CHAPTER 5: RISK ASSESSMENT

Lead-Based Paint Risk Assessment: How To Do It

1. The owner or occupant contacts a risk assessor.

2. The risk assessor determines if the owner is requesting a risk assessment, an inspection, or a combination of the two. The owner and the assessor reach an agreement on costs and scope of effort. If a child with an elevated blood lead level is being investigated, use the protocol in Chapter 16 and/or coordinate with the local health agency. If the dwelling unit was built after 1978 (or if *all* lead-based paint has been removed and clearance has been established), a risk assessment is not needed. If the dwelling is in good condition (as defined by Form 5.1 in this chapter), a lead hazard screen risk assessment 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. In all other cases, conduct a full risk assessment, a paint inspection, or a combination of the two.

3. The owner submits information on the type and condition of the buildings to the assessor on standard forms (or the risk assessor completes forms by phone interview).

4. Conduct environmental sampling and visual assessments in *each* dwelling if assessing owner-occupied, single-family houses; fewer than five rental units; or multiple rental units where the units are not similar. If there are five or more similar dwellings, select a few targeted dwellings using the criteria in this chapter (see Table 5.6).

5. Perform a visual assessment of the building and paint condition, using the standard forms and protocols in this chapter, and select sampling locations based on use patterns and visual observations.

6. Conduct dust sampling. Dust samples are typically collected in the entryway, common spaces, the kitchen, the living room, and a child's bedroom and playroom. Collect samples from floors, interior window sills (stools), window troughs, (window wells) and other surfaces suspected of contamination. One floor sample and one window trough or sill sample should be collected in each main room or area.

7. Conduct soil sampling. Soil samples are collected from bare spots in the play area, near the building foundation (drip line), in gardens, and perhaps the yard. If the total surface areas of bare spots is less than 1 square yard (9 sq. ft.)for each property, a lead-based paint hazard does not exist and soil samples are not necessary. Bare soil in a play area should always be sampled.

8. Conduct deteriorated paint sampling by collecting all layers of paint (not just the peeling layers) and submit the samples to a laboratory recognized by the U.S. Environmental Protection Agency (EPA) National Lead Laboratory Accreditation Program (NLLAP). Alternatively, deteriorated paint can be measured by portable x-ray fluorescence (XRF) if the deteriorated paint has a large enough uniform surface with all layers present. Destructive paint-chip sampling must always be done *after* dust sampling to prevent cross-contamination.

9. At the owner's request, collect 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 EPA has another program in this area. If a lead-contaminated water problem exists beyond the owner's service line, the local water authority should be notified. Air samples are not recommended for routine lead-based paint risk assessments.

10. Interpret the laboratory results.

11. Integrate the laboratory results with the visual assessment results 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. Discuss the various safe and effective lead hazard control options for specific lead hazards with the owner and determine the most feasible and effective options for the specific situation.

13. Prepare a report listing any hazards identified and acceptable control measures, including interim control and abatement options. Provide rough cost estimates of specific alternatives by building component, including the costs of reevaluation (if applicable). Inform the owner how to obtain educational materials from EPA, the Occupational Safety and Health Administration (OSHA), and the local childhood lead-poisoning prevention program and provide copies of these materials if possible. The report should also indicate which control method the owner has chosen to implement (if known).

14. After lead hazard control work has been completed, and clearance established, provide any statements of compliance or other documentation required by Federal, State, or local regulation.

Chapter 5: Risk Assessment

I. Introduction

Two broad types of evaluations can be performed to identify hazardous levels of lead in and around residential dwellings: risk assessments and paint inspections. 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. (See Chapter 3 for further information on this issue.)

A. Evaluation Options

Except where regulations specifically require a risk assessment or a paint inspection, there are no simple rules for choosing an evaluation method. Figure 5.1 provides a decision tree to help determine whether a risk assessment or a paint inspection is most appropriate. This section offers a quick overview of the options, so that owners will be able to make more informed decisions about the best method for them.

Risk assessments and paint inspections are two strategies for identifying lead-based paint hazards in housing *before* they actually cause lead poisoning in a child. Preventing lead hazards in housing is cost effective for all property owners, especially in light of the substantial medical, legal, and relocation expenses associated with the care of a child with an elevated blood lead level.

A property owner has a choice of the following evaluation options:

- Lead hazard screen risk assessment (for properties in good condition).
- Risk assessment.
- Paint inspection.
- Combination risk assessment/paint inspection.
- No hazard evaluation (proceed directly to hazard control).
- Investigation of a house having a child with an elevated blood lead level.

1. Bypassing Risk Assessments

These *Guidelines* generally discourage owners from skipping the preliminary evaluation process. Table 5.1 shows that for most building components, there is a significant chance that lead-based paint will not be present, especially in housing built after 1960, when lead-based paint began to be used less frequently. However, in cases where the owner thinks that deteriorated lead-based paint is present (e.g., on exterior walls constructed before 1940), the owner can correct the suspected hazard using the hazard control methods described elsewhere in these *Guidelines* without conducting an initial risk assessment (such corrections should be conducted by trained personnel only). It is important to note that bypassing the evaluation process can result in both the expensive correction of nonexistent hazards, and, even worse, the failure to correct undetected problems. If owners bypass the initial risk assessment, all painted surfaces must be assumed to contain lead-based paint, and all worker and resident protection measures and reevaluation schedules must be followed accordingly. All dust and soil should also be assumed to be contaminated. The clearance process for such a dwelling should include a followup risk assessment to determine whether all lead hazards were addressed. The followup risk assessment should be done by a certified risk assessor. On the other hand, the clearance process for a dwelling that has had a preliminary risk assessment need not include a followup risk assessment after hazard correction. In this case, a clearance examination can be conducted by a certified inspector technician. Additional details on the clearance process are provided in Chapter 15.

2. Risk Assessments

Risk assessments determine the presence or absence of lead-based paint hazards and suggest appropriate hazard control measures. They can be performed only by certified risk assessors who should use the standard forms provided

at the end of this chapter or equivalent forms. To provide the necessary guidance, a risk assessment must cover the following:

- Identification of the existence, nature, severity, source, and location of lead-based paint hazards (or documentation that no such hazards have been identified).
- Presentation of the various options for controlling lead hazards in the event that hazards are found, including interim controls, abatement measures, and any recommended changes to the management and maintenance systems.

In some cases, the risk assessor will provide recommendations beyond the basic lead hazard control options. For example, if lead-based paint will remain in a dwelling after present hazards are corrected, the risk assessor will provide information to the owner on how to keep that paint in a nonhazardous condition.

Table 5.1 Percentage of All Paint That Is Lead-Based, by Year and Component Type

Component Category	Interior	Exterior
Walls/Ceiling/Floor		
1960–1979	5	28
1940–1959	15	45
Before 1940	11	80
Metal Components[1]		
1960–1979	2	4
1940–1959	6	8
Before 1940	3	13
Nonmetal Components[2]		
1960–1979	4	15
1940–1959	9	39
Before 1940	47	78
Shelves/Others[3]		
1960–1979	0	—
1940–1959	7	—
Before 1940	68	—
Porches/Others[4]		
1960–1979	—	2
1940–1959	—	19
Before 1940	—	13

[1] Includes metal trim, window sills, molding, air/heat vents, radiators, soffit and fascia, columns, and railings.

[2] Includes nonmetal trim, window sills, molding, doors, air/heat vents, soffit and fascia, columns, and railings.

[3] Includes shelves, cabinets, fireplace, and closets of both metal and nonmetal.

[4] Includes porches, balconies, and stairs of both metal and nonmetal.

Source: HUD 1990b. These data are from a limited national survey and may not reflect the presence of lead in paint in a given dwelling or jurisdiction.

Risk assessments do not simply identify lead-based paint, but lead-based paint *hazards*. Risk assessments go beyond simply assessing the condition of paint, and take into account both resident and owner use patterns and management and maintenance practices that will affect that paint. Risk assessments also identify other potential sources of lead hazards, such as dust and soil. By considering all hazards and examining resident and owner practices, a risk assessor determines appropriate ways to control hazards and to modify management practices so that the chance of hazards recurring is reduced.

3. Lead Hazard Screen Risk Assessments

In dwellings in relatively good condition where the probability of finding lead-based paint hazards is low, a full risk assessment may be unnecessary. To avoid the costs of a full risk assessment, a lead hazard screen risk assessment may be conducted. A screen risk assessment employs more limited sampling and more sensitive hazard identification criteria. The protocol for lead hazard screen risk assessments 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.

Because lead hazard screen risk assessments employ more stringent evaluation criteria to act as a "negative screen," they are only cost-effective for dwellings in good condition. Lead hazard screen risk assessments 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 decisionmaking process to determine whether the lead hazard screen risk assessment option is appropriate is outlined in Figure 5.1.

4. Paint Inspections

Lead-based paint inspections (covered in Chapter 7) can be performed by either a certified inspector technician or a certified risk assessor. 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.

Figure 5.1 Lead Hazard Screen Decision Logic.

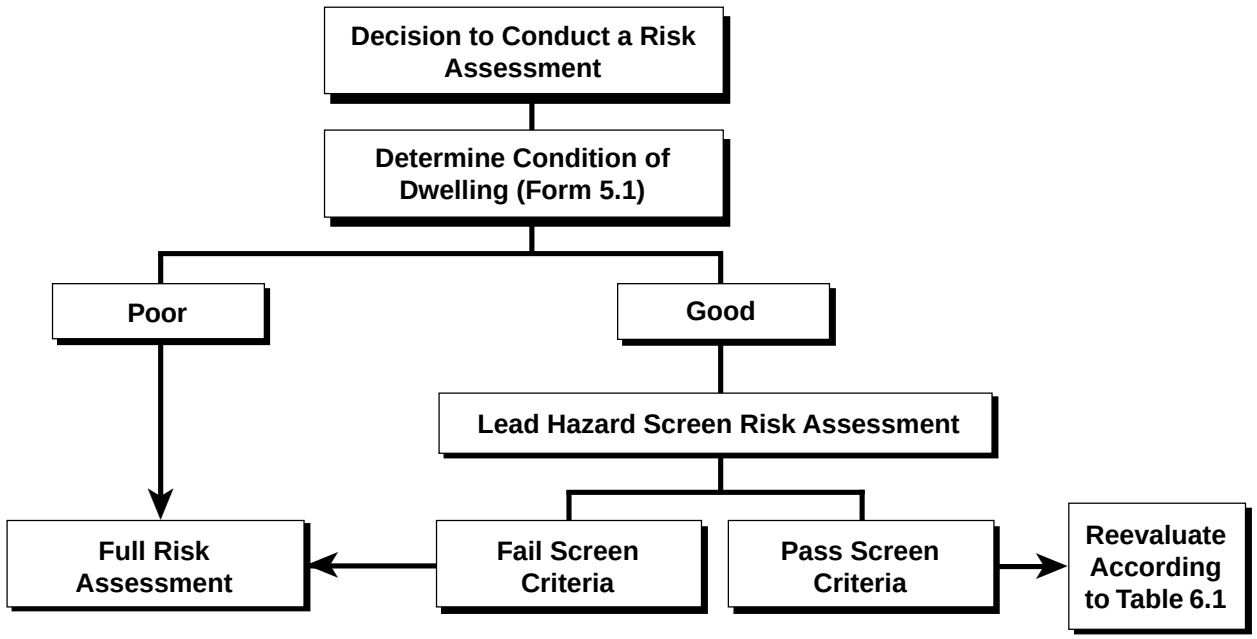


Table 5.2 Comparison of Risk Assessment and Paint Inspection

Analysis, Content, or Use	Risk Assessment	Paint Inspections
Paint	Deteriorated paint *only*	Surface-by-surface
Dust	Yes	Optional
Soil	Yes*	Optional
Water	Optional	Optional
Air	No	No
Maintenance status	Optional	No
Management plan	Optional	No
Status of any current child lead poisoning cases	If information is available	If information is available
Review of previous paint testing	Yes	Yes
Typical applications	1. Interim controls 2. Building nearing the end of expected life 3. Sale of property/turnover 4. Insurance (documentation of lead-safe status)	1. Abatement 2. Renovation work 3. Weatherization 4. Sale of property/turnover 5. Remodeling/Repainting
Final report	Lead hazard control plan or certification of lead-based paint compliance	Lead concentrations for each surface tested

* If local experience indicates that soil lead levels are all very low, repeated soil sampling is not necessary.

However, an inspection usually identifies only the presence of lead-based paint, and does not determine whether the paint presents an immediate hazard. The collection of dust and soil samples is also not part of a routine 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 (as defined in Title X) cannot be made.

Without data about hazards, an inspector technician cannot be expected to offer any guidance on lead hazard control, including appropriate lead hazard control measures. An inspector technician does not necessarily have the training to identify all hazard control options, while a risk assessor does.

Nevertheless, a paint inspection is the preferred evaluation method when an owner has decided to abate all lead-based paint or when the prevalence of lead-based paint is low. Because abatement activities can be costly, it is usually cost effective to complete a paint inspection before using resources to abate assumed hazards. Inspections are also appropriate when extensive renovation that is about to occur will disturb painted surfaces.

5. Combination Risk Assessments and Paint Inspections

It is sometimes advisable to conduct *both* a paint inspection and a risk assessment. 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 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, risk assessors 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.

B. The Risk Assessment Process

Whether hired by the owner or employed by the public sector, the risk assessor is an independent, trained professional certified by the State (or EPA) as being capable of objectively analyzing lead-based paint hazards. Risk assessors may also be licensed by local jurisdictions. Property owners may choose to have a member of their management staff trained and certified to aid in the decisionmaking 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 would be especially important in the event of litigation). In those States without a certification program, owners should use trained risk assessors, preferably certified in another State. The risk assessor (or risk assessment firm) should not 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. In single-family, owner-occupied dwellings, this information includes resident use patterns, such as where the child's principal play area is located. In rental dwellings, the information provides 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 sampling within the dwelling. 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 a visual assessment of the targeted dwelling and collection of environmental samples. The environmental samples (including deteriorated paint, surface dust, and soil) are then sent to a laboratory for analysis.

When the lab results are received, the risk assessor reviews all data, including visual assessment results, environmental sampling results, and management and maintenance information. The assessor then drafts a report identifying lead-based paint hazards and acceptable lead hazard control options, including a spectrum of treatments ranging from interim controls to full abatement of all identified lead hazards. The report includes rough cost estimates for each option, both in the short term and the long term. The control options identified 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 property owner must decide which hazard control option is most appropriate for the dwellings, 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, 1994b).

The risk assessment protocols contained in this chapter are based in part on procedures used in public housing (HES, 1991; HUD, 1992) and private housing (Rhode Island, 1993; EPA, 1994b). These protocols represent the *minimum* recommended procedures for conducting risk assessments, and attempt to strike a balance between the need to have enough data to make

informed decisions and the need to contain costs. More elaborate and extensive investigations may be conducted in certain situations (e.g., responding to parents' concerns about lead poisoning).

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 is not appropriate for an investigation of a dwelling presently housing a child with an elevated blood lead level. In these cases, a more comprehensive investigation of all sources of lead is necessary (see Chapter 16), because it is possible that the exposure is unrelated to the residence (e.g., glazed pottery or leaded toys), or another dwelling is the source of the poisoning. For more information about investigations involving children with elevated blood lead levels, consult the local childhood lead poisoning prevention program, and the local heath department, and review the protocols and recommendations issued by the Centers for Disease Control and Prevention (CDC), which are currently being revised.

2. Public Housing Risk Assessments

The protocols described in this chapter are not meant to replace the public housing protocol, which is designed to meet the more complex management and maintenance needs of public housing authorities.

3. 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 residence, although other obvious sources should be identified. 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 identify the potential source in their final report and notify the local health authority about their concerns. EPA has published information on additional sources of lead and how they should be addressed (EPA, 1994b).

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.

Water sampling is also optional for routine risk assessments. If a property owner 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 (1–800–426–4791). In communities where water contamination appears to be especially prevalent, EPA requires public water suppliers to evaluate and correct the problem.

Computer exposure or risk assessment models (EPA, 1989; Cohen, 1993) that integrate various exposure sources and pathways are not recommended for routine residential risk assessments for three reasons: they were developed for large populations, sampling of all sources in millions of dwellings is not feasible, and there is little agreement within the scientific community on which model best characterizes risk at this time.

II. Onsite Data Collection Procedures

The onsite phase of the risk assessment involves a visual inspection of the dwellings or common

areas being evaluated, and a collection of a limited number of paint, dust, and soil samples. Standard field sampling forms for onsite field testing are provided at the end of this chapter.

A. Visual Assessment

The visual assessment is conducted to locate potential lead-based paint hazards and evaluate the magnitude of the hazard. If a paint inspection has already been conducted, the assessor should focus on the painted surfaces that are known to contain lead-based paint and the dust reservoirs around them. The risk assessor should review all previously conducted inspections to determine if the findings are reliable (see p. 5–21 and Chapter 7). In dwellings where no inspection has been conducted, any painted surface that has not been replaced after 1977 must be assumed to contain lead-based paint. The assessment should also review the overall condition of the building.

The visual assessment should identify:

- Deteriorating painted surfaces.
- Areas of visible dust accumulation.
- Areas of bare soil.
- Painted surfaces that are impact points or subject to friction.
- Painted surfaces on which a child may have chewed.

Information from the visual assessment should be used to:

- Determine where environmental samples will be collected.
- Define in a preliminary way the extent of the lead hazard control efforts needed.
- Predict the efficacy of the various hazard control options given current maintenance practices.
- Determine housing conditions (such as water leaks) that, if not corrected, could lead to rapid paint deterioration.

1. Condition of Painted Surfaces

Every risk assessment should include an evaluation of the condition of painted surfaces. The risk assessor should observe the extent of any paint deterioration by rating the paint condition as "intact," "fair," or "poor." An attempt should be made to determine whether the deterioration is due to a moisture problem or some other existing building deficiency. 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. Poor surfaces are considered to be a hazard and should be corrected. Fair surfaces should be repaired, but are not yet considered to be a hazard; if not repaired, they should be monitored frequently. Intact surfaces should be monitored to ensure that they remain in a nonhazardous condition.

An example of the building components to be rated can be found in Forms 5.2 and 5.7 at the end of this chapter. If the paint on certain components is *known* not to contain lead above the regulatory limit, its condition need not be evaluated, although all deteriorated paint should be repaired since it may contain lower levels of lead.

While risk assessors should use their own professional judgment when evaluating the condition of painted surfaces, they should generally follow the guidelines and use the standardized definitions for intact, fair, and poor paint conditions provided in Table 5.3. The size of the area of deteriorated paint need not be measured but simply estimated.

The evaluation of paint conditions is critical to the lead hazard control decisionmaking process; therefore, risk assessors have found it helpful to have owners or maintenance personnel also rate the paint conditions in multifamily situations. Although most dwellings exhibit some minor degree of paint deterioration, it is common for building owners to rate the condition of their paint more highly than a trained, objective professional (HES, 1993). By discussing

Table 5.3 Categories of Paint Film Quality

	Total Area of Deteriorated Paint on Each Component		
Type of Building Component[1]	**Intact**	**Fair**[2]	**Poor**[3]
Exterior components with large surface areas.	Entire surface is intact.	Less than or equal to 10 square feet.	More than 10 square feet.
Interior components with large surface areas (walls, ceilings, floors, doors).	Entire surface is intact.	Less than or equal to 2 square feet.	More than 2 square feet.
Interior and exterior components with small surface areas (window sills, baseboards, soffits, trim).	Entire surface is intact.	Less than or equal to 10 percent of the total surface area of the component.	More than 10 percent of the total surface area of the component.

[1] Building component in this table refers to each *individual* component or side of building, *not* the combined surface area of all similar components in a room (e.g., a wall with 1 square foot of deteriorated paint is in "fair" condition, even if the other three walls in a room are intact).

[2] Surfaces in "fair" condition should be repaired and/or monitored, but are not considered to be "lead-based paint hazards" as defined in Title X.

[3] Surfaces in "poor" condition are considered to be "lead-based paint hazards" as defined in Title X and should be addressed through abatement or interim controls.

how to assess deteriorated paint, risk assessors have helped owners to be more vigilant when working on surfaces with potential lead-based paint hazards. While this exercise is not recommended for all assessments, it may be a valuable educational tool for some owners. Use Form 5.2 or 5.7 for recording the condition of paint.

Figures 5.2a through 5.2g illustrate seven different paint conditions that can be grouped into three general categories: surface deterioration, 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. Definitions and causes of paint deterioration are as follows:

Surface Deterioration.

Chalking—A formation of a fine powder on the surface of a paint film, usually caused by a failure to adequately prime or seal a porous surface, overthinning of paint, or exposure to sunlight, causing breakdown of the paint binder and release of pigment. Almost all exterior oil paints are designed to eventually chalk in order to wash dirt away in the rain and provide a good surface for repainting. The chalk may contain high levels of lead.

Mildew—A formation of microbial growth usually caused by excessive moisture. If unchecked, mildew formation can lead to extensive paint film failure. Mildew should be removed as a preventive measure to decrease the chance of paint film deterioration.

Worn Paint Due to Friction or Impact—Paint that is worn or chipped due to friction or mechanical damage is also considered deteriorated. Worn paint is often due to improperly hung

doors, sticky window sashes, etc. The building component should be repaired so that it operates smoothly before it is recoated.

Bulk Deterioration.

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.

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.

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.

Layered Deterioration.

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 lifespan of many forms of lead-based paint hazard control, especially paint film stabilization.

Figure 5.2a Forms of Paint Deterioration: Chalking.

Courtesy: National Decorating Products Association

Figure 5.2b Forms of Paint Deterioration: Scaling, Cornflaking, and Peeling.

Courtesy: National Decorating Products Association

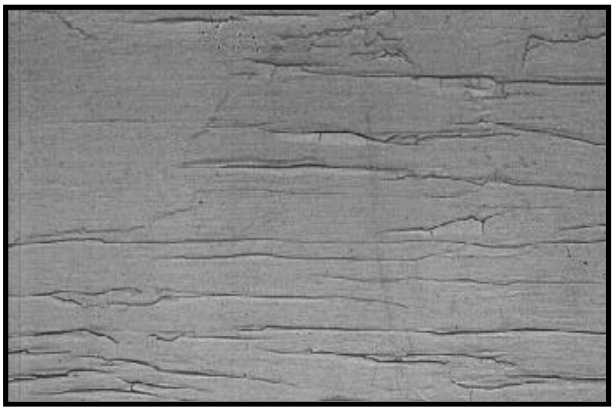


Figure 5.2c Forms of Paint Deterioration: Checking.

Courtesy: National Decorating Products Association

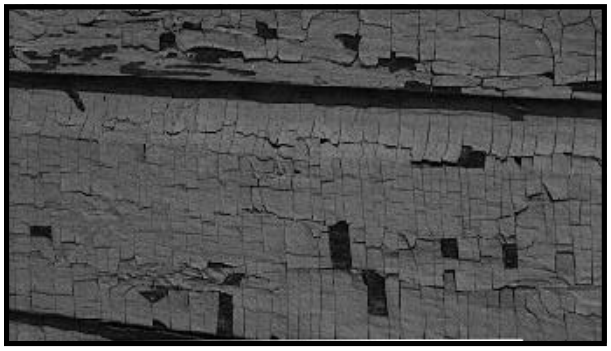


Figure 5.2d Forms of Paint Deterioration: Alligatoring.

Courtesy: National Decorating Products Association

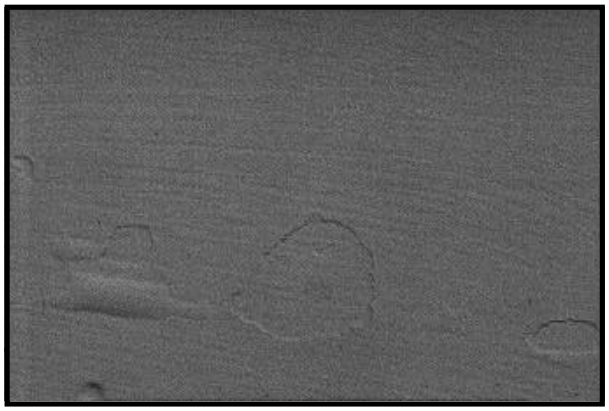


Figure 5.2e Forms of Paint Deterioration: Blistering.

Courtesy: National Decorating Products Association

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.

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.

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.

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.

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.

2. Condition of Building

During the evaluation of painted surfaces, overall building conditions should also be determined. The condition of the building can offer insights into where future lead-based paint hazards may occur and whether certain hazard control options are likely to be successful. A leaking roof should be noted since it could cause paint deterioration in the near future. A poorly maintained building may indicate that an owner is unlikely to sustain interim controls.

The recommended method of evaluating the overall condition of the building is to rate the building using the Building Condition Form (Form 5.1). If the condition of the building is

rated poor, a lead hazard screen is not an option. Risk assessors are responsible for informing owners of the frequency and duration that a dwelling should be reevaluated following lead hazard control treatments. Procedures to develop a site-specific Reevaluation Schedule are discussed in Chapter 6.

3. Condition of Friction and Impact Surfaces

Deterioration on friction and impact surfaces should be determined by operating several of the windows and doors that are used most frequently (if known). Windows that do not operate smoothly and doors that bind or otherwise contact the frame improperly are indications of a potential source of leaded dust. Operating three or four windows and three or four doors is usually adequate; it is not necessary to operate all windows and doors in the dwelling. For risk assessment purposes, it is not necessary to analyze the paint for lead content on these surfaces unless it is deteriorating.

4. Chewed Surfaces

Surfaces with teeth marks are considered hazards if the paint is lead based.

5. Common Areas

Paint and building conditions should be evaluated in all common areas accessible to children.

B. Dust Sampling

1. General Guidance and Definitions

These *Guidelines* provide advice on deciding which rooms to sample and which components to sample within rooms. However, only general guidance can be offered on exactly *where* samples should be collected. The exact spot to be sampled should be chosen based on the risk assessor's visual observations and the results of any resident interviews and use patterns (if available). Of course, no interviews or observation of use patterns can be done in vacant units. Generally, 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. Window dust samples in a given room should be collected from the window that is most frequently operated or 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. Conversely, the window trough of windows that are difficult to open and are infrequently operated should *not* be sampled, since contact by children is unlikely.

Figure 5.2f Forms of Paint Deterioration: Cracking, Peeling,and Blistering.

Courtesy: National Decorating Products Association

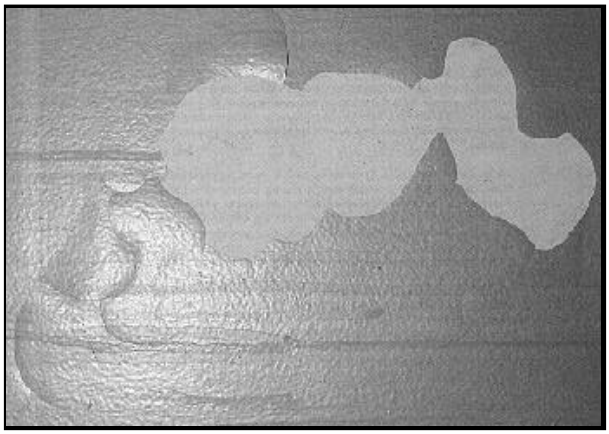


Figure 5.2g Forms of Paint Deterioration: Cracking and Peeling on Plaster.

Courtesy: National Decorating Products Association

Figure 5.3a shows where wipe samples should be collected from window assemblies. Samples should be collected from interior window sills (also known as stools or ledges), which are shown as Area C in Figure 5.3a. Samples should also be collected from window troughs (Area A or Areas A and B), formerly known as window wells (or exterior sills). It should be noted that the entire exterior sill is not sampled.

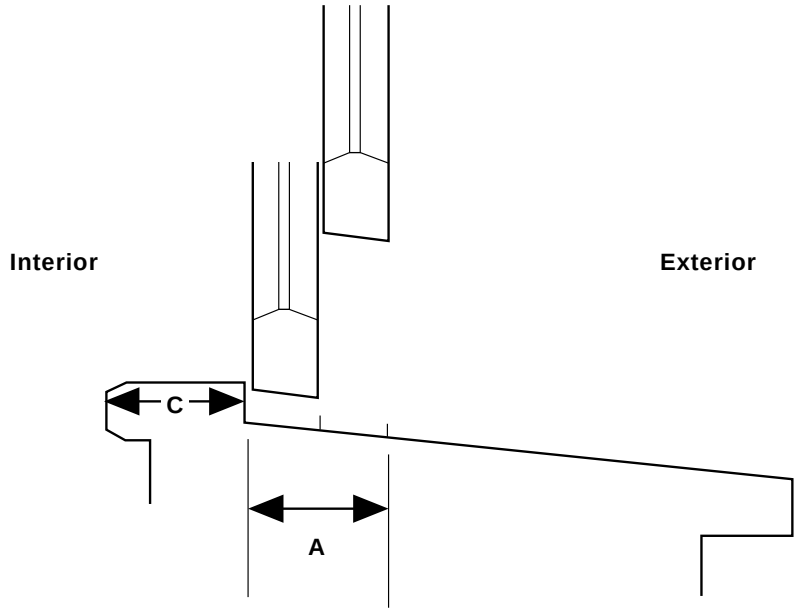
- Interior window sills—The portion of the horizontal window ledge that protrudes into the interior of the room, adjacent to the window sash when closed; technically called the window "stool."
- Window trough—The portion of the horizontal window sill that receives both the upper and lower window sashes when they are lowered, often located between the storm window and the interior window sash; sometimes called the window well. If there is no storm window, the window trough consists of the portion of the horizontal window trim that contacts the sashes when they are closed (i.e., not the entire exterior sill). See Figure 5.3 for an illustration of the window surfaces from which dust samples should be collected.

The risk assessor can conduct either composite or single-surface dust sampling. In composite sampling, samples are collected from common components in different rooms and analyzed as one. Composite sampling often reduces the total number of samples analyzed, thus lowering the cost, but offers only limited information about individual rooms. Single-surface sampling involves collecting and analyzing samples from individual components. Single-surface sampling incurs higher analytical costs, but 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.

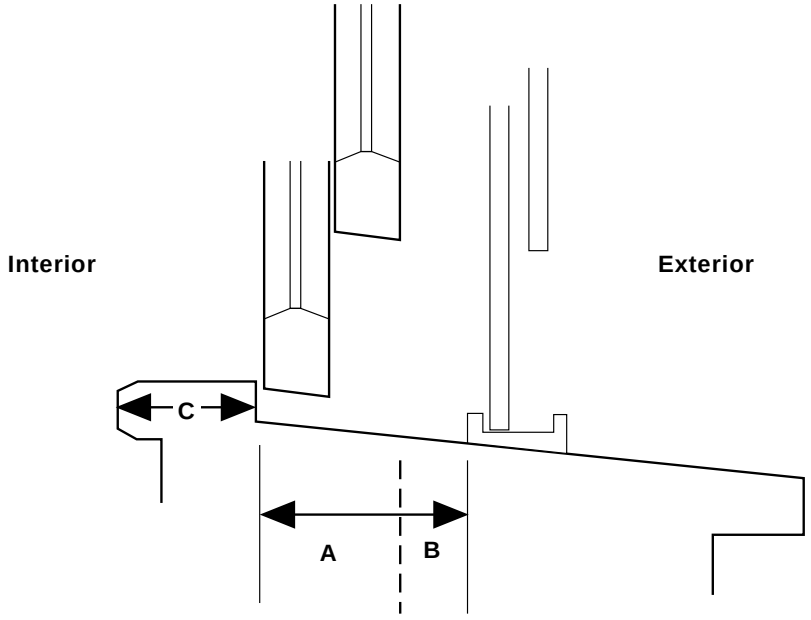
Dust samples can be collected using either a wet wipe or a special vacuum. The complete field sampling and analytical protocol for wipe sampling is contained in Appendixes 13 and 14. At this time, HUD is able to offer guidance on interpreting the results of wipe sampling only, because there is no recommended standard for vacuum sampling. While vacuum sampling may be used, it is up to the user to interpret the results. The results of wipe sampling and vacuum sampling are *not* interchangeable or equivalent. Further information on dust sampling will be available from EPA when health-based leaded dust standards are promulgated. The following considerations should be observed when collecting dust samples:

- Wipe sampling is the preferred method of dust collection because it is simple, inexpensive, and has been used successfully for a number of years in several States and in the public housing program. Recent research has indicated that wipe-sampling results correlate well with blood lead levels in children (Lanphear, 1994; Farfel, 1992). Currently, researchers are examining the efficacy of vacuum sampling, and HUD and EPA will provide further guidance on interpreting vacuum-sampling results pending further research.
- Whenever possible, dust samples from floors should be collected from hard surfaces. Wipe samples can be collected from the surface of carpets; however, carpet sampling is more ambiguous because of the variability among carpet styles.
- Only certain brands of wipes should be used, unless equivalence can be demonstrated through a blind dust-spike sample analysis (see Appendix 13.1).
- Whatman™ filters and thick diaper wipes should not be used. (Whatman™ filters are not sufficiently durable for use in the field, and many thick diaper wipes cannot be digested in routine lab analysis.)
- Unmarked spiked wipe samples should be submitted for analysis with regular field samples in order to ascertain the efficiency of the laboratory digestion procedure. See Section IV of this chapter and Appendix 14.3 for more information on spiking wipe-sample media with leaded dust.

Figure 5.3a Window Locations for Dust Sampling.



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 shown 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 sill (stool) is shown as area C. Interior window sills and window troughs should be sampled separately.

Figure 5.3b Deteriorated Window Troughs Often Contain High Levels of Lead-Contaminated Dust.

- Hard containers (not plastic bags) should be used to transport wipe samples from the sampling site to the lab, since the container will be rinsed quantitatively to recover all lead on the sample.
- Hard containers should be triple-rinsed in the laboratory to ensure quantitative transfer.
- Wipes should always be moist; if the wipes have dried out (e.g., from an open lid), they should not be used.

2. Composite Dust Sampling

If composite sampling is used, a minimum of three separate composite dust samples should be collected. A fourth composite sample would be needed if wall-to-wall carpets are present. The composite samples should be collected from floors, interior window sills, and window troughs.

Risk assessors should follow the composite sampling protocol found in Appendix 13.1. The following rules should be observed when conducting composite dust wipe sampling:

- Separate composite samples are required from carpeted and hard surfaces (e.g., a single composite sample should not be collected from both carpeted and bare floors).
- Separate composite samples are required from each different component sampled (e.g., a single composite sample should not be collected from both floors and interior window sills).
- Separate composite samples are required for each dwelling.
- Floor surface areas sampled in each room should be approximately the same size (1 ft^2 or 929 cm^2). Window trough and interior window sill sampling sizes are dependent on window characteristics, but should be as similar as possible from room to room (e.g., the surface sampling area should not be skewed so that one room is oversampled).
- A new wipe should always be used for each spot sampled.
- No more than four different wipes should be inserted into a single container for a composite sample. Acceptable recovery rates (80–120 percent of the "true" value) have been found when no more than four wipes are analyzed as a single sample (Jacobs, 1993c).

While a risk assessor should exercise professional judgment about the number and location of samples, three or four composite dust samples are sufficient for most evaluations in smaller dwellings.

In an unoccupied dwelling or a dwelling facing turnover, the areas that are most likely to have lead-contaminated dust should be sampled. In general, floor samples should be collected in the four rooms with the greatest evidence of chipping and peeling paint. In a dwelling where children reside, however, areas where young children are most likely to be exposed to lead hazards should be sampled. The recommended subsampling locations for houses with children are the following:

- Principal playroom for children (usually the TV room, living room, or dining room).

- Kitchen.
- Bedroom of the youngest child, who is over 6 months of age (children under 6 months are unlikely to be exposed to dust).
- Bedroom of the next oldest child.

The preceding locations for subsamples can be used for both single-family and multifamily dwelling risk assessments. However, substitute locations will be necessary in dwellings where the room designations cannot be determined. For example, in vacant units, the living room should be substituted for the playroom and the smallest bedroom for the youngest child's room.

3. Single-Surface Dust Sampling

If composite sampling is not used, at least six to eight single-surface dust samples are necessary to evaluate the hazards in each dwelling. Children are most likely to come into contact with dust in the following areas:

- Entryway (including porches).
- Children's principal play area (usually the TV room, living room, or dining room).
- Children's bedrooms.
- Kitchen.
- Bathroom.

Within these rooms, components that are likely to have high dust levels are:

- Floors near friction or impact spots or in areas with deteriorated paint.
- Interior window sills (of frequently opened windows).
- Window troughs (of frequently opened windows).
- Cabinets with deteriorated paint (housing dishes, toothbrushes, eating utensils, etc.).

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 multiple-dwelling assessment, 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 on the next page. This plan guarantees a mix of dust samples from floors, interior window sills, and window troughs, with a preponderance of samples collected from floors, which are more frequently contacted by children.

In some cases, a mixture of single-surface and composite samples may be the most appropriate approach. Composite samples should be used when all the surfaces are fairly similar. Single-surface sampling should be used on surfaces that are unique in some way. For example, if there is a single window trough 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. The selection of composite or single-surface sampling is a professional judgment that should be made by a certified risk assessor, and should be based on EPA standards when they are promulgated.

4. Common Areas (Multifamily Housing Only)

When sampling low-rise buildings (four stories or less), the risk assessor should collect two additional dust wipe samples: one from the entry area floor and one from the floor of the first-story landing of a common hallway or stairway. If there is a hallway window that is frequently used, the risk assessor should collect an interior window sill or window trough sample from this window and substitute this sample for the floor sample from the first-floor landing.

In high-rise buildings, the risk assessor should also collect two additional dust samples from the corridor of every fourth floor. The dust samples should be collected from floor areas and window troughs. If the window cannot be opened, or there is no trough present, a sample from the interior window sill should be collected. In addition, two dust samples should be collected from stairways: one from the stair treads, and one from the landing. When collecting the dust samples, the risk assessor should

Example of a Dust Sampling Plan

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

- One from the floor of the child's principal play area, TV room, or living room).
- One from the interior window sill of the most frequently opened window in the child's principal play area.
- One from the floor of the kitchen.
- One from the window trough of the kitchen window (if inaccessible, an interior window sill sample should be collected).
- 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 window trough of the bedroom of the next oldest child, if any (if inaccessible, an interior window sill sample should be collected).

At least one window trough sample should be collected in each dwelling. 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, three composite samples *or* eight 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 delete or add a sample location. For example, if a window is never opened, the window trough should not be sampled. If an additional location is identified that displays both a visible accumulation of dust *and* has obviously been exposed to a child, an additional sample from that location should be collected. A dusty tabletop in the child's play area, or a cabinet with deteriorated paint that holds dishes, aresurfaces that should be sampled.

record the conditions of all painted surfaces in the corridor or stairway where the samples are collected.

5. Dust Sampling in Onsite Community Buildings, Day Care, Recreational, or Other Spaces Frequented by Children

For spaces up to 2,000 square feet, dust samples should be collected as follows:

- Floors: Collect two dust samples from widely separated locations in "high-traffic" areas regularly used or accessible to children.
- Windows: Collect two samples, one from an interior window sill and the other from a window trough.

For spaces over 2,000 square feet, dust samples should be collected as follows:

- Floors: Collect one additional sample for each increment of 2,000 square feet.
- Windows: Collect one additional sample of either an interior window sill or a window trough for each additional increment of 2,000 square feet.

In the building's management office, one dust sample should be collected from the floor of the resident waiting area (if children are ever present in the area); two samples should be collected if the area is more than 400 square feet. Dust samples may be composited according to the rules explained earlier.

C. Paint Sampling

As part of the risk assessment, the risk assessor should determine whether any deteriorated paint is lead-based and therefore constitutes a lead hazard. If a paint inspection has been conducted, and the risk assessor believes that the inspection adequately follows the principles of testing described in Chapter 7, then the inspection results should be used to determine which deteriorated surfaces are lead hazards. If an inspection has not been completed, or the risk assessor questions its reliability, building components that exhibit deteriorated paint should be analyzed. Paint-chip samples should be collected, or measured by x-ray fluorescence (XRF) analysis *after* dust sampling is conducted in order to minimize the possibility of cross-contamination of dust and paint samples.

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 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 5.4. Chapter 7 contains detailed instructions on how repeated paint inspections can be completed.

If the answer to any of the Table 5.4 questions is negative, the past inspection or a portion of that inspection may not be reliable. 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. It is usually *not* necessary to retest all surfaces.

If Table 5.4 indicates that paint testing was adequate, the risk assessor can use the previous results without additional sampling.

2. Deteriorated Paint Analysis

Deteriorated paint analysis can be performed with either a portable XRF lead-based paint analyzer or by laboratory paint-chip analysis. More information on XRF testing can be found in Chapter 7. Risk assessors should be aware that most XRF analyzers can only be used on surfaces where the paint is intact over an area of at least 3 square inches with all layers present. XRF testing should not be used to analyze peeling paint or paint chips. Peeling or chipped paint should only be analyzed by a laboratory, unless an intact area nearby can be used for XRF analysis. Other methods, such as spreading pulverized paint chips out on a sheet of paper and then analyzing them by XRF, should not be used for risk assessment purposes at this time because equivalence with other standard analytical methods has not been established.

Paint-chip samples for laboratory analysis are collected by removing *all* layers of paint from the surface 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); (2) the result of the paint-chip analysis should be comparable to an XRF reading, which reads all layers; and (3) the cost of analyzing a single layer is the same as the cost of analyzing only the deteriorated layers. A complete protocol for sampling paint (intact, as well as deteriorated paint) can be found in Chapter 7 and Appendix 13.2. Minor cleanup of the immediate area should be done with wet wipes following any destructive paint-chip sampling effort.

One paint-chip sample should be collected from all similar building components with deteriorated paint that have similar painting histories. Paint chips should be collected from the exterior as well as the interior of the dwelling. As a rule of thumb, no more than five deteriorated painted surfaces are sampled for most risk assessments. If more surfaces must be sampled,

Table 5.4 Review of Previous Lead-Based Paint Inspections

		Yes	No
1	Did the report clearly explain the entire testing program and include an executive summary in narrative form?		
2	Did the report provide an itemized list of similar building components (testing combinations) and the percentage of each component that tested positive, negative, and inconclusive? (Percentages are not applicable for single-family dwellings.)		
3	Did the report include test results for the common areas and building exteriors as well as the interior of the dwelling units?		
4	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?		
5	If confirmation testing (laboratory 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?		
6	Was the unit selection process performed randomly?		
7	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?		
8	Did the report record the XRF calibration checks for each day that testing was performed?		
9	Did the calibration checks indicate that the instrument was operating within the Quality Control Value (see Chapter 7)?		
10	Were the required number of readings collected for each surface?		
11	Were substrate corrections performed (if necessary)?		
12	Were confirmatory paint-chip samples collected if XRF readings were in the inconclusive range?		
13	Was the procedure that was used to collect the paint-chip samples described?		
14	Was the laboratory that analyzed the paint samples identified?		

the owner should consider having a paint inspection done together with the risk assessment (see Chapter 7).

Wet chemical field test kits should not be used to analyze paint at this time. Although they demonstrate promise for the future, the chemical test kits are not yet sufficiently reliable for routine analysis of deteriorated paint, dust, or soil (RTI, 1991; Jacobs, 1991a; CMHC, 1993). However, if it is not possible to conduct XRF or laboratory paint-chip analysis, the kits may be used. Current EPA/HUD recommendations on the use of these kits can be obtained by calling 1–800–LEAD–FYI. It is possible that some kits may be approved in the future (see Chapter 7).

Composite Paint-Chip Sampling. A risk assessor can choose to perform either single-surface or composite sampling of paint chips. Just as in composite dust sampling, it is possible to lower

the cost of paint-chip analysis by combining individual samples into a single sample (i.e., by choosing composite sampling over single-surface sampling). As with all composite sampling, composite paint-chip sampling provides limited information in that it will not reveal exactly which surface is coated with lead-based paint. To conduct composite paint-chip sampling, each subsample added to the composite should be equal in size (about 1 square inch) and weight. For this reason, compositing of paint chips is best performed in the laboratory, where size and weight can be controlled. Due to laboratory restrictions, no more than five subsamples should be included in a single composite paint-chip sample. The laboratory must be instructed to analyze the *entire* sample (not a portion of the sample), or to completely homogenize the entire sample and analyze a sub-sample. Homogenization procedures are available from the EPA Lead Information Center (1–800–LEAD–FYI).

The lead-based paint standard should be divided by the number of subsamples contained in the composite sample to determine if any individual subsample can be above the standard. As shown in the following equation:

$$\text{Composite Paint Standard} = \frac{\text{Paint Standard}}{\text{Number of Subsamples}}$$

Consider the following example: A risk assessor identifies five surfaces with deteriorated paint. All five surfaces are sampled in an equivalent manner. Half of each sample is retained (in a separate container) by the risk assessor or laboratory, and half is used to form a single composite paint-chip sample. Since there are *five* subsamples, the composite lead-based paint standard *for this sample* is:

$$\frac{1 \text{ mg/cm}^2}{5 \text{ subsamples}} = 0.2 \text{ mg/cm}^2$$

or

$$\frac{5{,}000 \text{ µg/g}}{5 \text{ subsamples}} = 1{,}000 \text{ µg/g}$$

If the laboratory results are less than 0.2 mg/cm^2 or 1,000 µg/g, none of the individual subsamples can possibly contain lead at or above the national standard of 1 mg/cm^2 and therefore no further action is necessary. If the lab result is greater than 0.2 mg/cm^2, the paint subsamples that were retained should be submitted for individual analysis to determine if any of the subsamples contain lead equal to or greater than 1 mg/cm^2 or 5,000 µg/g. Composite paint-chip sampling is essentially a negative screen (i.e., it can prove that lead-based paint is *not* present). Proof that lead-based paint *is* present can only be established through single-surface sample analysis.

Composite sample results can be expressed in either mg/cm^2 or µg/g. To report the results in mg/cm^2, all subsamples must have the same surface area. To report the result in µg/g, all subsamples must be of equal weight. Since it is not feasible to weigh samples in the field, composite paint-chip samples should generally be reported in mg/cm^2 (i.e., it *is* feasible to measure the size of the area of the paint sample).

Why is the standard for a composite paint chip samples reduced while the standard for a composite dust sample remains unchanged, regardless of the number of subsamples included? The answer involves how the results will be used. The composite dust sample will determine whether cleaning is needed across all floors or all windows. The cost of cleaning an additional room is marginal, especially if the unit is vacant. However, deteriorated paint may be repaired in a number of different ways, making it necessary to know exactly *which* surface is contaminated. Abatement or interim control of a single building component may cost hundreds of dollars, while the cost of cleaning an additional room is far lower. Thus, compositing for paint is essentially a *screening* process to determine whether or not it is possible for any subsample to be above 1 mg/cm^2. For dust, the compositing process yields an average across all surfaces to determine if cleaning is needed. All dust and paint-chip compositing must be carefully coordinated with the laboratory.

Chewed Surfaces. Surfaces with deteriorated paint and surfaces that have been chewed (or

where chewing and mouthing are reported) should be tested. Chewed surfaces could include interior window sills, balusters, shelves, stairs, and other surfaces accessible to children's mouths. Deteriorated paint surfaces that display teeth marks or that have been identified as a site of mouthing should be analyzed either by paint-chip analysis or XRF testing. Surfaces with *intact* paint where chewing or mouthing is suspected should be analyzed with an XRF analyzer, when available. Although a chewed surface is by definition deteriorated, paint-chip sampling is *not* recommended for intact, chewed surfaces unless the surface can be covered with a durable material immediately. Disturbing intact paint may make a child more curious about the surface and may increase the likelihood of exposure. If no testing occurs, the surface should be assumed to be a lead-based paint hazard, and should be treated accordingly.

Intact Paint on Friction and Impact Surfaces. In general, paint-chip samples should not be collected from intact paint in good condition, since intact paint does not pose a lead hazard. Intact paint on friction or impact surfaces also does not need to be sampled, since any dust hazards that are being produced will be identified by dust sampling. If worn paint is seen on a friction or impact surface, the risk assessor should consider collecting a dust sample near that area. XRF or paint-chip analysis of worn painted areas is not recommended, since some of the lead-containing layer may have worn away. Usually, thicker sections of paint film should be analyzed to determine the presence of lead-based paint.

There is one exception to the general rule against sampling intact paint: If certain areas of intact paint are expected to be disturbed in the future due to renovation, maintenance, or other work, the paint in those areas should be analyzed by paint-chip analysis or XRF testing.

Deteriorated lead-based paint on furniture also constitutes a lead hazard, but it is the responsibility of the owner of the furniture to resolve those hazards. 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.

D. 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 Title X, the risk assessor should only sample areas of bare soil unless otherwise requested. Except for play areas, yard or soil areas containing a total of less than 9 square feet of bare soil are not considered to be hazardous and need not be sampled. 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).

Bare soil areas to be sampled for lead contamination include:

- Outdoor play areas.
- Building foundation or drip line.
- Vegetable gardens, pet sleeping areas, bare pathways.
- Sandboxes.

A minimum of two composite samples per dwelling or building sampled are recommended: one sample from the child's principal play area, one sample from bare soil areas in the front or back yard (if present), and/or an additional sample from the foundation drip line. The yard and building perimeter drip line areas can be combined into a single composite sample, but the play areas should be composited as a separate sample. If there is *no* bare soil, soil sampling is not necessary. However, in most cases, there will be at least small bare areas that should be sampled.

Samples may be collected using a coring tool to acquire the top half inch (1 cm) of soil. Alternatively, a stainless steel scoop or the lip of the sample container may be used. Soil coring devices may not be useful in sandy, dry, or friable soil.

Each composite sample should consist of approximately equal soil subsamples collected from 3–10 distinct locations roughly equidistant from each other along an axis. For samples collected along the foundation drip line, subsamples should be collected at least 2–6 feet away from each other. At other sampling locations, samples should be collected at roughly equidistant points along each axis of an "x" shaped grid.

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 oversample 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.

Since it is not necessary to know the lead concentration in each soil subsample, the soil standard is *not* divided by the number of subsamples included in the composite sample. The sample result for the soil composite sample should be compared directly to the standard, as is the case for dust.

E. Water Sampling

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 using the standard EPA protocol (see Appendix 13.5).

F. Lead Hazard Screen Risk Assessment Sampling Protocol

For a lead hazard screen risk assessment, the first step is to determine whether the dwelling is in good condition by completing Form 5.1. The risk assessor should take a 5- to 15-minute tour of the dwelling to note paint and building conditions, and to decide where to take dust samples. If the assessor observes painted surfaces in "poor" condition, then paint samples should be collected (or the painted surfaces should be measured by XRF) during the lead hazard screen risk assessment. The deteriorated paint sampling protocol in a screen is identical to the sampling performed in a full risk assessment. The lead hazard screen risk assessment is unlikely to be cost effective in dwellings in poor condition; in these situations, a full risk assessment should be completed to avoid the expense of a screen and a repeated trip to the site by a risk assessor.

In a lead hazard screen risk assessment, two composite dust samples are collected, one from floors and the other from window troughs. Each composite should include dust samples from the child's principal play area, the child's bedroom, the main entryway (usually the front porch or interior entryway), and one additional location to be determined by the risk assessor. The entryway is sampled in the screen since no soil samples are typically collected (soil sampling is optional). However, if there is evidence of paint chips from an earlier exterior repainting job, soil sampling should be done as part of the screen. A screen does not include any water or air sampling, and does not gather any data on property management or condition, which will be collected only if a full risk assessment is

needed. The evaluation criteria for a screen are also different (see Section V of this chapter) than those for a full risk assessment.

III. Risk Assessments for Different Size Evaluations

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 immediate 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 maintenance and management history, have a common painting 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 less than five similar rental dwellings or multiple dwellings that are *not similar*.

Table 5.5 summarizes the key elements of a risk assessment for each category of assessment.

Like many recommendations in these *Guidelines*, these categories should be modified when appropriate. 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, 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 and potential lead hazards.
- 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:

Table 5.5 Risk Assessment Approach For Different Size Evaluations

Action Required	Owner-Occupied, Single-Family Dwellings	Five or More Similar Rental Dwellings	Less Than Five 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

* There may be occasions when it is not necessary to sample all nonsimilar dwellings.

- Form 5.0—Resident Questionnaire.
- Form 5.1—Building Condition Form.
- Form 5.2—Paint Conditions on Selected Surfaces.
- Form 5.3—Field Sampling Form for Deteriorated Paint (single-surface) [or Form 5.3a (composite)].
- Form 5.4—Field Sampling Form for Dust (single-surface) [or Form 5.4a (composite)].
- 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 for targeted sampling.
- A visual assessment of the condition of the building and painted surfaces in the targeted dwellings.
- Environmental sampling of deteriorated paint, dust, and soil in the targeted dwellings (and common areas of multifamily developments).

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

- Form 5.1—Building Condition Form.

- Form 5.3—Field Sampling Form for Deteriorated Paint (single-surface) [or Form 5.3a (composite)].
- Form 5.4—Field Sampling Form for Dust (single-surface) [or Form 5.4a (composite)].
- Form 5.5—Field Sampling Form for Soil.
- Form 5.6—Management Data for Rental Dwellings.
- Form 5.7—Maintenance Data for Rental Dwellings.

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). The sampling protocol assumes 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.

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) and is confident that the target 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. A full discussion of random sampling and a random sampling protocol can be found in Chapter 7. Random sampling in multifamily settings with more than 20 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.

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 dwellings should also be assumed to contain similar hazards.

Number of Dwellings To Be Sampled. Table 5.6 describes the number of dwellings that are needed for targeted sampling. Targeted sampling cannot be used for evaluations of fewer than five similar dwellings. When fewer than five similar dwellings are being evaluated, *all* units should be sampled. The recommendations contained in Table 5.6 are drawn in part from a public housing risk assessment/insurance program. The empirical evidence suggests that the recommended number of units sampled adequately characterizes the risk in the entire housing development (HES, 1993).

When determining the number of targeted dwellings, dwellings that are known to currently house children 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. Dwellings housing children with blood lead levels greater than or equal to 20 μg/dL (or a persistent 15 μg/dL upon repeated testing) require environmental investigations (CDC, 1991b) different from the procedure described here (see Chapter 16).

Each and every dwelling housing a child with an elevated blood lead level must be investigated independently. This investigation may be performed by either the local health authority or the risk assessor. If, after consultation with the health department, it is agreed that the risk assessor will perform the 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 investigated as part of the risk assessment.

Since 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.

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.)

Table 5.6 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 to determine number of dwellings to be sampled.

- 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 5.6, 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 leaded dust 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 eliminated 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 (5.3a), 5.4 (5.4a), and 5.5)]. The "Example of Targeted Dwelling Selection" that follows 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. The risk assessor will not be able to draw solid conclusions from a smaller sample. Current evidence from the public housing risk assessment program suggests that hazards in different single-family, scattered-site dwelling units vary greatly (HES, 1993), unlike similar multifamily dwelling units where a clear pattern of hazards typically exists among dwellings.

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

- The collection of information from 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 deteriorated paint, dust, and soil in all dwellings (and common areas of multifamily developments).

The following forms should be used for this type of evaluation:

- Form 5.1—Building Condition Form.
- Form 5.3—Field Sampling Form for Deteriorated Paint (single-surface) [or Form 5.3a (composite)].
- Form 5.4—Field Sampling Form for Dust (single-surface) [or Form 5.4a (composite)].
- Form 5.5—Field Sampling Form for Soil.
- Form 5.6—Management Data for Rental Dwellings.
- Form 5.7—Maintenance Data for Rental Dwellings.

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 complete risk assessment 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 all of the targeted dwellings have high leaded dust levels in the window troughs, but nowhere else. In this situation, the risk assessor may suggest to the owner that the window troughs in 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. Optional Analysis of Management and Maintenance Practices

Many forms of lead hazard control will require property management planning and careful maintenance work on surfaces that are known or suspected 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 Forms 5.6 and 5.7. Information on these forms 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

A. Analytical Methods

Paint samples are to be analyzed according to the methods for total lead analysis specified in Appendix 14.1 or ASTM ES–28–94, ASTM ES–36–94 (or ES–37–94), and ASTM ES–1613–94. For risk assessment purposes, paint must not be analyzed using the Toxicity Characteristic Leading Procedure (TCLP) for hazardous waste characterization (leachable lead). All laboratories performing analyses of lead in soil, dust, and paint should be participants in EPA's National Lead Laboratory Accreditation Program and be accredited by an organization recognized by EPA (see Chapter 2 and Appendix 14.1).

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 5.3, 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.

B. Special Quality Control Procedures for Wipe Samples

Because of inadequate digestion techniques, the use of commercial wipe media may result in low recovery rates in the laboratory (Jacobs, 1991c). Currently, no laboratory proficiency testing program manufactures durable wipe material spiked with known amounts of leaded dust. For example, the Environmental Lead Proficiency Analytical Testing (ELPAT) program supplies Whatman™ filters spiked with known amounts of leaded dust, but Whatman™ filters have not been found to be sufficiently durable in the field. Therefore, the analytical recovery results from spiked Whatman™ filters may not reflect the results for more durable wipe media. As a result, Whatman™ filters are not recommended for risk assessment or clearance sampling purposes. Risk assessors should use more durable wipe media, such as Little Ones Baby Wash Cloths™ and Little Ones Diaper Wipes™ (both manufactured for KMart), since they have been shown to exhibit recovery rates

between 80 to 120 percent on a routine basis when spiked with leaded dust (HES, 1992). The National Institute for Occupational Safety and Health (NIOSH) has reported that Wash'n Dry™ wipes have acceptable recovery rates, although this has not been established in routine practice (NIOSH, 1993b). Other media may also have acceptable recovery rates, but must be evaluated before use. Other acceptable brands include Pure and Gentle Baby Wipes™, Walgreens Wet Wiper™, and Fame Baby Wipes™.

Laboratories can usually prepare spiked wipes upon request by risk assessors. Since there is no national proficiency program that examines laboratory performance of digestion procedures, it is necessary for risk assessors to insert spiked wipe samples with known amounts of leaded dust, at a frequency of 1 spiked wipe per 50 samples (see Appendixes 13 and 14.1 for complete protocol). The laboratory should be blinded to the amount of leaded dust on each wipe. These spiked samples are *in addition to* spiked samples prepared by the laboratory for its internal quality control/quality assurance program. Wipe samples should be spiked with leaded dust in the range of 50–300 μg lead/wipe (generally, 100 $\mu g/ft^2$ is the region of interest and 1 square foot is the area usually wiped). The risk assessor should relabel (but not repackage) the spiked wipe samples so that the laboratory is as "blind" as possible to which samples are spiked samples and which samples are field samples. Repackaging will result in some loss of leaded dust from the sample. Containers for spiked samples and field samples should be identical, and both composite and single-surface wipes should be spiked. Wipes can be spiked with Urban Particulate Standard Reference Material 1648 or Powdered Lead-Based Paint Standard Reference Material 1579a, both available from the National Institute for Standards and Technology, or an equivalent "secondary" reference material, such as that used in the ELPAT program. EPA recommends that wipe samples be spiked with leaded dust, not lead in solution (EPA, 1993b).

At the present time, blind spiking is the only way for a risk assessor to judge the performance of a laboratory's digestion procedure on commercial wipes. If the results of the blind spiked samples are within 20 percent of the actual value of lead on the wipe, then the laboratory's performance is acceptable. If the results are outside of this range, the risk assessor should consult with the laboratory about the discrepancy. Retesting *may* be necessary if questions about the laboratory results cannot be resolved. Risk assessors should also record the lot number of the wipes as a way of monitoring the performance of that lot.

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 inspection, 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 5.7.) 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. Evaluating Lead-Based Paint Hazards

Table 5.7 shows the criteria to be used for interpreting environmental samples collected during lead-based paint risk assessments.

1. Dust

Until EPA releases its health-based leaded dust standards (as mandated by Title X under TSCA, Title IV, Section 403), the HUD interim dust standards in Table 5.7 should be used to determine if hazardous leaded dust levels are present. These interim standards may change as a result of ongoing research. If leaded dust

samples collected by wipe sampling exceed the levels in Table 5.7, a lead-based paint hazard exists. (Even though this is technically a "dust hazard," the term "lead-based paint hazard" is used to remain consistent with the statutory definition in Title X.)

Vacuum sampling methods may also be acceptable, although each vacuum method will need its own standard. At this time HUD does not have interim standards for leaded dust using vacuum sampling.

Since the results represent *all* surfaces sampled, composite dust sampling results should *not* be divided by the number of subsamples collected.

Some State and local jurisdictions use different standards for lead-contaminated dust. At least one State (Rhode Island) measures hazardous levels of lead in dust in parts per million (known as concentration), instead of micrograms per square foot (known as loading). If it is necessary for the dwelling to pass a local lead-contaminated dust standard, the risk assessor should be familiar with the local standard and how that standard is measured. 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). In addition, cleaning can reduce loading but not necessarily concentration. Thus, loading is the most informative measure for risk assessment and postabatement clearance purposes currently available. Vacuum sampling can determine both concentration and loading, while wipe sampling measures loading only.

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

Table 5.7 Hazard Levels for Lead-Based Paint Risk Assessments

Media	Level	
Deteriorated paint (single-surface)	5,000 μg/g or 1 mg/cm^2	
Deteriorated paint (composite)	$\frac{\text{5,000 μg/g or 1 mg/cm}^2}{\text{Number of subsamples}}$	
Dust (wipe sampling only) (includes both single-surface and composite)	Risk assessment	Risk assessment screen (dwellings in good condition only)
		—
Carpeted floors*	100 μg/ft^2	50 μg/ft^2
Hard floors*	100 μg/ft^2	50 μg/ft^2
Interior window sills	500 μg/ft^2	250 μg/ft^2
Window troughs	800 μg/ft^2	400 μg/ft^2
Bare soil (dwelling perimeter and yard)	2,000 μg/g	
Bare soil (small high-contact areas, such as sandboxes and gardens)	400 μg/g	
Water (optional)—first draw	15 ppb (μg/L)	

* Whenever possible, sample hard floors, not carpets.

2. Paint

If paint contains lead equal to or greater than the following levels, it is considered to be lead-based paint under the Lead-Based Paint Poisoning Prevention Act:

- 5,000 μg/g (also expressed as 0.5 percent, 5,000 mg/kg, or 5,000 ppm by weight). (Paint chips analyzed in the laboratory by atomic absorption spectroscopy or inductively coupled plasma emission spectroscopy will usually be reported by weight percent.)
- 1.0 mg/cm^2 (XRF machines report lead content by area).

The standards may be lower (i.e., more stringent) in some State and local jurisdictions. In addition, paint that has lead just below the standard can still pose a health hazard. For example, deteriorated paint with 4,000 μg/g is more hazardous than intact paint with 5,000 μg/g of lead. Any component that contains deteriorated lead-based paint is a lead hazard and should be treated. If the amount of lead in deteriorated paint is below the regulatory limit, lead hazard control measures are not necessary to prevent exposures to lead (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. In the event that all paint-chip samples are below the standard, the owner cannot assume that *all* surfaces in the dwelling are free of lead-based paint, since all surfaces were not tested. Instead, the owner can have a paint inspection performed if a surface-by-surface analysis is needed.

3. Bare Soil

EPA is also developing residential soil lead standards under Title X. Until the standard has been established, the following level of lead in soil should be considered hazardous:

- 2,000 μg/g (bare soil only)—perimeter and yard samples.
- 400 μg/g bare soil in small, high-contact areas (e.g., sandboxes, gardens).

Areas of bare soil that contain levels of lead that exceed 2,000 μg/g should be considered a lead hazard and should be treated accordingly. The soil standard is lower in some State and local jurisdictions. Soil that is covered with grass or other covering does not need to be treated, although the covering needs to be maintained properly. Soil in play areas is considered hazardous at even lower lead levels since children's contact will be greater. The soil standard for high-contact areas is 400 μg/g.

Risk assessors may be asked to collect soil samples before exterior abatement or interim control work for clearance purposes (see Chapter 15) to determine baseline levels. These samples may be archived and not analyzed at all unless soil levels exceed clearance standards after the hazard control work has been completed.

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

Dust. When leaded dust is evaluated with targeted, worst-case, or random sampling, the risk assessor should calculate the arithmetic mean of the results for each type of component sampled (i.e., floors, interior window sills, window troughs, and carpets) by room type and entryway. If the mean leaded dust level for a component in the target dwellings equals or exceeds the dust standards described in Table 5.7, then a lead hazard has been identified for that component in all dwellings.

For example, if the mean dust level for window troughs in the targeted dwellings is 4,500 μg/ft^2 (above the standard of 800 μg/ft^2), then all window troughs in the housing development should be considered hazardous and treated accordingly.

If the mean is below the standard, but some of the individual sample results are above the standard, those individual surfaces and all other similar surfaces should be treated. The risk assessor should attempt to identify any common characteristics of the elevated samples. Where results are ambiguous, further sampling may be needed, or the owner may decide that the cost of cleaning is less than the cost of additional

sampling, in which case further evaluation is bypassed.

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-chip sampling should be analyzed by component and location. If all components at a given location are above the paint standard or all are below, then the risk assessor can assume that this condition is true for the total population of similar dwellings. However, if a component (e.g., living room baseboards) contains lead-based paint in some dwellings and not in others, the owner must assume that all similar components present a lead hazard unless a paint inspection shows otherwise.

5. Water

Water sampling, which is optional for a routine risk assessment, can be interpreted using the current EPA action level for lead in drinking water, which is:

- 15 ppb (15 μg/L)—drawn as a 1-liter first draw after the water has remained in the pipe for at least 6 hours.

If first-draw tap water samples exceed 15 ppb lead, the risk assessor should recommend that the homeowner contact the local water department to determine if corrosion control or other control measures are in the process of being implemented. Call the EPA Lead Information Center at 1–800–LEAD–FYI for further information on water sampling and interpretation of results. 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.

6. Other Lead Sources

If other lead sources are discovered in the dwelling, the risk assessor should 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. For information on other sources, consult the EPA pamphlet titled, *Lead-Based Paint: Protect Your Family*. If it appears that a parent or other resident works in a lead industry and is bringing lead hazards into the house, the Occupational Safety and Health Administration (OSHA) can be notified anonymously by the resident. The OSHA lead standard contains important provisions to prevent workers from "taking home" occupational leaded dust.

B. Evaluating Management Policies

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.

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. 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.
- Resident reports of deteriorated paint.
- 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.

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).

As part of the management evaluation process, the risk assessor should examine the owner's occupational safety and health program. 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. If qualified, the risk assessor should determine if respirator usage (and a respirator program), a medical surveillance program, or specialized equipment (notably a HEPA vacuum) are needed. If the risk assessor is not qualified to make such judgments, the OSHA lead pamphlet should be given to the owner.

The risk assessor should help the owner decide what immediate actions to take if a child with an elevated blood lead level appears. 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 must 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 suspected or

Example of a Lead Hazard Control Policy Statement

XYZ Property Management Company 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)
(Owner)

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

known sources of lead-based paint during these routine inspections.

The risk asssessor 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

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 surfaces known or suspected to contain lead-based paint are disturbed.

If the property owner uses standard work order forms, the risk assessor should determine whether they contain proper instructions about working on known or suspected lead-based painted surfaces. For example, the work orders should instruct workers when to use respirators and special cleaning measures (see Chapter 17).

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 conclude that maintenance is deficient and that lead-based paint hazards may not be adequately managed. Such a situation requires a more frequent monitoring schedule (unless full removal is completed). See Chapter 6 for further details.

D. Lead Hazard Screen Risk Assessments in Dwellings in Good Condition

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

If the results of the composite dust or composite paint samples are greater than the levels shown in Table 5.7, a full risk assessment should be performed to determine if hazards truly exist. The screen criteria were developed by dividing the hazard standards in half for floors and window troughs. (Interior window sills should not be sampled for screening purposes.) By reducing the standards in half, the ability of the screen to detect potential lead hazards is increased.

Deteriorated paint measurements or paint-chip sample result criteria are the same as for a full risk assessment. If lead levels exceed this level, then a full risk assessment should be completed.

VI. Report

The final report complied by the risk assessor documents the findings of the risk assessment and identified control methods. 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. See Appendix 8 for two examples of risk assessment reports.

A. Site-Specific Hazard Control Options

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

Table 5.8 Main Hazard Control Options That Could Be Identified in Risk Assessments

Treatment Option	Dust[1] on Floor	Dust[1] on Windows	Paint[2] on Doors	Paint[2] on Windows	Paint[2] on Floor and Walls	Paint[2] on Trim	High Soil Lead Levels
Dust removal	X	X	X	X	X	X	X
Paint film stabilization			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	X					X
Building component replacement			X	X	X	X	

[1] Lead-contaminated dust.

[2] Deteriorated lead-based paint.

[3] Limited areas only.

measures range from various short-term interim controls (e.g., specialized cleaning, minor wet scraping, and repainting) to long-term abatement methods (e.g., building component replacement, enclosure, and paint removal). Table 5.8 lists the major options and scenarios, although the number of possibilities and combinations is virtually unlimited. For example, if the risk assessor finds that window troughs 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, the entire window should be replaced.

1. Education

The risk assessor also 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. 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 taken in the process of developing the final report.

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. The EPA lead hazard information pamphlet or other local literature should be handed out (usually available at no charge to the risk assessor or owner from the National Lead Information Center).

Maintenance Staff. The risk assessor should inform the owner of the 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).

Residents. The risk assessor should also take every opportunity to educate residents on what they can do to reduce their exposure to lead-based paint hazards. The EPA lead hazard information brochure can be helpful here and can be obtained by calling 1–800–LEAD–FYI. Information on local childhood lead poisoning prevention programs and blood lead screening services should also be provided.

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 permit the owner to make 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 also subject to market conditions, making it difficult to provide firm cost figures. However, the risk assessor should provide a very rough estimate of cost for each control option based on local conditions. Cost estimates can be provided on either a dwelling-unit basis or a building-component basis.

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.
- Washing horizontal surfaces without stabilizing chalking vertical painted surfaces.
- 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.

Of course, the risk assessor must also emphasize the severe 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. How to Determine Site-Specific Reevaluation Schedules

The risk assessor is responsible for recommending a site-specific reevaluation schedule. The schedule depends on a variety of factors, including the hazard control method implemented, the general condition and maintenance of the building, and the degree of leaded dust contamination. Chapter 6 contains a complete discussion of Standard Reevaluation Schedules.

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 assessor should recommend to the owner that the painted surfaces be treated as though they contain lead. The risk assessor should encourage the owner to obtain an inspection, since no further reevaluation may be needed if it can be shown that no lead-based paint is present. Otherwise, the risk assessor should simply indicate that lead hazards are well controlled for now, but that lead hazards could still emerge in the event of paint deterioration or disturbance.

E. Report Format and Statements of Compliance

The following format is recommended for risk assessment reports:

Part I: Identifying Information

Identity of dwelling(s) covered by report, identity of property(ies).

1. Risk Assessor, Name and Number of Certificate (or License), and State Issuing Certificate/License.
2. Property Owner Name, Address, and Phone Number.
3. Date of Report and Date of Environmental Sampling.

Part II: Completed Management, Maintenance, and Environmental Results Forms and Analyses

4. List of Location and Type of Identified Lead Hazards and Summary of Optional Hazard Control Methods (including an indication of which hazards are priorities—this summary should be suitable for use as notification to residents).
5. Optional Management Information (Form 5.6) (not required for homeowners).
6. Maintenance/Paint Condition Information (Form 5.2 or 5.7).
7. Building Condition (Form 5.1).
8. Brief Narrative Description of Dwelling Selection Process (not required if all dwellings were sampled).

9. Analysis of Previous XRF Testing Report (if applicable).

10. Deteriorated Paint Sampling Results (Form 5.3 or 5.3a).

11. Dust Sampling Results (Form 5.4 or 5.4a).

12. Soil Sampling Results (Form 5.5).

13. Other Sampling Results (if applicable).

Part III: Lead Hazard Control Plan

14. Lead-Based Paint Policy Statement (not applicable for homeowners).

15. Name of Individual in Charge of Lead-Based Paint Hazard Control Program.

16. Recommended Changes to Work Order System and Property Management (optional, not applicable for homeowners or property owners without work order systems).

17. Acceptable Interim Control Options and Estimated Costs.

18. Acceptable Abatement Options and Estimated Costs.

19. Reevaluation Schedule (if applicable).

The information outlined above should be presented to the owner for consideration. The risk assessor should explain the various hazard control options and answer any questions that might arise. With or without the help of the risk assessor, the owner must decide which hazard control option is most appropriate. The final report for the owner should include the following information:

20. Interim Control/Abatement to Be Implemented in This Property (if known by the risk assessor).

21. A Training Plan for Managers, Maintenance Supervisors, and Workers (including named individuals), if applicable.

22. Method of Resident Notification of Results of Risk Assessment and Lead Hazard Control Program (not applicable for homeowners). Note: This section should include a discussion of how residents are to be educated about lead poisoning, *before* the risk assessment results are released.

23. Signature (Risk Assessor) and Date.

Part IV: Appendix

24. All Laboratory Raw Data.

See Appendix 8 for two examples of completed risk assessment reports.

If the owner remains undecided about which hazard control method to use, the risk assessor should state that no hazard controls have been implemented as of the date on the report. Subject to Federal and local laws and regulations, a statement of lead-based paint hazard compliance (with an expiration date based on the Reevaluation Schedule) may be provided by the risk assessor (or local enforcement agency) following the successful implementation of the accepted interim control or abatement method(s) and any associated clearance sampling.

Form 5.0
Resident Questionnaire
(To be completed by risk assessor via interview with resident.)

Children/Children's Habits

1. (a) Do you have any children that live in your home? Yes _____ No_____
   (If no children, skip to Question 5.)
   (b) If yes, how many?_____ Ages? _____ _____ _____ _____ _____
   (c) Record blood lead levels, if known. _____ _____ _____ _____ _____
   (d) Are there women of child-bearing age present? Yes _____ No_____
2. Location of the rooms/areas where each child sleeps, eats, and plays.

Name of child	Location of bedroom	Location of all rooms where child eats	Primary location where child plays *indoors*	Primary location where child plays *outdoors*

3. Where are toys stored/kept? _____
4. Is there any visible evidence of chewed or peeling paint on the woodwork, furniture, or toys?
   Yes _____ No _____

Family Use Patterns

5. Which entrances are used most frequently? _____
6. Which windows are opened most frequently? _____
7. Do you use window air conditioners? If yes, where? _____
   (Condensation often causes paint deterioration)
8. (a) Do any household members garden? Yes _____ No _____
   (b) Location of garden. _____
   (c) Are you planning any landscaping activities that will remove grass or ground covering? Yes_____ No_____
9. (a) How often is the household cleaned? _____
   (b) What cleaning methods do you use? _____
10. (a) Did you recently complete any building renovations? Yes _____ No _____
    (b) If yes, where? _____
    (c) Was building debris stored in the yard? If yes, where? _____
11. Are you planning any building renovations? If yes, where? _____
12. (a) Do any household members work in a lead-related industry? Yes _____ No _____
    (b) If yes, where are dirty work clothes placed and cleaned? _____

Form 5.1
Building Condition Form

Condition	Yes	No
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		
Plaster walls or ceilings 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		

* If the “Yes” column has two or more checks, the dwelling is usually considered to be in poor condition for the purposes of a risk assessment. 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.

Notes:

Form 5.2
Paint Conditions on Selected Surfaces
(Single-Family, Owner-Occupied)

Building component	Location Notes	Paint condition (intact, fair, poor, or not present) to be completed by risk assessor	Deterioration due to friction or impact?	Deterioration due to moisture?	Location of painted component with visible bite marks
Building siding					
Exterior trim					
Exterior windows					
Exterior doors					
Railings					
Porch floors					
Other porch surfaces					
Interior doors					
Ceilings					
Walls					
Interior windows					
Interior floors					
Interior trim					
Stairways					
Radiator (or radiator cover)					
Kitchen cabinets					
Bathroom cabinets					
Other surfaces:					

If the overall condition of a component is similar throughout a dwelling, that condition should be recorded. If a component in a couple of locations is in poor condition, but the overall condition is good or fair, the specific sites of the badly deteriorated paint should be noted. The specific locations of any component with bite marks should be recorded.

Form 5.3
Field Sampling Form for Deteriorated Paint
(One form for each housing unit, common area, or exterior)

Name of risk assessor _____

Name of property owner _____

Property address _____ Apt. no._____

Dwelling selection protocol _____All dwellings _____Targeted _____Worst case _____Random

Target dwelling criteria (check all that apply)

_____ Code violations
_____ Judged to be in poor condition
_____ Presence of two or more children between ages of 6 months and 6 years
_____ Serves as day-care facility
_____ Recently prepared for reoccupancy
_____ Random sampling

Sample number	Room	Building component	Lead (mg/cm^2 or μg/g)
HUD interim standard			5,000 μg/g or 1 mg/cm^2

Sample *all* layers of paint, not just deteriorated paint layers.

Total number of samples on this page_____

Page _____ of _____

Date of sample collection____/____/____ Date shipped to lab____/____/____

Shipped by _____ Received by _____
(signature) (signature)

Date results reported ____/____/____ Analyzed by_____

Approved by_____

Form 5.3a
Field Sampling Form for Deteriorated Paint
(Composite Sampling)

Name of risk assessor _____

Name of property owner _____

Property address _____ Apt. no._____

Dwelling selection protocol _____All dwellings _____Targeted _____Worst case _____Random

Target dwelling criteria (check all that apply)

_____ Code violations
_____ Judged to be in poor condition
_____ Presence of two or more children between ages of 6 months and 6 years
_____ Serves as day-care facility
_____ Recently prepared for reoccupancy

Composite samples number	Component sample	Rooms included in sample	Duplicate subsample number	Size of subsample (cm)	Lab result (mg/cm^2)	Lab result ($\mu g/g$)
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
HUD interim standard*					1.0*	5,000*

* For composite samples, the HUD standard must be divided by the number of subsamples in the composite sample.

Total number of samples on this page_____

Page _____ of _____

Date of sample collection____/____/____ Date shipped to lab____/____/____

Shipped by _____ Received by _____
(signature) (signature)

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

Name of risk assessor _____

Name of property owner _____

Property address _____ Apt. no._____

Dwelling selection protocol _____ All dwellings _____ Targeted _____ Worst case _____ Random

Target dwelling criteria (check all that apply)

_____ Code violations
_____ Judged to be in poor condition
_____ Presence of two or more children between ages of 6 months and 6 years
_____ Serves as day-care facility
_____ Recently prepared for reoccupancy

Sample number	Room (record name of room used by the owner or resident)	Surface type (circle the type)	Is surface smooth and cleanable?	Dimensions[1] of sample area (inches x inches)	Area (ft^2)	Result of lab analysis ($\mu g/ft^2$)
	Playroom _____	Floor		____ x ____		
	Playroom _____	Interior window sill or window trough		____ x ____		
	Kitchen _____	Floor		____ x ____		
	Kitchen _____	Interior window sill or window trough		____ x ____		
	Bedroom 1 _____	Floor		____ x ____		
	Bedroom 1 _____	Interior window sill or window trough		____ x ____		
	Bedroom 2 _____	Floor		____ x ____		
	Bedroom 2 _____	Interior window sill or window trough		____ x ____		
				____ x ____		
				____ x ____		

[1] Measure to the nearest 1/8 inch.

HUD standards: 100 $\mu g/ft^2$ (floors), 500 $\mu g/ft^2$ (interior window sills), 800 $\mu g/ft^2$ (window troughs)

Total number of samples on this page_____

Page _____ of _____

Date of sample collection____/____/____ Date shipped to lab____/____/____

Shipped by _____ Received by _____
(signature) (signature)

Form 5.4a
Field Sampling Form for Dust
(Composite Sampling)

Name of risk assessor _____

Name of property owner _____

Property address _____ Apt. no._____

Dwelling selection protocol _____ All dwellings _____ Targeted _____ Worst case _____ Random

Target dwelling criteria (check all that apply)

_____ Code violations
_____ Judged to be in poor condition
_____ Presence of two or more children between ages of 6 months and 6 years
_____ Serves as day-care facility
_____ Recently prepared for reoccupancy

Sample number	(Record name of rooms used by the owner or resident to be included in sample)	Dimension[1] of surface sampled in each room (inches x inches)	Total surface area sampled (ft^2)	Type of surface sampled	Is surface smooth and cleanable?	Lab result ($\mu g/ft^2$)
		____ x ____ ____ x ____ ____ x ____ ____ x ____		Smooth floors		
		____ x ____ ____ x ____ ____ x ____ ____ x ____		Carpeted floors		
		____ x ____ ____ x ____ ____ x ____ ____ x ____		Interior window sills		
		____ x ____ ____ x ____ ____ x ____ ____ x ____		Window troughs		

[1] Measure to the nearest 1/8 inch.

HUD standards: 100 $\mu g/ft^2$ (floors), 500 $\mu g/ft^2$ (interior window sills), 800 $\mu g/ft^2$ (window troughs)

Total number of samples on this page_____

Page _____ of _____

Date of sample collection____/____/____ Date shipped to lab____/____/____

Shipped by _____ Received by _____
(signature) (signature)

Form 5.5
Field Sampling Form for Soil
(Composite Sampling Only)

Name of risk assessor _____

Name of property owner _____

Property address _____

Sample number	Location	Bare or covered	Lab result (μg/g)
	Building perimeter		
	Building perimeter		
	Play area 1 (describe) _____		
	Play area 2 (describe) _____		
HUD interim standard for play area			400
HUD interim standard for perimeter			2,000

Collect only the top 1/2 inch of soil.

Total number of samples on this page_____

Page _____ of _____

Date of sample collection____/____/____ Date shipped to lab____/____/____

Shipped by _____ Received by _____
(signature) (signature)

User Instructions for Form 5.6

The risk assessor should use Form 5.6 to evaluate the property owner's management capabilities with regard to lead-based paint hazard controls. The risk assessor should briefly explain the purpose and content of the form to the owner to make sure that the type and scope of information requested is understood. All of the information should be supplied by the owner or a representative of the owner, either in writing or through an interview.

Part 1 of Form 5.6 requests background information about the property and additional data about the physical condition of each dwelling and the number of young children in residence.

Part 2 requests information about the management of the dwellings:

1. Staffing

Determine which management and maintenance personnel (by name and job title) are charged with responsibility for dealing with lead-based paint hazards. This typically includes the owner, manager, director of maintenance, centralized maintenance staff, and site maintenance staff. The risk assessor can help the owner determine which staff positions could be involved in lead hazard control efforts and identify the key contact persons.

Smaller scale multifamily housing is more likely to have a simplified management structure. Indeed, the owner may also act as manager and maintenance worker. If there is a division of labor between owner and manager, or manager and maintenance worker, the risk assessor should attempt to determine who has the recognized authority to handle lead-based paint issues.

2. Lead Hazard Control Policy Statement (optional)

Determine if the property management has established a lead hazard control policy statement. If so, review the statement. If no statement exists, the risk assessor may help the owner draft such a statement as an indication of a good faith effort to control lead hazards. See the section on Management of Multiple Dwellings for a sample lead hazard control policy statement.

3. Previous Lead-Based Paint Evaluations

Determine if previous lead-based paint testing has been completed. If so, obtain and review a copy of the report, using the criteria outlined in the section on Evaluating Previous Paint Testing.

4. Previous Lead Hazard Control Activity

Determine if previous lead-based paint abatement or hazard reduction has been completed. If so, obtain and review a copy of the report. Determine if clearance dust testing was completed following abatement.

5. Turnover Procedure

Determine how a vacant dwelling is prepared for reoccupancy. For example, the method of cleaning used on a dwelling prior to turnover should be analyzed.

6. Employee Health and Safety Plan

Determine if the property management has an employee health and safety plan. Employees working with lead hazards are required by OSHA to be involved in a Hazard Communication Program. After reviewing the current state of knowledge and hazard control practices, the risk assessor should help the owner develop site-specific management and maintenance plans.

7. HEPA Vacuum

Determine if a HEPA vacuum is available to clean up lead-contaminated dust.

8. Onsite Day-Care Facilities

User Instructions for Form 5.6

Determine if the property management operates or permits the onsite operation of day-care facilities (either formal or informal). Also, determine if there are onsite recreation halls or facilities operated by the owner that are frequented by young children. These spaces should be sampled by the risk assessor.

9. Management of Cases of Children with Elevated Blood Lead Levels

Determine if the property management has a plan to deal with children who have an elevated blood lead level. If necessary, the risk assessor should help the owner develop a plan.

10. Routine Inspections

If the owner or manager conducts periodic housing quality inspections, determine whether or not those inspections examine the condition of painted surfaces and could be used to identify lead hazards. The risk assessor will often recommend that the owner or manager conduct periodic inspections to ensure that lead hazard control treatments retain their effectiveness.

11. Code Violations

Determine if the dwellings have been cited for any housing code violations in the past several years. Dwellings that have been cited should be identified for targeted sampling.

12. Resident Notification

Determine if the owner has notified residents about known lead hazards at the property.

Form 5.6
Management Data for Risk Assessment of Lead-Based
Paint Hazards in Rental Dwellings (Optional)

NOTE: This form is designed for multiple rental dwellings under one ownership. Such dwellings may be in one property or many.

Part 1: Identifying information

Name of property owner _____

Name of building or development (if applicable) _____

Number of dwelling units_____

Number of buildings_____

Number of individual dwelling units/building _____

Date of construction (if one property) _____ (if between 1960–1978, consider a screen risk assessment)

Date of substantial rehab, if any _____

List of addresses of dwellings (attach list if more than 10 dwellings are present)

Street address, city, State	Dwelling unit no.	Year built (if known)	Number of children 0–6 years old	Recent code violation reported by owner?	Chronic maintenance problem reported by owner?

Record number and locations of common child play areas (onsite playground, backyards, etc.)

Number ____

_____ _____ _____

_____ _____ _____

_____ _____ _____

Form 5.6 (continued)

Part 2: Management Information

1. List names of 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. Use additional pages, if necessary.

   This information will be needed to devise the risk management plan contained in the risk assessor's report.

Name	Position	Training completed (if none, enter "None")
	Owner	
	Property manager	
	Maintenance	

2. Have there been previous lead-based paint evaluations?

   _____ Yes _____ No (If yes, attach the report)

3. Has there been previous lead hazard control activity?

   _____ Yes _____ No (If yes, attach the report)

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

   Repainting: _____
   Cleaning: _____
   Repair: _____
   Other: _____
   Comments: _____

5. Employee and worker safety plan

   a. Is there an occupational safety and health plan for maintenance workers?

      _____ Yes _____ No (If yes, attach plan)

   b. Are workers trained in lead hazard recognition?

      _____ Yes _____ No If yes, who performed the training? _____

Form 5.6 (continued)

c. Are workers involved in a hazard communication program?

_____ Yes _____ No

d. Are workers trained in proper use of respirators?

_____ Yes _____ No

e. Is there a medical surveillance program?

_____ Yes _____ No

6. Is a HEPA vacuum available?

_____ Yes _____ No

7. Are there any onsite licensed or unlicensed day-care facilities?

_____ Yes _____ No If yes, give location _____

8. Planning for resident children with elevated blood lead levels

a. Who would respond for the owner if a resident child with an elevated blood lead level is identified?

_____

b. Is there a plan to relocate such children?

_____ Yes _____ No If yes, where? _____

c. Does the owner know if there ever has been a resident child with an elevated blood lead level?

_____ Yes _____ No _____Unknown

9. Owner Inspections

a. Are there periodic inspections of all dwellings by the owner?

_____ Yes _____ No If yes, how often? _____

b. Is the paint condition assessed during these inspections?

_____ Yes _____ No

10. Have any of the dwellings ever received a housing code violation notice?

_____ Yes _____ No _____ Unknown

If yes, describe code violation_____

11. If previously detected, unabated lead-based paint exists in the dwelling, have the residents been informed?

_____ Yes _____ No _____Not Applicable

Form 5.7
Maintenance Data for Rental Dwellings

Recorded during onsite investigation.

1. Condition of paint on selected surfaces

Building component	Paint condition (intact, fair, poor, or not present) to be completed by risk assessor	Deterioration due to friction or impact	Deterioration due to moisture	Location of painted component with visible bite marks
Building siding				
Exterior trim				
Exterior windows				
Exterior doors				
Railings				
Porch floors				
Other porch surfaces				
Interior doors				
Ceilings				
Walls				
Interior windows				
Interior floors				
Interior trim				
Stairways				
Radiator (or radiator cover)				
Kitchen cabinets				
Bathroom cabinets				
Other surfaces:				

If the overall condition of a component is similar throughout a dwelling, that condition should be recorded. If a component in a couple of locations is in poor condition, but the overall condition is good or fair, the specific sites of the badly deteriorated paint should be noted. The specific locations of any component with bite marks should be recorded.

Form 5.7 (continued)

2. Painting frequency and methods
   a. How often is painting completed? every _____ years
   b. Is painting completed upon vacancy, if necessary?
      _____ Yes _____ No
   c. Who does the painting? _____Property Owner _____Residents
      (If residents, skip to Question 2)
   d. Is painting accompanied by scraping, sanding, or paint removal?
      _____ Yes _____ No
   e. How are paint dust/chips cleaned up? (check one)
      _____ Sweeping _____ Vacuum _____ Mopping _____ HEPA/wet wash/HEPA cycle
   f. Is the work area sealed off during painting?
      _____ Yes _____ No
   g. Is furniture removed from the work area?
      _____ Yes _____ No
   h. If no, is furniture covered with plastic during work?
      _____ Yes _____ No
3. Is there a preventive maintenance program?
   _____ Yes _____ No
4. Describe work order system (if applicable, attach copy of work order form).

   _____

   _____

   _____
5. 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?

   _____

   _____

   _____
6. Record location of dwellings recently prepared for reoccupancy.

   _____ _____ _____