFs are calibrated, and therefore they are the conditions under which reliable readings can be obtained. Therefore a portable XRF can be used to obtain a reliable and conclusive measurement of lead in a deteriorated painted surface only if an area of intact paint nearby on the same component can be used for XRF analysis – a situation that is not uncommon.

If, however, a portable XRF reading *is* taken of a paint surface in a manner that does not meet the conditions described in the previous paragraph, the reading, in milligrams of lead per square centimeter (mg/cm^2), is likely to be less than the true value. This is because either the distance from the detector to at least some levels of paint will be greater than the distance used in calibration or the area of paint surface from which energy is emitted from the surface in the direction of the detector will be less than that used in calibration. Therefore, under such conditions, if the reading is equal to or greater than the applicable definition of lead-based paint in mg/cm^2, the risk assessor may presume that the paint surface contains lead-based paint. On the other hand, if the reading is less than the applicable standard, one cannot conclude that the paint surface does not contain lead-based paint; laboratory analysis of a paint chip sample should be conducted.

More information on XRF testing can be found in Chapter 7.

Paint Chip Sample Collection and Analysis

Paint chip samples for laboratory analysis are collected by removing *all* layers of paint from a measured surface area without removing any substrate. It is important to collect *all* layers of paint from a sample location, not just the peeling layers. All layers of paint should be included in the sample for the following reasons: (1) All layers may be removed during the scraping involved in preparing the surface for repainting (repair process); and (2) the result of the paint chip analysis should be comparable to an XRF reading, which reads all layers. It takes practice to collect a paint chip sample properly. A complete protocol for sampling paint (intact, as well as deteriorated paint) can be found in Chapter 7 and Appendix 13.2. Also recommended is ASTM Standard Practice E 1729, "Standard Practice for Field Collection of Dried Paint Samples for Lead Determination by Atomic Spectrometry Techniques" (can be accessed at ***http://www.astm.org/Standards/E1729.htm***). Minor cleanup of the immediate area should be done with wet wipes following any destructive paint chip sampling effort (see Figure 5.17). Lead-based paint inspectors and risk assessors

are not generally responsible for repainting, unless specified in their contracts; owners and property managers are usually responsible for repainting.

FIGURE 5.17 Damage to painted surface caused by paint chip sampling.

Composite Paint Chip Sampling

Composite paint chip sampling, a rare practice, is not recommended. It decreases the information provided to the risk assessor and owner about the presence and location of lead-based paint in the housing, and is not cost effective.

Chemical test kits

Chemical test kits, also known as spot test kits, are intended to show a color change when a part of the kit makes contact with the lead in lead-based paint. Because of how long it has been since the application of lead-based paint in residential units was banned, often the surface coat does not contain significant levels of lead. Therefore many spot test kits require exposing all the layers of paint by slicing or some other method.

One type of chemical test kit is based on the formation of lead sulfide, which is black, when lead in paint reacts with sodium sulfide. Another is based on the formation of a red or pink color when lead in paint reacts with sodium rhodizonate. (For more technical and regulatory information on test kits, see Chapter 7, Section I.H.2.)

As of the publication of this edition of these *Guidelines*, a chemical test kit for lead can be recognized by the EPA (see the list at ***http://www.epa.gov/lead/pubs/testkit.htm*** to determine, for RRP Rule use, that lead-based paint is not present if the test kit meets the EPA's negative response criterion (40 CFR 745.88(b)(4) and (c).). Specifically, when a certified renovator obtains a negative response from an EPA-recognized test kit, i.e., indicating that lead-based paint is not detected, the certified renovator may use the response to determine whether the renovation project is exempt from the RRP Rule. Similarly, when a certified inspector or risk assessor obtains a negative response from an EPA-recognized test kit – but not a positive response – the response may be included in a lead-based paint inspection, hazard screen or risk assessment report. (These individuals need not be working for a laboratory recognized by NLLAP for analysis of lead in dust.)

3. Surfaces to Be Tested

Deteriorated Paint

One paint chip sample or XRF reading should be collected from all similar building components with deteriorated paint within each room equivalent on the exterior as well as the interior of the dwelling or common area. For example, if all 4 walls in a room have deteriorated paint, each of the walls must be tested, not just one wall. It is recommended that XRF testing be used where feasible in order to reduce the amount of paint chip sampling.

Chewed Surfaces

Surfaces found in the visual assessment to have been chewed (by virtue of evidence of teeth marks) should be tested if a child of less than six years of age resides in or regularly visits the site. Chewed surfaces could include interior window sills, balusters, shelves, stairs, and other surfaces accessible to children's mouths. Paint surfaces that display teeth marks should be analyzed either by paint chip analysis or XRF testing. If no testing occurs, the surface should be presumed to be a lead-based paint hazard, and should be treated accordingly.

Intact Paint on Friction Surfaces

The risk assessor should test intact paint on friction surfaces identified in the visual assessment, following principles described in Chapter 7.

Surfaces to be Disturbed by Rehabilitation or Maintenance

Generally, risk assessors do not test intact paint for lead content. However, if certain areas of intact paint are expected to be disturbed in the future due to rehabilitation, renovation, maintenance, or other work **that may disturb the paint,** the paint in those areas should be analyzed by XRF testing or paint chip analysis. The HUD Lead Safe Housing Rule requires that painted surfaces in HUD-assisted target housing that are to be disturbed or replaced during Federally assisted rehabilitation must be tested for lead or presumed to be lead-based paint (24 CFR 35.930) (see Appendix 6). Both EPA's RRP Rule and HUD's Lead Safe Housing Rule do not apply to target housing where a certified lead-based paint inspector or risk assessor has determined that the components affected by the renovation are free of regulated lead-based paint or that a property is free of lead-based paint for the purposes of the Lead Disclosure Rule.

The risk assessor may use the "Notes" column on the right side of Form 5.2 to indicate the existence of a surface to be disturbed, or he or she may use a separate list provided by the client. The advantage of using Form 5.2 is that all surfaces requiring paint testing are shown on the same form. See Appendix 8.1, Sample Pre-Rehabilitation Risk Assessment and Limited Paint Testing Report.

FIGURE 5.18 **Baby's bed exhibiting deteriorated paint and evidence of teeth marks.**

Paint on Old Furniture (Optional)

HUD considers deteriorated lead-based paint on furniture (not built-in) to constitute a lead hazard and risk to young children. It is the responsibility of the owner of the furniture to resolve those hazards (see Figure 5.18). A risk assessor should strongly recommend to dwelling owners that any furniture with deteriorated paint be analyzed. In rental dwellings, deteriorated paint from resident-owned furniture need not be sampled, since the building owner does not own the furniture and cannot control its correction if a hazard is found. However, the risk assessor should suggest to property owners that it may be in their best interest (as well as the interests of the residents) to identify all lead-based paint hazards. In some cases, the residents themselves may agree to pay for an analysis of their furniture. Whoever pays for the analysis, it must be

clear that the responsibility for treatment or removal of any resident-owned furniture rests with the resident. When no paint samples are collected, the risk assessor should still record the presence of deteriorated paint on old furniture in the final report.

4. Field Report of Paint Testing

If XRF results have been obtained, enter these testing results directly on Form 5.2, or similar form, in the "Paint Testing Results" column. Enter results of previous paint testing in the same column. For paint chip sampling, use Form 5.3, or similar form, but also enter the sample number in the "Paint Testing Results" column of Form 5.2 to establish a cross reference to the field sampling form (i.e., Form 5.3). This aids in confirming that all surfaces requiring paint testing have been tested.

G. Soil Sampling

The risk assessor should determine whether the soil outside of a dwelling poses a significant hazard to children. To accomplish this, it will be necessary to determine not only the concentration of lead in the soil, but also the use pattern (i.e., the frequency of contact and use of soil) for different soil locations and conditions. Since only areas of bare soil are considered potential lead-based paint hazards under EPA regulations, the risk assessor should sample only areas of bare soil unless otherwise requested. (See the definition of "bare soil" in the Glossary.)

1. Sample Locations

Bare soil areas to be sampled for lead contamination are:

- Each play area with bare soil, including sandboxes. (See the definition of "play area" in the Glossary.)
- Non-play areas in dripline/foundation areas. (See the definition of "dripline/foundation area" in the Glossary.)
- Non-play areas in the rest of the yard, including, but not limited to vegetable gardens, pet sleeping areas, and bare pathways.
- Vegetable gardens (recommended).

Risk assessors areas should be sure to check unusual areas, such as those beneath elevated porches, to see if they have bare soil and if there is evidence that the areas have frequent soil contact by children of less than 6 years of age, i.e., are play areas.

A property owner may wish to have additional sites sampled if the ground covering on those sites may be disturbed in the future (e.g., by gardening or excavation). As explained in Section II.G.7, above, while EPA regulations require sampling of bare soil in only two types of areas, (1) play areas and (2) non-play areas in the rest of the yard, these *Guidelines* recommend an additional separate sampling of non-play areas in the dripline/foundation area because research has found that average soil lead concentrations are significantly higher there than in other parts of the yard. It should also be noted that EPA regulations state (at 40 CFR 745.227(h)(4)(ii)) that determinations of the presence of soil lead hazards in non-play areas of the yard must be made for each residential building on a property. Sampling plans for different types of properties are discussed below in Section II.G.3, on "Number of Samples."

As explained in Section II.G.7, above, sampling of non-play areas of the yard is not necessary if bare soil totals no more 9 sq. ft. (but this flexibility may not apply in some states). If there is *no* bare soil, soil sampling is not necessary.

2. Sample Collection Method

Soil samples must be composite samples. Samples may be collected with either a coring tool or a scooping technique using a spoon or lip of a sample container. Coring tools may not be workable in sandy, dry, or friable soil. The top 5/8 inch (1.5 cm) of soil should be collected.

Samples should be collected in accordance with Appendix 13.3, or ASTM Standard Practice E 1727, "Standard Practice for Field Collection of Soil Samples for Lead Determination by Atomic Spectrometry Techniques," or the EPA report, "Residential Sampling for Lead: Protocols for Dust and Soil Sampling," March 1995 (EPA 747-R-95-001). A copy of the ASTM standard can be obtained for a fee by calling ASTM Customer Services at (610) 832-9582 or by fax at (610) 832-9355; or from ***http://www.astm.org/Standards/E1727.htm.***

Each composite sample should consist of subsamples that are of approximately equal bulk and that are collected from 3-10 distinct locations. Subsamples should be collected at least 2-6 feet away from each other if possible (small play areas may not be large enough for this spacing).

For non-play areas in both the dripline/foundation area and the rest of the yard, subsamples should be taken from bare soil locations and should be dispersed in a pattern roughly similar to the distribution of the surfaces of bare-soil area throughout the dripline/foundation area and the rest of the yard.

If paint chips are present in the soil, they should be included as part of the soil sample. However, there should be no special attempt to over-sample paint chips. The laboratory should be instructed to disaggregate ("break up") paint chips by forcing them through a sieve in the laboratory. Although paint chips should not be oversampled, they should also not be excluded from the soil sample, since they are part of the soil matrix.

FIGURE 5.19a,b,c Soil Sampling

For sampling vegetable gardens, 6–12 subsamples should be collected, depending on the size of the garden. Samples should be collected to a depth of 3 to 4 inches to account for previous soil mixing. Samples should be evenly spaced and collected using an "X" or zigzag pattern using a coring tool or trowel. Samples should be mixed in a clean plastic container and approximately one cup of soil removed for lead analysis (Rosen, 2002).

Submit samples to the laboratory using the sample submittal form (also known as a chain-of-custody form) provided by the laboratory.

3. Number of Samples

Play Areas

EPA has interpreted the regulatory definition of a soil lead hazard (at 40 CFR 745.65(c)) as requiring that one composite sample must be collected from *each* play area with bare soil. While most residential properties probably have no more than one or two play areas with bare soil, some may have many more than that. This is especially true of large multi-family projects. At some point, sampling of additional play areas provides minimal benefit to the risk assessment. Therefore these *Guidelines* offer the following general guidance on the number of play areas to sample. If there are multiple play areas with bare soil, select those that appear to have the greatest use by young children. The selected play areas will represent all play areas associated with the building.

- If the risk assessment covers a single residential building (i.e., a building containing dwelling units):
  - If the building has no more than 10 dwelling units, select no more than 2 play areas for sampling.
  - If the building has more than 10 dwelling units, select no more than 3 play areas for sampling.
- If the risk assessment covers between 2 and 5 residential buildings, sample play areas associated with all residential buildings, with the number of play areas per building (2 or 3) determined by the number of dwelling units in each individual building, as discussed above.
- If the risk assessment covers more than 5 residential buildings, select 5 of the buildings for sampling.
  - To the extent possible, select buildings based on: (1) residence by young children, if known, and (2) the presence of play areas with bare soil.
  - If more than 5 buildings have these characteristics, randomly select 5 of them.
  - Select play areas associated with, or used by residents of, each selected building in the same manner as described above for an individual building. Do not double-sample play areas associated with more than one residential building.
  - This guidance, which is summarized in Table 5.6, is considered general guidance only. Risk assessors should exercise professional judgment, especially when assessing very large buildings or large multi-building properties.

Table 5.6 Recommended Number of Play Areas To Be Sampled.

Number of Residential Buildings Covered by Risk Assessment	Number of Dwelling Units Per Residential Building	Recommended Number of Play Areas to be Sampled
1-5	1-10	No more than 2 per building
	More than 10	No more than 3 per building
More than 5	1-10	No more than 10 (2 per building x 5 selected buildings)
	More than 10	No more than 15 (3 per building x 5 selected buildings)

Non-play Areas in Dripline/Foundation Area

For bare soil in non-play areas in the dripline/ foundation area, an important question is whether samples should be collected in the dripline/foundation areas of nonresidential outbuildings on the property as well as residential buildings. It is recommended that the risk assessor sample bare soil in the dripline/foundation area of a nonresidential outbuilding if the following conditions are present:

(1) the building is a substantial permanent structure, such as a garage;

(2) it is known to have been built before 1978, or its year of construction is not known and there is no reason to presume that it was built more recently;

(3) there is evidence that the walls or the roof are or have been painted;

(4) it is free-standing and not structurally connected or part of a residential building; and

(5) the bare soil is accessible to young children (i.e., access is not effectively blocked by a fence, wall, thorny bushes, etc.).

If these conditions do not apply, any bare soil in the dripline/foundation area of an outbuilding should be considered as part of the soil represented by the rest-of-the-yard sample.

Collect one composite sample of bare soil in the dripline/foundation area of each residential building, if the property covered by the risk assessment contains 1-5 residential buildings. Also collect one sample for each nonresidential building that meets the criteria described above. For very large buildings, the risk assessor may decide to collect more than one sample per building.

If more than five residential buildings are covered by the risk assessment, select five residential buildings for sampling. Select five buildings based on the following conditions:

(1) occupancy by young children, if known;

(2) presence of bare soil in the dripline/foundation area;

(3) evidence that the walls or roof are or were painted; and

(4) accessibility of the bare soil to young children.

If these conditions are not present, select buildings randomly. Collect one composite sample of bare soil, if any, in the dripline/foundation area of each selected residential building plus one sample from each nonresidential building that is associated with the selected residential building and that meets the criteria for dripline sampling described above for nonresidential buildings. (For very large buildings the risk assessor may collect more than one sample.) Do not double-sample nonresidential buildings associated with more than one residential building. Table 5.7 provides a summary of this guidance.

Table 5.7 Recommended Number of Soil Samples in Non-play Areas of Dripline/Foundation Areas.

Number of Residential Buildings Covered by Risk Assessment	Number of Dwelling Units Per Residential Building	Recommended Number of Dripline/Foundation Area Samples to Collect if Bare Soil is Present*
1-5	(not relevant)	No more than 1 per residential building + 1 per nonresidential building, if any
More than 5	(not relevant)	No more than 1 for each of 5 selected residential buildings + 1 per nonresidential building, if any, associated with each selected residential building

** For very large buildings, the risk assessor may collect more than one sample for each such building.*

Non-play Areas in the Rest of the Yard

For bare soil in non-play areas in the rest of the yard, collect one composite sample per residential building. The risk assessor may collect more than one sample for very large yards. If more than five residential buildings are covered by the risk assessment, select five residential buildings based on the following conditions: (1) presence of bare soil in the rest of the yard, and (2) presence nearby of a possible source of lead contamination, such as a recently painted building, or a **heavily used thoroughfare, roadway or industrial facility that uses or emit lead.** If the residential buildings do not vary significantly by these conditions, select five buildings at random. Collect one composite sample of bare soil in the rest of the yard of each selected building. Table 5.8 provides a summary of this guidance.

Table 5.8 Recommended Number of Soil Samples in Non-play Areas of the Rest of the Yard Outside of Dripline/Foundation Areas.

Number of Residential Buildings Covered by Risk Assessment	Number of Dwelling Units Per Residential Building	Recommended Maximum Number of Rest-of-the-Yard Samples to Collect if Bare Soil is Present*
1-5	(not relevant)	No more than 1 per building
More than 5	(not relevant)	No more than 5 (1 per residential building x 5 selected buildings)

** For very large yards, the risk assessor may collect more than one sample per residential building.*

4. Field Report

Use a separate Form 5.5, or similar form, for each residential building sampled. Indicate locations on the site plan sketch used in the visual assessment. If the property covered by the risk assessment includes more than five residential buildings, indicate the five buildings selected for sampling on the site plan sketch. On Form 5.5, or similar form, record the location of each composite sample, the approximate area of bare soil represented by the sample in square feet, and the sample number. Sample numbers should also be indicated on the site-plan sketch in order that users will be able to unambiguously identify the location of samples listed on the form. Recording the approximate area of bare soil in each sample facilitates the work write up if soil hazard controls must be conducted.

H. Water Sampling (Optional)

Water sampling is not required for a routine risk assessment, but may be requested by the property owner. Local water authorities are already mandated by the EPA to monitor the lead levels of the water they supply. If the owner is concerned that lead may be leaching into the water between the service line and the faucet, samples can be collected and analyzed.

It is important to recognize, however, that the EPA-recommended protocol for determining whether a specific faucet is a contributor of lead is not the same as that used to test the water supply. See the EPA manual, "Lead in Drinking Water in Schools and Non-Residential Buildings," April 1994 (EPA 812-B-94-002) (***http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=20013NC6.txt)***. Another EPA publication is "Sampling Lead in Drinking Water in Nursery Schools and Day Care Facilities, April 1994 (EPA 812/B-94-003) (***http://www.epa.gov/safewater/lcrmr/pdfs/guidance_lcmr_sampling_nursery_day_care.pdf***). The water supplier may be able to offer information or assistance with such testing. It will probably be necessary to find a laboratory certified in the state to analyze lead in drinking water samples and proceed as the laboratory recommends. Assistance may

also be available from the EPA Safe Drinking Water Hotline (800-426-4791) or the National Lead Information Center (800-424-LEAD). (Hearing- or speech-challenged individuals may access these numbers through TTY by calling the toll-free Federal Relay Service at 800-877-8339.)

If the dwelling does not use public water or receive water from a water supplier, but instead uses a private drinking water well, see the EPA's web site on Private Drinking Water Wells (***http://water.epa.gov/drink/info/well/***). In particular, that website has a page on "What You Can Do," which recommends testing at least annually, and information on how to identify potential sources of groundwater contamination. It has another page on "Frequent Questions," that identifies some reasons to test your water and what to test it for.

I. Lead Hazard Screen Protocol

As discussed in Section I.A.2, above, a lead hazard screen may be a cost-effective alternative to a full risk assessment for housing that is in good condition and was built after 1960. EPA work practices standards for a lead hazard screen are found at EPA 40 CFR 745.227(c).

A lead hazard screen consists of the following steps:

1. Questionnaire

Certain questions are necessary in a lead hazard screen in order to determine optimum dust sampling locations. For individual occupied units, use Form 5.0, or similar form, but questions 10-16 can be omitted. For multi-family properties, use Form 5.6, or similar form, but questions 4-6 can be omitted.

2. Building Condition

The building condition survey is important in order to document that the building is in good enough condition to justify a lead hazard screen. Use Form 5.1, or similar form. It is prudent to conduct the building condition survey before administering the questionnaire if the risk assessor is uncertain as to whether the building is in good enough condition for a screen.

3. Floor-Plan Sketch (Optional)

The risk assessor should decide whether a floor plan sketch is needed in order to unambiguously describe the location of surfaces with deteriorated paint and surfaces from which dust samples are collected. If the dwelling unit is relatively small, has few occurrences of deteriorated paint, and there is little likelihood that the descriptions on the visual assessment and dust sampling forms will be unclear, the sketch can be omitted. Otherwise, and usually, preparing the sketch will probably be worth the time. A site-plan sketch is usually not needed for a lead hazard screen, because soil sampling is usually not conducted.

4. Visual Assessment

In a lead hazard screen, the objective of the visual assessment is limited to identifying deteriorated paint, both interior and exterior, and paint chips on the ground. It is not necessary to identify friction surfaces, impact surfaces, or chewable surfaces, except that the risk assessor

should attempt to identify chewable surfaces if the owner or resident indicates in the questionnaire that a young child tends to mouth or chew painted surfaces. Use Form 5.2, or similar form.

5. Dust Testing

The risk assessor should conduct a basic dust sampling plan, as described in Section II.E. above. Dust testing for confirmation of friction-surface hazards is not necessary. Dust samples may be single-surface samples and/or composite samples. Before conducting a lead hazard screen, the risk assessor should confirm with the laboratory that its minimum reporting limit for lead in dust wipe samples will be adequate (that is, sufficiently low) to make a determination based on the stringent screening standards that apply. The laboratory may recommend that the sample areas (i.e., the areas wiped) be increased to assure a conclusive screen.

6. Paint Testing

Deteriorated paint surfaces must be tested for lead in accordance with the guidance in Section II.F, above. Testing of intact paint on friction surfaces is not necessary. Testing of paint on a chewable surface is required only if teeth marks are seen on the surface and there is a child under age 6 in the household.

7. Soil Testing

Soil sampling is necessary in a lead hazard screen only if there are paint chips on the ground.

8. Interpretation of Testing Results

For a lead hazard screen, dust testing results are interpreted against more stringent standards than those used in a regular risk assessment. (While the interior window sill standard for a lead hazard screen was reduced in half, from 250 µg/ft² to 125 µg/ft², the floor standard for a screen was reduced to 25 µg/ft² instead of 20 µg/ft² because some laboratory analytical methods and quality control measures may not provide sufficient reliability below 25 µg/ft².) Paint and soil testing results, however, are interpreted against the same standards as for a risk assessment. See Section V.D, below, for further guidance on interpreting testing results in a lead hazard screen.

9. Report

The report of the lead hazard screen must contain at least the following information:

- The date of the lead hazard screen.
- The address of each building included in the screen and apartment numbers (if applicable).
- Date of construction of the buildings.
- Name, address, and telephone number of each building owner and building manager.
- Name, signature, and certification number of the risk assessor conducting the screen.
- Name, address, and telephone number of the certified firm employing the risk assessor.

- Name, address, and telephone number of each laboratory conducting analyses of samples.
- The results of the visual assessment.
- Paint testing methods used.
- Specific locations of each painted component tested for lead.
- Results from onsite paint testing, including quality control data and, if used, the serial number of any XRF used.
- Results from laboratory analyses of paint and dust samples, and soil samples, if collected.
- Any background information from the administering of a questionnaire and/or the building condition survey.
- The risk assessor's interpretation of the paint, dust, and, if applicable, soil testing and his or her conclusion as to whether the property should or should not be subject to a full risk assessment.

The observations and environmental testing results of the lead hazard screen are usable in a follow-up full risk assessment, if necessary.

III. Risk Assessments for Evaluations of Different Size

The scope of the risk assessment will be determined in part by the number of dwellings that need to be evaluated. For single-family, owner-occupied dwellings, the basic information that the risk assessor needs to complete a comprehensive assessment is relatively easy to collect. A short interview with the owner will provide information about resident use patterns, past maintenance practices, and the resources that the owner can devote to hazard control. However, for an evaluation of a large number of rental dwellings, the assessor must gather information from the owner about the residents, the management company (if any), and the maintenance staff in order to confidently assess the viability of various hazard control options. Therefore, the protocols for collecting information from owners of multiple dwellings are more extensive than the protocols for owner-occupants.

At the same time, owners with a large number of dwellings to be evaluated may be able to reduce the per-unit costs of the risk assessment greatly. If, in the judgment of the risk assessor, the dwellings to be evaluated are sufficiently *similar*, the protocols allow the risk assessor to limit sampling to the dwellings that are most likely to present lead hazards to residents, as described below. The environmental sampling from these targeted similar dwellings is used to represent the lead-based paint hazards in all dwellings. For the purposes of risk assessment, the term *similar dwellings* describes those dwellings that:

- were built at the same time;
- have a common painting history;
- have a common maintenance and management history; and
- are of similar construction.

Similar dwellings do not need to be contained in a single housing development or in a single building to meet this definition; they also need not have the same number of rooms.

This section describes slightly different risk assessment protocols for the following situations:

- Assessment of an owner-occupied, single-family dwelling.
- Assessment of five or more similar rental dwellings.
- Assessment of fewer than five similar rental dwellings or multiple dwellings that are *not similar.*

Table 5.9 summarizes the key elements of a risk assessment for each category of assessment.

Table 5.9 Risk Assessment Approach for Evaluations of Different Size.

Action Required	Owner-Occupied, Single-Family Dwellings	Five or More Similar Rental Dwellings	Up to Four Rental Dwellings, or Rental Dwellings That Are Not Similar
Assess every dwelling	Yes	No	Yes
Deteriorated paint sampling (if no inspection conducted)	Yes	Yes	Yes
Dust sampling	Yes	Yes	Yes
Bare soil sampling	Yes	Yes	Yes
Water sampling	Optional	Optional	Optional
Air sampling	No	No	No
Management system analysis	Not applicable	Optional	Optional
Maintenance work systems modified	Cleaning and repair practices modified	Optional	Optional
Housing condition and characteristics assessment	Yes	Yes	Yes
Demographics and use patterns description	Yes	Yes	Yes

Like many recommendations in these *Guidelines*, these categories can be modified when necessary. The rationale for such modifications should be documented. For example, when evaluating a duplex or three-dwelling building where one dwelling is owner-occupied, the single-family protocols should be used with some minor modifications. In large multiple-unit dwellings that are not similar (see Section III, above), a risk assessor may be able to use dwelling selection procedures to contain costs. The selection process must be done with special care and with limitations fully described. To assist the risk assessor, standard risk assessment forms have been developed and are provided at the end of this chapter.

A. Risk Assessments for Owner-Occupied, Single-Family Dwellings

Evaluations in owner-occupied, single-family dwellings should include:

- An interview with the homeowner about resident use patterns, about the condition of the property, the age and location of children in residence, and the management and maintenance practices for the dwelling (optional).
- A visual assessment of the condition of the building and painted surfaces.
- Environmental sampling of deteriorated paint, dust, and soil.

The following forms should be used in the assessment of owner-occupied, single-family dwellings:

- **Form 5.0 –** Questionnaire for a Lead Hazard Risk Assessment of an Individual Occupied Dwelling Unit.
- **Form 5.1 –** Building Condition Form for Lead Hazard Risk Assessment.
- **Form 5.2 –** Field Report of Visual Assessment for Lead Hazard Risk Assessment.
- **Form 5.3 –** Field Paint-Chip Sampling Form.
- **Form 5.4a –** Field Sampling Form for Dust (Single-Surface Sampling) or
- **Form 5.4b** Field Sampling Form for Dust (Composite Sampling).
- **Form 5.5 –** Field Sampling Form for Soil.

B. Risk Assessments for Five or More Similar Dwellings

Risk assessments for five or more similar dwellings should include:

- Information from the owner (or owner's representative) about the condition of the property, the age and location of children in the residence (if known), and the management and maintenance practices for the dwellings.
- The selection of dwellings and common areas for sampling.
- A visual assessment of the condition of the building and painted surfaces in the selected dwellings and common areas.
- Environmental sampling of dust, soil, and deteriorated paint in the selected dwellings and common areas.

The following forms should be used for evaluations of five or more similar dwellings:

- **Form 5.1 –** Building Condition Form for Lead Hazard Risk Assessment.
- **Form 5.2 –** Field Report of Visual Assessment for Lead Hazard Risk Assessment.
- **Form 5.3 –** Field Paint-Chip Sampling Form.
- **Form 5.4a –** Field Sampling Form for Dust (Single-Surface Sampling), or **Form 5.4b** (Composite Sampling).
- **Form 5.5 –** Field Sampling Form for Soil.
- **Form 5.6 –** Questionnaire For a Lead Hazard Risk Assessment of More Than Four Rental Dwelling Units.

1. Targeted, Worst Case, and Random Sampling

The risk assessment protocol described here uses a targeted sampling strategy. Targeted sampling selects dwellings that are most likely to contain lead-based paint hazards to represent the other dwellings *based on information supplied by the owner* (i.e., units are not selected randomly or on the basis of visual evidence obtained by the risk assessor). The sampling protocol presumes that if the selected dwellings are free of lead hazards, it is highly probable that the other similar dwellings are also free of lead hazards. Targeted sampling has been used in public housing risk assessments for several years. This sampling protocol reduces the cost of assessment and is unlikely to miss significant lead hazards, provided accurate targeting information is provided by the owner.

Alternatively, similar dwellings can be evaluated with worst case sampling or random sampling. Worst case sampling requires a walk-through survey of *all* dwellings by the risk assessor in order to select the highest-risk dwellings based on direct visual evidence. Worst case sampling is not practical for most multiple dwellings, since it is nearly impossible to gain entry to all units in an expeditious fashion.

Some concerns have been raised about both targeted and worst case sampling, because it is not possible to quantify the degree of certainty associated with the findings as is the case for random sampling. However, if the risk assessor is conscientious about the proper selection of dwellings to be sampled (using the dwelling selection criteria), is confident that the information supplied by the owner is credible and complete, and is confident that the targeted dwellings meet the selection and similarity criteria, then the risk in a given development can be characterized sufficiently for the purpose of hazard control.

If the owner requires a statistically significant degree of confidence about the existence of lead-based paint hazards, random sampling should be used. Random sampling is recommended for lead-based paint inspections because the results are often used to develop more expensive, long-term hazard control measures or to provide a regulatory exemption if no lead-based paint is found. (Only a full lead-based paint inspection, not a risk assessment or limited paint testing, may be used to determine the absence of lead-based paint on a property.) A full discussion of random sampling and a random sampling protocol can be found in Chapter 7. Random sampling in multi-family settings with more than 20 pre-1960 units, or more than 10 1960-1977 units, usually requires more dwellings to be sampled and therefore may increase

the cost of the risk assessment compared with targeted or worst case sampling, with the trade-off that random sampling avoids questions about the quality of the criteria used for targeting or worst case sample selection. **However, the relatively small additional cost can provide for a more precise overall determination of the existence and location of lead-based paint hazards, which could significantly reduce the potential costs of conducting lead hazard control, and ongoing maintenance, activities.**

The risk assessor must be confident that targeted dwellings meet the dwelling selection criteria defined below. Targeted sampling should not be conducted if the owner is unable to provide accurate information about the occupancy status and physical condition of the dwellings to be sampled. If it appears that this information is unavailable or is being concealed by the owner, the risk assessor should resort to random or worst case sampling. Regardless of the sampling method, if any of the sampled dwellings contain identified lead hazards, all similar unsampled dwellings should also be presumed to contain similar hazards.

The risk assessor should provide, in the final report, a description of the unit sampling method used.

a) **Number of Dwellings to be Sampled.** Table 5.10 describes the number of dwellings that are needed for targeted sampling. Targeted sampling cannot be used for evaluations of fewer than five similar dwellings, because, when fewer than five similar dwellings are being evaluated, *all* units should be sampled. The recommendations contained in Table 5.10 are drawn in part from a public housing risk assessment and insurance program. The empirical evidence suggests that the recommended number of units sampled adequately characterizes the risk in the entire housing development.

   When determining the number of targeted dwellings, dwellings that are known to currently house children under age 6 with elevated blood lead levels should be excluded from the total unless there are more than 10 such units, in which case they should be added to the total. (See Chapter 16.)

   Each dwelling housing a child under age 6 with an elevated blood lead level must be evaluated independently. Depending on state or local procedures, this evaluation may be performed by the state or local health authority or the risk assessor. If, after consultation with the health department, it is agreed that the risk assessor will perform an investigation, the evaluation should use the protocol that is described in Chapter 16 for dwellings housing children with elevated blood lead levels. This investigation should be completed *in addition to* the other units included in the risk assessment.

   Since individual blood lead levels are confidential medical information, owners may not know whether children with elevated blood lead levels reside in their dwellings. Nevertheless, the risk assessor should request this information from the owner in order to try to better target the study.

b) **Dwelling Selection Criteria.** The selection criteria found here offer general guidance for selecting targeted dwellings. Risk assessors should obtain the information needed from the owner's records (if available) or through interviewing the owner. Targeted dwellings should meet as many of the following criteria as possible (criteria are listed in order of importance).

- Dwellings cited with housing or building code violations within the past year.
- Dwellings that the owner believes are in poor condition.
- Dwellings that contain two or more children between the ages of 6 months and 6 years. (Preference should be given to dwellings housing the largest number of children.)
- Dwellings that serve as day-care facilities.
- Dwellings prepared for reoccupancy within the past 3 months.

If additional dwellings are required to meet the minimum sampling number specified in Table 5.9, the risk assessor should select them randomly.

If there are a number of dwellings that all meet the same criteria, then the dwellings with the largest number of children under the age of 6 should be selected. (Children tend to cause increased wear and tear on painted surfaces; therefore, dwellings where children reside are more likely to contain dust-lead hazards.) When possible, at least one dwelling in the sample should have been recently prepared for reoccupancy (although it need not be vacant), since the repainting and other repairs that are often conducted during vacancy can create a leaded-dust hazard. However, the risk assessor should not sample *only* dwellings that have recently been cleaned and repainted, since this would not accurately represent the conditions in the rest of the dwellings. If there are too many units that all meet the same criteria, the required number should be selected randomly. (See Chapter 7 for a discussion of random selection methods.) There can be many combinations of targeted dwellings that will all meet the selection criteria. The risk assessor should document which of the criteria were used to designate the dwelling as a targeted unit on the field sampling forms (Forms 5.3, 5.4a (or 5.4b), and 5.5). Figure 5.20, "Example of Targeted Dwelling Selection," below shows how such a targeting system works.

C. Risk Assessments of Fewer Than Five Rental Dwellings and Multiple Dwellings That Are Not Similar

When evaluating fewer than five similar rental dwellings or multiple dwellings that are not similar, each of the dwellings should be assessed individually (see Section III.A above for the description of "similar dwellings," and for forms and other information). The risk assessor will not be able to draw solid conclusions from a smaller sample. Evidence from the public housing risk assessment program suggests that hazards in different single-family, scattered-site dwelling units vary greatly, unlike similar multi-family dwelling units where a clear pattern of hazards typically exists among dwellings.

Table 5.10 Minimum Number of Targeted Dwellings to Be Sampled Among Similar Dwellings (random sampling may require additional units).

Number of Similar Dwellings	Number of Dwellings to Sample*
1-4	All
5-20	4 units or 50% (whichever is greater)**
21-75	10 units or 20% (whichever is greater)**
76-125	17
126-175	19
176-225	20
226-300	21
301-400	22
401-500	23
501+	24 + 1 dwelling for each additional increment of 100 dwellings or less

**Does not include dwellings housing children with elevated blood lead levels.*

***For percentages, round up fractional dwellings to determine number of dwellings to be sampled.*

1. Assessments of Five or More Dwellings That Are Not Similar

Owners of a large number of dwellings that are not similar may find the costs of a risk assessment evaluating all dwelling units daunting. These *Guidelines* therefore recommend that risk assessors use their professional judgment to determine whether there is a pattern of lead hazards among dwellings. If a clear pattern emerges, it may not be necessary to evaluate all dwellings.

The sampling method that should be employed is a modification of the targeted sampling model. Usually, it will be necessary to sample more dwellings due to increased variability.

- The risk assessor should collect information about the condition of the building(s) and the age and location of children in residence, and rank the dwellings based on the selection criteria.
- The risk assessor should then sample 25 percent of the total number of dwellings or five dwellings (whichever is greater).

— The first group of dwellings to be sampled should be chosen from the units thought to be at highest risk. The results should be evaluated to determine if a clear pattern of lead-based paint hazards can be discerned.

— If no clear pattern emerges, additional dwellings should be sampled until a pattern of hazard severity and location becomes apparent or until all dwellings have been sampled.

For example, a risk assessor evaluating 100 different dwellings selects a sample of 25 targeted dwellings. The risk assessor finds that 20 of the 25 targeted dwellings have high leaded-dust levels on interior window sills, but no other lead-based paint hazards are found. In this situation, the risk assessor may suggest to the owner that the interior window sills in most or all 100 dwellings are likely to be contaminated and therefore should be cleaned without further sampling. The owner must decide whether to follow this recommendation or continue the risk assessment for additional dwellings.

2. Assessments of Fewer Than Five Similar Dwellings

When conducting evaluations of less than five dwellings, risk assessors may find that it is appropriate to modify the amount of information they request from owners. Owners of a small number of dwellings are likely to have simplified management structures (e.g., the owner acts as both manager and maintenance worker). If this is the case, the risk assessor should shorten both the management and maintenance questionnaires.

For small evaluations, the risk assessor may find it helpful to interview residents using the resident questionnaire (after obtaining permission to do so from the owner). Risk assessors should notify residents that the questionnaire is optional and should not make more than one trip to the dwelling to collect the information. For large evaluations, the use of the questionnaire is not feasible.

D. Analysis of Management and Maintenance Practices (Optional)

Many forms of lead hazard control will require property management planning and careful maintenance work on surfaces that are known or presumed to contain lead-based paint. To help owners undertake these activities, risk assessors can collect information on how management and maintenance work is structured on a given property by using Form 5.6. Information on this form will help the risk assessor make practical recommendations on how maintenance work can be done safely for both workers and resident children. Analysis of management and maintenance practices is recommended but not required.

IV. Laboratory Analytical Procedures

Samples of paint, dust or soil must be analyzed for lead by a laboratory recognized by EPA under the National Lead Laboratory Accreditation Program (NLLAP) for analysis of lead in that medium. NLLAP monitors the analytical proficiency, management and quality control procedures of each laboratory participating in the program. NLLAP does not specify or recommend analytical methods. Information on this program can be obtained by calling the National Lead Information Center at 1-800-424-LEAD.

(Hearing- or speech-challenged individuals may access this number through TTY by calling the toll-free Federal Relay Service at 800-877-8339.) Useful information on the NLLAP program is available on the EPA web site at ***http://www.epa.gov/lead/pubs/nllap.htm***. See Chapter 7 for further guidance.

EPA-recognized chemical test kits ("spot test kits") which do not involve collecting a sample of the paint may be used by a certified renovator, certified lead-based paint inspector or certified risk assessor as described in Section II.F.2, above; these individuals need not be working for a laboratory recognized by NLLAP for analysis of lead in dust.

Field-portable XRF measurement of lead in paint does not involve collecting a sample of the paint, so it is not covered by NLLAP, and the measurements need not be performed by an NLLAP-recognized laboratory. See Chapter 7 for further guidance.

Field-portable XRF analysis has been used for measurement of lead in dust (Sterling, 2000; Harper, 2002) or soil (EPA, 2004; Binstock, 2009) with varying degrees of success; these methods do involve collecting a sample of the medium, so samples collected from target housing or pre-1978 child-occupied facilities, must be analyzed by a laboratory recognized by NLLAP for analysis of lead in the particular medium. The laboratory may be a mobile laboratory, field sampling and measurement organization, or a fixed-site laboratory, as discussed in Section II.E.6, above.

V. Evaluation of Findings

The ultimate goal of any risk assessment is to use the data gathered from the questionnaires and/or interviews, the visual assessment, and the environmental sampling to determine whether any lead-based paint hazards are present. (Hazardous levels of lead for risk assessment purposes are summarized in Table 5.11, below). If lead hazards are found, the risk assessor will also identify acceptable options for controlling the hazards in each property. These options should allow the property owner to make an informed decision about what actions should be taken to protect the health of current and future residents. The risk assessor's recommendations could include hazard control measures to correct current lead-based paint hazards, and/or new property management and maintenance policies designed to prevent hazards from occurring or recurring.

A. Interpreting Results of Environmental Testing

Table 5.10 shows the criteria to be used for interpreting environmental samples collected during lead-based paint risk assessments.

1. Dust

EPA Hazard Standard

A dust-lead hazard is present in a residential dwelling, when the mass-per-area concentration of lead (also called "lead loading") is equal to or greater than the levels in Table 5.11, below (see 40 CFR 745.65).

While most risk assessors use single-surface dust sampling, and comparing the results of each sampled area with the dust-lead hazard standards in order to obtain the most specific information about where lead in dust is located, several dust wipe samples from the same surface type (e.g., floor) may be combined to determine if a dust-lead hazard is present using the weighted

arithmetic mean of the samples (see 40 CFR 745.63). The purpose of weighting is to give influence to a sample relative to the surface area it represents. The weighted sample may include single-surface samples and/or composite samples. A composite sample may contain from two to four sub-samples, each of which should have been taken from an area that is the same size as the other, and the same size as any single-surface samples. Each single-surface sample included in the averaging with a composite should have the same area as each subsample (for example, 1 square foot on a floor). The weighted arithmetic mean is obtained in several steps; an example is shown to demonstrate how the process works:

The example (see the table below) is of a single-surface sample containing 60 µg/ft², a composite sample (with three subsamples) containing 100 µg/ft², and a composite sample (with four sub-samples) containing 110 µg/ft².

Step 1: For each sample being composited, calculate the product of the sample's lead loading multiplied by the number of subsamples in the sample. (For example, in the third sample shown in the table below, the product is 110 * 3 = 330.)

Step 2: Sum up the products (calculated in step 1) for all of the samples. (For example, 60 * 1 = 60, 100 * 3 = 300, and 110 * 4 = 440; and the sum of the products is 60 + 300 + 440 = 800.)

Step 3: Sum up the total number of subsamples in all samples. (For example, 1 + 3 + 4 = 8.)

Step 4: Divide the sum of the products (calculated in step 2) by the total number of subsamples in all samples (calculated in step 3). (For example, 800 / 8 = 100.)

The result in this example is that the weighted arithmetic mean is 100 µg/ft².

This result can also be obtained using the following formula, which is equivalent to the series of steps above:

$$[(60 * 1) + (100 * 3) + (110 * 4)] / (1+3+4) = [800] / (8) = 100.$$

Sample weight (µg/ft²)	Number of subsamples
60	1
100	3
110	4

If both carpets and hard floors are sampled, the weighted average for floors should include both types of floor samples. That is, both carpet and hard-floor samples should be averaged together.

The EPA standards are based on "loading" (mass over area) instead of concentration (mass over mass). Loading is a better indicator of elevated blood lead levels and total amount of leaded-dust present inside the dwelling and is easily measured by the most widespread and inexpensive method of settled dust sampling, wipe sampling (Lanphear, 1996). The dust-wipe sampling protocols in Appendix 13.1 and in ASTM E 1728 are equivalent to the sampling method used in the research reported in Lanphear, 1996. In addition, cleaning can reduce loading but not necessarily concentration. Thus, loading is the most informative measure for risk assessment and post-lead hazard control clearance purposes currently available.

Some state and local jurisdictions use different standards for dust-lead hazards. If it is necessary for the dwelling to pass a local dust-lead hazard standard, the risk assessor should be familiar with the local standard and how that standard is measured. Where there are different legal or regulatory standards that may apply to a specific risk assessment or clearance examination, the most stringent (protective) applies.

Interpreting Detection Limits, Reporting Limits, "Non-detects" and "None Detected"

Methods used by laboratories to analyze the amount of lead in a wipe sample are limited in terms of how small an amount of lead can be measured and reported reliably. Therefore, laboratories accredited under the NLLAP program do not report values less than a "quantitation limit" or "reporting limit" that they have established for a given type of analysis, which is higher than the "method detection limit" (or, informally, "detection limit").

- The "detection limit" or "method detection limit" is defined in 40 CFR, Part 136, Appendix B, which is cited by the NLLAP LQSR (see, especially pages 20, 24 and 50; ***http://www.epa.gov/lead/pubs/lqsr3.pdf***) as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte (substance) concentration is greater than zero. In other words, the presence of the analyte can be confirmed, but the precise concentration cannot be reliably determined.
- The "reporting limit" or "quantitation limit" is the lowest concentration that can be reliably measured (within specified limits of precision and accuracy) by the laboratory, it is generally 3 to 10 times the method detection limit. (NLLAP LQSR, especially pages 20, 24 and 41) Results that fall below the reporting limit will be reported as "less than" the value of the reporting limit, e.g., <11.0 µg/ft², BRL (below reporting limit), BQL (below quantitation limit), or ND (none detected), etc., dependent upon the laboratory's reporting format. (NLLAP LQSR, especially pages 42 and 51)
- Results that are between the reporting limit and the maximum reporting limit will be reported as the determined value.

Lead professionals should contact their laboratory if they have specific questions on these matters.

Table 5.11 Federal Hazard Levels for Lead Hazard Risk Assessments.

Media	Lead Level (equal to or greater than)	
Paint*	1 mg/cm² or 5,000 ppm (or µg/g)	
Dust (wipe sampling only; single-surface or composite; the weighted arithmetic mean of all samples of the same component type within a dwelling or common area is compared to the hazard level; for floors, carpet and hard-floor samples are averaged together):	**Risk assessment**	**Lead hazard screen** (dwellings in good condition only)
Carpeted floors	40 µg/ft² (0.43 mg/m²)	25 µg/ft² (0.27 mg/m²)
Hard floors	40 µg/ft² (0.43 mg/m²)	25 µg/ft² (0.27 mg/m²)
Interior window sills	250 µg/ft² (2.70 mg/m²)	125 µg/ft² (1.40 mg/m²)
Bare soil:*		
Bare soil in play areas	400 µg/g	
Bare soil in non-play areas in the dripline / foundation area and/or the rest of the yard (including gardens, pet sleeping areas, bare paths, and other spots)	1,200 µg/g	
Water (optional) — first draw, 250 mL	20 ppb (µg/L) **	

** See 40 CFR 745.65. Hazard levels may be lower in some state or local jurisdictions.*

** 58 *Federal Register* 26548, June 7, 1991, *at* 26479. *Not based on the risk assessment regulation at 40 CFR 745; see Section V.A.5, below.*

Laboratory reporting limits typically vary from 10 to 20 µg for analysis of dust wipe samples for lead. Many, if not most, laboratories are in the 15-20 µg range. It is not uncommon for analyses of dust samples to yield values less than these reporting limits. How should a risk assessor calculate the weighted arithmetic mean lead loading if one or more of the samples are "non-detects?"

These *Guidelines* recommend that the risk assessor use the reporting limit minus 1 as the value to be included in the calculation of the weighted average for those samples that are reported by the laboratory to have an amount of lead that is less than the reporting limit. Thus, if the reporting limit is 15, presume for this purpose that the sample contained 15 minus 1, or 14 µg of lead. This procedure errs on the side of protectiveness, because it is quite likely that the actual level is less that the presumed level.

Interpreting Individual Samples That Exceed the EPA Standard

Because the EPA hazard standard is based on an average of all the wipe samples taken on the relevant surface (floor or interior window sill), the question arises as to what response is appropriate if one or more individual dust samples exceeds the hazard level but the average of all samples for a dwelling unit or common area does not. In this case there is no hazard according the EPA standard, yet the risk assessor is confronted with one or more surfaces with high dust-lead levels. These *Guidelines* recommend that, in these cases, the risk assessor recommend cleaning of the surfaces or spaces with the high levels, and untested surfaces of the same component type. Possible examples of this situation might include a high lead level on the entryway floor, or a high level on a hard surface floor in a dwelling unit with mostly carpeted floors (that typically have lower lead levels in wipe samples than hard floors), or a high level on a specific window sill with a friction-surface hazard.

Figure 5.20 Example of Targeted Dwelling Selection.

A risk assessor is hired to conduct a risk assessment for 30 dwellings owned by a single property owner. Twenty-five of these dwellings are apartments in the same building, have similar construction and painting histories, and were acquired simultaneously. The other five were acquired from different owners at different times, have had little previous rehabilitation work, and have different construction styles. One of the 25 similar dwellings is known to house a child with an elevated blood lead level. The local health department has already informed the risk assessor that the department has no plans to evaluate the dwelling due to a staffing shortage.

In this case, the risk assessor will evaluate the following:

- Five dwellings of different construction.
- One dwelling housing the child with the elevated blood lead level (see Chapter 16).
- Ten dwellings of similar construction (in Table 5.4, 24 total dwellings require 10 dwellings to be sampled).

The risk assessor will conduct sampling in 16 dwellings, with the 10 targeted dwellings used to represent the 24 similar dwellings that do not house children with elevated blood lead levels. For the 24 similar dwellings, the owner has provided the following information about residents:

- Six dwellings have three children under age 6.
- Three dwellings have two children under age 6.
- Five dwellings have one child under age 6.

- Nine dwellings have an unknown number of children.
- One dwelling is vacant and has recently been prepared for reoccupancy. In addition, the owner has supplied the following resident use and maintenance information:
- Two dwellings have building code violations (one with three children, one with one child).
- Three dwellings have a history of chronic maintenance problems and are in relatively poor condition (two with an unknown number of children, one with two children).
- There are no known day-care facilities.

Based on this information, the risk assessor targets the following dwellings:

- Two dwellings with building code violations (one with three young children).
- Three dwellings rated in poor condition.
- One dwelling recently prepared for reoccupancy.

This yields six dwellings. The final four dwellings should be selected from among the five remaining similar dwellings that house three young children. Since there are no distinguishing factors among the five dwellings, the final four dwellings are selected randomly from this group.

Risk assessments of fewer than five similar dwellings or multiple dwellings that are not similar should include:

- The collection of information from the resident and/or the owner (or owner's representative) about the condition of the property, the age and location of children in residence, and the management and maintenance practices for the dwelling (optional).
- A visual assessment of the condition of the building(s) and painted surfaces of all dwellings.
- Environmental sampling of dust, soil and deteriorated paint in all dwellings (and common areas of multi-family developments).
- Use the forms for single family evaluations

For all hazard evaluations, the data should be examined to determine if consistent patterns emerge (e.g., the interior window sills contain high levels, while floors are low); such patterns will aid in the development of recommendations for focused, cost-effective control measures.

2. Paint

If paint contains lead equal to or greater than either of the following levels, it is considered to be lead-based paint under the Lead-Based Paint Poisoning Prevention Act (see Appendix 6):

- 5,000 µg/g (also expressed as 0.5 percent by weight, 5,000 mg/kg, or 5,000 ppm by weight). (paint chip samples analyzed in the laboratory by atomic absorption spectroscopy or inductively coupled plasma emission spectroscopy will usually be reported by weight percent.)
- 1.0 mg/cm² (XRF machines report lead content by area).

These are not equivalent standards. They are alternative standards, which are necessary because of the fundamentally different methods of measurement: the first is a concentration (mass over mass), and the second, "loading" (mass over area).

Some state and local jurisdictions may have lower (i.e., more stringent) standards.

It should be understood paint that has lead below the federal (or other) standard can still pose a health hazard, such as if a large enough area of such paint is subject to high-speed abrasion without dust capture.

Any component that contains deteriorated lead-based paint is a lead-based paint hazard and should be treated. If the amount of lead in deteriorated paint in federally-owned or -assisted housing is below the regulatory limit, lead hazard control measures are not required by Federal regulation (although paint stabilization is still recommended). Any component with deteriorated paint that is not tested and does not have a painting history similar to a tested component should be considered a lead-based paint hazard. (See Chapter 7 for guidance on sampling of components.) In the event that all paint tests are below the standard, the owner cannot presume that *all* surfaces in the dwelling are free of lead-based paint, since not all surfaces were tested. Instead, the owner must have a complete lead-based paint inspection (not a risk assessment) performed to document the absence of lead-based paint on a property. The owner should presume that untested paint surfaces in pre-1978 structures contain lead-based paint.

3. Bare Soil

Play Area Hazard Determination

A play area with bare soil containing lead levels equal to or exceeding 400 ppm is considered a soil-lead hazard. If all play areas with bare soil were sampled, the risk assessor should recommend lead hazard controls for each play area that is a soil-lead hazard, based on laboratory results. If, however, certain play areas were selected for soil sampling, and one or more of those play areas is determined to be a soil-lead hazard, the risk assessor should recommend *either* that all *unsampled* play areas with bare soil be treated as soil-lead hazards *or* that soil samples be collected from the unsampled play areas and that those with lead levels in excess of the standard be treated as hazards.

Non-play Area Hazard Determination

Bare soil in a non-play area, whether in a dripline/foundation area or in the rest of the yard, is considered a soil-lead hazard if it is represented by a composite soil sample with a lead level equal to or exceeding 1200 ppm.

The EPA's soil-lead hazard standard does not include a *de minimis* bare soil area threshold. "EPA's reasoning is that the disadvantages of establishing a *de minimis* outweighed the advantages. EPA has no analysis or data that relate the amount of bare soil to risk. EPA also believes that a *de minimis* area of bare soil provides little benefit." (EPA. Lead; Identification of Dangerous Levels of Lead; Final Rule. 66 *Federal Register* 1206, January 5, 2001, *at* 1226-1227. ***http://www.epa.gov/fedrgstr/EPA-TOX/2001/January/Day-05/t84.pdf***.) EPA went on to say (*at* 1227) that, "However, EPA highly recommends using the HUD Guidelines for risk assessment (Ref. 5). This would avoid declaring very small amounts of soil to be a hazard in the non-play areas of the yard. This would also help target resources by eliminating the need to evaluate soil or respond to contamination or hazards for properties where there is only a small amount of bare soil."

This edition of these *Guidelines* recommends, similarly to its recommendation in the 1995 edition cited by EPA, that, if the total surface area of bare spots in non-play areas on a property is no more than 9 square feet (0.83 square meters), the risk assessor may declare that soil samples are not necessary and avoid declaring that a lead-based paint hazard exists in those non-play areas.

If two or more composite samples were collected to represent bare soil in a certain area, the risk assessor should calculate an arithmetic mean of the results of the sample analyses in order to determine whether the subject area is a soil-lead hazard.

These general principles are illustrated in Figure 5.21.

- **Example:** In this example, the property has nine residential buildings, five of which were selected for sampling in accordance with principles described in Section II.G.3, above. A composite sample of bare soil was collected from the dripline/foundation area and from the rest of the yard associated with each of the five selected buildings, except that no sample was collected from the dripline/foundation area of buildings #1 and #4 and no sample was collected from the rest of the yard in buildings #3 and #8, because there was no bare soil. The following data are obtained from Form 5.5, or similar form, for non-play areas:

There are no soil-lead hazards in non-play areas of the rest of the yard in the sampled buildings. Therefore the risk assessor may find that there are no hazards in the rest of the yards associated with the unsampled buildings.

For the sampled buildings, soil-lead hazards are present in the dripline/foundation areas of buildings #6 and #8. In order to determine whether there are hazards in the dripline/foundation areas of unsampled buildings, the risk assessor should calculate an arithmetic average of the results of the dripline/foundation area samples that were collected.

Figure 5.21 Example of Soil Hazard Determination in Non-Play Areas.

Residential Building No.	Type of Non-play Area Sampled	Laboratory Result (ppm)
#1	Rest of the yard	300
#3	Dripline/foundation area	800
#4	Rest of the yard	350
#6	Dripline/foundation area	2,000
#6	Rest of the yard	750
#8	Dripline/foundation area	2,400

For the non-play areas of the rest of the yard in the sampled buildings, because all of the lead concentrations are below the soil-lead hazard level of 1200 ppm, there are no soil-lead hazards in these rest-of-the-yard areas. Therefore the risk assessor may find that there are no hazards in the rest-of-the-yard areas associated with the unsampled buildings.

For the dripline/foundation areas of sampled buildings #3, #6 and #8, some of the lead concentrations are at or above the soil-lead hazard level of 1200 ppm, and some are below. In order to determine whether there are hazards in the dripline/foundation areas of unsampled buildings, the risk assessor should calculate an arithmetic average of the results of the dripline/foundation area samples that were collected.

The average of the three results is calculated as follows:

800 + 2,000 + 2,400 = 5,200

5,200 / 3 = 1,733

Because 1733 is greater than the standard of 1200, the risk assessor must determine that any bare soil in dripline/foundation areas associated with the unsampled buildings is a soil-lead hazard. This determination would be changed if such unsampled soil is sampled and the laboratory results indicate the absence of a hazard.

There is no federal hazard standard or guideline for lead in garden soil. Research on plant uptake of lead suggests that a lead concentration 400 ppm is reasonably protective as a maximum value for vegetable garden soil (Finster, 2004). This recommendation is also based on the need to protect young children when accompanying adults in garden areas.

Note, finally, that some state, tribal, and local jurisdictions may have soil-lead standards that are more protective than those discussed above.

4. Hazard Evaluation by Targeted, Worst-Case, or Random Sampling

a) **Dust:** When a multi-family property is evaluated with targeted, worst-case, or random sampling of dwelling units (see unit III.B.1, above), the risk assessor must conclude that a dust-lead hazard is present on floors or interior window sills of an unsampled dwelling unit or common area if a dust-lead hazard is found (using procedures and standards described in the preceding paragraphs) on floors or interior windows sills, respectively, in one or more of dwelling units or common areas on the property.

When any of the sampled dwelling units or common areas have dust-lead hazards, the risk assessor and the property owner or manager must decide whether it is more cost-effective to clean and control hazards in all the unsampled units (or common areas) or to conduct dust sampling in a random sampling or all of the unsampled units or areas and clean and control only those units found to contain hazards. The owner, with the assistance of the risk assessor, should estimate the costs and benefits of more sampling versus cleaning all units. It would not pay to continue sampling if almost all of the sampled units and common areas have dust-lead hazards. It would pay to sample more if only a small percentage have hazards, except when renovation or paint-lead hazard control work will be conducted in most of the unsampled units, in which case cleanup will be required after the work anyway. If random sampling is to be conducted of previously unsampled units or common areas, it is recommended that the random sampling procedures and interpretive decision logic of Chapter 7 be followed.

- For properties constructed between 1960 and 1977, and for properties constructed before 1960 which have fewer than 178 units, the entire number of units in the properties is used for determining the number of units to be randomly sampled in accordance with Chapter 7's table 7.3. The units sampled through targeted or worst-case selection of those properties are not considered in the random selection process; all units in the property are used for the random selection process. (If it happens that some of the already-sampled units are selected for random sampling, the results for those already-sampled units may be used without having to be retested.)

- For properties constructed before 1960 which have 178 or more units, the entire number of units in the properties is used for determining the number of units to be randomly sampled in accordance with Chapter 7's table 7.3, but the units sampled through targeted or worst-case selection are excluded from the random selection process because those already-sampled units are counted for the random selection process, and their sampling results used as part of the random sample results. The number of units already sampled is subtracted from the number of units to be sampled randomly per table 7.3; the remaining unsampled units are the ones from which units are randomly selected. (For example, during targeted sampling, in a property of 200 pre-1960 units, 20 units were sampled. Once the owner chooses to switch to random sampling, table 7.3 indicates that 51 units are to be sampled randomly. Only 51 – 20 = 31 units need to be randomly sampled; these units are selected from among the 200 – 20 = 180 unsampled units.)

b) **Paint.** Targeted sampling presumes that all dwellings under assessment have similar (but not identical) painting histories. Therefore, if the bathroom door in one dwelling is coated with lead-based paint, then it is highly likely that bathroom doors in all similar dwellings are also coated with lead-based paint. To determine that lead-based paint is *not* present

throughout a development, see Chapter 7. The results of the paint testing should be analyzed by component type and room-equivalent type. If all components of a certain type in a type of room equivalent are at or above the paint standard or all are below, then the risk assessor can presume that this condition is true for the total population of similar dwellings. However, if a component/room-equivalent combination (e.g., living room baseboards) contains lead-based paint in some dwellings and not in others, the owner must presume that all similar components present a lead hazard unless paint testing or a lead-based paint inspection shows otherwise.

5. Water (Optional)

Water sampling, which is optional for a routine risk assessment, can be interpreted using the current EPA action level for lead in drinking water at individual outlets (not the entire distribution system) in schools (because EPA does not have an action level for individual outlets in homes), which is:

- 20 ppb (20 parts per billion; 20 micrograms per liter; 20 µg/L; or 0.020 mg/L) – drawn as a 250 mL first draw after the water has remained in the pipe overnight (with the water standing for at least 6 hours).

(EPA noted that the distribution system-wide lead action level of 15 ppb in water at the 90th percentile of the sampled outlets, and the individual-outlet "lead action level[] differ because of the different problems they seek to detect and the different monitoring protocols used in the two situations." 58 *Federal Register* 26548, June 7, 1991, *at* 26479. ***http://water.epa.gov/drink/info/lead/excerptfrom58.cfm***).

If any of the first-draw tap water samples exceed 20 ppb lead, the risk assessor should recommend that the client (typically the owner) take the water outlets from which those samples were drawn out of service, and that the owner contact the local water department to determine if corrosion control or other control measures are in the process of being implemented. (***http://water.epa.gov/drink/info/lead/testing.cfm***) If the dwelling does not use public water or receive water from a water supplier, but instead uses a private drinking water well, see Section II.H, above, and the references in that section.

See appendix 13.5, "EPA Information on Drinking Water," for the EPA pamphlet, "Is there lead in my drinking water?" This pamphlet, intended for the general public, is also available in the graphic format in the appendix at ***http://www.epa.gov/safewater/lead/pdfs/fs_leadindrinkingwater_2005.pdf***, as well as in a text format as a factsheet at ***http://water.epa.gov/drink/info/lead/leadfactsheet.cfm***.

The risk assessor should inform the owner and/or resident that often the simplest way to reduce lead in drinking water is to flush the water lines by letting the cold water kitchen tap run for a minute or two whenever the water has not been used for 6 hours. This helps only if the lead is from the home's plumbing, not the service lines.

Further information on water sampling and interpretation of results is at EPA's "Lead in Drinking Water" website, at ***http://water.epa.gov/drink/info/lead/***, and the EPA's Safe Drinking Water Hotline at 800-426-4791. (Hearing- or speech-challenged individuals may access this number through TTY by calling the toll-free Federal Relay Service at 800-877-8339.)

6. Other Lead Sources (Optional)

If other lead sources are discovered in the dwelling, the risk assessor should inform the client (typically the owner), and recommend the client contact the local health department or the local childhood lead poisoning prevention program for assistance in devising control strategies and assessing the degree of risk. However, it should be understood that a typical risk assessment, as distinguished from an environmental investigation in response to a child with an elevated blood lead level (see Chapter 16), does not seek to identify all possible sources of lead that may be present on a property. Rather, a typical risk assessment is designed to identify only "lead-based paint hazards" as defined in Section I, above.

For information on other sources, consult the Federal lead information pamphlet, *Protect Your Family from Lead in Your Home* (***http://www.epa.gov/lead/pubs/leadpdfe.pdf***).

If it appears that a parent or other resident works in a setting that exposes them to lead, and is bringing lead hazards into the house, the Occupational Safety and Health Administration (OSHA) can be notified anonymously by the resident. ***http://www.osha.gov/html/Feed_Back.html*** is OSHA's The Contact Us webpage; it shows:

- The toll free number to report unsafe working conditions or safety and health violations, or ask workplace safety and health related questions, 1-800-321-OSHA (6742) (hearing- or speech-challenged individuals may access this number through TTY by calling 1-877-889-5627);
- The procedure for filing a complaint form with OSHA;
- Information on submitting workplace safety and health related questions by e-mail, mail, or on-line form;
- A map of OSHA offices, with links to the addresses and phone and fax numbers for the OSHA Regional Offices, Area Offices, and On-site Consultation Program Offices; and
- Instructions on how to view, download and order publications, forms, or the OSHA poster.

The OSHA lead standards (29 CFR 1910.1025 and 1926.62) contain important provisions to prevent workers from "taking home" occupational dust containing lead. (See Chapter 9 and Appendix 6.)

B. Evaluating Management Policies (Optional)

Except in the case of complete removal of all lead-based paint (or all components coated with lead-based paint), some type of ongoing management and maintenance of lead hazards will be required for all properties. Homeowners and owners of only a few dwellings will generally have to take on this responsibility themselves. When a risk assessor begins to describe hazard control options to these owners, it is important that the ongoing management and maintenance, monitoring, and reevaluation requirements are explained fully for each option. Chapter 6 provides guidance on lead-safe maintenance.

For owners of larger multiple dwellings, adequate management staff may already be in place, but this new responsibility may not be understood. The owner should assign responsibility for managing the various aspects of a lead hazard control program, and the program should be described in

a Lead Hazard Control Policy Statement (see Figure 5.22). The Statement documents the owner's awareness of the lead hazard problem and intention to control it. In addition, the Statement authorizes a specific individual to carry out the lead hazard control plan; assigning clear responsibility to a single individual is especially important for multiple owners and property management companies. The owner (with input from the risk assessor) should determine which employees are best positioned to conduct the following activities:

- Training and management of staff who will maintain hazard controls.
- Periodic surveillance of lead hazards and hazard controls.
- Response to resident reports of deteriorated paint.
- Response to reports of resident children with elevated blood lead levels.
- Controlled maintenance and repair work.
- Other lead-related activities or problems.

The risk assessor should recommend that the responsible individual acquire training. Often, the best person for this role is someone in authority who has received previous training and who has demonstrated concern about the issue. HUD recommends that lead managers take an appropriate lead management course. If none is available, a HUD-approved curriculum in Lead Safe Work Practices, such as the EPA/HUD Renovation, Repair and Painting (RRP) course (see Appendix 6) should suffice. Information about the curricula listed is available on HUD's website at: ***www.hud.gov/offices/lead/training***. These curricula are approved by EPA and HUD as meeting the training requirement of EPA's RRP Rule for individuals performing or supervising maintenance or interim controls activities that disturb significant amounts of paint in target housing and pre-1978 child occupied facilities. (If all of the work that would trigger the RRP Rule will be performed by outside contractor(s), so that the lead hazard control program manager is not directly performing the work or supervising the workers, the manger is not required to take the training, although HUD recommends doing so in order to enhance the manger's understanding of the activities of the contractor(s).)

The dwelling turnover process should be reviewed to determine if work practices and cleaning efforts require modification. The risk assessor should decide what types of wet cleaning and repainting efforts can be achieved safely by the owner. Environmental data gathered from dwellings recently prepared for reoccupancy should be examined to determine if hazard control measures are taking place while the dwelling is vacant (when such measures are often much easier and cheaper to complete).

Figure 5.22 Example of a Lead Hazard Control Policy Statement.

_____(property owner/management firm name) is committed to controlling lead-based paint hazards in all its dwellings.

_____(name), _____(position or job title), has my authority to direct all activities associated with lead hazard control, including directing training, issuing special work orders, informing residents, responding to cases of children with elevated blood lead levels, correcting lead-based paint hazards on an emergency repair basis, and any other efforts that may be appropriate. The company's plan to control such hazards is detailed in a risk assessment report and lead hazard control plan.

(Signed) _____ _____ (Date)
(Property Owner/Property Manager)

(Signed) _____ _____ (Date)
(Lead Hazard Control Program Manager)

As part of the management evaluation process, the risk assessor should examine the owner's occupational safety and health program. See Chapter 9. Training is essential for maintenance personnel to ensure that they are protected and that they do not inadvertently create lead hazards in the course of their duties. Training is required for maintenance personnel in federally assisted, pre-1978 properties. For maintenance work that is covered by EPA's RRP Rule, at least the certified renovator who is supervising the work, must be trained and certified; the RRP Rule requires at least on-the-job training for the other workers, and permits the other workers also to be certified as renovators. For maintenance work that is covered by HUD's Lead Safe Housing Rule (typically in addition to being covered by EPA's RRP Rule), the supervisor and the other workers must be trained and certified as renovators. (See Chapter 11 and Appendix 6.) If qualified to address these occupational safety and health issues, the risk assessor may determine if respirator usage (and a respirator program), a medical surveillance program, or specialized equipment (notably a HEPA vacuum) are needed.

The risk assessor should help the owner decide what immediate actions to take if a child with an elevated blood lead level is identified. For example, the owner should consider what options are available to house the family temporarily (e.g., in one of the owner's lead-safe dwellings) if it appears the original dwelling may contain the source of lead. At a minimum, the owner should know where alternate housing can be found on a rapid response basis. Some property owners perform periodic general housing quality inspections, either on turnover or on a set schedule. The risk assessor should assist the owner in developing a plan for evaluating the condition of presumed or known sources of lead-based paint during these routine inspections.

The risk assessor can also help a larger property owner decide which properties should be assessed first, through developing a risk assessment/hazard control plan.

C. Maintenance of Multiple Dwellings (Optional)

In the course of the risk assessment, the risk assessor should determine if current maintenance practices are adequate to control lead hazards. Specifically, repainting should be performed at least every 5 years (more frequently when paint appears to be in poor condition). When repainting, the owner should be encouraged to use a lead-specific cleaner or deglossing agent to prepare the surface, and/or change to wet scraping and sanding, followed by the appropriate cleaning procedures described in Chapters 11 and 14. Specialized cleaning should always be performed following maintenance or repainting when disturbed surfaces are known or presumed to contain lead-based paint. Chapter 6 provides guidance on lead-safe maintenance.

If the property owner uses standard work order forms, the risk assessor should determine whether they contain proper instructions about working on known or presumed lead-based painted surfaces. For example, the work orders should instruct workers when to use respirators, implement dust containment, work wet, and use special cleaning measures (see Chapter 6).

The quality of the maintenance operation should also be evaluated from the prevalence of building or housing code violations, the condition of paint, and the condition of the building as rated on Form 5.1. If the building is in "poor condition," if there have been more than two code violations over the past 2 years, or if the condition of the paint is especially poor, then the risk assessor should evaluate the relationship between these findings and the implementation of the maintenance operation to see if it is deficient and if lead-based paint hazards are not being adequately managed. Such a situation may require a more frequent monitoring schedule (until removal of all lead-based paint is completed). See Chapter 6 for further details.

D. Lead Hazard Screen in Dwellings in Good Condition

Different criteria are employed to evaluate the results of lead hazard screens, which are limited to dwellings that are in good condition. Since less data and fewer samples are collected, more stringent standards are applied to determine if a full risk assessment is needed. This minimizes the possibility of failing to detect a lead-based paint hazard.

If the results of the dust or paint samples are equal to or greater than the levels shown in Table 5.11 (in Section V.A.1, above) for a lead hazard screen, a full risk assessment should be performed to determine if and where hazards truly exist in the housing. Environmental sampling results obtained from the lead hazard screen can be used in the full risk assessment. The screen criteria were developed by reducing the hazard standards for floors and for interior window sills. Reducing the standards, increases the ability of the screen to detect potential lead hazards is increased.

The criteria for the presence of lead-based paint in deteriorated paint, whether by XRF measurements or paint chip sample results, are the same as for a full risk assessment. If more than the *de minimis* amount of deteriorated paint (see Section II.D.3, above) is found to be lead-based paint, that deteriorated paint is a lead-based paint hazard, so a full risk assessment should be completed.

VI. Risk Assessment Report

The report compiled by the risk assessor documents the findings of the risk assessment and identified control methods. Report writing is an important element of completing risk assessments. The

professional responsibilities of a risk assessor include writing reports that are well-written, understandable, and meet EPA requirements. Clients, such as owners, are encouraged to request report revisions for clarity and regulatory compliance. This section describes the format of such a report, as well as general guidance on how to provide control options. The hazard control chapters of these *Guidelines* provide further information on the various forms of lead hazard control.

A. Site-Specific Hazard Control Options

First, the report should state whether any lead hazards were found at the dwelling. After the nature, severity, and location of identified lead hazards are described, the report should inform the owner of the range of acceptable hazard control measures.

1. Control Measures

These control measures range from various interim controls (e.g., specialized cleaning, minor wet scraping, and repainting) to abatement measures (e.g., building component replacement, enclosure, and paint removal) that may not, for such reasons as funding limitations, be conducted for a while. Table 5.12 lists the major options and scenarios, although the number of possibilities and combinations is virtually unlimited, and the absence of an "x" in a cell of the table does not mean that the recommendation may not be made. For example, if the risk assessor finds that interior window sills are highly contaminated with leaded-dust and deteriorated lead-based paint, but the owner has very limited resources, dust removal and paint film stabilization would be the most appropriate course of action. However, if more resources are available, perhaps the entire window should be replaced. For some properties, federal, state or local regulations may require a specific type of hazard control action.

Special attention should be given to hazard control recommendations pertaining to friction, impact and chewable surfaces as well as to deteriorated paint. If there is a *friction-surface* hazard (i.e., there is lead-based paint on a friction surface and the dust underneath the surface (or on it, in the case of a floor or stair tread) is a dust-lead hazard), the painted surface should be treated in such a way that paint that is known or presumed to be lead-based paint does not continue to be subject to friction or abrasion. Paint stabilization is not sufficient. Interim control of friction-surface hazards on windows is often difficult. Channel liners sometimes interfere with the smooth operation of the window and may not stay in place. While friction-surface hazards on doors can often be eliminated by properly re-hanging the door, this is rarely the case with double-hung windows, where there is usually some rubbing between the sash and the channel, even with a smoothly operating window.

It is important to note that paint stabilization may be an acceptable option if there is deteriorated lead-based paint on a friction surface but the risk assessor has *not* determined that there is a dust-lead hazard under or, for floors or stair treads, on the surface. In this case, a friction-surface hazard has not been established.

Friction-surface hazards on floors, stairs, counters, shelves and similar surfaces should be covered with a durable material appropriate to the surface, or the paint should be removed or the component should be replaced.

Paint hazards on impact surfaces can often be eliminated by paint stabilization and correcting the mechanical problem causing the impact, such as installing a door stop or, again, re-hanging the door.

If there is a chewed surface with lead-based paint and a child under 6 is present, the surface should be covered with a material that cannot be penetrated by the bite of a young child, the paint should be removed or the component replaced.

2. Education

The risk assessor who has an ongoing relationship with the property owner or property manager / agent has a special role to play in educating the various parties involved in lead-poisoning prevention. Title X specifically states that lead hazard control efforts should include education, since it is critical to the success of any interim control or abatement plan. In a multi-family development, this includes education for management and maintenance staff and residents. While the risk assessor cannot be expected to train and educate everyone, some simple steps can and should be recommended in the final report.

a) **Management Staff Education.** While meeting with the owner or property manager to describe the lead hazard control options available, the risk assessor can help educate them on the seriousness of lead hazards and the feasibility of avoiding or controlling them. The EPA lead hazard information pamphlet, pre-renovation education pamphlet, or other local literature should be handed out. Information on the EPA Pre-Renovation Education Rule and the EPA Renovation, Repair, and Painting (RRP) Rule should also be provided (see Appendix 6). The EPA brochures are available from the National Lead Information Center (800-424-LEAD; ***www.epa.gov/oppt/lead/pubs/nlic.htm***) and the EPA website, ***http://www.epa.gov/lead/pubs/brochure.htm***. (Hearing- or speech-challenged individuals may access this number through TTY by calling the toll-free Federal Relay Service at 800-877-8339.)

b) **Maintenance Staff.** The risk assessor should inform the owner of the EPA RRP Rule and OSHA Lead Standard requirements as they apply to maintenance workers who may be involved in repair work on surfaces coated with lead-based paint and the employer's obligation to train those workers (see Chapter 9 and Appendix 6).

c) **Residents.** The risk assessor should recommend to the owner that all information regarding the presence of lead-based paint hazards be shared with tenants. Under the Lead Safe Housing Rule, if the target housing property receives housing assistance from HUD or is owned by HUD, the owner must provide the results of the risk assessment to residents (24 CFR 35.125). Also, under the Lead-Based Paint Disclosure Rule issued by both HUD and EPA, landlords must disclose knowledge, records and reports of lead-based paint hazards (and lead-based paint) to prospective tenants, and disclosure must also be made to existing tenants at time of lease renewal if there is new information (24 CFR Part 35, Subpart A, and 40 CFR Part 745, Subpart F).

Table 5.12 Main Hazard Control Options That Could Be Identified in Risk Assessments Based on Actual Conditions.

Treatment Option	Dust[1] on Floor	Dust[1] on Window Sills	Paint[2] on Doors	Paint[2] on Windows	Paint[2] on Floor and Wall	Paint[2] on Trim	High Soil Lead Levels
Dust Removal	x	x	x	x	x	x	x
Paint Film Stabilization	x	x	x	x	x		
Friction Reduction Treatments	x		x		x		x
Impact Reduction Treatments	x	x			x		x
Planting Grass						x	x
Planting Sod						x	x
Paving the soil						x	x
Encapsulation				x	x		
Enclosure				x	x		
Paint Removal by Heat Gun[3]		x	x	x	x		
Paint Removal by Chemical[3]		x	x	x	x		
Paint Removal by Contained Abrasive[3]		x	x	x	x		
Soil Removal	x[4]					x	x
Building Component Replacement		x	x	x	x		

[1] *Dust-lead hazard.*

[2] *Deteriorated lead-based paint.*

[3] *Limited areas only.*

[4] *If soil-lead hazard present.*

B. Cost and Feasibility

1. Cost

Each owner will have a different level of available funding. Some will be able to make a long-term investment that will require a large capital outlay but will be less expensive in the long run, adding to the value of the property. Others will be unable to make this type of investment and will opt for short-term measures that require smaller initial outlays and more frequent monitoring. The risk assessor should endeavor to provide information that will assist the owner in making an informed decision on this complex issue. The owner, not the risk assessor, must make the final decision. Costs for various treatments vary considerably from one locale to the next and are subject to market conditions, making it difficult to provide cost estimates. However, the risk assessor should at least indicate the order in which acceptable hazard control options for a given hazard fall in terms of relative initial cost. That is, the options should be described in terms such as "lower initial cost" and "higher initial cost."

2. Feasibility

In addition to cost, the risk assessor should identify treatments that are unlikely to be effective, such as:

- Repainting or encapsulating an area of deteriorated paint caused by moisture problems (leaky roof, poor vapor barrier, uncorrected plumbing problem, window air conditioner, etc.) without correcting the moisture problem first.
- Repainting or encapsulating an area subject to impact and friction.
- Repainting or encapsulating deteriorated paint or varnish without preparing the surface first.
- Attaching encapsulants or enclosures to deteriorating structural members that may not be able to support the integrity of the enclosure or the additional weight of the encapsulant.
- Applying liquid encapsulants to deteriorated substrates.
- Replacing window sashes in frames that are severely deteriorated.
- Cleaning surfaces that are not sealed or made "cleanable."
- Cleaning highly soiled furnishings and carpets, instead of replacing them.
- Mulching or covering lead-contaminated soil in areas where pets tend to sleep or dig.
- Planting grass seed in high-traffic areas.
- Treatments in properties which are frequently damaged.
- Of course, the risk assessor must also emphasize the danger of using prohibited methods of lead hazard control, such as uncontained abrasive, sand, or water blasting; power-sanding; or open-flame burning of painted surfaces.

C. Reevaluation Recommendation

If the property is HUD-assisted, the risk assessor's recommendation should follow the applicable provisions of the Lead Safe Housing Rule (24 CFR 35.1355(b)(4)) for reevaluation at least as often as every two years.

If the property is not HUD-assisted, and lead hazards were identified, the risk assessment report should recommend reevaluation after completion of interim controls, encapsulation or enclosure of the lead hazards identified, unless all of the lead-based paint is to be removed and the housing passes a clearance examination. (If the risk assessor determines that soil-lead hazards may pose an ongoing health risk after the removal of the lead-based paint, the report may recommendation reevaluation of the soil.)

If the property is not HUD-assisted, and no lead hazards were identified by the risk assessment, the report should recommend a visual assessment annually and at occupant turnover, with reevaluation an option, based on the owner's lead hazard control policy.

See Section VII.B and C, below, for the main discussion of reevaluation, including the reevaluation schedule and protocol, respectively.

D. Recommendations to Owners When No Hazards Are Identified

If no lead hazards are identified, but no lead-based paint inspection has been completed, the risk assessment report should recommend to the owner that painted surfaces that the risk assessment found to be lead-based paint, and any untested painted surfaces, be treated as though they contain lead.

The risk assessor may encourage the owner to obtain an inspection, especially for a property constructed shortly before 1978, because the property will be exempt from Federal lead-based paint regulations if the lead-based paint shows that no lead-based paint is present. In the absence of an inspection, the risk assessor should indicate that lead hazards could still emerge in the event of paint deterioration or disturbance.

E. Report Format

The following is a suggested format for risk assessment reports. Other formats are acceptable, provided the necessary information is included. Items required by EPA regulations (40 CFR 745.227(d)(11)) are indicated as "EPA-required."

1. Executive Summary

It is recommended that a brief summary of the essential findings of the risk assessment be provided at the beginning of the report. This is helpful for all clients, but is especially useful for rental housing receiving Federal housing assistance, because HUD regulations require that tenants of such housing be notified of the results of a risk assessment (24 CFR 35.125). The HUD-required notification may be in the form of a summary and may be posted in a central place or distributed to individual units. The format of the executive summary provided at Form 5.7 meets the HUD requirements.

2. Table of Contents

To assist the reader in finding the information needed, reports should include a table of contents highlighting the key sections of the report.

3. Identifying Information and Risk Assessor's Signature (EPA-required)

The following information is required. Items in executive summary need not be repeated.

- Date of risk assessment.
- Address of each building.
- Year of construction of buildings.
- Apartment number (if applicable).
- Name, address, and telephone number of each owner of each building and each building manager.
- Name, address, and telephone number of the certified firm employing each certified risk assessor (if applicable).
- Name, address, and telephone number of each recognized laboratory conducting analyses of collected samples.
- Name, signature, and certification of the certified risk assessor conducting the risk assessment.

4. Purpose of This Risk Assessment

The report should contain a brief explanation of the purpose of the investigation, including the following:

a. Definition of a risk assessment

b. Explanation of why this risk assessment was performed. Some common reasons include:

   — An investigation of sources of exposure of a child with an elevated blood-lead level (EBL),

   — Required for a federally-assisted rehabilitation,

   — Required for Federally owned housing being sold,

   — Required for a federally-assisted multi-family property,

   — Required for a public housing development,

   — Requested by an owner or a prospective buyer of a home.

c. Description of any special requests by client.

5. Definitions

It is suggested that providing definitions of at least the terms below will be useful to owners so that they should be provided in the report. Risk assessors may wish to use the definitions in the Glossary of these *Guidelines,* (see Appendix 8.1, where these definitions are provided in the sample report) or the regulatory and/or statutory definitions for these terms. Risk assessors should note that, if lead-based paint, or lead hazard standards of an applicable EPA-authorized state, tribal or local program are more protective (e.g., have lower values) differ from federal standards, those applicable standards should be substituted for the values in the hazard definitions provided below.

- Abatement
- Bare soil
- Chewable surface
- Clearance examination
- Deteriorated paint
- Dripline/foundation area
- Dust-lead hazard
- Friction surface
- Garden area
- Impact surface
- Interim controls
- Lead-based paint
- Lead-based paint hazard
- Paint-lead hazard
- Play area
- Soil-lead hazard

6. Description of Lead-Based Paint Hazards and Acceptable Hazard Control Options (EPA-required)

EPA regulations require that the risk assessment report includes hazard control options and prioritization for addressing each hazard. It is suggested that the hazards and control options be described in a format similar to that shown in Tables 5-13 to 5-15, below, in order to help the owner prepare a work write-up.

Table 5.13 Paint-Lead Hazards.

Room or Exterior Location	Component	Type of Hazard	Approximate Area or Length	Quantity	Acceptable Hazard Control Options	
					Interim	Abatement

Table 5.14 Soil-Lead Hazards.

Type of Area	Location	Approximate Area of Bare Soil	Acceptable Hazard Control Options	
			Interim	Abatement

Table 5.15 Dust-Lead Hazards.

Room	Surface	Acceptable Hazard Control Method

7. Recommendations for Maintenance and Monitoring (EPA-required)

Recommendations for maintenance and monitoring of lead-based paint hazard controls should include the following:

- Recommendations for lead-safe maintenance, based on Chapter 6.
- The reevaluation schedule, if required, based on Section VII, below.

8. Additional Recommendations for Management (optional)

Additional recommendations for owners and managers of a multi-family property may include:

- Recommendations for notification of residents of results of the risk assessment and of scheduled follow-up hazard controls (Note that risk assessments (and lead hazard screens) of federally-assisted target housing require that residents be notified of the results within 15 calendar days. (24 CFR 35.125(a).)
- An overarching lead-based paint policy statement, describing the owner's strategy and long-term goals for preventing lead exposures.
- A lead hazard control plan (see Chapter 11), with a strategy for prioritizing control of lead-based paint hazards that may be identified in the future (i.e., after the current hazards are controlled).
- A training plan for maintenance workers.
- Changes to the work order system to incorporate lead-safe maintenance practices.

9. Supporting Information (EPA-required)

Supporting information should be presented as a description of findings, based on data collection forms used in the field and laboratory reports, or copies of the field forms and reports themselves can be included. In either case, the original field forms and laboratory reports should be retained for at least three years. The following information must be provided:

- Results of Questionnaire for a Lead Hazard Risk Assessment (from either Form 5.0 or 5.6).
- Results of building condition survey (from Form 5.1).
- Description of the process used to select dwelling units and common areas for sampling, if unit sampling was performed in a multi-family development.
- Results of visual assessment of both paint and soil (from forms 5.2 and 5.5 and site-plan sketch). Make sure there is a record of where deteriorated paint and bare soil were observed.
- Location designation system used for sides, walls, and components.
- Testing methods used to determine the levels of lead in paint and the results of each XRF reading and paint chip sampling. Provide the serial number of any XRF device used.
- Analysis of previous lead-based paint inspection report (if applicable).
- Dust sampling results (from Form 5.4a or 5.4b, or from laboratory report).
- Paint testing results (both XRF and paint chip sampling, the latter from Form 5.3).
- Soil Sampling results (from Form 5.5 or from laboratory report).
- Other sampling results, if applicable.

VII. Reevaluation

A. Purpose and Applicable Properties

In general terms, a reevaluation is a risk assessment that is performed to provide the owner with independent, professional documentation of whether ongoing monitoring and maintenance are keeping dwellings free of lead-based paint hazards or, if not, what actions should be taken. The reevaluation should be conducted by a certified risk assessor and should include:

(1) a review of prior reports to determine where lead-based paint and lead-based paint hazards have been found, what controls were done, and when these findings and controls happened;

(2) a visual assessment to identify deteriorated paint, failures of previous hazard controls, visible dust and debris, and bare soil;

(3) testing for lead in dust, newly deteriorated paint, and newly bare soil; and

(4) a report describing the findings of the reevaluation, including the location of any lead-based paint hazards, the location of any failures of previous hazard controls, and, as needed, acceptable options for the control of hazards, the repair of previous controls, and modification of monitoring and maintenance practices.

The risk assessor should recommend reevaluation if the property is not HUD–owned or –assisted, if it was built before 1960, and if lead-based paint hazards have been found and treated with interim controls. Reevaluations are recommended for properties that are not HUD–owned or –assisted, built before 1960, and in which lead-based paint hazards have been found by a risk

assessor and treated with interim controls or, if no risk assessment has been performed, standard treatments have been conducted. If the property is HUD–owned or –assisted, the risk assessor's recommendation should follow the applicable provisions of the Lead Safe Housing Rule (24 CFR 35, subparts B–R); the applicable provisions depend on the type and, in some cases, the amount of HUD assistance.

Only 11 percent of the housing units built between 1960 and 1977 have significant lead-based paint hazards compared to 39 percent for those built between 1940 and 1959 and 67 percent for pre-1940 housing, according to a survey conducted in 2005-2006. (HUD, 2011) (See also Jacobs, 2002, for which the percentages for a similar survey conducted in 1998-1999 were 8, 43, and 68, respectively.) Furthermore, research has found that reaccumulation of lead in dust after paint-lead hazards have been controlled is usually very slow, even in very old housing (NCHH, 2004). Therefore reevaluations are generally not cost effective for properties built after 1959, although ongoing visual monitoring and lead-safe maintenance are strongly recommended for all pre-1978 housing known or presumed to contain lead-based paint. Also, reevaluation is not needed for properties of any construction period for which an initial risk assessment has found no lead-based paint hazards, provided visual assessment and ongoing lead-safe maintenance are performed in accordance with these *Guidelines*. Although such properties may contain lead-based paint, the likelihood is small that hazards will appear if correct monitoring and maintenance practices are followed. Finally, reevaluation is not required for properties that have had all lead-based paint abated (i.e. permanently eliminated in accordance with EPA regulations). This is true even if lead-based paint has been enclosed or encapsulated, provided ongoing visual monitoring and lead-safe maintenance are performed as recommended in these *Guidelines*. Failures of encapsulations or enclosures can be identified by visual observation.

B. Reevaluation Schedule

If the property is HUD-assisted, the reevaluation schedule should follow the applicable provisions of the Lead Safe Housing Rule (24 CFR 35.1355(b)(4)) for reevaluation at least every two years.

If the property is not HUD-assisted, and lead hazards were identified, the reevaluation schedule should include:

- A visual assessment annually and at occupant turnover, and
- Reevaluation:
  - No later than two years after completion of interim controls, encapsulation or enclosure of the lead hazards identified by the risk assessment; with
  - Subsequent reevaluations conducted at intervals of two years, plus or minus 60 days; but
- Reevaluation is generally not needed after:
  - Two consecutive reevaluations are conducted two years apart without finding a lead-based paint hazard; or
  - All of the lead-based paint has been removed and the housing has passed a clearance examination; but

— If the risk assessor determined that soil-lead hazards may pose an ongoing health risk after the removal of the lead-based paint, the reevaluation schedule should include reevaluation of the soil.

If the property is not HUD-assisted, and no lead hazards were identified by the risk assessment, the owner should conduct (using trained staff or contractors):

- A visual assessment annually and at occupant turnover, and
- Optionally, reevaluation, based on the owner's lead hazard control policy.

C. Reevaluation Protocol

Reevaluations determine if the following conditions have reappeared:

- Leaded-dust above applicable standards.
- Deteriorated paint films with lead-based paint.
- Lead-based paint on friction, impact, and chewable surfaces.
- Deteriorated or failed interim controls, or encapsulant or enclosure treatments.
- New bare soil with lead levels above applicable standards.

These conditions can be detected through a visual assessment and limited dust, paint and soil sampling.

The procedure for a reevaluation is similar to that of a risk assessment, as described in this chapter, but is different in two important respects. First, data on the presence of lead in paint and soil may be available from a prior risk assessment or lead-based paint inspection. If so, the risk assessor should use such information to the extent possible and minimize the cost of additional testing. Secondly, existing lead hazard controls may be in place, and, if so, they must be visually examined to determine whether they are still performing as designed or whether repairs or improvements are needed.

1. Review of Prior Reports

The certified risk assessor conducting the reevaluation should begin by reviewing any past risk assessment, lead-based paint inspection, and reevaluation reports and any available information on lead hazard controls in existence at the time of the reevaluation, including but not limited to paint stabilizations, window and door treatments, encapsulations and enclosures of painted surfaces, and interim controls of soil-lead hazards. These reports, if properly prepared, should provide a list of previous lead-based paint hazards and lead hazard controls, which the risk assessor will be able to revisit during the visual assessment phase of the reevaluation. Risk assessor should identify the prior reports and indicate the extent to which they were used for this assessment.

2. Visual Assessment

A careful visual assessment should be conducted to identify:

- All known existing paint-lead hazard control measures that have failed. Examples of possible failures include, but are not limited to, an encapsulant that is peeling away from the wall, a painted surface that is no longer stabilized, or an enclosure that has been breached. Findings should be recorded on Form 5.2, or similar form, along with notes on the nature and scope of needed repairs. If any lead hazard control measure is failing, the risk assessor conducting the reevaluation should identify acceptable options for controlling the hazard, taking into account the likely cause of the failure.
- All deteriorated paint on untreated components that is known or presumed to be lead-based paint. Findings should be recorded on Form 5.2, or similar form, along with notes as to the probable cause (including but not limited to friction, impact, and moisture).
- Any chewable surfaces with evidence of teeth marks, if a child under 6 years of age lives in the unit. Record findings on Form 5.2, or similar form.
- All existing soil-lead hazard controls, to identify bare soil that indicates controls that have failed. Each controlled play area and non-play area should be examined for bare soil. Findings from visual assessments of soil should be recorded on Form 5.2, or similar form. If soil is tested, the sampling information and test results should be recorded on Form 5.5, or similar form.
- All bare soil in play areas and other yard areas that have not been previously treated, to identify bare soil in locations that are known or presumed to contain lead in soil exceeding applicable soil-lead hazard standards. Findings should be recorded on Form 5.5 or similar form.

3. Dust Sampling

Dust sampling should be conducted in accordance with procedures described in Section II.E, above. Results should be reported on Form 5.4a (for single-surface sampling) and/or 5.4b (for composite sampling), or similar form.

4. Testing Deteriorated Paint and Bare Soil for Lead

If possible, the risk assessor should use information from previous past lead-based paint inspections or risk assessments to discover whether any of the surfaces known to contain lead-based paint are now in a deteriorated condition or whether any soil known to have lead exceeding applicable standards is now bare. If relevant data from prior inspections or risk assessments are unavailable, the assessor should test the deteriorated paint and bare soil for lead, using methods described above in Sections II.F and II.G, respectively. Findings should be reported on Form 5.2 for XRF readings, Form 5.3 for results of paint chip sampling, or Form 5.5 for samples of bare soil, or similar forms.

5. Reevaluation Report

The risk assessor conducting the reevaluation should produce a report that:

- Documents the presence or absence of lead-based paint hazards.
- Identifies any lead hazards previously detected and controlled and the effectiveness of these interventions.
- Describes any new hazards, with suggested hazard control options.
- Identifies when the next reevaluation should occur, if it is needed in accordance with the schedule described in Section VII.B, above.
- Recommends a visual assessment annually and at occupant turnover, whether or not reevaluation is conducted.
- If the report is for rental property(ies), includes a summary of the report for use in notifying occupants of the results of the reevaluation.

6. Sampling in Multi-family Dwellings

Reevaluations in multi-family dwellings should target different units than those sampled previously. Worst-case sampling or random sampling, discussed in Section III.B, above, should be used for this purpose.

Form 5.0 Questionnaire for a Lead Hazard Risk Assessment of an Individual Occupied Dwelling Unit.

(To be completed by risk assessor via interview with owner-occupant or, if a rental unit, an adult resident and, for questions 15 & 16, the owner.)

Property address _____

Apt. No. _____ Unit is ☐ Owner occupied ☐ Renter occupied

Year of construction _____ Prior LBP testing? ☐ Yes ☐ No

Name of owner interviewed _____ Owner interview date: ___/___/___

Name of resident interviewed (if rental unit) _____ Interview date: ___/___/___

Name of risk assessor _____

Children and Children's Habits

1. Do any children under age 6 live in the home or visit frequently? ☐ Yes ☐ No
   (*If no children under age 6, skip to Question 5.*)
2. If yes, how many?_____
3. Please provide the following information about each child under 6 to the extent you can.

	Child 1	Child 2	Child 3	Child 4
(a) Age:				
(b) Blood lead level :				
(c) Month/year of blood lead test:				
(d) Location of bedroom:				
(e) Main room where child eats:				
(f) Main room where child plays:				
(g) Main room where toys are stored:				
(h) Main locations where child plays outdoors:				

(If a resident child under age 6 has had an elevated blood lead level, an environmental investigation may be necessary [see Chapter 16 of the HUD Guidelines*].)*

4. (a) Do any children tend to chew on any painted surfaces, such as interior window sills? ☐ Yes ☐ No

   (b) If yes, where? _____

Form 5.0 Questionnaire for a Lead Hazard Risk Assessment of an Individual Occupied Dwelling Unit.

Property address _____ Apt. No. _____

Other Household Information and Family Use Patterns

5. Do women of child-bearing age live in the home? ☐ Yes ☐ No

6. If this home is in a building with other dwelling units, what common areas in the building are used by children?

_____

7. (a) Which entrance is used most frequently? _____
   (b) What other entrances are used frequently? _____

8. Which windows are opened most frequently? _____

9. (a) Do you use window air conditioners?* ☐ Yes ☐ No
   (b) If yes, where? _____
   **Condensation underneath window air conditioners often causes paint deterioration.*

10. (a) Do you or any other household members garden? ☐ Yes ☐ No
    (b) If yes, where is the garden?_____

11. (a) Are you planning any landscaping activities that will remove grass or ground covering? ☐ Yes ☐ No
    (b) If yes, where?_____

12. (a) Which areas of the home get cleaned regularly? _____
    (b) Which areas of the home do not get cleaned regularly? _____

13. (a) Are any household members exposed to lead at work? ☐ Yes ☐ No
    (If no, go to question 14.)

    (b) If yes, are dirty work clothes brought home? ☐ Yes ☐ No
    (c) If they are brought home, who handles dirty work clothes and where are they placed and cleaned?

    _____

14. (a) Do you have pets? ☐ Yes ☐ No
    (b) If yes, do these pets go outdoors? _____

Building Renovations

15. (a) Were any building renovations or repainting done here during the past year? ☐ Yes ☐ No
    (b) If yes, what work was done, and when? _____
    (c) Were carpets, furniture and/or family belongings present in the work areas? ☐ Yes ☐ Noo
    (d) If yes, which items and where were they? _____
    (e) Was construction debris stored in the yard? ☐ Yes ☐ No
    (f) If yes, please describe what, where and how was it stored._____

16. (a) Are you conducting or planning any building renovations? ☐ Yes ☐ No
    (b) If yes, what work will be done, and when?_____

Form 5.1 Building Condition Form for Lead Hazard Risk Assessment.

Property address _____ Apt. No. _____

Name of property owner _____

Name of risk assessor _____ Date of assessment: ____ /____ /____

Condition	Yes	No	Comments
Roof missing parts of surfaces (tiles, boards, shakes, etc.)			
Roof has holes or large cracks			
Gutters or downspouts broken			
Chimney masonry cracked, bricks loose or missing, obviously out of plumb			
Exterior or interior walls have obvious large cracks or holes, requiring more than routine pointing (if masonry) or painting			
Exterior siding has missing boards or shingles			
Water stains on interior walls or ceilings			
Walls or ceilings deteriorated			
More than "very small" amount of paint in a room deteriorated			
Two or more windows or doors broken, missing, or boarded up			
Porch or steps have major elements broken, missing, or boarded up			
Foundation has major cracks, missing material, structure leans, or visibly unsound			
** Total number			

* The "very small" amount is the *de minimis* amount under the HUD Lead Safe Housing Rule (24 CFR 35.1350(d)), or the amount of paint that is not "paint in poor condition" under the EPA lead training and certification ("402") rule (40 CFR 745.223).

** If the "Yes" column has any checks, the dwelling is usually considered not to be in good condition for the purposes of a risk assessment, and conducting a lead hazard screen is not advisable. However, specific conditions and extenuating circumstances should be considered before determining the final condition of the dwelling and the appropriateness of a lead hazard screen. If the "Yes" column has any checks, and a lead hazard screen is to be performed, describe, below, the extenuating circumstances that justify conducting a lead hazard screen.

Notes (including other conditions of concern):

Form 5.2 Report of Visual Assessment (for Lead Hazard Risk Assessment).
Form 6.0 Report of Visual Assessment (for Ongoing Lead-Safe Maintenance).

Property address _____ Apt. No. _____ **Page** ____ **of** ____

Name of property owner _____

Name of risk assessor _____ Date of assessment ____ /____ /____

Area Description		**Deteriorated Paint**			Friction or Impact Surface? (F or I)	Visible Teeth Marks? (Y or N)	Paint Testing Results[4]	Notes [e.g., paint testing (e.g., XRF, lab analysis) indicates paint is or is not lead-based paint; cause(s) of hazard control failures]
Location of Building Component, Dust or Bare Soil	Building Component, Dust, or Bare Soil Play Area/ Non-Play Area	Area (sq. ft.)	Is Area Small?[2] (Y or N)	Probable Cause(s) of Deterioration if Known[3]				

[1] Include room equivalent or exterior side or wall, as appropriate.

[2] Lead-safe work practices and clearance/cleaning verification are not required if work does not disturb painted surfaces that total more than

- For assisted housing: HUD's *de minimis area* of: 20 ft² or less on exterior surfaces, 2 ft² or less in any one interior room or space, or 10 percent of the total surface area on an interior or exterior type of component with a small surface area (such as trim, window sills, baseboards);
- For unassisted housing, and for child-occupied facilities, EPA's minor repair and maintenance activities threshold of: 6 ft² or less per room; or 20 ft² or less for exterior activities; provided that no prohibited or restricted work practices were used and no window replacement or demolition of painted surface areas is to be done.

[3] Common causes of paint deterioration are: moisture (indicate source if apparent), mildew, friction or abrasion, impact, damaged or deteriorated substrate, and severe heat.

[4] If paint testing results are obtained on site, use this column to record the result. If a paint chip sample is sent to the laboratory, use this column to record the sample number (or other unique identifier) as a reference to another record containing the sampling data and laboratory results.

Form 5.3 Field Paint Chip Sampling Form.

(Use a separate form for each housing unit, common area, or exterior. Sample all layers of paint, not just deteriorated paint layers.) **Page ____ of ____**

Property address _____ Name of property owner _____

Apt. No. _____ Common Area, Housing Unit, or Exterior _____

Name of risk assessor _____ Date of assessment ____ /____ /____

Sample Number	Location	Room Equivalent	Building Component	Size of Sample (cm x cm)*	Lead (mg/cm^2)	Lead (µg/g)	Notes
				Federal standard	1.0	5,000	

**Samples submitted to the laboratory for analysis must include the area in square centimeters for the result to be reported as mg/cm^2.*

Total number of samples on this page _____

Date of sample collection ____ /____ /____ Date shipped to lab ____ /____ /____ Shipped by_____ (signature)

Received by _____ (signature and date)

Reviewed by _____ (signature and date)

Date results reported (by lab) ____ /____ /____ Reviewed by _____ (signature and date)

Form 5.4a Field Sampling Form for Dust. (Single-Surface Sampling)

(Use a separate form for each housing unit, common area, or exterior. Sample all layers of paint, not just deteriorated paint layers.) **Page ____ of ____**

Property address _____

Name of property owner _____ Apt. No. _____ Common Area, Housing Unit, or Exterior No. _____

Name/Firm of risk assessor _____ Date of assessment ____/____/_____

Sample Number	Room or Entryway	Surface Type[1]	Exact Location of Wipe Sample	Is surface smooth & cleanable?	Sample Area[2] (inches x inches)	Sample Area[3] (ft^2)	Lab Result[4] ($\mu g/ft^2$)	Notes
					____ x ____			
					____ x ____			
					____ x ____			
					____ x ____			
					____ x ____			
					____ x ____			
					____ x ____			
					____ x ____			
					____ x ____			
					____ x____			

[1] Hard Floor (HF), Carpeted Floor (CF), or Interior Window Sill (S)

[2] Measure to the nearest 1/8th or 1/10th of an inch. [1/8 = 0.125, 2/8 = 0.25, 3/8 = 0.375, 4/8 = 0.5, 5/8 = 0.625, 6/8 = 0.75, 7/8 = 0.875]

[3] Calculate sample area in square feet as follows: Calculate square inches, then divide by 144.

[4] Provide areas, direct laboratory to report the dust lead result in $\mu g/ft^2$.

NOTE: EPA standards: 40 $\mu g/ft^2$ (interior floors); 250 $\mu g/ft^2$ (interior window sills) for Risk Assessment; 25 $\mu g/ft^2$ and 125 $\mu g/ft^2$ for screen.

Total number of samples on this page _____ Date of sample collection ____ /____ /____

Shipped to lab by _____ ____ /____ /____ (signature and date)

Received by _____ ____ /____ /____ (signature and date)

Reviewed by _____ ____ /____ /____ (signature and date)

Date results reported by lab ____ /____ /____ Reviewed by _____

Form 5.4b Field Sampling Form for Dust. (Composite Sampling)

Property address _____ **Page** _____ **of** _____

Name of property owner _____ Apt. No. _____ Common Area, Housing Unit, or Exterior No. _____

Name/Firm of risk assessor _____ Date of assessment ____/____/_____

Sample Number	Type of Surface	Location of Subsamples		Is surface smooth and cleanable?	Area of Each Surface Sampled[1] (inches x inches)	Total Surface Area Sampled[2] (ft^2)	Lab Result[3] ($\mu g/ft^2$)	Notes
		Room	Exact Location on Component					
	Hard floors				___x ___ ___x ___ ___x ___ ___x ___			
	Carpeted floors				___x ___ ___x ___ ___x ___ ___x ___			
	Interior sills				___x ___ ___x ___ ___x ___ ___x ___			
	Entryway				___x ___			

[1] Measure to the nearest 1/8th or 1/10th of an inch. [1/8 = 0.125, 2/8 = 0.25, 3/8 = 0.375, 4/8 = 0.5, 5/8 = 0.625, 6/8 = 0.75, 7/8 = 0.875]
[2] Calculate sample area in square feet as follows: Calculate square inches for each surface sampled, add together, then divide total by 144.
[3] Provide areas, direct laboratory to report the dust lead result in $\mu g/ft^2$.

NOTE: EPA standards: 40 $\mu g/ft^2$ (interior floors); 250 $\mu g/ft^2$ (interior window sills) for Risk Assessment; 25 $\mu g/ft^2$ and 125 $\mu g/ft^2$ for screen.

Total number of samples on this page _____ Date of sample collection ____ /____ /____

Shipped to lab by _____ ____ /____ /____ (signature and date)

Received by _____ ____ /____ /____ (signature and date)

Reviewed by _____ ____ /____ /____ (signature and date)

Date results reported by lab ____ /____ /____ Reviewed by _____ ____ /____ /____

Form 5.5 Field Sampling Form for Soil.

(Composite sampling only. Use a separate form for each residential building in a multi-building property.) **Page _____ of _____**

Name of owner _____ Name of risk assessor _____ Date of completion of this form ____ /____ /____

Type of Area Sampled	Sample Number	Location of Composite Sample(s)	Approximate Area of Bare Soil Represented by Composite Sample (ft.^{2})	Laboratory Result (ppm or µg/g)
Bare Soil in Play Areas				
Bare Soil in Non-play Areas in Dripline/ Foundation Area				
Bare Soil in Non-play Areas in the Rest of the Yard				
Weighted average of soil-lead concentration in non-play areas of dripline/foundation areas and the rest of the yard:				

NOTE: EPA hazard standard for bare play area soil is 400 ppm or µg/g; for bare non-play area soil is 1,200 ppm or µg/g.

Total number of samples on this page _____ Date of sample collection ____ /____ /____

Shipped to lab by _____ ____ /____ /____ (signature and date)

Received by _____ ____ /____ /____ (signature and date)

Reviewed by _____ ____ /____ /____ (signature and date)

Date results reported by lab ____ /____ /____ Reviewed by _____ ____ /____ /____

Form 5.6 Questionnaire for a Lead Hazard Risk Assessment of More Than Four Rental Dwelling Units. Page 1 of 4

(This form is designed for multiple rental dwellings under one ownership. Such dwellings may be in one or more than one property.)

Name of owner _____

Name of risk assessor _____ Date of completion of this form ____ /____ /____

1. Information on Properties *(Attach list if there are more than 4 properties.)*

Property Address	Name of Development (if applicable)	Year Built	Year of Substantial Rehabilitation	No. of Buildings	No. of Dwelling Units	Previous LBP Evaluation? (If yes, obtain report)	Previous LBP Hazard?(If yes, obtain report)	Code Violation Reports? (If yes, obtain report)

2. Information for Targeted Sampling *(Attach list if there are more than 10 dwelling units. It is not necessary to complete the following table if not using targeted sampling. Refer to Chapter 7 for guidance on random sampling.)*

Property Address (For units at same address, enter address once, and enter ditto marks or down- arrow.)	Dwelling unit no.	No. of children < 6 years old	Code violations in past year?	Chronic maintenance problem reported by owner?	Recently prepared for reoccupancy?	Comments

3. Information on Interior Common Areas *(Attach list if more room needed.)*

Property Address (For common areas at same address, enter address once, and enter ditto marks or down- arrow.)	Interior Common Area Name/Location	Frequented by a Child <6 Years Old?	Comments

4. Information on Play Areas with Bare Soil *(Attach list if more room needed. Obtain information on play areas for all properties. Record the total number of play areas and the location of each common child play area in onsite playgrounds, back-yards, etc.)*

Total number of play areas with bare soil: _____

Property Address (For play areas at same address, enter address once, and enter ditto marks or down- arrow.)	Description of Each Play Area and Its Location (Identify each play area with a code number within each property, and show code number on site plan sketch(es))

Form 5.6 Questionnaire for a Lead Hazard Risk Assessment of More Than Four Rental Dwelling Units.

5. Management Information (Optional)

a. 1) Attach a list of names and contract information for individuals who have responsibility for lead-based paint. Include owner, property manager (if applicable), maintenance supervisor and staff (if applicable), and others. Include any training in lead hazard control work (by inspector, supervisor, worker, etc.) that has been completed. This information will be needed to devise the management plan contained in the risk assessor's report.

2) Is the property owner or property management firm (if separate) a certified lead renovation firm? ☐ Yes ☐ No
(If yes, list the name of each certified firm and the expiration date of its renovation firm certification.)

b. Maintenance usually conducted at time of dwelling turnover, including typical cleaning, repainting, and repair activity:

Repainting _____

Cleaning _____

Repair _____

Other _____

Comments _____

c. Employee and worker safety plan.

1) Is there an occupational safety and health plan for maintenance workers? ☐ Yes ☐ No (If yes, attach plan.)
2) Are any employees certified lead renovators or certified lead abatement supervisors? ☐ Yes ☐ No
(If yes, list, for each certified individual, the person's name, type of certification and certification expiration date.)
3) If answer 2 is "No," Are workers trained in lead hazard recognition? ☐ Yes ☐ No (If yes, what was the title, and who did the training?)
4) Are workers involved in a lead hazard communication program? ☐ Yes ☐ No (If yes, attach plan.)
5) Are workers trained in proper use of respirators? ☐ Yes ☐ No
6) Is there a medical surveillance program pertaining to lead? ☐ Yes ☐ No
7) Is a HEPA vacuum available? ☐ Yes ☐ No

d. On-site child care center facilities.

1) Are there any onsite child-care facilities, whether licensed or unlicensed? ☐ Yes ☐ No
2) If yes, give location(s): _____

e. Planning for resident children with elevated blood lead levels (EBLs):

1) Who would respond for the owner if a resident child with an EBL is identified? _____
2) Is there a plan to relocate such children? ☐ Yes ☐ No If yes, where? _____
3) Does the owner know if there ever has been a resident child with an elevated blood lead level? ☐ Yes ☐ No ☐ Unknown

f. Routine Inspections. Are there periodic inspections of all dwellings by the owner? ☐ Yes ☐ No

1) If yes, how often? _____
2) Is the paint condition assessed during these inspections? ☐ Yes ☐ No

g. Notification of Residents. If previously detected lead-based paint that is unabated exists in the dwelling, have the residents been informed?
☐ Yes ☐ No ☐ Not Applicable

Form 5.6 Questionnaire for a Lead Hazard Risk Assessment of More Than Four Rental Dwelling Units.

6. Maintenance Information (Optional)

a. Painting frequency and methods /

1) How often is painting completed? Every _____ years
2) Is painting completed upon vacancy, if necessary? ☐ Yes ☐ No
3) Who does the painting? ☐ Property Owner ☐ Residents (If residents, skip to Question b.)
4) Is painting accompanied by scraping, sanding, or paint removal? ☐ Yes ☐ No
5) How are paint dust/chips cleaned up? (check any that apply)

☐ Sweeping ☐ Vacuum ☐ Mopping ☐ HEPA/wet wash/HEPA cycle

6) Is the work area sealed off during painting? ☐ Yes ☐ No
7) Is furniture removed from the work area? ☐ Yes ☐ No
8) If no, is furniture covered with plastic during work? ☐ Yes ☐ No

b. Is there a preventive maintenance program? ☐ Yes ☐ No

1) If yes, does it include an ongoing maintenance program for lead? ☐ Yes ☐ No (If yes, attach ongoing maintenance plan for lead.)

c. Describe work order system (if applicable, attach copy of work order form).

d. How are resident complaints received and addressed? How are requests prioritized? If formal work orders are issued, is the presence or potential presence of lead-based paint considered in the work instructions?

Form 5.7 Format for an Executive Summary of a Lead Hazard Risk Assessment. Page 1 of 2

Property address _____ Date of risk assessment ____ /____ /____

Building or Apt. Designation _____

Summary of Results: (*either*) No lead-based paint (LBP) hazards were found -or-Lead-based paint (LBP) hazards were found; below is a summary of findings.

Paint-Lead Hazards: (if applicable)

Unit Number Common Area, or Exterior Location	Room or Room Equivalent	Building Component	Type of Hazard*	Lead Level (mg/cm^2 or µg/g)**	Options for Corrective Action

* LBP on friction surface with dust-lead hazard beneath, impact surface, chewable surface with teeth marks, or other deteriorated LBP.
** Milligrams per square centimeter (mg/cm^2), or micrograms per gram (µg/g; parts per million; ppm).
NOTE: EPA standard for LBP: 1.0 mg/cm^2, or 5,000 µg/g.

Dust-Lead Hazards: (if applicable)

Unit Number or Common Area	Room or Room Equivalent	Surface*	Lead Level ($µg/ft^2$)**	Options for Corrective Action

* Floor, or interior window sill. ** Micrograms per square foot ($µg/ft^2$)
NOTE: EPA dust-lead hazard standards: 40 µg/ft.² (floors); 250 µg/ft.² (interior window sills).

Summary of Results: Soil-Lead Hazards (bare soil only): (if applicable)

Type of Area*	Location	Lead Level (ppm or µg/g)**	Options for Corrective Action

* Play area, dripline/foundation area, or rest of the yard. ** Parts per million, or micrograms per gram.
EPA standards: 400 ppm (play areas); 1,200 ppm (non-play areas in the dripline/foundation area or the rest of the yard).

Property address _____ Date of risk assessment ____ /____ /____

Building or Apt. Designation _____

Intact Paint Surfaces With Lead-Based Paint: (if client has requested additional testing)

Unit Number, Common Area, or Exterior Location	Room or Room Equivalent	Building Component	Lead Level (mg/cm^2)*	Options for Corrective Action

* NOTE: EPA standard for LBP: 1.0 mg/cm^2, or 5,000 µg/g.

Contact Person for Further Information (name, address, phone number) _____

_____

_____

Person Who Prepared This Summary (printed name, firm/agency, address, phone number, state/EPA RA certification number and expiration date) _____

_____

_____

Signature of Preparer and date _____ ____ /____ /____

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Chapter 16: Investigation And Treatment Of Dwellings That House Children With Elevated Blood Lead Levels

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Chapter 16: Investigation And Treatment Of Dwellings That House Children With Elevated Blood Lead Levels

How to Do It

1. **Identify children with "elevated blood lead levels" (EBL) and, in particular, those children with blood levels considered by applicable statutes or regulations as "environmental intervention blood lead levels" (EIBLL).**

   - **EBL**: Develop a mechanism whereby children under age 6 years with blood lead levels (BLLs) at or above the Centers for Disease Control and Prevention's (CDC's) "blood lead reference value" for children under age 6 years are identified. As of the publication of this edition of these *Guidelines*, this reference value is 5.0 micrograms of lead per deciliter of blood (5.0 µg/dL), taken from a venous sample (i.e., from a vein) with the testing result having been verified by confirmatory testing. A child's BLL can be determined through local health departments, local childhood lead-poisoning prevention programs, or other health care providers. If the child's BLL is above the reference value, refer the findings to the child's parents or guardians. Coordinate with the child's parents or guardians and the appropriate public health, environmental, and housing agencies to avoid duplication of efforts and to determine how the investigation (inspection) should best be conducted.

   - **EIBLL**: Where a statute or regulation (such as HUD's Lead Safe Housing Rule (LSHR) as of the publication of this edition of these *Guidelines*) requires action at higher BLLs than EBL, develop a mechanism whereby such children are identified. In particular, under the LSHR, the mechanism should ensure that children under age 6 years with an environmental intervention blood lead level (EIBLL), that is, with a confirmed venous blood lead level at or above 20 µg/dL in a single test, or at 15-19 µg/dL in two tests taken at least three months apart, are identified. Blood lead levels can be determined through local health departments, local childhood lead-poisoning prevention programs, or other health care providers. If the child's BLL is an EIBLL, refer the findings to the child's parents or guardians. (If the child's BLL is at or above 45 µg/dL, the referral should note that CDC states that the response includes evaluation and treatment requiring chelation.) If the child is living in publicly owned or subsidized housing, also refer the findings to the housing agency or other housing assistance provider, and ensure that further medical treatment or case management is undertaken by the responsible authorities. Coordinate with the child's parents or guardians and the appropriate public health, environmental, and housing agencies to avoid duplication of efforts and to determine how the investigation (inspection) should best be conducted.

2. **Review any assessments.** Review the findings of any risk assessment or reevaluation (Chapter 5) or lead-based paint inspection (Chapter 7) that has already been completed for the property. The protocols in Chapters 5 and 7 usually are not sufficient for use in dwellings with a lead-poisoned child because additional environmental testing and interviewing are often required.

3. **Interview family of the child with an EBL.** Conduct a comprehensive interview based on the CDC checklist (Table 16.2) or use the questionnaire in this chapter (Form 16.1 at the end of the chapter) or an equivalent questionnaire. If a clear lead hazard is identified, correct the hazard within the applicable regulatory or guidance timeframe. If necessary, conduct environmental sampling to confirm the presence of the hazard.

4. **Conduct a full risk assessment.** Whether or not a clear lead hazard is identified, conduct a full risk assessment of the child's dwelling and of any other dwelling or space (e.g., child care center) in which the child spends a significant amount of time, because the identified lead hazard may not be the only one to which the child is exposed. Follow the guidance in Chapter 5 as augmented by the protocol in this chapter. In consultation with the child's case manager, determine what, if any, other possible sources of exposure should be investigated, including:

   - First-flush drinking water.
   - Glazed pottery or tableware that may contain lead glazes.
   - Work clothes or vehicle that may have been contaminated from a parent's or guardian's work place.
   - Imported cosmetics, hobbies, and folk remedies.

5. **When lead hazard control measures are conducted, relocate child with EBL.** In cases where lead hazard control measures are ordered, relocate the child to a lead-safe environment until the work is completed and clearance is achieved, and coordinate follow-up with the local health department and child's case manager. Prior to the remedial lead hazard control work, ensure that temporary lead hazard control measures, including cleaning, are taken immediately to protect the child living in the dwelling unit.

6. **Conduct clearance examination.** Use the guidance in Chapter 15.

7. **Permit reoccupancy when property is cleared.** Permit re-occupancy when results of clearance testing are acceptable, that is, when the work passes clearance (see Chapter 15).

8. **Provide copies of assessment to caseworker and family.** Copies of the augmented assessment results should be provided to the case manager and to the family of the child with EBL. A copy of the environmental assessment and clearance testing results should be provided to the owner of any rental property. Include recommendations to minimize exposures in the future – e.g. diet, frequent hand and toy washing, frequent floor cleaning, avoidance of cosmetics and other products that have high lead levels, etc.

I. Introduction

This chapter provides a method for investigating the possible causes of lead poisoning for an individual child under age 6 years. Although lead-based paint and lead-contaminated dust and soil are the causes of most lead exposure in American children, another lead source may be the principal cause for a specific instance of lead poisoning or contribute to the blood lead elevation (secondary source). The methods and descriptions contained in this chapter are consistent with those recommended by the Centers for Disease Control and Prevention (CDC) (CDC, 2002) with modifications to reflect the early evolution of the recommendations based on the 2012 CDC Response to Advisory Committee on Childhood Lead Poisoning Prevention Recommendations in *"Low Level Lead Exposure Harms Children: A Renewed Call of Primary Prevention"* (CDC, 2012a); available at ***http://www.cdc.gov/nceh/lead/ACCLPP/CDC_Response_Lead_Exposure_Recs.pdf***. The Advisory Committee's report itself (CDC ACCLPP, 2012) is available at the Recommendations of the Advisory Committee for Childhood Lead Poisoning Prevention link, ***http://www.cdc.gov/nceh/lead/ACCLPP/Final_Document_030712.pdf***, on the CDC's Advisory Committee On Childhood Lead Poisoning Prevention (ACCLPP) page, ***http://www.cdc.gov/nceh/lead/ACCLPP/acclpp_main.htm***.

Because CDC, HUD, and other agencies are expected to continue to develop guidance, outreach documents and other materials pertaining to identifying and responding to children with EBL, the CDC's Lead website (***http://www.cdc.gov/nceh/lead/***), the HUD lead and healthy homes website (***http://www.hud.gov/offices/lead***), and the lead websites of additional federal and applicable state, tribal and local agencies, should be checked regularly for updates.

As of the publication of this edition of these *Guidelines*, HUD's Lead Safe Housing Rule (LSHR, 24 CFR part 35, subparts B through R), requires specific actions in certain pre-1978 ("target") housing receiving federal assistance when a child living there is found to have an environmental intervention blood lead level (EIBLL), that is, a blood lead level at or above 20 µg/dL in a single test, or at 15-19 µg/dL in two tests taken at least three months apart (24 CFR 35.110). The actions to be taken are specified in the Rule in its subparts, which are organized around the types of housing assistance:

Subpart D, Project-Based Assistance Provided by a Federal Agency Other Than HUD;

Subpart G, Multi-family Mortgage Insurance;

Subpart H, Project-Based Rental Assistance;

Subpart L, Public Housing Programs; and

Subpart M, Tenant-Based Rental Assistance (also known as the housing choice voucher program).

The LSHR is at HUD's Lead-Safe Housing Rule web page, ***http://www.hud.gov/offices/lead/enforcement/lshr.cfm***, with a link to HUD's Interpretive Guidance about the rule, which is posted at ***http://portal.hud.gov/hudportal/documents/huddoc?id=DOC_25476.pdf***. See Appendix 6 for more information about the LSHR.

The protocol in this chapter is different from the risk assessment protocol in Chapter 5 of these *Guidelines*. That protocol is meant for use in dwellings regardless of a resident child's blood lead level, as a "primary prevention" measure. Primary prevention is the process of preventing lead hazards from occurring and, when they do occur, controlling lead hazards to prevent exposure before a child is poisoned. The protocol in this chapter is intended for use as part of "secondary prevention," the process of identifying children who have elevated blood lead levels, and controlling or eliminating the sources of further exposure. In particular, secondary prevention involves medical and environmental follow-up services for individual children with an EBL. However, many of the basic procedures and sampling methods are similar between primary and secondary prevention. The investigations of dwellings that house children with EBLs differ from ordinary risk assessments in the following three important ways:

1. The purpose of the investigation is to identify lead hazards in the environment of a child. A ordinary risk assessment attempts to uncover lead-based paint hazards in a dwelling, regardless of whether a child has an EBL.

2. The investigator is obligated to conduct a comprehensive investigation of all sources of lead in the child's environment, not just those lead exposures directly related to the child's residence. This investigation includes studying less-common sources of lead, such as glazed pottery and folk medicines or remedies, etc., and other dwellings or areas frequented by the child. Some of these sources may be discovered by the results of the questionnaire.

3. The investigator tests deteriorated paint on furniture identified as a potential hazard to the environmental intervention blood lead (EIBLL) child, regardless of who owns the furniture.

FIGURE 16.1 Health Department case managers work with parents and guardians of lead-poisoned children.

Many activities described in this chapter are generally performed by State or local health departments and childhood lead poisoning prevention programs, which bear the principal responsibility for responding to individual cases (see Figure 16.1).

However, situations may occur when State or local public health authorities, or parents or guardians hire private risk assessors or investigators to investigate the dwelling of a child with an elevated blood lead level. Some of these agencies can only respond to the children with blood lead levels higher than the EBL threshold, for any of several reasons, leaving cases of children below their action threshold for others to investigate. In addition, some jurisdictions may not have programs available to investigate children with EBL. Medicaid and other third-party payers may reimburse expenses for investigations performed by certified, private-sector investigators.

Investigators who gather the information needed to characterize possible hazards in dwellings that house children with EBL should possess good interviewing techniques as well as proficiency in risk assessment and environmental sampling techniques.

Private individuals who respond to lead poisoned children should always coordinate their activities with local authorities, including public health case managers, public health environmental investigators, housing agencies, and health care providers to prevent unnecessary duplication of effort and to acquire information on sources of lead poisoning that may be significant in a specific locale or culture. In some instances, risk assessments or lead-based paint inspections may have already been completed. Before eliminating paint or dust as the cause of the poisoning, the investigator should carefully review any previous reports to assess the quality of the previous investigations and to ensure that dust test results are a reflection of the current exposure.

Investigators are sometimes asked to explain the meaning of a particular blood lead level. For a specific child, this interpretation is best left to the child's pediatric health care provider or public health case manager. States and local health departments may also provide the basic information to parents or guardians.

II. Management of Lead Hazards in the Environment of Individual Children

The investigation of lead poisoned children is a complex issue requiring teamwork. Three governmental entities are most likely involved: public health, environmental health, and housing agencies.

A. Public Health Case Management

Public health case management consists of coordinating, providing, and overseeing services to reduce children's blood lead levels below the CDC blood lead reverence level (as of the publication of this edition of these *Guidelines,* 5.0 µg/dL), and to control or eliminate lead hazards in the child's environment. Case managers are trained public health professionals, including public health nurses, social workers, and public health investigators. Case management includes ensuring prompt and effective environmental management, monitoring medical care, providing education to the family, and coordinating any needed services following an individual plan of care.

Medical follow-up includes repeated blood lead level testing, development assessment, and iron therapy and chelation treatment as indicated. CDC's scheduling recommendations include schedules for obtaining a confirmatory venous sample, and for follow-up blood lead testing (CDC ACCLPP, 2012, tables 2 and 3, respectively).

Families should be educated about lead poisoning, including the meaning of the child's blood lead level and the potential effects of lead on their child, the medical and environmental follow-up planned, how to reduce risks, and how to help their child get well. Environmental investigation and intervention are essential. Some families will need extensive case management and referral to social service providers. The public health case manager is the primary point of contact between the childhood lead poisoning prevention program and the family.

B. Environmental Investigation and Intervention

Environmental investigation and intervention for children with EBL are usually overseen by agencies and programs with legal responsibility for the protection of human health in the dwelling environment, typically local and State health departments. Responsibilities may be shared by public health, environmental, and housing agencies. Public health or environmental agencies may have the responsibility, technical equipment, and expertise for the investigation, but housing agencies may have to enforce the codes or laws. For children with EBL, both a thorough environmental investigation of all possible sources of lead exposure for the individual child and intervention are needed to protect the child from further exposure and harm. Lead-based paint or the lead-contaminated dust and soil may or may not be the main source of the child's exposure to lead. The risk assessor should talk with the public health authorities and improve the communication with the family in order to collect accurate information about the child's exposure, and to ensure the success of any needed intervention.

The environmental investigation should be performed during a visit to the child's current dwelling unit and other sites where the child spends a significant amount of time (e.g., child care center or grandparent's home).

Information about year of construction should be obtained from tax assessor records or other city housing records. The parents or guardians should be questioned regarding all possible lead sources and risk factors. CDC developed guidelines for questioning parents or guardians (see Table 16.2). A detailed questionnaire is set forth in Form 16.1 for use by investigators. Information on child or family member behavioral risk factors, including hand to mouth or toy-to mouth activity, pica (abnormal appetite or craving of non-nutritive substances or non-food items), or parents' or guardians' occupation and the determination that such behaviors are affecting a child's blood lead level is best left to a medical health care provider. If the child has recently moved, the child's blood lead level may reflect exposure to lead hazards at the previous residence. When primary and other locations are identified (such as present and previous dwelling unit and/or child care center, whether in a commercial building or in a home), all of the locations should be investigated. Testing a previous residence or a child care center has the additional benefit that it may also identify lead hazards that could harm other young children currently living in that dwelling.

FIGURE 16.2 **Environmental investigations include sites where the child spends time.**

If assessment of additional dwelling units or a child care center/dwelling is required, the investigator should make the necessary arrangements for assessment and possible testing at these locations after consultation with the child's case manager or local health department (see Figure 16.2).

Testing should include the following at a minimum: house dust, paint/coatings that are not intact or subject to friction, and bare soil, especially in play areas. Testing of drinking water should be done only if: the community drinking water is known to be at risk; the family's home is served by a private well; history suggests contamination; or no other sources of lead can be found. Public health authorities can provide this information.

Where the questionnaire results indicate that the child may have been exposed to other sources of lead, including toys, children's jewelry, folk or "home" remedies, imported cosmetics, candy or candy wrappers (the Consumer Product Safety Commission has information on many such consumer products, see ***http://www.cpsc.gov***), or each parent's or guardian's occupation and hobbies, additional environmental testing may be required. The environmental investigator should consult with the child's case manager or local health department about sampling to identify whether lead hazards are present. Once the assessment of all possible sources of lead exposure has been completed, the most probable source(s) of the child's poisoning can be identified and remedial actions to eliminate further lead exposure of the child can be recommended. The investigator should identify the likely sources of lead exposure to the child's family during the investigation. The investigator should always recommend temporary measures to immediately reduce the child's exposure to lead hazards including a thorough cleaning of the dwelling unit and the placement of temporary barriers over areas with peeling, chipping paint (see Chapter 11). Where probable sources of poisoning are not related to a building (e.g., use of ceramics or folk remedies), follow-up should be referred to the public health team.

The results of the investigation should be released only to parents or guardians, and appropriate government authorities. Confidential information about the child or family should not be revealed to any other individual without the informed consent of the child's parents or guardians. Information concerning building and site hazards, and options for control of those hazards should be reported to both the owner and/or occupant.

If legal action is necessary, public health authorities should determine (based on Federal, State and local law) the nature and extent of requirements for the property. In some cases, the appropriate response may be to help the family move the poisoned child into a lead-safe dwelling unit.

Table 16.1 Summary of Recommendations for Assessment and Remediation of Residential Lead Exposure

1. Conduct an environmental investigation for all children under age 6 years with confirmed blood lead levels greater than or equal to the CDC blood lead reference value (as of 2012, 5.0 µg/dL). This investigation should include:
    a. An inspection of the child's home and other sites where the child spends significant amounts of time.
    b. A history of the child's exposure
    c. Measurements of environmental lead levels, including at a minimum:
        i. House dust.
        ii. Paint that is not intact or is subject to friction.
        iii. Exposed soil, especially in play areas.
        iv. Other media as appropriate.
2. Ensure that interventions to reduce ongoing exposure:
    a. Focus on control of current lead hazards.
    b. Include prompt initial measures (e.g., house dust control by professional cleaners) where appropriate, to reduce lead exposure rapidly.
    c. Use lead-safe practices by trained workers to avoid increasing lead exposure to occupants and workers. If the interventions include renovation, repair or painting (RRP) work that is not covered by EPA's minor repair and maintenance exemption from the EPA's RRP Rule, the work must be conducted by a certified renovation firm using a certified renovator conducting or supervising the work, and, if used, all additional workers must be trained to work in a lead-safe manner on the job.
    d. Keep to a minimum on-site removal of intact leaded paint.
    e. Replace or enclose building components when elimination of intact leaded paint is performed.
    f. Include visual inspection and clearance testing following lead hazard reduction work to ensure that lead levels are safe prior to the dwelling being re-occupied.
    g. Include temporary occupant relocation or other measures to protect occupants from exposure to leaded dust produced by lead hazard control activities.
    h. Relocate children permanently to lead-safe housing if necessary to reduce their lead exposure in a timely manner.

Sources: CDC, 2002; adapted with regard to CDC, 2012a, and to EPA's Renovation, Repair and Painting Rule (40 CFR 745, especially subpart E).

In some situations, the investigator and public health case manager will be unable to identify sources of lead exposure. The source may be obscure; the parent or guardian may be concealing information about someone, such as a babysitter or family member, whose interests they want to protect; or the parent or guardian may fear reprisal for disclosing certain information. This situation can best be handled by establishing a good rapport with the family and convincing them that the intent is not to find the family or any individual at fault but rather to help the child get well.

During the investigation and remediation, the investigator and public health team should discuss their concerns with the family in a clear and direct manner for the well-being of the child. If exposures continue, the child will be unable to get well. The best approach is to provide clear information and to maintain contact and open communication with the family. The public health case manager will continue to coordinate follow-ups for the child and family until the case is closed.

C. State/Local Housing Intervention

With prompt and effective environmental management as their priority, public-sector health and housing agencies should take joint responsibility for coordination of the housing effort for lead-poisoned children. This follow-up effort may involve working closely with the environmental investigator to control identified lead hazards in a timely manner. Housing officials can also use their access to State and locally managed properties and programs to ensure that lead-safe, temporary housing is available for families with lead-poisoned children and to pay for emergency services if needed to rapidly reduce exposure to lead hazards and protect children. The HUD Lead-Safe Housing Rule requires owners of rental housing receiving certain types of Federal financial assistance to respond promptly when informed that a lead poisoned child lives in an assisted unit (see Section I, above). HUD also requires public housing authorities to attempt to share and match information on addresses of families receiving Federal housing assistance with local health agencies that have information on children with EIBLL (24 CFR 35.1225(f)).

III. Lead Hazard Identification

Lead hazards are identified through the administration and evaluation of a questionnaire (see Tables 16.2 and Form 16.1) and through environmental sampling. Sampling procedures are addressed in Chapters 5 and 7 and Appendices 13.1, 13.2 and 13.3. The questionnaire should always be completed prior to sampling. Although a clear lead source may emerge from the answers to the questionnaire, the investigation of exposure sources in the child's residence should be thorough and complete. Environmental testing should be linked to the child's history and may include a prior residence or other areas frequented by the child. If another residence or childcare facility is identified as a probable source of lead exposure, appropriate environmental sampling should be conducted after discussion with the child's community or local health department. Testing should include the following samples at a minimum:

- X-ray fluorescence (XRF) or laboratory paint chip analysis of all defective paint or coatings on the child's residence including furniture, play structures, and on buildings frequented by the child.
- XRF or laboratory paint chip analysis of all impact and friction surfaces and surfaces that appear to have been chewed, including windowsills.
- Dust samples from areas frequented by the child, including play areas, porches, kitchens, bedrooms, and living and dining rooms. Additional dust samples may be collected from other surfaces (e.g. shoes, boots, cars) for which there are no standards; the information may be helpful in identifying other sources of exposure.
- Soil samples from bare soil areas, particularly child play areas (areas near the foundation of the house and areas from the yard). If the child spends significant time at a park or other public play area, samples should also be collected from these areas, unless the area has already been sampled.
- Where water testing is indicated, first-drawn and flushed water samples from the tap most commonly used for drinking water, infant formula, or food preparation.
- Where applicable, other media as appropriate including glazed tableware or ceramic cookware likely to contain lead.

Table 16.2 Guidelines for Questions to Ask Regarding a Child's Environmental History

Paint and soil exposure

- What is the age and general condition of the residence?
- Is there evidence of chewed or peeling paint on woodwork, furniture, or toys?
- How long has the family lived at that residence?
- Have there been recent renovations or repairs in the house?
- Are there other sites where the child spends significant amounts of time?
- What is the character of indoor play areas?
- Do outdoor play areas contain bare soil that may be contaminated?
- How does the family attempt to control dust/dirt?

Relevant behavioral characteristics of the child

- To what degree does the child exhibit hand-to-mouth activity?
- Does the child exhibit pica?
- Are the child's hands washed before meals and snacks?

Exposures to and behaviors of household members

- What are the occupations of adult household members (Lead smelter, machining or grinding of lead alloys, battery or radiator manufacturing, home renovation/remodeling, demolition of old structures, steel bridge maintenance, welding or cutting of old painted metal, thermal stripping or sanding of old paint).
- What are the hobbies of household members? (Fishing, working with ceramics or stained glass, and hunting are examples of hobbies that involve risk for lead exposure.)
- Are painted materials or unusual materials burned in household fireplaces?

Miscellaneous questions

- Does the home contain vinyl mini-blinds made overseas and purchased before 1997?
- Does the child receive or have access to imported food, cosmetics, or folk remedies?
- Is food prepared or stored in imported pottery or metal vessels?

Managing Elevated Blood Lead Levels Among Young Children, CDC, March 2002

Table 16.3 Common Sources of Lead Exposure to Consider in an Environmental Investigation

(Less-common sources should be considered where appropriate – see Table 16.4)

Source	Standards[a]/Comments
Paint	*Existing paint in structures built prior to 1978, i.e., lead-based paint: 1 mg/cm^2 or 0.5%* *New paint: 90 ppm in dried paint film.* Hazard is increased if leaded paint is deteriorated; present on surfaces subject to friction (e.g., window sashes) or impact (e.g., door knob banging); or disturbed during maintenance, repair, and renovation, especially during surface preparation for repainting. See the note on the lead-based paint standard, below.
Interior dust	*Floors: 40 micrograms per square foot (µg/ft^2)* *Interior window sills: 250 µg/ft^2* *Window troughs: 400 µg/ft^2* See the note on these standards, below.
Soil	*Bare play area soil: 400 ppm* *All other soil: 1200 ppm* Dust on paved surfaces in urban areas often contains elevated lead concentrations.
Drinking water	*First draw from tap (stagnant sample): 15 ppb* Probability of contamination depends on the chemistry of the water. For communities served by public water systems, available data may indicate whether testing is likely to be helpful.
Jobs, hobbies	House dust may be contaminated with lead indirectly via contaminated work clothes, shoes, or hair. Direct contamination can occur from hobbies that generate lead fumes (from heating) or dust.

[a] The source of lead exposure should be controlled if the results of this sampling indicate that lead levels are equal to or greater than the limits listed below. These were the standards 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, regarding the lead-based paint, dust-lead standards and clearance standards, EPA and HUD were reviewing those standards. (See ***http://www.epa.gov/oppt/chemtest/pubs/petitions.html#petition5*** for links to the petition and EPA's response.) Investigators should become familiar with their State and local jurisdiction standards, which may require action at a lower level. Investigators should consult the literature and the government web-sites to keep up to date with and follow the current regulations and guidance documents.

Lead-Based Paint

1.0 mg/cm^2 or 5,000 µg/g (0.5 percent).

Dust (by wipe sampling)

40 µg/ft^2 - floors
250 µg/ft^2 - windowsills

Clearance Standards

40 µg/ft^2 – interior floors.
250 µg/ft^2 – interior windowsills.
400 µg/ft^2 – window troughs [sometimes, improperly, called window wells].

Bare Residential Soil

400 ppm or µg/g in play areas
1200 ppm or µg/g in non-play areas [recommend for gardens].

Water

15 ppb, first draw, 1 L sample volume

Ceramic or Pottery Glazes

Soluble lead compounds can leach out of ceramic ware (these released compounds are called leachates) when the glaze is improperly fired or when the glaze has broken down because of wear from daily usage, particularly after repeated use in a microwave or dishwasher. Chips and cracks in ceramic ware also allow leaching of lead. When lead that is released into food and drink from ceramics, hazardous levels can contaminate food substances and expose children and adults to toxic levels. The leachate is liquid that, in passing through matter, extracts solutes, suspended solids or any other component of the material (such as lead) through which it has passed.

The U.S. Food and Drug Administration's (FDA's) compliance program guidelines on toxic elements in foodware describes FDA's approach to inspecting ceramic or pottery glazes for lead (FDA, 2003). The leachate for ceramic foodware is analyzed by graphite furnace atomic absorption spectrometry using Method 973.32 of the Association of Official Analytical Chemists (FDA, 2000b; FDA, 2005). The FDA uses the following ceramicware action levels (FDA, 2000a):

	µg/ml leaching solution
Flatware (average of 6 units)	3.0
Small hollowware (other than cups and mugs) (any 1 of 6 units)	2.0
Large hollowware (other than pitchers) (any 1 of 6 units)	1.0
Cups and mugs (any 1 of 6 units)	0.5
Pitchers (any 1 of 6 units)	0.5

IV. Lead Hazard Reduction

A. Time Limits

After reviewing the results of the questionnaire and the environmental sampling, immediate steps should be taken to remove and/or control the lead source from the dwelling unit or to relocate the child.

For public housing, certain other federally supported housing programs, and certain State and locally funded housing programs, regulations may require that all testing be completed within 15 days after an EIBLL child is identified. For example, this 15-day requirement applies to housing receiving federal assistance under programs covered by HUD's LSHR's subparts H, I, L or M (see Section I, above, for the subpart names, and see 24 CFR 35.730(a), 35.830(a), 35.1130(a), and 35.1225(a), for the respective regulatory requirements). For these HUD housing programs, interim control of all lead-based paint hazards must be completed within 30 days after receipt of the risk assessment report or the health department's evaluation (see 24 CFR 35.730(c), 35.830(c), 35.1130(c), and 35.1225(c).) See, also, Appendix 6.

Checking with the state, tribal and/or local jurisdiction is important, since they may have shorter time requirements than HUD's that will apply if the housing is receiving federal assistance, or they may have requirements that apply if the housing is not receiving federal assistance. If a child is present and the lead hazard reduction work will be delayed, short-term interventions, such as lead-safe dust removal, should be taken to rapidly reduce the child's exposure to lead hazards until the work will be conducted.

B. Modifications to Ordinary Lead-Based Paint Hazard Controls

Dwellings where extensive lead hazard control activities are occurring, particularly those that increase leaded dust levels, should achieve leaded dust clearance standards before the lead poisoned child and family reoccupy the dwelling. Children with EBL should not be permitted to reenter the dwelling at the end of the workday as indicated in Chapter 8. All children with EBL should leave the dwelling until *all* the lead hazard control work has been completed and clearance established, regardless of the size of the area to be treated. The child's family may need to be relocated temporarily to a dwelling free of lead-based paint hazards if interim controls of lead-based paint hazards are conducted (see 24 CFR 35.1345(a)(2) for the situations in which family relocation is required).

In some cases it may make sense for the family to move permanently to a lead-safe house. The owner may be required to facilitate such a move, or local government may assume some or all of the responsibility. In some cities, public housing authorities may be one source of providing lead-safe housing on an emergency basis. Local governments should consider implementing a system of prioritization to ensure that children with EBL are moved to a lead-safe dwelling as soon as possible. However, efforts to make sure that the original housing unit is made lead-safe are essential to preventing lead poisoning in other children who may move into the unit.

C. Elimination or Control of Other Lead Hazards

All lead hazards identified in the course of the investigation should be eliminated or controlled. If lead hazards not containing paint are identified, contact the appropriate agency and coordinate plans for hazard control with the local health department and the child's case manager. Drinking water is usually regulated by the local public works agency or water and sewage authority. Notify State or local environmental regulatory agencies as appropriate. If probable occupational lead hazards are identified or contaminated work clothing is being taken into the dwelling, counsel the worker regarding the possibility of take-home exposures and inform him/her of the steps needed to protect family members. Where appropriate, work with the case manager to refer adult household members for blood lead testing. If occupational exposure is suspected, inform the federal Occupational Safety and Health Administration (OSHA) or the state, tribal or local occupational safety and health agency.

In some cases, no probable source of lead may be identified. In these instances, public health authorities should reassess possible sources of exposure, with increased emphasis on folk remedies and other culturally related exposures. A list of published reports of some less common sources of lead exposure is in Table 16.4, below.

Table 16.4 Published Reports of Less Common Causes of Elevated Blood Lead Levels (EBLs) in Children

(see Appendix I in CDC, 2000)

Exposure Source	Description/Exposure Pathway	Study Type*	Study Description
Occupational Take Home Exposures			
Battery reclamation	Lead carried home by battery workers. (Only a minority of battery workers showered or changed clothes before going home.)	E	Twelve (75%) of 16 children of lead-exposed workers had EBLLs and a higher average BLL than neighborhood controls (22.4 vs. 9.8 µg/dL, *p*=.049).
Ceramics	Ceramic-coated capacitors made with fritted glass containing lead.	E	Case-control study of 51 children under 6 years (20 exposed, 31 controls) showed higher average BLLs in exposed children (13.4 vs. 7.1 µg/dL, p<.001).
Furniture refinishing	Lead carried home by workers who restored furniture that had undergone chemical stripping and was thought to be lead-free.	CR	Report of six workers and three of their children aged 4-18 months
Construction	Lead dust on skin and clothes taken home.	E	Case-control study of 50 children under 6 years (31 exposed, 19 controls) showed 25.8% of workers' children had EBLLs compared to 5.3% of control children (OR=6.1).
Radiator repair	Lead carried home by workers who did soldering to repair radiator.	E	The mean BLL for 18 children (under 7 years) of lead-exposed workers was 10 µg/dL.

Exposure Source	Description/Exposure Pathway	Study Type*	Study Description
Imported Cosmetics			
Kohl, Kajal (Middle East, India, Pakistan, some parts of Africa)	A gray or black eye cosmetic applied to the conjunctival margins of the eyes. Can contain up to 83% lead. It is believed to strengthen and protect the eyes against disease. Also known as Al Kohl.	E	A study of 538 girls aged 6 to 12 years demonstrated that the application of kohl was associated with higher BLLs (p=0.0461).
Pakistani eye cosmetics	Eye cosmetics are often applied to the eyes of children.	E	Retrospective chart review of 175 children aged 8 months to 6 years showed an average BLL of 4.3 µg/dL for Pakistani/ Indian children not using eye cosmetics and 12.9 µg/dL for those using eye cosmetics (p=0.03).
Surma (India)	A black fine powder applied to the eyes for medicinal and cosmetic reasons.	E	A case-control study of 62 children demonstrated higher BLLs in children using surma (p<.001).
Contaminated Foods			
Apple cider	Cider was made in a maple syrup evaporator that had lead solder joining the interior seams.	CR	Report of a 7-year-old child.
Flour (Middle East)	Lead fillings used in stone mills contaminated flour.	E	Investigation of 43 symptomatic patients aged zero to 80 years and their families and of 563 children aged 10 to 18 years demonstrated that 33 (23%) of 146 community stone mills had lead contamination and that 171 (30.4%) of 563 children had BLLs exceeding 30 µg/dL.
Lozeena	An orange powder used to color rice and meat that contains 7.8%-8.9% lead.	CR	Report of brothers aged 2 and 3 years and their parents. In addition, 9 of 18 extended family members had EBLLs.
Infant formula	Infant formula was made with contaminated tap water from copper pipes with lead solder.	CR	Report (with environmental sampling data) of a 13-month-old child.
Tamarind candy (Mexico)	Tamarind candy jam products from Mexico. During the manufacturing process, the candied jam is packaged in stoneware or terra cotta ceramic jars that can leach lead.	CR	Report of two children under 6 years old, six older children, and one adult.

Exposure Source	Description/Exposure Pathway	Study Type*	Study Description
Beverage Containers			
Bulk-water storage tank	Lead leached from soldered seams and brass fittings in bulk-water storage tanks.	CR	Report of three children aged 6, 12, and 14 months.
Ceramic glaze	Lead in ceramic glaze can leach into stored beverages, especially juices since they are acidic. The risk is highest for improperly fired containers.	CR	Multiple reports.
Cocktail glass	Lead leached from cocktail glass.	CR	Report of a family with one adult and children aged 4, 5, and 14 years.
Iranian urn (samovar)	Lead spot solder from the original manufacturing process leached into water used to make baby formula.	CR	Reports of a 10-week-old child with seizures and of a 4-month-old child.
Lead-soldered kettle	Lead leached into infant formulas.	CR	Reports of a 3-month-old child and of a 1-day-old child.
Folk Remedies			
Azarcon	Also known as **alarcon**, **coral**, **luiga**, **maria luisa**, or **rueda**. Bright orange powder used to treat empacho (an illness believed to be caused by something stuck in the gastrointestinal tract, resulting in diarrhea and vomiting). Azarcon is 95% lead.	E	Report of 15-month-old and 3-year-old siblings who expired with seizures and a subsequent survey of 545 systematically selected households for azarcon and greta usage.
Ayurvedic medicine (Tibet)	Unnamed folk medicine.	CR	Single case.
Ba-Baw-San (China)	Herbal medicine used to treat colic pain or to pacify young children.	E	Study of 319 children aged 1 to 7 years demonstrated that consumption was associated with increased BLLs (p=.038).
Bint Al Zahab (Iran)	Rock ground into a powder and mixed with honey and butter given to newborn babies for colic and early passage of meconium after birth.	CR	Report of six children aged 2 days to 3 months.
Bint Dahab (Saudi Arabia; means "daughter of gold")	A yellow lead oxide used by local jewelers and as a home remedy.	CR	Report of 10 children aged 7 days to 13 months, including three who took bint dahab.

Exposure Source	Description/Exposure Pathway	Study Type*	Study Description
Folk Remedies (continued)			
Bokhoor (Kuwait)	A traditional practice of burning wood and lead sulphide to produce pleasant fumes to calm infants.	CR	Report of four children aged 16 days to 4.5 months.
Ghasard	Brown powder used as a tonic to aid in digestion.	CR	Report of a 9-month-old child who died.
Greta (Mexico)	Yellow powder used to treat empacho (see **azarcon**); can be obtained through pottery suppliers, as it is also used as a glaze for low-fired ceramics. Greta is 97% lead.	E	See azarcon.
Jin Bu Huan (China)	An herbal medicine used to relieve pain.	CR	Report of three children aged 13 and 23 months and 2.5 years.
Pay-loo-ah (Vietnam)	A red powder given to children to cure fever or rash.	CR	Report of a 6-month-old child.
Po Ying Tan (China)	An herbal medicine used to treat minor ailments in children.	CR	Report of a 4-month-old child.
Santrinj (Saudi Arabia)	An amorphous red powder containing 98% lead oxide used principally as a primer for paint for metallic surfaces, but also as a home remedy for "gum boils" and "teething."	CR	Report of 10 children aged 7 days to 13 months, including 7 who took santrinj.
Surma (India)	Black powder used as a cosmetic and as teething powder.	E	A case-control study of 62 children demonstrated higher BLLs in children using surma ($p<.001$).
Tibetan herbal vitamin	Used to strengthen the brain.	CR	Report of a 5-year-old child.
Saudi folk medicine	Orange powder prescribed by a folk medicine practitioner for teething; also has an antidiarrheal effect.	CR	Report of three children aged 11, 22, and 44 months.
Miscellaneous			
Automobile key-chain emblem	Ingestion of lead-containing automobile key-chain emblem.	CR	Report of a 23-month-old child.
Clothing accessory	Ingestion of a "simulated watch."	CR	Report of 3-year-old child who required endoscopy.

Exposure Source	Description/Exposure Pathway	Study Type*	Study Description
Miscellaneous (continued)			
Curtain weights	Ingestion of lead-containing curtain weights.	CR	Report of deaths of a 23-month-old child and a 2-year-old child.
Fishing sinkers	Ingestion of a lead-containing fishing sinker.	CR	Report of an 8-year-old.
Gasoline sniffing	Lead in gasoline absorbed through gasoline sniffing.	CR	Report of six of seven siblings aged 10 to 17 years.
Lead bullet	Lead absorbed from a retained bullet.	CR	Report of one adult and review of 18 other cases including seven children under 2 years old.
Lead pellets	Ingestion of lead pellets from pellet gun.	CR	Report of a 6-year-old child.
Lead shot and toy (boat keel)	Lead shot used in a toy boat keel that was eaten by a child.	CR	Report of a 4-year-old child.
Newsprint fireplace log	Lead inhaled during burning of a log made from old newsprint.	CR	Report of a 6-month-old child.
Pool cue chalk	Lead contained in pool cue chalk.	CR	Report of two children aged 28 and 27 months.
Vinyl miniblinds	Lead dust from vinyl miniblinds.	E	A study of 92 children aged 6 to 72 months attributed 9% of lead poisoning cases to vinyl miniblind exposure.

***CR = case report, E = epidemiological study**

See, also, the CDC lead website's pages for information and links about, for example:

- Folk Medicine (***http://www.cdc.gov/nceh/lead/tips/folkmedicine.htm***), regarding lead in some traditional (folk) medicines from a variety of cultures.
- Candy (***http://www.cdc.gov/nceh/lead/tips/candy.htm***), regarding lead from candy imported from Mexico.
- Sindoor (***http://www.cdc.gov/nceh/lead/tips/sindoor.htm***), regarding lead poisoning related to ingesting sindoor, a red powder, typically used as a cosmetic and in certain religious ceremonies, but which has been used as a food additive.
- Toy jewelry (***http://www.cdc.gov/nceh/lead/tips/jewelry.htm***), regarding swallowing lead jewelry or putting it in the mouth.
- Toys (***http://www.cdc.gov/nceh/lead/tips/toys.htm***), especially regarding toys imported into the U.S., or antique toys and collectibles passed down.

- Artificial turf (***http://www.cdc.gov/nceh/lead/tips/artificialturf.htm***), of which some made of nylon or nylon/polyethylene blend fibers contain levels of lead that pose a potential public health concern when they show signs of weathering, including fibers that are abraded, faded or broken.

The CDC lead website also has pages of general interest, and particular interest when no probable source of lead may be identified, regarding At-Risk Populations (***http://www.cdc.gov/nceh/lead/tips/populations.htm***), including linked pages with information and further links on:

- International adoption and prevention of lead poisoning (***http://www.cdc.gov/nceh/lead/tips/adoption.htm***), for adopting parents, adoption agencies, and health care providers.
- Refugees (***http://www.cdc.gov/nceh/lead/tips/refugees.htm***), with a link to CDC's Lead Poisoning Prevention in Newly Arrived Refugee Children tool kit page (***http://www.cdc.gov/nceh/lead/Publications/RefugeeToolKit/Refugee_Tool_Kit.htm***) and, from there, to the tool kit itself (***http://www.cdc.gov/nceh/lead/Publications/RefugeeToolKit/pdfs/CDCRecommendations.pdf***). The webpage provides recommendations for primary prevention of EBLs, identification of children with EBLs, early post-arrival evaluation and therapy, and health education/outreach. The tool kit is divided into three sections, a refugee resettlement worker module (for state and local health departments, refugee coordinators, refugee health coordinators, and others involved with the well-being and resettlement of refugees), a medical provider module (for those involved with direct medical services to refugees) and resources (for refugee resettlement workers, medical providers and others interested in refugee issues).
- Pregnant Women (***http://www.cdc.gov/nceh/lead/tips/pregnant.htm***), with guidance for pregnant women and links to the CDC's Guidelines for the Identification and Management of Lead Exposure in Pregnant and Lactating Women (***http://www.cdc.gov/nceh/lead/publications/LeadandPregnancy2010.pdf***) for health care providers and public health professionals, and a CDC Podcast about the guidelines (***http://www2c.cdc.gov/podcasts/player.asp?f=3467768***).

The CDC lead website has a page listing and providing links to dozens of Childhood Lead Poisoning Publications, arranged by topic:

- Data and Surveillance Reports
- Health Care Systems/Insurance Guidelines
- International Response
- Lead Exposure Case Studies
- Lead Policy Statements
- Lead Toxicology Reports
- Primary Prevention Guidelines
- Screening and Case Management Guidelines

Case management will continue until case closure, based on decline in the child's blood lead level, control of identified lead hazards, and completion of an individualized plan for follow-ups.

References

CDC, 2002. Centers for Disease Control and Prevention. Managing Elevated Blood Lead Levels Among Young Children: Recommendations from the Advisory Committee on Childhood Lead Poisoning Prevention, Chapter 2, "Assessment and Remediation of Residential Lead Exposure." March 2002. See ***http://www.cdc.gov/nceh/lead/CaseManagement/caseManage_main.htm***.

CDC, 2012a. Centers for Disease Control and Prevention. CDC Response to Advisory Committee on Childhood Lead Poisoning Prevention Recommendations in *"Low Level Lead Exposure Harms Children: A Renewed Call of Primary Prevention."* May 2012. ***http://www.cdc.gov/nceh/lead/ACCLPP/CDC_Response_Lead_Exposure_Recs.pdf***

CDC, 2012b. Centers for Disease Control and Prevention. Fact Sheet: Blood Lead Levels in Children – Important Information for Parents. May 2012. ***http://www.cdc.gov/nceh/lead/ACCLPP/Lead_Levels_in_Children_Fact_Sheet.pdf***

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FDA, 2000b. U. S. Food and Drug Administration, Center for Food Safety and Applied Nutrition. Elemental Analysis Manual for Food and Related Products. January 2000. See ***http://www.fda.gov/Food/ScienceResearch/LaboratoryMethods/ElementalAnalysisManualEAM/ucm221685.htm***. Method 4.2 - Graphite Furnace Atomic Absorption Spectrometric Determination of Lead and Cadmium Extracted from Ceramic Foodware. See ***http://www.fda.gov/Food/ScienceResearch/LaboratoryMethods/ElementalAnalysisManualEAM/ucm224852.htm***.

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FDA, 2005. U.S. Food and Drug Administration, Office of Regulatory Affairs. ORA Laboratory Manual, Volume IV, Section 6-Elemental Analysis. See ***http://www.fda.gov/ora/science_ref/lm/vol4/section/06.pdf***

Form 16.1 Resident Questionnaire for Investigation of Children with Elevated Blood Lead Levels (EBL)

General Information

1. Where do you think the child is exposed to the hazard?_____

2. Do you rent or own your home? ❑ rent ❑ own
   If rented, are there any rent subsidies? ❑ yes ❑ no
   If yes, what type: ❑ Public housing authority ❑ Section 8 _____ ❑ Federal Rent Subsidy
   ❑ Other (specify) _____
   _____

Landlord information (or Rent Collector Agent)

Name: _____

Address: _____ Phone: _____

3. When did you/your family move into this home? (month/year)_____

Complete the following for all addresses where the child has lived during the past 12 months, including this home.

Dates of Residency	Address Include City and State	Approximate Year Built	General Condition of Dwelling: Any renovation or deteriorated paint?

Form 16.1 Resident Questionnaire for Investigation of Children with EBL (2 of 9)

4. Is the child cared for away from the home? (This includes preschool and/or child care at a center, dedicated home, or with a friend or relative.)

   If yes, complete the following table.

Type of Care	Location of care Contact name, address and phone	No. hours/wk at location	General Condition of Dwelling: Any renovation or deteriorated paint?

Lead-Based Paint and Lead-Contaminated Dust Hazards

1. Has this dwelling been tested for lead-based paint or lead-contaminated dust? ❑ yes ❑ no
   If yes, when?_____ Where can this information be obtained? _____

3. Approximately what year was the dwelling built? _____
   a. If unknown, was it before 1950? ❑ yes ❑ no

3. Has there been any recent repainting, remodeling, renovation, window replacement, sanding or scraping of painted surfaces inside or outside this dwelling unit? If yes, describe activities, time and duration of work.

   _____
   _____
   _____
   _____

4. Has any lead abatement or other lead hazard control work been conducted at this dwelling recently?
   ❑ yes ❑ no

5. Where does the child like to play, hide, or frequent? (Include rooms, closets, porches & outbuildings)

   _____

Form 16.1 Resident Questionnaire for Investigation of Children with EBL (3 of 9)

Use the table below.

Areas where the child likes to play, hide, or frequent	Paint condition* (intact, not intact, or not present)	Location of painted component with visible bite marks

** Paint condition: Note location and extent of any visible chips and/or dust in window wells, on window sills, or on the floor directly beneath windows. If you see peeling, chipping, chalking, flaking, or deteriorated paint, make sure you include the locations and extend of deterioration.*

Assessment - Probable: ❑ lead-based paint hazard ❑ lead-dust hazard ❑ no lead hazard

Actions:

❑ Obtain records of previous environmental testing noted above.

❑ XRF inspection of dwelling (check one) ❑ limited ❑ complete

❑ Paint testing of deteriorated paint: add to Form 5.3.

❑ Leaded dust sampling of home: add additional areas to Form 5.4 list of rooms to be sampled

❑ Other sampling (specify): _____

Water Lead Hazards

Determine whether the dwelling is located in a jurisdiction known to have lead in drinking water in either public municipal or well water. Consult with state/local public health authorities for details.

Check one: ❑ at risk ❑ not at risk

1. What is the source of drinking water for the family? ❑ Municipal water ❑ Private well
   ❑ Other (specify): _____

(This information will be used to help determine responsibility and methods of controlling lead exposures from water.)

If tap water is used for drinking, answer questions 2 through 6. If not, go to Lead in Soil Hazards.

Form 16.1 Resident Questionnaire for Investigation of Children with EBL (4 of 9)

2. From which faucets do you obtain drinking water? (Sample the main drinking water faucet.)

   _____

3. Do you use the water immediately? ❑ yes ❑ no
   Do you let the water run for a while first? ❑ yes ❑ no

   (If water-lead levels are elevated in the first draw, but low in the flushed sample, recommend flushing the water if it has not been used for more than 6 hours before drinking.)

4. Is tap water used to prepare infant formula, powdered, milk, or juices for the children? ❑ yes ❑ no
   If yes, do you use hot or cold tap water? ❑ hot ❑ cold

   If no, from what source do you obtain water for the children?_____

5. Has new plumbing been installed within the last 5 years? ❑ yes ❑ no
   If yes, identify location(s). _____

   Did you do any of this work yourself? ❑ yes ❑ no
   If yes, specify. _____

Assessment: ❑ water lead hazard risk ❑ no water lead hazard risk

Actions:

❑ Test water (first draw and flush samples).

❑ Other testing (specify): _____

_____

❑ Counsel family (specify): _____

_____

Lead in Soil Hazards

Use the following information to determine where soil samples should be collected.

1. Where outside does the child like to play? _____
2. Where outside does the child like to hide? _____
3. Is this dwelling near a lead-producing industry (such as a battery plant, smelter, radiator repair shop, boat keel manufacturer, electronics plant, or soldering plant)? ❑ yes ❑ no
4. Is the dwelling located within two blocks of a major roadway, freeway, elevated highway, or other transportation structure? ❑ yes ❑ no
5. Are buildings or structures on the property or nearby being renovated, repainted, or demolished: ❑ yes ❑ no
   If no: Has any of this kind of work been done recently: ❑ yes ❑ no
6. Is there deteriorated paint on outside fences, garages, play structures, railings, building siding, windows, trims, or mailboxes: ❑ yes ❑ no

Form 16.1 Resident Questionnaire for Investigation of Children with EBL (5 of 9)

7. Were gasoline or other solvents ever used to clean parts or disposed of at the property: ❑ yes ❑ no
8. Are there any visible paint chips near the perimeter of the house, fences, garages, or play structures? ❑ yes ❑ no
   If yes, note location(s). _____
   _____
9. Has soil ever been tested for lead: ❑ yes ❑ no
   If yes, when and where can this information be obtained? _____
10. Have you burned painted wood in a woodstove or fireplace? ❑ yes ❑ no
    If yes, have you emptied ashes onto soil? ❑ yes ❑ no
    If yes, where? _____

Assessment: ❑ probable soil lead hazard ❑ no soil lead hazard risk

Actions:

- ❑ Test soil (single samples of bare soil where children play). Complete Form 5.5 for Field Sampling.
- ❑ Advise family to obtain washable doormats for entrances to the dwelling
- ❑ Counsel family to keep children away from bare soil areas thought to be at risk (specify).
- ❑ Counsel family to cover bare soil areas with mulch or other material.
- ❑ Counsel family to remove the cause of lead contamination.

Additional Notes:

_____
_____
_____

Occupational and Hobby Lead Hazards

Use the information in this section to determine if the child may be exposed to lead due to the work environment or hobby of parents, siblings, or other adults. Occupations that may cause exposure include:

Paint removal (e.g., sandblasting, scraping, sanding, abrasive blasting, using heat guns or torches)	Remodeling, repairing, or renovating dwellings or buildings, or demolition (tearing down buildings or metal structures like bridges)
Chemical Strippers	Working at a firing range
Plumbing	Making batteries
Repairing radiators	Making paint or pigments
Melting metal for reuse (smelting)	Painting
Welding, burning, cutting or torch work	Salvaging metal or batteries
Pouring molten metals (foundries)	Making or splicing cable or wire
Auto body repair work	Creating explosives or ammunition
Making or repairing jewelry	Making pottery
Building, repairing or painting ships	Working in a chemical plant, glass factory, oil refinery, or any other work involving lead
Soldering electrical connections	

Form 16.1 Resident Questionnaire for Investigation of Children with EBL (6 of 9)

Answer the following questions.

1. Where does anyone in the household and any frequent visitors work? (Include parents, older siblings, and other adults)

Name	Place of Employment	Occupation	Probable Exposure
			❑ yes ❑ no
			❑ yes ❑ no
			❑ yes ❑ no
			❑ yes ❑ no
			❑ yes ❑ no

2. Are work clothes separated from other laundry? ❑ yes ❑ no

3. Has anyone in the household removed paint or varnish while in the dwelling? (This includes paint removal from woodwork, furniture, cars, bicycles, boats, etc.) ❑ yes ❑ no

4. Has anyone in the household soldered electric parts while at home? ❑ yes ❑ no

5. Does anyone in the household apply glaze to ceramic or pottery objects? ❑ yes ❑ no

6. Does anyone in the household work with stained glass? ❑ yes ❑ no

7. Does anyone in the household use artist's paints to paint pictures or jewelry? ❑ yes ❑ no

8. Does anyone in the household reload bullets, target shoot, or hunt? ❑ yes ❑ no

9. Does anyone in the household melt to make bullets, fishing sinkers, or toys? ❑ yes ❑ no

10. Does anyone in the household work on auto body repair at home or in the yard: ❑ yes ❑ no

11. Is there evidence of take-home work exposures or hobby exposures in the dwelling? ❑ yes ❑ no

Assessment Probable:

❑ occupational related lead exposure ❑ hobby related lead exposure ❑ neither

Actions:

❑ Counsel family (specify) _____

❑ Refer to (specify): _____

Form 16.1 Resident Questionnaire for Investigation of Children with EBL (7 of 9)

Child Behavior Risk Factors (Evaluate each child under age 6.)

1. Does the child suck his/her fingers? ❑ yes ❑ no

2. Does child put painted objects in the mouth? ❑ yes ❑ no

   If yes, specify:_____
   _____

3. Does child chew on painted surfaces, such as old painted cribs, windowsills, furniture edges, railings, door molding, or broom handles? ❑ yes ❑ no

   If yes, specify:_____
   _____

4. Does the child chew on putty around windows? ❑ yes ❑ no

5. Does the child put soft metal objects in the mouth? ❑ yes ❑ no
   These may include lead and pewter toys and toy soldiers, jewelry, gunshot, bullets, beads, fishing sinkers, or items containing solder (e.g., electronics).

6. Does the child chew or eat paint chips or pick at painted surfaces? ❑ yes ❑ no

7. Is the paint intact in the child's play areas? ❑ yes ❑ no

8. Does the child put foreign, printed material (newspapers, magazines) in the mouth? ❑ yes ❑ no

9. Does the child put matches in the mouth? (may contain lead acetate) ❑ yes ❑ no

10. Does the child play with cosmetics, hair preparations, or talcum power or put them in the mouth? ❑ yes ❑ no If yes, are any of these products foreign made? ❑ yes ❑ no

11. Does the child have a favorite: cup? ❑ yes ❑ no eating utensil? ❑ yes ❑ no
    If yes, are either of them handmade or ceramic? ❑ yes ❑ no

12. Does the child have a dog, cat, or other pet that could track in contaminated soil or dust from outside?

    ❑ yes ❑ no If yes, where does the pet sleep? _____

13. Where does the child obtain drinking water? _____

14. If a child is present, note the extent of hand-to-mouth behavior observed. _____

Form 16.1 Resident Questionnaire for Investigation of Children with EBL (8 of 9)

Assessment if Child is at Risk:

- ❑ Hand-to-mouth behavior
- ❑ Mouthing probable lead-containing source
- ❑ Other behavior (specify) _____
- ❑ No observed at-risk behavior

Actions:

Counsel family to limit access to use of (specify) _____

Other (specify) _____

Other Household Risk Factors

1. Are imported cosmetics, such as Kohl™, Surma™, or Ceruse™, used in the home? ❑ yes ❑ no
2. Does the family ever use any home remedies or herbal treatments? ❑ yes ❑ no
   If yes, what type? _____
3. Are any liquids stored in metal, pewter, or crystal containers? ❑ yes ❑ no
4. What containers are used to prepare, serve, and store the child's food? _____
   _____
   Are any of the imported potteries, metal, soldered, or glazed? ❑ yes ❑ no
   Does the family cook with a ceramic bean pot? ❑ yes ❑ no
5. Does the family use imported canned items regularly? ❑ yes ❑ no
6. Does the child play in, live in, or have access to any areas where the following materials are kept: shellacs, lacquers, driers, coloring pigments, epoxy resins, pipe sealants, putty, dyes, industrial crayons or markers, paints, pesticides, fungicides, gear oil, detergents, old batteries, battery casings, fishing sinkers, lead pellets, solder, or drapery weights? ❑ yes ❑ no
7. Does the child take baths in an old bathtub with deteriorated or nonexistent glazing? ❑ yes ❑ no
8. Does the home contain vinyl mini-blinds made overseas and/or purchased before 1997?
   ❑ yes ❑ no

Assessment if Child is at Risk:

- ❑ Increased risk of lead exposure due to: _____
- ❑ No observed risk

Actions:

- ❑ Counsel family to limit access or use (specify): _____
- ❑ Other (specify) _____

Form 16.1 Resident Questionnaire for Investigation of Children with EBL (9 of 9)

Assessment for Likely Success of Temporary Hazard Control Measures

1. What cleaning equipment does the family have in the dwelling?
   ❑ broom ❑ mop & bucket ❑ vacuum that works ❑ sponge & rags
2. How often does the family:
   Sweep the floors? _____ Wet mop the floors? _____
   Vacuum the floors? _____ Wash the windowsills? _____
   Wash the window troughs? _____
3. What type of floor coverings are found in the dwelling? (check all that apply)
   ❑ vinyl/linoleum ❑ carpeting ❑ wood ❑ other (specify): _____
4. Are floor coverings smooth and cleanable? ❑ yes ❑ no
5. Cleanliness of dwelling (check one using table below)
   ❑ appears clean ❑ some evidence of housecleaning ❑ no evidence of housecleaning

Appears Clean	Some evidence of housecleaning	No evidence of housecleaning
No visible dust on most surfaces	Slight dust buildup in corners	Heavy dust buildup in corners
Evidence of recent vacuuming	Slight dust buildup on furniture	Heavy dust buildup on furniture
No matted or soiled carpeting	Slightly matted and/or soiled carpeting	Matted and/or soiled carpeting
No debris or food scattered about	Some debris or food scattered about	Debris or food scattered about
Few visible cobwebs	Some visible cobwebs	Visible cobwebs
Clean kitchen floor	Slightly soiled kitchen floor	Heavily soiled kitchen floor
Clean door jambs	Slightly soiled door jambs	Heavily soiled door jambs

Assessment if Child is at Risk:

- ❑ Cleaning equipment inadequate
- ❑ Cleaning routine inadequate
- ❑ Floor coverings inadequate to maintain clean environment
- ❑ No observed risk

Actions:

- ❑ Counsel family to limit access or use (specify room and location): _____
  _____
- ❑ Provide cleaning equipment
- ❑ Instruct family on special cleaning methods
- ❑ Demonstrate special cleaning methods
- ❑ Flooring treatments needed (specify rooms) _____
  _____
- ❑ Other (specify) _____