



CHAPTER 1: INTRODUCTION

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Chapter 1: Introduction

The *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* provide detailed, comprehensive technical information on how to identify lead-based paint and related hazards in housing and how to control such hazards safely and efficiently. The purpose of this document, hereafter referred to as the *Guidelines*, is to help property owners, government agencies, and private contractors sharply reduce childhood exposure to lead without unnecessarily increasing the cost of housing.

The *Guidelines* address lead hazards posed by paint, dust, and soil in the residential environment. Lead exposures from air emissions, Superfund sites, drinking water, ceramics, home remedies, cosmetics, or other sources of lead exposure are not covered in these *Guidelines*.

This document replaces *Lead-Based Paint: Interim Guidelines for Hazard Identification and Abatement in Public and Indian Housing*, which was issued by the U.S. Department of Housing and Urban Development (HUD) in 1990. (Section I of this chapter includes a description of the differences between the *Interim Guidelines* and the new *Guidelines*.) These new *Guidelines* are applicable to lead hazard evaluation and control in *all* federally associated housing, not just public and Indian housing. Of course, the *Guidelines* may also be useful in housing that has no connection with the Federal Government, as well as day-care centers and public buildings that operate under conditions that are similar to those in residential structures.

The *Guidelines* complement regulations and other directives and guidelines to be issued by HUD, the Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor, and the Centers for Disease Control and Prevention (CDC) of the U.S. Department of Health and Human Services. Other Federal agencies, as well as State and local governments, may also issue regulations and other directives pertaining to housing under their

jurisdictions. Regulations generally specify minimum requirements for *what* must be done and *when*, minimum training and certification requirements for those conducting the work, and certain basic standards as to *how* work must be done. The *Guidelines* generally provide more detailed information than regulations on *how* activities related to lead-based paint should be carried out and *why* certain measures are recommended.

The *Guidelines* are not enforceable by law unless a Federal, State, or local statute or regulation requires that certain parts of this document be followed.

HUD prepared the *Guidelines* in close consultation with EPA, CDC, OSHA, and several other interested Federal agencies. The National Center for Lead-Safe Housing wrote the document, with the help of numerous experts and practitioners who served as writers and reviewers.

Readers should be aware that lead hazard control is a rapidly changing field in which new products, methods, procedures, and standards are being introduced frequently. Therefore, the *Guidelines* will be updated periodically as research and experience provide new information, as technology advances, and as Federal regulations are revised. HUD welcomes comments and suggestions on ways to improve these *Guidelines*. Please send written comments to:

Director, Office of Lead-Based Paint
Abatement and Poisoning Prevention
U.S. Department of Housing and
Urban Development
451 Seventh Street SW., Room B-133
Washington, DC 20410

This introductory chapter explains further the legislative basis for the *Guidelines*, the intended readership, and the relationship of the *Guidelines* to the 1990 *Interim Guidelines* and to Federal regulations. The chapter also includes a brief summary of the problem of childhood lead



poisoning, an explanation of the basic concepts that underlie the methods and procedures set forth in the *Guidelines*, and a description of how the document is structured.

I. Legislative Basis and Relationship to Federal Programs and Regulations

A. Legislative Basis

The *Guidelines* are issued pursuant to Section 1017 of the Residential Lead-Based Paint Hazard Reduction Act of 1992, which is often referred to as Title X (“Title Ten”) because it was enacted as Title X of the Housing and Community Development Act of 1992 (Public Law 102–550). The *Guidelines* are based on the concepts, definitions, and requirements set forth in Title X. Section III of this chapter describes the framework of concepts and definitions in Title X.

As required by Section 1017, the *Guidelines* are to be used as guidance for “federally supported work,” which is defined in the Act as “any lead hazard evaluation or reduction activities in federally owned or assisted housing or funded in whole or in part through any financial assistance program of the Department of Housing and Urban Development, the Farmers Home Administration, or the Department of Veterans Affairs.” The term “federally owned housing” is defined in the Act as “residential dwellings owned or managed by a Federal agency, or for which a Federal agency is a trustee or conservator.” In this context, the term “Federal agency” includes HUD, the Farmers Home Administration, the Resolution Trust Corporation, the General Services Administration, the U.S. Department of Defense, the U.S. Department of Veterans Affairs, the U.S. Department of the Interior, the U.S. Department of Transportation, and any other Federal agency. The term “federally assisted housing” is defined in the Act as “residential dwellings receiving *project-based* assistance under programs including—

- (A) section 221(d)(3) or 236 of the National Housing Act;
- (B) section 1 of the Housing and Urban Development Act of 1965;
- (C) section 8 of the United States Housing Act of 1937; or
- (D) sections 502(a), 504, 514, 515, 516 and 533 of the Housing Act of 1949.”

B. Relationship to Earlier HUD Guidelines

These *Guidelines* supersede and replace HUD’s *Lead-Based Paint: Interim Guidelines for Hazard Identification and Abatement in Public and Indian Housing* (HUD, 1990a). For those familiar with the 1990 *Interim Guidelines*, an appreciation of the significant differences in context and scope is important. HUD’s 1990 *Interim Guidelines* were based on the legislation at that time, which, as explained in Section III of this chapter, required the identification and abatement of all lead-based paint regardless of condition or location. Also, the *Interim Guidelines* were written for use primarily in conventional public housing settings, which are multifamily developments. The new *Guidelines* cover a broader spectrum of housing types and categories of ownership, and they address the full range of activities involved in evaluating and controlling lead-based paint hazards, as introduced in 1992 by Title X. For example, these *Guidelines*:

- ◆ Cover risk assessment methods for evaluating current lead-based paint hazards in addition to inspection methods for identifying the presence of lead-based paint. These risk assessment procedures are similar to the risk assessment protocol published by HUD in June 1992 for use in public and Indian housing, but they call for less data on management, maintenance, and occupancy; therefore, the June 1992 protocol (or its successor) will remain as a requirement for the public and Indian housing program until further notice.



- ◆ Include a completely rewritten chapter on paint inspection (Chapter 7) with new procedures based on recent research.
- ◆ Focus on correcting lead-based paint hazards, as opposed to abatement of all lead-based paint (except in public and Indian housing where requirements to abate all lead-based paint still apply).
- ◆ Describe new procedures for interim controls to manage lead-based paint in place.

C. Intended Audience

These *Guidelines* have been developed to provide technical guidance to the many individuals and groups involved with or affected by lead-based paint in residential housing units. The audience of these *Guidelines* includes the following:

- ◆ Lead-based paint abatement contractors.
- ◆ Lead-based paint risk assessors and inspector technicians.
- ◆ Lead-based paint training providers.
- ◆ State contractor certifying or licensing agencies.
- ◆ Residential building owners and managers, including public and Indian housing agencies; private, nonprofit housing development organizations; and private, for-profit landlords, managers, and building owners.
- ◆ State and local housing and community development agencies.
- ◆ State and local health agencies.
- ◆ Building maintenance personnel.
- ◆ Architects and designers.
- ◆ Federal agency staff.
- ◆ Environmental laboratory personnel.
- ◆ Real estate agents and brokers.
- ◆ Casualty and liability insurers.

- ◆ Lenders and appraisers.

These *Guidelines* are not intended for use by untrained persons attempting to control lead-based paint hazards. Under proposed EPA regulations, contractors and individuals must be trained and certified to conduct inspections, risk assessments, and lead-based paint abatement activities.

II. Background on Childhood Lead Poisoning, Sources of Lead in the Environment, and the Evolution of Lead Poisoning Prevention

As understanding of lead's adverse health effects and the sources and pathways of exposure to children has improved, so has recognition of the seriousness of lead-based paint hazards.

A. Childhood Lead Poisoning

Childhood lead poisoning is "the most common environmental disease of young children," (CDC, 1991a) eclipsing all other environmental health hazards found in the residential environment (ATSDR, 1988).

1. Health Hazards

Lead is highly toxic and affects virtually every system of the body. At high exposure levels, lead poisoning can cause coma, convulsions, and death. While adults can also suffer from excessive lead exposures (discussed in Chapter 9), the groups most at risk are fetuses, infants, and children under age 6. At low levels lead's neurotoxic effects have the greatest impact on children's developing brains and nervous systems, causing reductions in IQ and attention span, reading and learning disabilities, hyperactivity, and behavioral problems (Davis, 1993). These effects have been identified in many carefully controlled research studies (National Academy of Sciences, 1993). However, the vast majority of childhood lead-poisoning cases go undiagnosed and untreated, since most poisoned children have no obvious symptoms.

2. Prevalence Rates

In October 1991, CDC formally revised its statement on *Preventing Lead Poisoning in Young Children* (CDC, 1991b). CDC reduced its “intervention level” for childhood lead poisoning from the previous threshold of 25 $\mu\text{g}/\text{dL}$ to 10 $\mu\text{g}/\text{dL}$ (see Appendix 1 for a description of units of measure for lead in blood, paint, dust, soil, air, and water). This change was based on scientific evidence indicating that adverse health effects can occur at levels as low as 10 $\mu\text{g}/\text{dL}$. Federal agencies estimate that nationwide 8.9 percent (1.7 million) of American children under age 6 have elevated blood lead levels (EBLs) (Brody, 1994; Perkle, 1994). (It should be noted that the 1991 CDC statement did not recommend environmental or medical intervention at the level of 10 $\mu\text{g}/\text{dL}$. It recommended medical evaluation at or above 20 $\mu\text{g}/\text{dL}$ and environmental intervention at or above 20 $\mu\text{g}/\text{dL}$ or if blood lead levels of 15–19 persist. Various counseling, monitoring and communitywide prevention activities were recommended at levels between 10–19 $\mu\text{g}/\text{dL}$.)

3. Highest Risk Populations

Lead poisoning affects children across all socioeconomic strata and in all regions of the country. However, because lead-based paint hazards are most severe in older, dilapidated housing, the poor in inner cities are disproportionately affected. In many such neighborhoods over half of all young children are lead poisoned. Nationwide, African-American children are twice as likely to be lead poisoned as white children across all income categories (ATSDR, 1988; EPA 1992b).

4. Health Screening

In 1990 CDC called for a phase-in of universal blood lead testing of all young children (unless it can be shown that the community has no lead poisoning problem) because most poisoned children do not exhibit easily identifiable symptoms and virtually all children are at risk (CDC, 1991a). The 1992 *Medicaid Guidelines* called for all children under age 6 to be tested (HCFA, 1992). In 1993 the American Academy of Pediatrics (AAP) also revised its policy to

recommend the routine screening of virtually all young children under age 6 (AAP, 1993).

B. Causes of Childhood Lead Poisoning

Today, children in the United States are lead poisoned primarily through ingestion by normal hand-to-mouth activity and, to a lesser extent, inhalation. Because lead is ubiquitous in industrial societies, there are many sources and pathways of lead exposure.

1. Lead in Residential Paint

The foremost cause of childhood lead poisoning in the United States today is lead-based paint and the accompanying contaminated dust and soil found in older houses (CDC, 1991b; Rabinowitz, 1985b; Jacobs, 1994). As early as 1897, lead-based paint was identified as a cause of childhood lead poisoning (Turner, 1897; Reich, 1992). Many countries prohibited the use of lead in residential paints as far back as 1922 (Rabin, 1989). Lead was a major ingredient in most interior and exterior oil house paints prior to 1950, with some paints containing as much as 50 percent lead by dry weight. In the early 1950s, other ingredients became more popular, but some lead pigments, corrosion inhibitors, and drying agents were still used. Lead was first regulated in residential paint in 1972 at 0.5 percent and “banned” in 1978, meaning that paint could contain no more than 0.06 percent lead by dry weight (Reich, 1992; Rabin, 1989).

2. Lead-Based Paint in Housing

HUD estimates that three-quarters of pre-1980 housing units contain some lead-based paint. The likelihood, extent, and concentration of lead-based paint all increase with the age of the building. Fully 90 percent of privately owned units built before 1940, 80 percent of units built between 1940 and 1959, and 62 percent of units built between 1960 and 1979 contain some lead-based paint (HUD, 1990b). Because the greatest risk is in dwellings built before 1950, older housing generally commands a higher priority for lead hazard controls. However, there is



evidence that significant amounts of lead-based paint were sold as late as 1971, when New York City's Health Department tested 78 "new" residential paints and found 8 of them to have lead ranging from 2.6 percent to 10.8 percent (NY Times, 1971). See Chapters 3 and 5 for lead prevalence data by year of construction and by building component type.

3. Lead in Surface Dust

The belief that in order to be poisoned children *must* eat lead-based paint chips is unfounded. The most common cause of poisoning is the ingestion—through hand-to-mouth transmission—of lead-contaminated surface dust (Clark, 1991; Bellinger, 1991; Roberts, 1991; Chisolm, 1985; Farfel, 1990; Farfel, 1994). Lead-contaminated dust may be so fine that it cannot be seen by the naked eye. In addition, lead-contaminated dust is difficult to clean up. Leaded dust is generated as lead-based paint deteriorates over time, is damaged by moisture, abraded on friction and impact surfaces, or disturbed in the course of renovation, repair, or abatement projects. Lead can also be tracked into homes from exterior dust and soil. These *Guidelines* address lead in surface dust and soil as well as in paint since Congress also defined lead found in dust and soil to be lead-based paint hazards.

4. Lead in Soil

Children can also be exposed to lead in bare soil. The high levels of lead in soil typically come from deteriorating exterior lead-based paint around the foundation of a house (Ter Harr, 1974; Linton, 1980). The fallout of lead emissions from the combustion of leaded automobile gasoline, lead-based paint, and industrial sources also contributes to lead levels in soil (ATSDR, 1988). In some areas high leaded soil levels result from factory and smelter emissions or deteriorating lead-based paint on steel structures, such as bridges. Bare soil that is contaminated with lead poses a hazard to children who play in it. Lead in soil may also be tracked into a home, increasing interior leaded dust levels. These *Guidelines* address lead-contaminated soil, as well as lead-based paint.

5. Other Causes of Lead Poisoning

Other sources and pathways of lead poisoning in children can include drinking water, point sources (such as smelters or industrial dischargers), ceramics, lead brought home from a parent's workplace, home and folk remedies, cosmetics, and hobbies (such as casting lead sinkers or toy soldiers, making stained glass, loading ammunition, and soldering). For some children these sources may account for their exposure; however, for most children, paint, dust, and soil are the primary sources of lead poisoning.

C. The Evolution of Prevention Approaches

The approach to identifying and responding to lead-based paint hazards in American housing has evolved over the past several decades.

1. Medical Treatment of Poisoned Children (Tertiary Treatment)

During the 1940s and 1950s, deaths from childhood lead poisoning were common. Using chelation therapy (the use of drugs to excrete lead from the body), medical providers attempted to treat symptomatic cases to prevent death, with the assumption that children who survived had been cured. During the 1950s studies in Chicago (Williams, 1952), Boston (1954), New York City (McLaughlin, 1956), and Baltimore (Chisolm, 1956) demonstrated conclusively that children who survived serious lead poisoning were often left mentally retarded or otherwise permanently impaired (Lin Fu, 1982).

2. Screening and Case Management Programs (Secondary Prevention)

Recognition of these neurological problems gave rise to expanded screening and case management programs in many cities and States. Traditionally, the approach to childhood lead-poisoning prevention has been reactive, relying on the identification of a poisoned child to trigger investigation of lead hazards in the home environment.

Based on the belief that children had to eat lead-based paint chips to be poisoned, the typical response to a lead poisoning during the 1970s and early 1980s consisted of removing deteriorated lead-based paint by scraping, uncontrolled sanding, or open-flame burning. Approaches differed slightly from city to city. Some required removal of all lead-based paint to a certain height, such as 5 feet; others required only that deteriorating paint be removed. However, these traditional abatements had one common characteristic: little attention was paid to controlling, containing, and cleaning up leaded dust. In many cases these paint removal methods actually aggravated the problem and increased lead exposures, poisoning workers and children in the process. Several studies found that uncontrolled abatement and inadequate cleanup caused increased blood lead levels (Farfel and Chisolm, 1990; Rabinowitz, 1985a; Amitai, 1987).

3. Primary Prevention

In 1987 Congress concluded that responding to lead-based paint hazards on an individual basis only after a poisoning was inappropriate. The Housing Act of 1987 (P.L. 100–242) directed attention to finding and abating lead-based paint in housing to prevent lead poisoning (primary prevention). The presence of lead-based paint on any and all surfaces was considered to be a hazard, and permanent abatement of all lead-based paint was deemed the only appropriate response. Requirements for action were limited primarily to conventional public and Indian housing, where full abatement of all lead-based paint is completed during substantial rehabilitation or if an EBL child is identified. HUD's 1990 *Interim Guidelines*, which evolved from this statute, properly emphasized the danger of lead-contaminated dust and the need for worker protection and thorough cleanup.

III. The Title X Framework

Title X fundamentally reorganizes the national approach to controlling lead-based paint hazards in housing by focusing attention on lead

hazards through the establishment of new requirements for property owners as well as Federal agencies and mandating action to improve the safety and effectiveness of lead-based paint activities.

A. Definition of "Lead-Based Paint Hazard"

Most importantly Title X redefines the concept of "lead-based paint hazards." Under prior Federal legislation, a lead-based paint hazard was defined as any paint containing 1 mg/cm² or more of lead regardless of its condition or location. Title X states that a lead-based paint hazard is "any condition that causes *exposure* to lead from lead-contaminated dust; bare, lead-contaminated soil; or lead-based paint that is deteriorated or intact lead-based paint present on accessible surfaces, friction surfaces, or impact surfaces that would result in adverse human health effects." Thus, under this definition, intact lead-based paint on most walls and ceilings is not considered a "hazard," although the condition of the paint should be monitored and maintained to ensure that it does not become deteriorated.

While most efforts to reduce lead hazards in housing will now be aimed at controlling lead-based paint hazards as defined by Title X, Federal law makes one notable exception: in public and Indian housing, all lead-based paint must be abated when the housing is modernized.

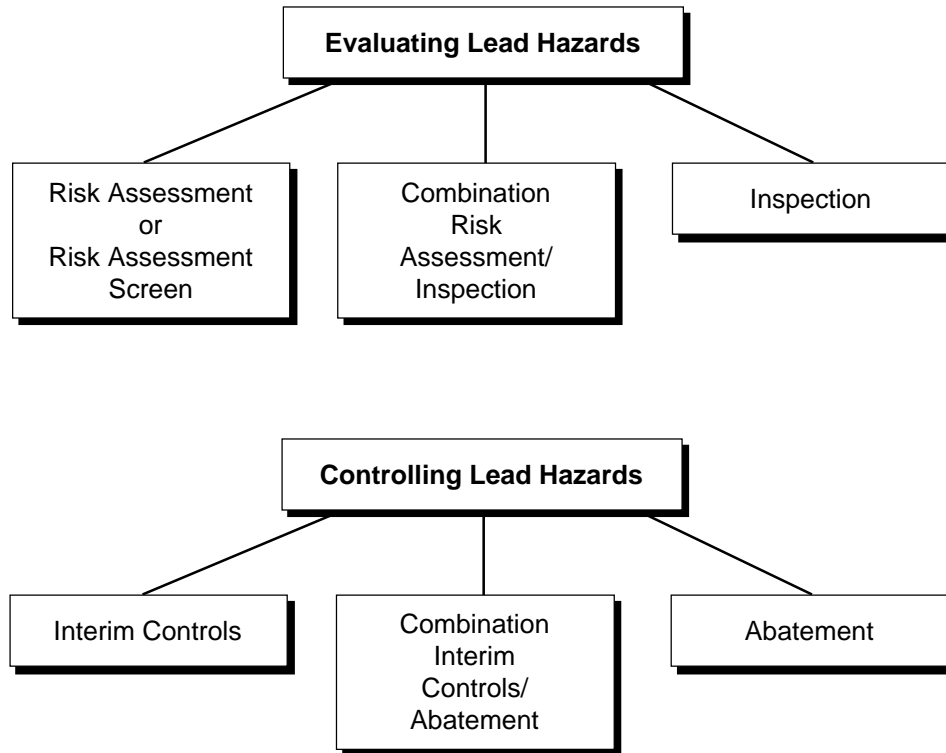
B. Strategic Framework for Lead Hazard Control

As shown in Figure 1.1, Title X's objective of reducing exposures from lead-based paint hazards is accomplished by evaluating and controlling lead-based paint hazards.

1. Evaluating Lead Hazards

Lead hazard evaluation may be accomplished by risk assessment or inspection, or by a combination of the two. The combination approach results in an identification of all lead-based paint *and* lead-based paint hazards.

Figure 1.1 Title X's Lead Hazard Control Framework.



“Paint inspection” is a surface-by-surface investigation of all painted surfaces—interior and exterior, in common areas of multifamily buildings, as well as in dwelling units—using portable x-ray fluorescence (XRF) analyzers and/or laboratory analysis of paint samples to determine the presence of lead-based paint, and the provision of a report on the results.

Inspections to identify the presence of lead-based paint should not be confused with clearance examinations, risk assessments, or investigations of homes with lead-poisoned children.

“Risk assessment” is an onsite investigation of a residential dwelling for lead-based paint hazards and includes, but may not be limited to, a visual inspection; limited environmental samplings of dust, soil, and deteriorated paint; and a report of the results that identifies acceptable abatement and interim control strategies for

controlling any lead-based paint hazards identified. Risk assessments and paint inspections can be combined (see Chapters 3, 5, and 7).

2. Controlling Lead Hazards

Title X provides for three types of lead hazard control: interim controls, abatement of lead-based paint hazards, and complete abatement of all lead-based paint.

“Interim controls,” according to Title X, are “a set of measures designed to reduce temporarily human exposure or likely exposure to lead-based paint hazards, including specialized cleaning (to reduce lead-contaminated dust), repairs, maintenance, painting, temporary containment, ongoing monitoring of lead-based paint hazards or potential hazards, and the establishment and operation of management and resident education programs.” Interim controls include dust



Figure 1.2 Some Lead-Based Paints Had as Much as 50 Percent Lead.

removal, paint film stabilization, and friction and impact surface treatments. Interim controls are appropriate for implementation on a broad scale and may prove cost-effective in many cases. Whenever interim controls are employed, ongoing monitoring of lead hazards must be undertaken by the property owner, as some potential hazards are still present.

"Abatement of lead-based paint hazards," according to Title X, is "any set of measures designed to permanently eliminate lead-based paint hazards . . ." Such measures may include "(A) the removal of lead-based paint and lead-contaminated dust, the permanent containment or encapsulation of lead-based paint, the replacement of lead-based painted surfaces or fixtures, and the removal or covering of lead-contaminated soil; and (B) all preparation,

cleanup, disposal, and post-abatement clearance testing activities associated with such measures." Consistent with its focus on lead-based paint *hazards*, Title X has redefined the term "abatement" to mean the elimination of "lead-based paint hazards," not necessarily all lead-based paint.

"Complete abatement of lead-based paint," is the permanent control of all lead-based paint, interior or exterior, intact or deteriorated, using the same methods as those included in the definition of abatement of lead-based paint hazards. Title X requires complete abatement for public and Indian housing (according to the statutory requirements that have been in place since 1987). Specifically, all pre-1978 public and Indian housing must be inspected, and *all* lead-based paint identified must be abated (not just lead-based paint hazards). Abatement usually occurs during rehabilitation or modernization.

C. Requirements To Ensure Quality Control

To ensure that lead hazard control work is carried out safely and effectively, Title X imposes new requirements for consistency and quality control.

1. Training and Certification

Title X requires EPA to promulgate regulations to ensure that all risk assessors, inspector technicians, and abatement supervisors meet minimum training requirements and are certified by an EPA-approved State program (or by EPA in those States that have not sought approval for their lead control program within 2 years after EPA has issued its regulations). All workers and project planners must be properly trained by an accredited training provider. The proposed regulation can be found in the *Federal Register* (Vol. 59, No. 170, P. 45871 September 2, 1994). In addition, it should be noted that the National Lead Abatement Council (NLAC) is establishing the XRF Operators Registry for inspectors who use the XRF instrument.



2. Accreditation of Training Providers

Lead-based paint-related training must be provided by a training program that has been formally accredited either by EPA or by an EPA-approved State program. EPA has developed or is developing model training courses for inspector technicians, abatement supervisors, abatement workers, and risk assessors, and is establishing minimum national criteria for training providers. Also, in an effort to build a national network of training providers, EPA has provided “seed” money grants to five university-based training centers (see Chapter 2).

3. Health-Based Standards

Consistent criteria must be used for identifying lead-based paint hazards and triggering lead hazard control action. Title X directs EPA to identify dangerous levels of lead in soil, dust, and existing paint films.

4. Performance Standards for Testing and Abatement Products

Title X also requires that appropriate criteria, testing protocols, and performance characteristics be developed for lead-based paint testing and abatement products. It is expected that these standards will be developed jointly by HUD and EPA, with technical support from the National Institute for Standards and Technology (NIST). Private-sector organizations such as the American Society for Testing and Materials (ASTM) may also play a role in developing such standards.

5. Laboratory Accreditation

Laboratories analyzing environmental samples of lead in paint film, dust, and soil must follow established protocols and procedures and be accredited through the EPA National Lead Laboratory Accreditation Program (NLLAP). Such laboratories will become “EPA recognized.” Property owners, risk assessors, inspector technicians, and contractors should ensure that laboratory analyses are performed by an “EPA-recognized” laboratory.

D. State and Local Regulations

If there is a difference between Federal, State, or local regulations, the more stringent requirements must be observed in any given jurisdiction.

IV. Organization and Use of the Guidelines

Evaluation and control of lead-based paint hazards is an evolving field. For cases in which research has demonstrated that certain techniques are appropriate, references are cited. In some cases, there has been no research done that clearly describes the best approach to solving a specific problem. Recognizing that problems require answers, these *Guidelines* offer advice based on the experience and considered judgment of the authors and reviewers. For cases in which citations are not provided, the reader should assume that the source of the advice is anecdotal and is the best advice that HUD can provide at this time. Those references that are unpublished are available through the EPA National Lead Information Center (see Chapter 2).

A. Chapter Organization

A short summary of steps is provided at the beginning of each technical chapter to alert the reader to especially critical points and action steps. In general, the material is presented in each chapter in order of sequence in a typical project; however, a complete reading and understanding of these *Guidelines* is essential before any project is undertaken. Wherever possible, the *Guidelines* explain the rationale for recommendations and provide a technical description of the action to be taken.

1. Chapters 1–4: Background Information

Understanding the background material is critical to the successful completion of any project. Chapter 1 (“Introduction”) describes the purpose and application of the *Guidelines*; briefly reviews the hazards of lead-based paint in

housing; summarizes major departures from past approaches; and provides context in terms of Federal law, regulations, and agency programs. Chapter 2 (“Where to Go for Help”) introduces the types of individuals involved in evaluating and controlling lead-based paint hazards in housing, explains their roles, and summarizes their qualifications. Chapter 3 (“Before You Begin the Project”) identifies the critical issues that must be examined to avoid problems and mistakes that can result in project delays and cost overruns. Chapter 4 (“Renovation and Lead-Based Paint”) provides general advice on how to carry out work in older housing so that lead hazards are not inadvertently created (e.g., by disturbing lead-based paint) and how to combine renovation with abatement work.

2. Chapters 5–7: Hazard Evaluation

Hazard evaluation helps to ensure the selection of the safest and most cost-effective hazard control strategy for each situation. Chapter 5 (“Risk Assessment”) provides detailed guidance on how risk assessments are to be conducted in various categories of housing, including protocols for environmental sample collection and interpretation, evaluation of building and paint condition, and methods for sampling a subset of units in multifamily buildings. Chapter 6 (“Ongoing Monitoring”) describes how reevaluations are to be performed and provides detailed schedules for when they are needed. Chapter 7 (“Paint Inspection”) provides detailed information on methods for testing housing to determine the presence of lead-based paint on a surface-by-surface basis, including the use of portable XRF analyzers and paint-chip sampling for laboratory analysis.

3. Chapters 8–10: Preparation for the Project

The critical steps in preparing to control lead-based paint hazards are covered in Chapters 8–10. Chapter 8 (“Occupant Protection and Containment”) provides guidance on the steps needed to ensure that occupants are not endangered and that contamination is not spread. Chapter 9 (“Worker Protection”) provides

detailed advice on how to comply with the OSHA Lead in Construction Standard while performing work in housing. Chapter 10 (“Hazardous and Nonhazardous Waste”) provides detailed, practical advice on methods for segregating, handling, and disposing various kinds of debris to protect the environment and meet hazardous waste requirements at the lowest cost.

4. Chapters 11–15: Hazard Control, Cleanup, and Clearance

Detailed information on how to carry out all aspects of lead hazard control is provided in Chapters 11–15. Chapter 11 (“Interim Controls”) provides specific guidance on interim controls: general principles of interim controls, dust removal, paint film stabilization, friction surface treatments, and soil and exterior dust treatments. Chapter 12 (“Abatement”) covers general principles of abatement such as component replacement, enclosure, paint removal methods, and soil abatement. Chapter 13 (“Encapsulation”) describes how to use encapsulants and the status of such products pending the development of performance standards pursuant to Title X. Chapter 14 (“Cleanup”) details cleanup procedures for lead hazard control projects. Chapter 15 (“Clearance”) explains how to conduct clearance tests after a lead hazard control project to ensure that a unit or area is safe for reoccupancy.

5. Chapters 16–18: Other Issues

Information on addressing lead-based paint hazards in special situations is provided in the final chapters of these *Guidelines*. Chapter 16 (“Evaluation of Houses With Lead-Poisoned Children”) describes the special measures that are usually taken by health department staff and others to investigate environmental lead hazards once a child has been identified as poisoned. Chapter 17 (“Maintenance”) addresses the range of issues related to lead-based paint as it is encountered in the course of routine maintenance work. Chapter 18 (“Historic Preservation”) discusses the special situations and issues surrounding lead-based paint in historic dwellings.



6. Glossary and Appendixes

The definitions of key terms are consolidated in the glossary and deserve special attention because the meanings of several key terms (such as “abatement”) differ from common usage. The appendixes provide detailed background information and technical materials.

B. Units of Measurement

- ◆ $\mu\text{g}/\text{ft}^2$ —micrograms per square foot.
- ◆ ppm—parts per million by weight (10,000 ppm = 1 percent), equivalent to $\mu\text{g}/\text{g}$.
- ◆ ppb—parts per billion by weight (1,000 ppb = 1 ppm).
- ◆ $\mu\text{g}/\text{g}$ —micrograms per gram of sample, equivalent to ppm by weight.
- ◆ percent—percent by weight, used usually for paint (1 percent = 10,000 $\mu\text{g}/\text{g}$).
- ◆ mg/cm^2 —milligrams per square centimeter, used for paint.
- ◆ $\mu\text{g}/\text{m}^3$ —micrograms per cubic meter, used for air.
- ◆ $\mu\text{g}/\text{dL}$ —micrograms per deciliter, used for blood.

C. Federal Lead Standards

If Federal standards differ from State and local standards, the most stringent standards must be applied.

1. Paint

- ◆ $1.0 \text{ mg}/\text{cm}^2$ or $5,000 \mu\text{g}/\text{g}$ (0.5 percent).

2. Leaded Dust Levels for Risk Assessments (by wipe sampling)

- ◆ $100 \mu\text{g}/\text{ft}^2$ —floors (carpeted and uncarpeted).
- ◆ $500 \mu\text{g}/\text{ft}^2$ —interior window sills.

- ◆ $800 \mu\text{g}/\text{ft}^2$ —window troughs (previously called “window wells” in the literature).

3. Dust Levels for Lead Hazard Screen Only

- ◆ $50 \mu\text{g}/\text{ft}^2$ —floors.
- ◆ $400 \mu\text{g}/\text{ft}^2$ —window troughs.

4. Leaded Dust Clearance Levels (by wipe sampling)

- ◆ $100 \mu\text{g}/\text{ft}^2$ —floors (includes carpeted and uncarpeted floors).
- ◆ $500 \mu\text{g}/\text{ft}^2$ —interior window sills.
- ◆ $800 \mu\text{g}/\text{ft}^2$ —window troughs (previously called “window wells” in the literature).
- ◆ $800 \mu\text{g}/\text{ft}^2$ —exterior concrete surfaces.

5. Bare Residential Soil

- ◆ $5,000 \mu\text{g}/\text{g}$ —paving or removal criteria.
- ◆ $2,000 \mu\text{g}/\text{g}$ —building perimeter and yard.
- ◆ $400 \mu\text{g}/\text{g}$ —play areas and high-contact areas for children.

6. Airborne Lead Particulate

- ◆ $30 \mu\text{g}/\text{m}^3$ —OSHA action level (8-hour, time-weighted average).
- ◆ $50 \mu\text{g}/\text{m}^3$ —OSHA permissible exposure limit (8-hour, time-weighted average).

7. Elevated Blood Lead Level

- ◆ $20 \mu\text{g}/\text{dL}$ (or $15\text{--}19 \mu\text{g}/\text{dL}$ in two consecutive samples taken several months apart)—CDC environmental intervention level for individual child.

8. Waste

- ◆ 5 ppb (parts per billion) by TCLP test.