CHAPTER 5: RISK ASSESSMENT

Step-by-Step Summary ............................................................................................................. 5-3

I. Introduction .......................................................................................................................... 5-5
   A. Evaluation Options .......................................................................................................... 5-5
      1. Bypassing Risk Assessments ...................................................................................... 5-5
      2. Risk Assessments ........................................................................................................ 5-5
      3. Lead Hazard Screen Risk Assessments .................................................................. 5-7
      4. Paint Inspections ......................................................................................................... 5-7
      5. Combination Risk Assessments and Paint Inspections ..................................... 5-9
   B. The Risk Assessment Process ....................................................................................... 5-9
   C. Limitations of This Risk Assessment Protocol ............................................................. 5-10
      1. Risk Assessments of Dwellings Housing Children With Elevated Blood Lead Levels .............................................................................................................. 5-10
      2. Public Housing Risk Assessments ........................................................................... 5-10
      3. Assessment of Less Common Sources of Lead Exposure ..................................... 5-10

II. Onsite Data Collection Procedures ............................................................................... 5-10
   A. Visual Assessment ........................................................................................................... 5-11
      1. Condition of Painted Surfaces ............................................................................... 5-11
      2. Condition of Building ............................................................................................. 5-14
      3. Condition of Friction and Impact Surfaces ............................................................. 5-15
      4. Chewed Surfaces ...................................................................................................... 5-15
      5. Common Areas .......................................................................................................... 5-15
   B. Dust Sampling .................................................................................................................. 5-15
      1. General Guidance and Definitions ......................................................................... 5-15
      2. Composite Dust Sampling ..................................................................................... 5-18
      3. Single-Surface Dust Sampling ............................................................................... 5-19
      4. Common Areas (Multifamily Housing Only) ............................................................ 5-19
      5. Dust Sampling in Onsite Community Buildings, Day Care, Recreational, or Other Spaces Frequent by Children ................................................................. 5-20
   C. Paint Sampling ................................................................................................................. 5-21
      1. Evaluating Previous Paint Testing .......................................................................... 5-21
      2. Deteriorated Paint Analysis .................................................................................... 5-21
   D. Soil Sampling ................................................................................................................... 5-24
   E. Water Sampling ............................................................................................................... 5-25
   F. Lead Hazard Screen Risk Assessment Sampling Protocol ............................................. 5-25
III. Risk Assessments for Different Size Evaluations .................. 5–26
A. Risk Assessments for Owner-Occupied, Single-Family Dwellings .......... 5–26
B. Risk Assessments for Five or More Similar Dwellings ................. 5–27
C. Risk Assessments of Fewer Than Five Rental Dwellings and Multiple Dwellings That Are Not Similar ............................. 5–30
   1. Assessments of Five or More Dwellings That Are Not Similar ........ 5–30
   2. Assessments of Fewer Than Five Similar Dwellings ................ 5–31
D. Optional Analysis of Management and Maintenance Practices ......... 5–31

IV. Laboratory Analytical Procedures ........................................ 5–31
A. Analytical Methods .................................................................. 5–31
B. Special Quality Control Procedures for Wipe Samples ................ 5–32

V. Evaluation of Findings ......................................................... 5–33
A. Evaluating Lead-Based Paint Hazards ..................................... 5–33
   1. Dust ...................................................................................... 5–33
   2. Paint .................................................................................... 5–35
   3. Bare Soil .............................................................................. 5–35
   5. Water .................................................................................. 5–36
   6. Other Lead Sources .......................................................... 5–36
B. Evaluating Management Policies ............................................ 5–36
C. Maintenance of Multiple Dwellings ......................................... 5–38
D. Lead Hazard Screen Risk Assessments in Dwellings In Good Condition ...... 5–38

VI. Report ................................................................................. 5–38
A. Site-Specific Hazard Control Options ..................................... 5–38
   1. Education ......................................................................... 5–40
B. Cost and Feasibility .............................................................. 5–40
   1. Cost .................................................................................. 5–40
   2. Feasibility ......................................................................... 5–40
C. How to Determine Site-Specific Reevaluation Schedules ............. 5–41
D. Recommendations to Owners When No Hazards Are Identified ...... 5–41
E. Report Format and Statements of Compliance .......................... 5–41
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 A ccreditation Program (NLLA P). 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...
Chapter 5: Risk Assessment

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

<table>
<thead>
<tr>
<th>Component Category</th>
<th>Interior</th>
<th>Exterior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walls/Ceiling/Floor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1960–1979</td>
<td>5</td>
<td>28</td>
</tr>
<tr>
<td>1940–1959</td>
<td>15</td>
<td>45</td>
</tr>
<tr>
<td>Before 1940</td>
<td>11</td>
<td>80</td>
</tr>
<tr>
<td>Metal Components¹</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1960–1979</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>1940–1959</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Before 1940</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>Nonmetal Components²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1960–1979</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>1940–1959</td>
<td>9</td>
<td>39</td>
</tr>
<tr>
<td>Before 1940</td>
<td>47</td>
<td>78</td>
</tr>
<tr>
<td>Shelves/Others³</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1960–1979</td>
<td>0</td>
<td>—</td>
</tr>
<tr>
<td>1940–1959</td>
<td>7</td>
<td>—</td>
</tr>
<tr>
<td>Before 1940</td>
<td>68</td>
<td>—</td>
</tr>
<tr>
<td>Porches/Others⁴</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1960–1979</td>
<td>—</td>
<td>2</td>
</tr>
<tr>
<td>1940–1959</td>
<td>—</td>
<td>19</td>
</tr>
<tr>
<td>Before 1940</td>
<td>—</td>
<td>13</td>
</tr>
</tbody>
</table>

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

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

* 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. A n 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 health 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

<table>
<thead>
<tr>
<th>Type of Building Component¹</th>
<th>Total Area of Deteriorated Paint on Each Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exterior components with large surface areas.</td>
<td>Intact</td>
</tr>
<tr>
<td>Interior components with large surface areas (walls, ceilings, floors, doors).</td>
<td>Entire surface is intact.</td>
</tr>
<tr>
<td>Interior and exterior components with small surface areas (window sills, baseboards, soffits, trim).</td>
<td>Entire surface is intact.</td>
</tr>
</tbody>
</table>

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.
Chapter 5: Risk Assessment

5–14

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 5.3a 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 Area 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 Appendices 13 and 14. At this time, H U D 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 H U D 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 spike-sample media with leaded dust.
Chapter 5: Risk Assessment

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.
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 ft² or 929 cm²). 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).
Children’s 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.
Chapter 5: Risk Assessment

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, are surfaces 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 Frequent 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.