National Survey of Lead and Allergens in Housing

FINAL REPORT

Volume I: Analysis of Lead Hazards

Revision 6.0

Prepared for:

Office of Lead Hazard Control
U.S. Department of Housing and Urban Development
451 7th Street, N.W.
Washington, D.C. 20410

By:

Robert P. Clickner, Ph.D.
David Marker, Ph.D.
Susan M. Viet, Ph.D., CIH
John Rogers
Pamela Broene

Westat, Inc.
1650 Research Boulevard
Rockville, MD 20850

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EXECUTIVE SUMMARY

The National Survey of Lead and Allergens in Housing (referred to as the National Survey or NSLAH) was conducted under the sponsorship of the Department of Housing and Urban Development (HUD) and the National Institute of Environmental Health Sciences (NIEHS) to assess children's potential household exposure to lead and allergens. The National Survey measured the levels of lead in dust, soil, and paint, the prevalence of hazardous levels of lead, and levels and patterns of various indoor allergens in dust in homes. Volume I includes the findings for lead hazards, and describes lead levels in dust, soil, and paint in the nation's housing by age, type, geographical location, and exposed populations. This Executive Summary refers to the standards of HUD's new "Lead Safe Housing Rule" on Federally-owned and -assisted housing.[1] Appendix A compares the National Survey findings using these current standards with the guidance provided in HUD's 1995 *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* ("*Guidelines*"). The definition of lead-based paint is the same for both (1.0 mg/cm^2), while the definition of lead-based paint hazard has changed in accordance with advances in scientific understanding and statutory changes.

Results: Extent of Lead-Based Paint and Lead-Based Paint Hazards in Housing

An estimated 38 million[2] homes (40 percent of all homes) in the United States have lead-based paint somewhere in the building. Of these, 20 million homes have lead-based paint present on both interior and exterior surfaces, 9 million homes have lead-based paint only on the interior, and another 9 million homes have lead-based paint only the exterior.

Although a large number of homes have lead-based paint, most of them have relatively small surface areas of it. The average home with lead-based paint has an estimated 259 square feet of interior lead-based paint and 996 square feet of exterior lead-based paint.

An estimated 26 million (27 percent) homes have significant lead-based paint hazards somewhere in the building or on the premises; this is similar to earlier HUD estimates of 24 million homes. Based on the HUD Lead Safe Housing Rule, a home is said here to have a significant lead-based

[1] Title 24 of the Code of Federal Regulations, Part 35 was issued September 15, 1999 in Volume 64 of the Federal Register, pages 50140-50231, and is effective September 15, 2000. It implements sections 1012 and 1013 of the Residential Lead-Based Paint Hazard Reduction Act of 1992, which is Title X of the Housing and Community Development Act of 1992 (P.L. 102-550). A copy is available on the Internet at www.hud.gov/lea.

[2] The 95 percent confidence intervals for the estimates are presented in the main body of the report.

paint hazard if one or more of the following conditions exists: lead-based paint with deterioration larger than *de minimis* levels specified in the Lead Safe Housing Rule,[3] dust lead loadings at or above specified thresholds on floors or window sills;[4] bare soil in children's play areas above specified thresholds; or more than 9 square feet of bare soil in the rest of the yard with lead concentrations at or above specified thresholds.[5]

Of the 16.4 million homes with one or more children under age 6, an estimated 5.7 million (34 percent) have significant lead-based paint hazards. Of all 4.8 million homes with household incomes under $30,000 and one or more children under age 6, an estimated 1.6 million (34 percent) have significant lead-based paint hazards. Thus, one in three homes with young children among the residents have significant lead-based paint hazards. Table ES.1 summarizes these basic estimates of the prevalence of lead-based paint and significant lead-based paint hazards.

Table ES.1 Summary Estimates of Prevalence of Lead-Based Paint and Lead-Based Paint Hazards

Housing Unit Characteristic[1]	Number of Housing Units (millions)	Number of Housing Units with Lead-Based Paint (millions)	Number of Housing Units with Significant Lead-Based Paint hazards (millions)
Total housing units	95.7	37.9	25.5
One or more children under age 6	16.4	5.3	5.7
One or more children under age 6, less than $30,000/year household income	4.8	1.4	1.6

[1] "Housing units" include permanently occupied, noninstitutional housing units in which children are permitted to live.

[3] The *de minimis* levels for LBP deterioration are in Section 35.1350(d) of the Lead Safe Housing R rule. These levels are: deterioration of more than 20 square feet (exterior) or 2 square feet (interior) of LBP on large surface area components (walls, doors) or deterioration of to more than 10% of the total surface area of interior small surface area components types (window sills, baseboards, trim). These are the same levels used in the U.S. Environmental Protection Agency's lead hazard standards rule implementing the Toxic Substance Control Act's section 403.

[4] The floor and window sill dust lead loading thresholds are dust on floors with greater than or equal to 40 $\mu g/ft^2$ lead and dust on window sills with greater than or equal to 250 $\mu g/ft^2$ lead. They are in the HUD Lead Safe Housing rule and in the EPA Rule *Identification of Dangerous Levels of Lead*; 40 CFR Part 745, January 5, 2001.

[5] The thresholds for bare, lead-contaminated soil are more than 9 square feet of bare soil with a lead concentration greater than or equal to 2,000 ppm lead, or 400 ppm for bare soil in an area frequented by a child under the age of 6 years. These thresholds are in the HUD Lead Safe Housing Rule. The EPA Rule *Identification of Dangerous Levels of Lead* has the same threshold for children's play areas, but a threshold of 1,200 ppm for the rest of the yard.

Of the 26 million homes with significant lead-based paint hazards, an estimated 17 million have interior dust lead hazards, 14 million have deteriorated lead-based paint at or above *de minimis* levels and 6 million have soil lead hazards.

Dust lead levels above the Lead Safe Housing Rule's standards are associated with the presence of interior lead-based paint. An estimated 29 million homes have some interior lead-based paint, of which 39 percent have dust lead levels above the Lead Safe Housing Rule's standards. In contrast, only 6 percent of the 67 million homes without interior lead-based paint have dust levels above the Lead Safe Housing Rule's standards.

Soil lead levels above the Lead Safe Housing Rule's standards are associated with the presence of deteriorated lead-based paint. While 13 percent of the 14 million homes with deteriorated lead-based paint above *de minimis* levels have lead in bare soil at or above 2,000 parts per million, only 2 percent of the 82 million homes free of such deteriorated lead-based paint have bare soil lead above this threshold.

Survey Design and Methodology

The principal lead-related purpose of the National Survey of Lead and Allergens in Housing was to develop a scientific description of the existing lead levels in paint, dust, and soil in the nation's housing. Additional objectives were to obtain data to: (1) estimate the number and percent of homes with dust and soil lead levels above selected thresholds; (2) identify sources of lead in dust in housing, e.g., paint and soil; (3) permit future analyses of lead hazard control strategies and costs, e.g., quantities of deteriorated painted surfaces; and (4) permit future analyses for regulation, policy, and guidance that minimize regulatory and program implementation burden.

The target population included approximately 96 million homes, out of the of the 112 million total homes in the nation, including single- and multi-family buildings and manufactured housing units, e.g., mobile homes and trailers. Homes built in all age categories were included. Vacant housing, group quarters, and hotels and motels were excluded for operational reasons. Housing where children were not permitted to live, e.g., elderly care facilities, were excluded because the primary interest was in children's exposure to lead. Thus, 16 million units out of 112 million total units were excluded from this survey.

The main field survey was conducted in 1998-1999, with an augmentation of the soil sampling in 2000. A nationally-representative sample of 1,984 homes was drawn from 75 clusters (each a metropolitan statistical area (MSA) or a cluster of counties) called *primary sampling units* (PSUs).[6] A total of 831 eligible homes were recruited and completed the survey.

Four rooms were randomly selected for environmental sample collection and testing from each of four room types: kitchen, common living areas, bedrooms (preferably those occupied by children), and other rooms. In each of these four rooms floor, window sill, and window trough dust samples were collected, painted surfaces were measured for lead content, and the condition of painted surfaces was assessed. Outside the building, soil samples were taken and exterior painted surfaces were tested. A floor dust sample was collected in the interior common area of multi-family buildings.

Measurements of lead in paint were made by State- or EPA-certified lead-based paint inspectors using an XRF analyzer and a protocol based on the 1997 *Guidelines*' inspection procedure. The instrument model used does not require making substrate corrections, nor have an inconclusive range, both of which involve destructive sampling of painted surfaces. One XRF reading was made per painted component in each room, approximately in the center of a randomly selected quadrant of the total building component surface area.

Single wipe dust samples were collected by the technique described in ASTM E 1728-95.[7] Floor dust samples were collected in the center of the largest open floor area in the room. The floor samples in the major entrance and interior common area were collected approximately six inches away from the center of the doorway. One-square-foot templates were used for floor samples. Window sill and trough samples were collected from a random, openable window in each selected room. The entire area was wiped for window sill and trough samples (up to two square feet). All dust samples were analyzed by flame atomic absorption spectrophotometry, using the Environmental Protection Agency's (EPA's) SW-846 method 3050 digestion method and the American Industrial Hygiene Association's *Environmental Lead Laboratory Accreditation Program (*ELLAP*)* proficiency testing procedures.

Soil sampling was conducted in accordance with core sampling procedures described in the 1995 HUD *Guidelines.* Only the top one-half inch of each soil core, i.e., that portion most accessible to children, was included in the sample. Where necessary, grass or leaf covering was gently removed

[6] A PSU is a metropolitan statistical area (MSA) or a cluster of counties.

[7] ASTM E 1728-95. (1995b). *Standard practice for the field collection of settled dust samples using wipe sampling methods for lead determination by atomic spectrometry techniques*. American society of Testing and Materials, Philadelphia, PA.

before taking the core. Soil samples were taken outside the building at the major entrance, and along the dripline and mid-yard area of two sides of the building. Soil samples were collected from children's play areas in a subsample of 375 homes. Soil samples were analyzed by inductively-coupled plasma atomic emission spectroscopy, using the SW-846 digestion method and the ELLAP proficiency testing procedures.

Conclusion

This most recent HUD survey shows that the number of housing units with lead-based paint has declined from 64 million in 1990 to 38 million ten years later. Despite this decline, one in three homes with resident children under 6 years old have significant lead-based paint hazards.