APPENDIX H

REVIEW OF PUBLISHED INFORMATION ON POST-INTERVENTION WIPE DUST-LEAD LOADINGS ON FLOORS AND WINDOW SILLS

H1.0 INTRODUCTION

One goal of the §403 risk analysis was to determine how the likelihood of children with blood-lead concentrations exceeding certain thresholds (10 and 20 µg/dL) declines as a result of reducing environmental-lead levels when interventions are performed in response to §403 rules. An empirical model was used in both a pre- and post-intervention setting to predict geometric mean blood-lead concentration as a function of environmental-lead levels, including average dust-lead loadings for floors and window sills. It was assumed that pre-intervention average dust-lead loadings on floors and window sills were reduced when performing the following interventions:

- Dust cleaning (as triggered by exceeding either the floor or window sill dust-lead standards)
- Interior paint abatement
- Soil removal

For each of these interventions, the assumed post-intervention wipe dust-lead loadings are as follows:

- Floors: 40 µg/ft^2 or the pre-intervention value, whichever is smaller
- Window sills: 100 µg/ft^2 or the pre-intervention value, whichever is smaller.

Note that both assumptions are below their respective §403 standards. Post-intervention dust-lead loadings are assumed to hold for four years following a dust cleaning, 20 years following interior paint abatement, and permanently following soil removal.

Since the §403 risk analysis was performed, additional information has been identified which could be used to refine the assumptions on post-intervention wipe dust-lead loadings. This appendix examines some of that information and summarizes existing data from intervention studies to characterize pre- and post-intervention wipe dust-lead loadings.

H2.0 REVIEW OF AVAILABLE INFORMATION

According to Section 6.1.1 of the §403 risk analysis report, the post-intervention dust-lead loadings of 40 µg/ft^2 for floors and 100 µg/ft^2 for window sills were selected based on data from EPA's Comprehensive Abatement Performance (CAP) study and the Baltimore Experimental Paint Abatement study. Justification was as follows:

- Geometric mean vacuum dust-lead loadings from abated units in the CAP study were 29 µg/ft^2 for floors (187 samples) and 92 µg/ft^2 for window sills (78 samples), where the samples were collected approximately two years after paint intervention performed within the HUD Lead-Based Paint Abatement Demonstration.

- Geometric mean wipe dust-lead loadings in the Baltimore Experimental Paint Abatement study were 41 $\mu g/ft^2$ for floors and 103 $\mu g/ft^2$ for window sills, in 13 housing units approximately 18-42 months after complete paint intervention.

Intervention studies that contain information on pre- and post-intervention dust-lead loadings (assuming either wipe dust collection methods or a method in which the reported loadings can be converted to wipe-equivalent loadings) and that can be used to evaluate the §403 assumptions on post-intervention dust-lead loadings are identified in Table H-1. These studies were included in USEPA, 1995a, and USEPA, 1998, which contain summary information on studies available in the scientific literature whose findings could be used to make conclusions on the effectiveness of lead hazard intervention (defined as "any non-medical activity that seeks to prevent a child from being exposed to the lead in his or her surrounding environment"). A summary of key information on study design and conclusions for the studies in Table H-1 is found in Appendix H2.

When comparing dust-lead loading results across the studies in Table H-1, the following issues should be considered:

Converting vacuum dust-lead loadings to wipe-equivalent loadings

Two of the studies in Table H-1 used dust collection methods other than the wipe method. The Baltimore R&M study used the BRM vacuum method, while the CAP study used a cyclone vacuum specifically developed for the study. While post-intervention wipe dust-lead loadings are of interest here, these two studies are included in Table H-1 as previous efforts allow the vacuum dust-lead loadings to be converted to wipe-equivalent loadings. These conversions were made prior to displaying results from these two studies in this appendix.

The Baltimore R&M study collected composite dust samples using the BRM vacuum method. The conversion of BRM dust-lead loadings to wipe-equivalent loadings for the Baltimore R&M study was developed within the §403 risk analysis effort (USEPA, 1997a) and takes the following form:

Floors: $\text{Wipe} = (p \times 8.34 \times \text{BRM}^{0.371}) + ((1-p) \times 3.01 \times \text{BRM}^{0.227})$

Window sills: $\text{Wipe} = 14.8 \times \text{BRM}^{0.453}$

where Wipe is the average wipe dust-lead loading, BRM is the average BRM dust-lead loading, and p is the proportion of a composite floor-dust sample obtained from uncarpeted floors. These conversion equations were determined based on side-by-side BRM/wipe dust-lead loading data from four studies.

Dust-lead loadings for samples collected by the CAP study's cyclone vacuum were converted to wipe-equivalent loadings based on the conclusion made within the CAP study that vacuum dust-lead loadings were, on average, 1.38 times larger than wipe dust-lead loadings

Table H-1. Studies Containing Information on Pre-Intervention and Post-Intervention Dust-Lead Loadings on Floors and Window Sills, Where Wipe Collection Methods or a Method Whose Loadings Can Be Converted to Wipe-Equivalents Were Used

Study	Study Duration	Type of Interventions Considered	Type of Wipe Digestion Method	Reference(s)
Baltimore (MD) Dust Control Study	1981	Paint interventions Some units received periodic dust control	Cold HCl	Charney et al., 1983
Baltimore (MD) Experimental Paint Abatement Studies	1986-87 (Study #1) 12/91 - 01/92 (Study #2)	Paint interventions using experimental procedures, with extensive cleanup	Cold HCl	Farfel and Chisolm, 1991 Farfel et al., 1994
Baltimore (MD) Follow-up Paint Abatement Study	01/91 - 06/92	Paint interventions with extensive clean-up	Cold HCl	MDE, 1995
Baltimore (MD) Repair and Maintenance (R&M) Study	1993-95	Various types of R&M paint interventions (including cleanup, prevention of recontamination, and education)	BRM vacuum method was used	USEPA, 1996b USEPA, 1997b USEPA, 1997c
Baltimore (MD) Traditional/Modified Paint Abatement Study	1984-85	"Traditional" and "modified" paint abatements, with some cleanup.	Cold HCl	Farfel and Chisolm, 1990
Boston (MA) Interim Dust Intervention Study	05/93 - 04/95	Intervention groups received paint and/or dust intervention (low-tech). Comparison group received an outreach visit.	Cold HCl	Aschengrau et al., 1998 Mackey et al., 1996
Evaluation of the HUD Lead-Based Paint Hazard Control Grant Program (HUD Grantees) (data collected through August, 1997)	1994 - present	Wide range of interventions to reduce/eliminate lead-based paint hazards.	Heated HNO_3/H_2O_2	NCLSH and UC, 1997 NCLSH and UC, 1998
HUD Abatement Demonstration Program/EPA Comprehensive Abatement Performance (CAP) Study	1989-90 (HUD Demo) 03/92 - 04/92 (CAP Study)	Encapsulation/enclosure Various paint removal methods	Heated HNO_3/H_2O_2 (CAP Study cyclone was used in the CAP Study)	HUD, 1991 USEPA, 1996a

Table H-1. (cont.)

Study	Study Duration	Type of Interventions Considered	Type of Wipe Digestion Method	Reference(s)
Jersey City (NJ) Children's Lead Exposure and Reduction (CLEAR) Dust Intervention Study	1992-94	Biweekly dust control assistance and educational sessions	Heated HNO_3/H_2O_2	Adgate et al., 1995 Lioy et al., 1997
Paris Paint Abatement Study	01/90 - 02/92	Paint interventions with dust cleaning	Unspecified	Nedellec et al., 1995
Rochester (NY) Educational Intervention Study	08/93 - 06/94	Intervention group received direction on performing periodic dust control. Control group received educational materials only.	Heated HNO_3/H_2O_2	Lanphear et al., 1996

(USEPA, 1996a), regardless of lead level or sampling component. This conclusion was made by fitting a log-linear regression model, using an errors-in-variables approach, on lead loading data for 33 pairs of side-by-side vacuum/wipe dust samples collected within the CAP study. The model predicted vacuum dust-lead loading as a function of wipe dust-lead loading. Therefore, the conversion of vacuum dust-lead loading data from the CAP study (for both floors and window sills) involved dividing each vacuum dust-lead loading by 1.38 to obtain a wipe-equivalent loading. The estimated geometric mean wipe dust-lead loading equals the geometric mean vacuum dust-lead loading, divided by 1.38.

Handling differences in wipe digestion methods

The studies in Table H-1 are identified according to the type of wipe digestion method used in the analytical process. Generally, one of two categories of digestion methods was used by each study. The "heated HNO_3/H_2O_2" method, which is the method recommended in EPA's National Lead Laboratory Accreditation Program (NLLAP), allows total lead amounts in the sample to be determined. The "cold HCl" method, documented in Vostal et al., 1974, and used at the Kennedy Krieger Institute in Baltimore, MD, generally allows only "bioavailable" lead amounts to be measured in the sample. Therefore, in order to make wipe dust-lead loadings comparable across all studies in Table H-1, it is necessary to adjust the "bioavailable" lead loadings that are reported in the studies that used the "cold HCl" digestion method to reflect total lead amounts. Appendix A of USEPA, 1997a, provided a means by which this adjustment can be made:

$$T = B^{1.1416}$$

where T is the total dust-lead loading, and B is the "bioavailable" dust-lead loading. This adjustment was developed by fitting a log-linear regression model (with no intercept term) on existing uncarpeted floor dust-lead loading data that were collected in a pilot study that investigated how dust-lead loadings changed across five different sampling and analysis methods. (See USEPA, 1997a, for details.)

In this appendix, summary statistics for studies labeled in Table H-1 as utilizing the "cold HCl" wipe digestion method were calculated on dust-lead loadings that were adjusted by the method in the previous paragraph. This implies taking geometric means calculated on the study data to the 1.1416 power.

Considering different intervention methods across studies

As seen in the second column of Table H-1, the studies utilized different intervention approaches. The HUD Grantees evaluation program is the most widely-encompassing of the studies, containing dust-lead loading data at up to 12 months post-intervention for floors and window sills in over 500 housing units as measured by 14 Grantees across the country. Therefore, the impact of intervention activities on dust-lead loading will likely vary considerably across these studies. Furthermore, caution should be used in considering the results of certain studies, such as the educational intervention studies, when the aim is to evaluate the effect of performing highly-intensive dust and paint abatements on dust-lead loading.

H3.0 RESULTS

For eight studies in Table H-1 that measured and documented post-intervention dust-lead loadings and which considered paint and/or dust interventions (i.e., not just educational interventions), Tables H-2 and H-3 provide summaries of the measured dust-lead loadings from these studies, both prior to intervention (if available) and at specified time points following the interventions, for floors and window sills, respectively. Summaries are presented according to study group within each study. These tables contain geometric mean dust-lead loadings for all studies but the HUD Grantees evaluation, whose references provided only median dust-lead loadings. Note that not all studies in these tables provided information on pre-intervention dust-lead loadings. Also, as discussed in the previous chapter, the measured dust-lead loadings in the Baltimore R&M study and the CAP study have been converted from vacuum to wipe-equivalent loadings, and dust-lead loadings in studies using the "cold HCl" wipe digestion method have been adjusted to reflect total lead loadings, prior to preparing the summaries in Tables H-2 and H-3.

More detailed dust-lead loading summaries are provided in the tables in Appendix H3. These tables include the information in Tables H-2 and H-3, along with sample sizes associated with the summaries, 95% confidence intervals for selected estimates, and reported differences in dust-lead loadings from pre-intervention which were measured in the Paris Paint Abatement study and the Rochester Educational Intervention Study.

Table H-2. Summaries of Pre- and Post-Intervention Floor Dust-Lead Loadings from Studies Evaluating Paint and/or Dust Interventions

Study	Study Group	Pre-Intervention Floor Dust-Lead Loadings[1] ($\mu g/ft^2$)	Post-Intervention Floor Dust-Lead Loadings[1]	
			Time Following Intervention	Summary Value ($\mu g/ft^2$)
Baltimore Experimental Paint Abatement Studies[2]	Study 1 (6 homes)	1261	Immediately	259
			6-9 Months	99
	Study 2 (13 homes)	556	Immediately	20
			1.5 - 3.5 Years	69
Baltimore Follow-up Paint Abatement Study[2]	6-Month Follow-up		Immediately	47
			5-7 Months	22
	12-Month Follow-up		Immediately	41
			10-14 Months	20
	19-Month Follow-up		Immediately	24
			14-24 Months	36
Baltimore R&M Study[3]	All Occupied Units	40.9	Immediately	52.5
			2 Months	40.2
			6 Months	26.5
			12 Months	27.1
			18 Months	24.8
			24 Months	24.1
			48 Months	8.4
	Previously-Abated Units	45.6	6 Months	41.1
			12 Months	39.8
			18 Months	37.3
			24 Months	33.0
	Units Slated for R&M Intervention	58.6	Immediately	52.5
			2 Months	40.2
			6 Months	36.3
			12 Months	39.9
			18 Months	33.3
			24 Months	35.0
	Modern Urban Units	10.0	6 Months	8.1
			12 Months	7.3
			18 Months	7.8
			24 Months	7.1
			48 Months	8.4
Baltimore Traditional/ Modified Paint Abatement Study[2]	Traditional	549	Immediately	4033
			6 Months	714
	Modified	642	Immediately	1626
			6 Months	714

Table H-2. (cont.)

Study	Study Group	Pre-Intervention Floor Dust-Lead Loadings[1] ($\mu g/ft^2$)	Post-Intervention Floor Dust-Lead Loadings[1]	
			Time Following Intervention	Summary Value ($\mu g/ft^2$)
Boston Interim Dust Intervention Study[2]	Automatic Intervention	33.2	6 Months	23.9
	Randomized Intervention	37.3	6 Months	31.4
HUD Grantees	All Grantees	19	Immediately	17
			6 Months	14
			12 Months	14
	Baltimore	41	Immediately	18
			6 Months	42
			12 Months	41
	Boston	24	Immediately	54
			6 Months	16
			12 Months	18
	Massachusetts	24	Immediately	20
			6 Months	11
			12 Months	9
	Milwaukee	14	Immediately	15
			6 Months	10
			12 Months	10
	Minnesota	18	Immediately	18
			6 Months	18
			12 Months	18
	Rhode Island	26	Immediately	7
			6 Months	6
			12 Months	6
	Vermont	28	Immediately	17
			6 Months	21
			12 Months	21
	Wisconsin	9	Immediately	8
			6 Months	6
			12 Months	5
CAP Study[4]	Abated Units		2 Years	21.0
Jersey City CLEARS	Intervention Group	22	12 Months	15

[1] Values are geometric means except for the HUD Grantees studies, where values are medians.

[2] Results are adjusted to reflect total dust-lead loadings by exponentiating the "bioavailable" dust-lead loadings as reported in the study to the 1.1416 power.

[3] Results for the Baltimore R&M Study are converted from BRM dust-lead loadings to wipe-equivalent loadings.

[4] Results for the CAP study are converted from CAPS cyclone dust-lead loadings to wipe-equivalent loadings.

Table H-3. Summaries of Pre- and Post-Intervention Window Sill Dust-Lead Loadings from Studies Evaluating Paint and/or Dust Interventions

Study	Study Group	Pre-Intervention Sill Dust-Lead Loadings[1] ($\mu g/ft^2$)	Post-Intervention Sill Dust-Lead Loadings[1]	
			Time Following Intervention	Summary Value ($\mu g/ft^2$)
Baltimore Experimental Paint Abatement Studies[2]	Study 1 (6 homes)	15215	Immediately	737
			6-9 Months	958
	Study 2 (13 homes)	2784	Immediately	19
			1.5 - 3.5 Years	199
Baltimore Follow-up Paint Abatement Study[2]	6-Month Follow-up		Immediately	50
			5-7 Months	71
	12-Month Follow-up		Immediately	50
			10-14 Months	41
	19-Month Follow-up		Immediately	50
			14-24 Months	147
Baltimore R&M Study[3]	All Occupied Units	356.2	Immediately	185.4
			2 Months	241.4
			6 Months	138.2
			12 Months	136.2
			18 Months	135.1
			24 Months	117.5
			48 Months	37.1
	Previously-Abated Units	163.5	6 Months	107.4
			12 Months	116.0
			18 Months	89.1
			24 Months	97.6
	Units Slated for R&M Intervention	778.4	Immediately	185.4
			2 Months	241.4
			6 Months	247.0
			12 Months	237.6
			18 Months	246.8
			24 Months	204.9
	Modern Urban Units	45.6	6 Months	41.7
			12 Months	40.0
			18 Months	40.5
			24 Months	34.8
			48 Months	37.1
Baltimore Traditional/ Modified Paint Abatement Study[2]	Traditional	3708	Immediately	11460
			6 Months	4360
	Modified	5209	Immediately	1496
			6 Months	4662
Boston Interim Dust Intervention Study[2]	Automatic Intervention	787	6 Months	210
	Randomized Intervention	205	6 Months	110

Table H-3. (cont.)

Study	Study Group	Pre-Intervention Sill Dust-Lead Loadings[1] ($\mu g/ft^2$)	Post-Intervention Sill Dust-Lead Loadings[1]	
			Time Following Intervention	Summary Value ($\mu g/ft^2$)
HUD Grantees	All Grantees	258	Immediately	52
			6 Months	97
			12 Months	90
	Baltimore	1191	Immediately	49
			6 Months	87
			12 Months	68
	Boston	174	Immediately	53
			6 Months	48
			12 Months	49
	Massachusetts	328	Immediately	32
			6 Months	77
			12 Months	50
	Milwaukee	264	Immediately	84
			6 Months	231
			12 Months	217
	Minnesota	266	Immediately	66
			6 Months	86
			12 Months	77
	Rhode Island	314	Immediately	18
			6 Months	87
			12 Months	85
	Vermont	147	Immediately	21
			6 Months	60
			12 Months	40
	Wisconsin	150	Immediately	22
			6 Months	37
			12 Months	51
CAP Study[4]	Abated Units		2 Years	66.4
Jersey City CLEARS	Intervention Group	75	12 Months	24

[1] Values are geometric means except for the HUD Grantees studies, where values are medians.
[2] Results are adjusted to reflect total dust-lead loadings by exponentiating the "bioavailable" dust-lead loadings as reported in the study to the 1.1416 power.
[3] Results for the Baltimore R&M Study are converted from BRM dust-lead loadings to wipe-equivalent loadings.
[4] Results for the CAP study are converted from CAPS cyclone dust-lead loadings to wipe-equivalent loadings.

Floor dust-lead loadings

Table H-2 contains post-intervention floor dust-lead loading summaries for 24 study groups, including two control groups from the Baltimore R&M study and a total of nine groups from the HUD Grantees evaluation.

Eighteen study groups in Table H-2 contain information on dust-lead loading measurements immediately after intervention. Of these 18 groups, 10 had geometric mean or median dust-lead loadings ranging from 7-24 $\mu g/ft^2$ immediately after intervention. Eight of these 10 groups were from the HUD Grantees evaluation, whose pre-intervention median dust-lead loadings were no higher than 41 $\mu g/ft^2$. Eight of the 18 groups had geometric mean or median dust-lead loadings above 40 $\mu g/ft^2$ immediately after intervention.

Among the nine study groups in the HUD Grantees evaluation, seven groups had median dust-lead loadings that remained constant or steadily declined to below 20 $\mu g/ft^2$ for up to 12 months post-intervention. The other two study groups had median loadings increase to approximately pre-intervention levels over this 12-month period. In addition, the CAP study, the Baltimore Follow-up Paint Abatement study, the Baltimore R&M study, and Boston Interim Dust Intervention study, and the CLEARS suggest that geometric mean dust-lead loadings of below 40 $\mu g/ft^2$ can be observed for up to two years post-intervention. Only in study #1 of the Baltimore Experimental Paint Abatement studies and the Baltimore Traditional/Modified Paint Abatement study did geometric mean dust-lead loadings exceed 40 $\mu g/ft^2$ at approximately six months post-intervention; however, pre-intervention levels were higher than in the other studies.

Window sill dust-lead loadings

The same 24 study groups represented in Table H-2 also are included in Table H-3, where post-intervention window sill dust-lead loading summaries are presented. Results in Table H-3 indicate that post-intervention window sill dust-lead loadings are generally higher (up to double the value) than those for floors. The post-intervention geometric means (or medians) range from 18 $\mu g/ft^2$ to over 11,000 $\mu g/ft^2$.

As in Table H-2, 18 study groups in Table H-3 contain information on dust-lead loading measurements immediately after intervention. In the nine study groups of the HUD Grantees evaluation, the three groups of the Baltimore Follow-up Paint Abatement study, and study #2 of the Baltimore Experimental Paint Abatement studies, geometric mean or median dust-lead loadings immediately after intervention were below 100 $\mu g/ft^2$ (range: 18-84 $\mu g/ft^2$). In particular, study #2 of the Baltimore Experimental Paint Abatement studies saw a substantial decline in the geometric mean from pre-intervention (2,784 $\mu g/ft^2$) to immediately post-intervention (19 $\mu g/ft^2$). The remaining five study groups (study #1 of the Baltimore Experimental Paint Abatement studies, and study groups from the Baltimore R&M study and the Baltimore Traditional/Modified Paint Abatement study) had geometric mean dust-lead loadings exceeding 180 $\mu g/ft^2$ immediately post-intervention, but these groups had geometric mean pre-intervention dust-lead loadings above 300 $\mu g/ft^2$.

Except for the Milwaukee grantee, the study groups within the HUD Grantees evaluation had median window sill dust-lead loadings below 100 $\mu g/ft^2$ for up to 12 months post-intervention. Only two grantees (Boston and Wisconsin) did not have a decline in median window sill dust-lead loadings over the 12-month period.

In addition to the HUD Grantees evaluation, geometric mean window sill dust-lead loadings remain below 100 $\mu g/ft^2$ for up to 12 months post-intervention in the Baltimore Follow-up Paint Abatement study, the CAP study, and the CLEARS (Table H-3). However, in studies such as the Baltimore R&M study, the Baltimore Traditional/Modified Paint Abatement study, the Baltimore Experimental Paint Abatement studies, and the Boston Interim Dust Intervention study, geometric mean dust-lead loadings remain above 100 $\mu g/ft^2$ over time. In addition, the 19-month follow-up study group within the Baltimore Follow-up Paint Abatement study and the Baltimore Experimental Paint Abatement studies suggest that geometric mean dust-lead loadings can dip below 100 $\mu g/ft^2$ immediately after intervention, but then increase substantially after one year or so.

The summaries in Tables H-2 and H-3 are calculated across housing units in specified study groups. With the lack of results for individual housing units and the absence of variability estimates associated with these summaries, these summaries do not necessarily indicate what may be occurring in specific units (such as those housing units that see little, if any, change from pre- to post-intervention). Additional information on results within housing units should also be considered if such information is available.

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APPENDIX H2

INFORMATION ON THE INTERVENTION STUDIES INCLUDED IN TABLE H-1

Baltimore (MD) Dust Control Study

- Conducted in 1981 to assess whether lead-based paint abatement followed by periodic dust control would be more effective in reducing blood-lead concentration than performing only lead-based paint abatement.

- The study targeted housing units containing lead-based paint and children aged 15-72 months of age with at least two confirmed blood-lead concentration measurements between 30-49 µg/dL.

- Two groups of housing units (a control group of 35 homes and an experimental group of 14 homes) underwent lead-based paint abatement which entailed removing all peeling lead-containing interior and exterior paint from the residence. In addition, all child accessible surfaces (below 1.2 m) which may be chewed on were covered or rendered lead-free. No extensive clean-up procedures were required following the abatements.

- The experimental group received periodic dust-control (twice-monthly visits by a dust-control team) involving wet-mopping all rooms in the residence where dust-lead loadings in an initial survey exceeded 100 $\mu g/ft^2$.

- In the experimental group, dust samples were collected from all areas within the residence where the child spent time. The samples were collected with alcohol-treated wipes within a 1 ft^2 area of floor or from the entire window sill. The samples were collected at recruitment and both before and after each dust-control measure was performed.

Baltimore (MD) Experimental Paint Abatement Studies

- Studies to demonstrate and evaluate experimental lead-based paint abatement practices developed in response to the inadequacies uncovered in the Baltimore (MD) Traditional/Modified Paint Abatement Study.

- The experimental practices called for floor-to-ceiling abatement of all interior and exterior surfaces where lead content of the paint exceeded 0.7 mg/cm^2 by XRF or 0.5% by weight by wet chemical analysis. Several methods were tested, including encapsulation, off-site and on-site stripping, and replacement. The abatements took place either in unoccupied dwellings or the occupants were relocated during the abatement process. Lead-contaminated dust was contained and minimized during the abatement, and extensive clean-up activities included HEPA vacuuming and off-site waste disposal. In addition, extensive worker training and protection were provided.

- One study involving 6 housing units (poorly-maintained, had multiple lead-based paint hazards, built in the 1920s) received abatements from 10/86-1/87 as part of a pilot study examining the

experimental procedures. Four units were vacant, and two contained lead-poisoned children. This study evaluated short-term abatement efficacy (up to 9 months).

- Dust samples from the 6 housing units were collected immediately before abatement, during abatement, after the final clean-up, and at 1, 3, and 6-9 months following abatement.

- Another study which evaluated longer-term abatement efficacy (1.5-3.5 years) involved 13 occupied housing units which received experimental abatements from 1988-1991 by local pilot projects.

- Dust samples from the 13 housing units were collected from 12/91 - 01/92 at the same locations, where possible, that had been sampled pre- and immediately post-abatement.

- Alcohol-treated wet wipes were used to collect dust samples.

Baltimore (MD) Follow-up Paint Abatement Study

- Paint interventions (encapsulation, off-site and on-site stripping, and replacement) were performed (from floor to ceiling) on all interior and exterior surfaces where lead content of paint exceeded 0.7 mg/cm^2 by XRF or 0.5% by weight by wet chemical analysis. Abatements took place in unoccupied dwellings or after occupants were relocated.

- Lead-contaminated dust was contained and minimized during the abatement.

- Extensive clean-up activities (including HEPA vacuuming and off-site waste disposal) followed the abatement to ensure clearance. Clearance levels for floors, window sills, and window wells were set at 200 $\mu g/ft^2$, 500 $\mu g/ft^2$, and 800 $\mu g/ft^2$, respectively.

- Wipe dust-lead loading samples were taken upon clearance and at approximately 6, 12, and 19 months post-intervention from floors, window sills, and window wells in rooms where the child spent time.

- By 19 months post-intervention, only 5% of the homes were above clearance for floors, while 42% and 47% of the homes were above clearance levels for window sills and window wells, respectively.

Baltimore (MD) Repair & Maintenance (R&M) Study

- Study begun in 1993 to measure the short-term (2 to 6 months) and long-term (12 to 24 months) changes in dust-lead loadings and concentrations and in children's blood lead concentrations associated with conducting R&M interventions, and to make comparisons with

houses that had undergone previous comprehensive abatement, as well as a group of modern urban houses.

- Three types of dwellings were recruited in this study: 16 dwellings that were previously abated (in 1988-1992), 75 dwellings slated to receive R&M interventions, and 16 modern urban dwellings (assumed to be free of lead-based paint).

- The 75 R&M dwellings were older (mostly pre-1940), low-income dwellings which were divided into three equal groups according to the intervention performed in this study; the R&M-I group had low-level interventions (wet scraping, limited repainting, wet cleaning with TSP, HEPA vacuuming, placing an entryway mat, exterior surface stabilization, cleaning supplies and education to residents), the R&M-II group had intermediate-level interventions (R&M-I interventions plus treatments to floors, windows, and doors to reduce abrasion), and the R&M-III group had high-level interventions (R&M-II interventions plus trim replacement and encapsulation). The remaining dwellings acted as control dwellings.

- The BRM vacuum method was used to collect dust samples in this study (a modified HVS_3 cyclone collector). Floor and window sill dust samples were composites across multiple rooms. The environmental sampling design was as follows:

	Type of Data [1]							
	Blood		Dust		Soil		Water	
Campaign	RM [2]	Control [3]	RM	Control	RM	Control	RM	Control
Initial	/[a]	/	/	/	/	/	/[a]	/
Immediate Post-R&M	/		/		/		/[b]	
2 Months Post-R&M	/		/					
6 Months Post-R&M	/	/	/	/	/	/	/	/
12 Months Post-R&M	/	/	/	/				
18 Months Post-R&M	/	/	/	/	/	/	/	/
24 Months Post-R&M	/	/	/	/				

1. A '/' indicates that the data were collected for all R&M groups or all control groups. Symbol '/[a]' indicates that data collected only for R&M I and II groups, and '/[b]' only for R&M II and III.
2. RM denotes the component including three R&M groups: R&M I, R&M II and R&M III.
3. Control denotes the component including two control groups: Previously Abated and Modern Urban.

Baltimore (MD) Traditional/Modified Paint Abatement Study

- Conducted from 1984-1985 to evaluate the health and environmental impact of "traditional" and "modified" Baltimore practices for abating lead-based paint.

- The study contained housing units with multiple interior surfaces coated with lead-based paint and containing at least one child with a blood-lead concentration exceeding 30 µg/dL.

- "Traditional" abatements (conducted in 53 housing units) addressed deteriorated paint on surfaces up to four feet from the floor, and all hazardous paint on accessible surfaces which may be chewed on. Paint with a lead content greater than 0.7 mg/cm² by XRF or 0.5% by weight by wet chemical analysis was denoted hazardous. Open-flame burning and sanding techniques were commonly used, the abated surfaces were not repainted, and clean-up typically entailed, at most, dry sweeping.

- "Modified" abatements (conducted in 18 housing units) included the use of heat guns for paint removal and the repainting of abated surfaces. Furnishings were protected during abatement. In addition, clean-up efforts were conducted that involved wet-mopping with a high phosphate detergent, vacuuming with a standard shop vacuum, and off-site disposal of debris. In addition, worker training, protection, and supervision were provided.

- Neither traditional nor modified abatements considered window wells.

- Dust samples were obtained using a alcohol-treated wipe within a defined area template (1 ft²).

- Increased dust-lead loadings were measured immediately following traditional abatements (usually within two days) on or in close proximity to abated surfaces. Dust-lead levels measured after modified abatements were also higher than pre-abatement levels, but not to the extent seen for traditional practices. At six months post-abatement, PbD levels were comparable to, or greater than, their respective pre-abatement loadings in both study groups.

- Despite the implementation of improved practices, modified abatements, like traditional abatements, did not result in any long-term reductions of levels of lead in house dust. In addition, the activities further elevated blood-lead concentrations.

Boston (MA) Interim Dust Intervention Study

- Children under 4 years of age with modestly-elevated blood-lead concentration (11-24 µg/dL) and living in homes containing lead-based paint on at least two window sills or wells were targeted for participation. Lead hazard reduction activities were not previously conducted in these homes.

- Units with severe household lead hazards (i.e., paint chips on floors, large amounts of loose dust or paint chips in window wells, or holes larger than one inch wide in walls containing lead-based paint) were placed into an "automatic intervention" group (n=22).

- Remaining units were randomly assigned to a "randomized intervention" group (n=22) or a "randomized comparison" group (n=19).

- Units in the two intervention groups received a one-time paint and/or dust intervention. The intervention was considered "low-technology" and consisted of HEPA vacuuming all window well, window sill, and floor surfaces; washing window well and window sill surfaces with a tri-sodium phosphate (TSP) and water solution; repairing holes in walls; and re-painting window well and window sill surfaces to seal chipping or peeling paint. These units also received outreach and educational information including a demonstration of effective housekeeping techniques and monthly reminders with instructions to wash hard surface floors, window sills and wells with a TSP and water solution at least twice a week.

- The "randomized comparison" group received only the outreach visit, in which the home was visually assessed for lead hazards and the family was educated about the causes and prevention of lead poisoning. They were also provided with cleaning instructions and a free sample of TSP cleaning solution.

- 16 study units had permanent lead-based paint hazard remediation performed outside of the study protocol during the 6-month follow-up period. It is uncertain whether data for these units were treated differently in the study as a result.

- Dust samples were collected from floors, window sills, and window wells at baseline and 6 months post-intervention in all units, and at one month post-intervention for the two intervention groups. However, results were not reported for the one-month post-intervention campaign.

- Dust, soil, and water samples were analyzed using atomic absorption spectrophotometry (AAS). The detection limit for dust-lead loading results was 30 $\mu g/ft^2$.

- At 6 months post-intervention, geometric mean floor dust-lead loadings had decreased slightly for both intervention groups and increased in the comparison group. Geometric mean window sill dust-lead loadings decreased in all three groups, and geometric mean window well dust-lead loadings decreased for both intervention groups, but remained the same for the comparison group. None of the changes in dust-lead loadings was statistically significant.

Evaluation of the HUD Lead-Based Paint Hazard Control Grant Program (HUD Grantees)

- A formal evaluation of this ongoing study is being conducted to determine the effectiveness of various abatement methods used by State and local governments (who are HUD grantees) to reduce lead-based paint hazards in housing.

- Data collection began in 1994 and is expected to continue through 1999.

- Enrollment criteria varied among the different grantees and included targeting high-risk neighborhoods, homes with a lead-poisoned child, and unsolicited applications.

- Grantees were given the flexibility to select the type and intensity of the lead treatments for any particular unit. The intensity of an intervention is reported by location (interior, exterior, or site) and consists of a number representing the type of intervention performed in that location. The interventions range from taking no action, to a simple cleaning, to window replacement or full lead-based paint abatement. Some interim controls on soil (e.g., cover), as well as soil removal, were also performed.

- The grantees followed the same sampling protocols when collecting environmental samples (including dust using wipe techniques) and used standard forms developed specifically for the evaluation.

- Dust samples are collected from occupied housing units at four times during the study: at pre-intervention, immediately after intervention, and at 6 and 12 months following intervention. Nine of the 14 grantees participating in this evaluation are also collecting data at 24 and 36 months following intervention (these data have not yet been collected).

HUD Abatement Demonstration Program/
EPA Comprehensive Abatement Performance (CAP) Study

- The FHA portion of the HUD Abatement Demonstration Program ("HUD Demo") was conducted to estimated the comparative costs of alternative methods of lead-based paint abatement, to assess the efficacy of these methods, and to confirm the adequacy of worker protection safeguards during abatement.

- In the HUD Demo, lead-based paint abatements were performed in 172 HUD-owned, single-family properties located in seven cities across the country.

- Wipe dust samples were collected immediately following intervention and cleaning in the HUD Demo to evaluate whether lead levels were below 200 $\mu g/ft^2$ for floors and 500 $\mu g/ft^2$ for window sills. Repeated iterations of cleaning and dust sampling were performed if additional cleaning was deemed necessary.

- The CAP study was a follow-up to the HUD Demo performed in Denver, CO. The objectives of the CAP study were to assess the long-term efficacy of two primary abatement methods (encapsulation/enclosure and removal methods), to characterize lead levels in dust and soil in unabated homes and homes abated by different methods, to investigate the relationship between household dust-lead and lead from other sources (i.e., soil and air ducts), and to compare dust-lead loading results from cyclone vacuum sampling and wipe sampling protocols.

- The CAP study collected approximately 30 dust and soil samples at each of 52 occupied houses in Denver. Of these houses, 39 had lead-based paint abatements performed approximately two years earlier as part of the HUD Demo. The remaining 17 houses were considered within the HUD Demo, but were found to be free of lead-based paint and therefore had no abatements performed.

- The CAP study used a cyclone vacuum for collecting dust samples, where this vacuum was designed especially for this study. Dust samples were collected from the floor perimeter, window sills, window wells, entryway floors, and air ducts in either two or three rooms. Some wipe dust samples were also collected to make comparisons between wipe and vacuum dust-lead loadings.

- For window sills within 10 houses, pre-abatement dust-lead loadings and loadings measured during the CAP study both averaged between 175-200 $\mu g/ft^2$ (i.e., there was no evidence of significant differences between pre- and post-intervention dust-lead loadings). However, no adjustment was made between the wipe and vacuum methods used in pre- and post-intervention, respectively. A similar comparison between pre- and post-intervention dust-lead loadings for floors was not possible due to a lack of sufficient pre-intervention data.

- Abatements were found to be effective in that no significant difference in dust-lead loadings were observed between abated and unabated units in the CAP study (with the exception of dust from air ducts).

Jersey City (NJ) Children's Lead Exposure and Reduction (CLEAR) Dust Intervention Study

- Children under 3 years of age and at risk for elevated blood-lead concentration were targeted for participation.

- Lead hazard intervention consisted of biweekly assistance with home dust control (which included wet mopping of floors, damp-sponging of walls and horizontal surfaces, and HEPA vacuuming) and a series of educational sessions about lead. The cleaning teams provided the education during the course of their visits and mainly focused on teaching the caretakers how to clean the home.

- Dust-wipe samples were collected from uncarpeted floors in the kitchen and the floor of one other room frequented by the enrolled child.

- This analysis indicated that a thorough cleaning program reduced the geometric mean of the dust and lead loading and found that 68%, 75%, and 81% of the Lead Group (Study) homes had a reduction in lead loading on the kitchen floors, bedroom floors, and window sills, respectively.

Paris Paint Abatement Study

- Children less than 6 years of age, identified as severely lead-poisoned, and living in homes with lead-based paint were targeted for participation.

- A one-time paint intervention was performed, consisting of chemical stripping with caustic products, encapsulation (consisting of covering the toxic paint with coating material which prevents the dispersion of chips and particles into the home), replacement of antiquated elements and paint coatings of lead-based paints, and a final dust cleaning. Chemical stripping, using Peel Away™, was used on 52% of the items abated, a combination of stripping and encapsulation was used on 36% of the items abated, and a combination of encapsulation and replacement was used on 12% of the abated items. Families were relocated during abatement.

- Dust samples were collected in 29 homes at baseline, during the intervention, and at 1 to 2 months, 3 to 6 months, and 7 to 12 months post-intervention. Dust sampling was done by wiping the floor 1 meter from the wall, over an area of 30x30 cm^2, with a paper towel impregnated with alcohol.

- For 11 homes having an initial dust-lead loading greater than 92.9 $\mu g/ft^2$, median decreases were 144 $\mu g/ft^2$ at 1 to 2 months follow up and 157 $\mu g/ft^2$ at 3 to 6 months post-intervention.

- By 6 to 28 months post-intervention, the maximum dust-lead loadings were less than 92.9 $\mu g/ft^2$ for 40 out of 45 households.

Rochester (NY) Educational Intervention Study

- Included 104 of the 205 children in the Rochester Lead-in-Dust study, aged 12-31 months at enrollment, with low to moderate blood-lead concentration. Households were randomly assigned to an intervention or control group.

- Aim of the study was to determine the effectiveness of simple dust control by household members as a means of reducing children's blood-lead concentration.

- A trained interviewer visited families assigned to the intervention group. The interviewer stressed the importance of dust control as a means of reducing lead exposure and provided the household with cleaning supplies (paper towels, spray bottles and Ledisolv, a detergent developed specifically for lead contaminated house dust). Families were instructed to clean the entire house once every three months, interior window sills, window wells and floors near windows once every month, and carpets once a week with a vacuum cleaner, if available.

- For families assigned to the control group, only a brochure was provided containing information about lead poisoning and its prevention.

- Dust samples (using a K-mart brand of baby wipes) were collected at the time of the home visit (baseline) and at seven months following the visit. Locations of dust samples included entryway floors and the kitchen, as well as from the floors, interior window sills and window wells of the child's principal play area.

APPENDIX H3

DETAILED SUMMARY TABLES

Table H3-1. Summary of Floor Dust-Lead Loadings, Under Wipe Dust Sampling Techniques, at Pre- and Post-Intervention

Name of Study	Group of Housing Units Within the Study	Pre-Intervention Floor Dust-Lead Loadings			Post-Intervention Floor Dust-Lead Loadings				Difference from Pre-Intervention			
		N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)	Time Following Intervention	N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)	Time Following Intervention	N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)
Baltimore Experimental Paint Abatement Studies[2]	Study 1 (6 homes)	70	GM (95% CI)	1261 (908, 1761)	Immediately	70	GM (95% CI)	259 (196, 366)				
					6-9 Months	63	GM (95% CI)	99 (79, 136)				
	Study 2 (13 homes)	42	GM (95% CI)	556 (289, 1074)	Immediately	47	GM (95% CI)	20 (9.8, 40)				
					1.5 - 3.5 Years	71	GM (95% CI)	69 (40, 125)				
Baltimore Follow-up Paint Abatement Study[2]	6-Month Follow-up				Immediately Following Clearance	29	GM (95% CI)	29 (20,41)				
					5-7 Months		GM (95% CI)	22 (15, 31)				
	12-Month Follow-up				Immediately Following Clearance	27	GM (95% CI)	41 (25, 63)				
					10-14 Months		GM (95% CI)	20 (15, 29)				
	19-Month Follow-up				Immediately Following Clearance	22	GM (95% CI)	24 (14, 38)				
					14-24 Months		GM (95% CI)	36 (20, 63)				

Table H3-1. (cont.)

Name of Study	Group of Housing Units Within the Study	Pre-Intervention Floor Dust-Lead Loadings			Post-Intervention Floor Dust-Lead Loadings				Difference from Pre-Intervention			
		N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)	Time Following Intervention	N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)	Time Following Intervention	N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)
Baltimore R&M Study[3]	All Occupied Units	90	GM	40.9	Immediately	37	GM	52.5				
					2 Months	37	GM	40.2				
					6 Months	66	GM	26.5				
					12 Months	66	GM	27.1				
					18 Months	64	GM	24.8				
					24 Months	62	GM	24.1				
					48 Months	7	GM	8.4				
	Previously-Abated Units	16	GM	45.6	6 Months	14	GM	41.1				
					12 Months	14	GM	39.8				
					18 Months	13	GM	37.3				
					24 Months	13	GM	33.0				
	Units Slated for R&M Intervention	58	GM	58.6	Immediately	37	GM	52.5				
					2 Months	37	GM	40.2				
					6 Months	37	GM	36.3				
					12 Months	37	GM	39.9				
					18 Months	37	GM	33.3				
					24 Months	35	GM	35.0				

Table H3-1. (cont.)

Name of Study	Group of Housing Units Within the Study	Pre-Intervention Floor Dust-Lead Loadings			Post-Intervention Floor Dust-Lead Loadings				Difference from Pre-Intervention			
		N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)	Time Following Intervention	N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)	Time Following Intervention	N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)
Baltimore R&M Study[3]	Modern Urban Units	16	GM	10.0	6 Months	15	GM	8.1				
					12 Months	15	GM	7.3				
					18 Months	14	GM	7.8				
					24 Months	14	GM	7.1				
					48 Months	7	GM	8.4				
Baltimore Traditional/ Modified Paint Abatement Study[2]	Traditional	280	GM (95% CI)	549 (482, 645)	Immediately	271	GM (95% CI)	4033 (3269, 4936)				
					6 Months	234	GM (95% CI)	714 (594, 834)				
	Modified	82	GM (95% CI)	642 (433, 908)	Immediately	50	GM (95% CI)	1626 (1082, 2418)				
					6 Months	57	GM (95% CI)	714 (526, 983)				
Boston Interim Dust Intervention Study[2]	Automatic Intervention	10	GM	33	6 Months	10	GM	24				
	Randomized Intervention	9	GM	37	6 Months	9	GM	31				

Table H3-1. (cont.)

Name of Study	Group of Housing Units Within the Study	Pre-Intervention Floor Dust-Lead Loadings			Post-Intervention Floor Dust-Lead Loadings				Difference from Pre-Intervention			
		N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)	Time Following Intervention	N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)	Time Following Intervention	N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)
HUD Grantees	All Grantees	557	Median	19	Immediately Post	557	Median	17	Immediately Post	557	Percent Change	-11%
					6 Months		Median	14	6 Months			-26%
					12 Months		Median	14	12 Months			-26%
	Baltimore	32	Median	41	Immediately Post	32	Median	18				
					6 Months		Median	42				
					12 Months		Median	41				
	Boston	28	Median	24	Immediately Post	28	Median	54				
					6 Months		Median	16				
					12 Months		Median	18				
	Mass.	42	Median	24	Immediately Post	42	Median	20				
					6 Months		Median	11				
					12 Months		Median	9				
	Milwaukee	170	Median	14	Immediately Post	170	Median	15				
					6 Months		Median	10				
					12 Months		Median	10				

Table H3-1. (cont.)

Name of Study	Group of Housing Units Within the Study	Pre-Intervention Floor Dust-Lead Loadings			Post-Intervention Floor Dust-Lead Loadings				Difference from Pre-Intervention			
		N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)	Time Following Intervention	N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)	Time Following Intervention	N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)
HUD Grantees	Minnesota	105	Median	18	Immediately Post	105	Median	18				
					6 Months		Median	18				
					12 Months		Median	18				
	Rhode Island	31	Median	26	Immediately Post	31	Median	7				
					6 Months		Median	6				
					12 Months		Median	6				
	Vermont	43	Median	28	Immediately Post	43	Median	17				
					6 Months		Median	21				
					12 Months		Median	21				
	Wisconsin	48	Median	9	Immediately Post	48	Median	8				
					6 Months		Median	6				
					12 Months		Median	5				
CAP study[4]	Unabated homes				2 years	51	GM (25^{th} %ile) (75^{th} %ile)	15 (4.1) (47)				
	Abated homes				2 years	187	GM 25^{th} %ile 75^{th} %ile	21 (4.9) (76)				
Jersey City (NJ) CLEARS	Intervention Group	42	GM	22	12 Months	40	GM	15				

Table H3-1. (cont.)

Name of Study	Group of Housing Units Within the Study	Pre-Intervention Floor Dust-Lead Loadings			Post-Intervention Floor Dust-Lead Loadings				Difference from Pre-Intervention			
		N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)	Time Following Intervention	N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)	Time Following Intervention	N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)
Paris Paint Abatement Study	Intervention Group	24	Median	83.6					During Intervention	24	Median	+697
									1-2 Months	24	Median	-33.9
									3-6 Months	24	Median	-45.5
Rochester Educational Intervention Study	Intervention Group - Uncarpeted Floors								7 Months	80	Median Absolute Change (IQ Range)	-9.9 (-20,-2.3)
	Intervention Group - Carpeted Floors								7 Months	80		-6.9 (-10,-2.5)

[1] GM = geometric mean. AM = arithmetic mean. CI = Confidence Interval.
[2] Results (for geometric means and medians ONLY) are adjusted to reflect total dust-lead loadings by exponentiating the "bioavailable" dust-lead loadings as reported in the study to the 1.1416 power.
[3] Results for the Baltimore R&M Study are converted from BRM dust-lead loadings to wipe-equivalent loadings.
[4] Results for the CAP study are converted from CAPS cyclone dust-lead loadings to wipe-equivalent loadings.

Table H3-2. Summary of Window Sill Dust-Lead Loadings, Under Wipe Dust Sampling Techniques, at Pre- and Post-Intervention

Name of Study	Group of Housing Units Within the Study	Pre-Intervention Sill Dust-Lead Results			Post-Intervention Sill Dust-Lead Results				Difference from Pre-Intervention			
		N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)	Time Following Intervention	N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)	Time Following Intervention	N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)
Baltimore Experimental Paint Abatement Studies[2]	Study 1 (6 homes)	34	GM (95% CI)	15215 (9389, 24618)	Immediately Post	35	GM (95% CI)	737 (411, 1364)				
					6-9 Months	31	GM (95% CI)	958 (526, 1681)				
	Study 2 (13 homes)	53	GM (95% CI)	2784 (1322, 5891)	Immediately Post	54	GM (95% CI)	19 (9.8, 35)				
					1.5 - 3.5 Years	59	GM (95% CI)	199 (119, 331)				
Baltimore Follow-up Paint Abatement Study[2]	6-Month Follow-up				Immediately Following Clearance	27	GM (95% CI)	50 (32, 81)				
					5-7 Months	27	GM (95% CI)	71 (43, 119)				
	12-Month Follow-up				Immediately Following Clearance	26	GM (95% CI)	50 (31, 81)				
					10-14 Months	26	GM (95% CI)	41 (49, 132)				

Table H3-2. (cont.)

Name of Study	Group of Housing Units Within the Study	Pre-Intervention Sill Dust-Lead Results			Post-Intervention Sill Dust-Lead Results				Difference from Pre-Intervention			
		N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)	Time Following Intervention	N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)	Time Following Intervention	N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)
Baltimore Follow-up Paint Abatement Study[2]	19-Month Follow-up				Immediately Following Clearance	19	GM (95% CI)	50 (19, 52)				
					14-24 Months	19	GM (95% CI)	147 (66, 324)				
Baltimore R&M Study[3]	All Occupied Units	90	GM	356.2	Immediately	37	GM	185.4				
					2 Months	37	GM	241.4				
					6 Months	66	GM	138.2				
					12 Months	66	GM	136.2				
					18 Months	64	GM	135.1				
					24 Months	62	GM	117.5				
					48 Months	7	GM	37.1				
	Previously-Abated Units	16	GM	163.5	6 Months	14	GM	107.4				
					12 Months	14	GM	116.0				
					18 Months	13	GM	89.1				
					24 Months	13	GM	97.6				
	Units Slated for R&M Intervention	58	GM	778.4	Immediately	37	GM	185.4				
					2 Months	37	GM	241.4				
					6 Months	37	GM	247.0				
					12 Months	37	GM	237.6				
					18 Months	37	GM	246.8				
					24 Months	35	GM	204.9				

Table H3-2. (cont.)

Name of Study	Group of Housing Units Within the Study	Pre-Intervention Sill Dust-Lead Results			Post-Intervention Sill Dust-Lead Results				Difference from Pre-Intervention			
		N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)	Time Following Intervention	N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)	Time Following Intervention	N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)
Baltimore R&M Study[3]	Modern Urban Units	16	GM	45.6	6 Months	15	GM	41.7				
					12 Months	15	GM	40.0				
					18 Months	14	GM	40.5				
					24 Months	14	GM	34.8				
					48 Months	7	GM	37.1				
Baltimore Traditional/ Modified Paint Abatement Study[2]	Traditional	249	GM (95% CI)	3708 (2953, 4600)	Immediately Post	246	GM (95% CI)	11460 (8929, 14654)				
					6 Months	199	GM (95% CI)	4360 (3356, 5674)				
	Modified	45	GM (95% CI)	5209 (3765, 7246)	Immediately Post	64	GM (95% CI)	1496 (1058, 2114)				
					6 Months	66	GM (95% CI)	4662 (3126, 6961)				
Boston Interim Dust Intervention Study[2]	Automatic Intervention	10	GM	787	6 Months	10	GM	210				
	Randomized Intervention	9	GM	205	6 Months	9	GM	110				

Table H3-2. (cont.)

Name of Study	Group of Housing Units Within the Study	Pre-Intervention Sill Dust-Lead Results			Post-Intervention Sill Dust-Lead Results				Difference from Pre-Intervention			
		N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)	Time Following Intervention	N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)	Time Following Intervention	N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)
HUD Grantees	All Grantees	547	Median	258	Immediately Post	547	Median	52	Immediately Post	547	Median Percent Change	-80%
					6 Months		Median	97	6 Months			-62%
					12 Months		Median	90	12 Months			-65%
	Baltimore	32	Median	1191	Immediately Post	32	Median	49				
					6 Months		Median	87				
					12 Months		Median	68				
	Boston	29	Median	174	Immediately Post	29	Median	53				
					6 Months		Median	48				
					12 Months		Median	49				
	Mass.	43	Median	328	Immediately Post	43	Median	32				
					6 Months		Median	77				
					12 Months		Median	50				
	Milwaukee	166	Median	264	Immediately Post	166	Median	84				
					6 Months		Median	231				
					12 Months		Median	217				

Table H3-2. (cont.)

Name of Study	Group of Housing Units Within the Study	Pre-Intervention Sill Dust-Lead Results			Post-Intervention Sill Dust-Lead Results				Difference from Pre-Intervention			
		N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)	Time Following Intervention	N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)	Time Following Intervention	N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)
HUD Grantees	Minnesota	108	Median	266	Immediately Post	108	Median	66				
					6 Months		Median	86				
					12 Months		Median	77				
	Rhode Island	31	Median	314	Immediately Post	31	Median	18				
					6 Months		Median	87				
					12 Months		Median	85				
	Vermont	32	Median	147	Immediately Post	32	Median	21				
					6 Months		Median	60				
					12 Months		Median	40				
	Wisconsin	45	Median	150	Immediately Post	45	Median	22				
					6 Months		Median	37				
					12 Months		Median	51				
CAP study[4]	Unabated homes				2 years	38	GM (25^{th} %ile) (75^{th} %ile)	34 (7.1) (163)				
	Abated homes				2 years	78	GM 25^{th} %ile 75^{th} %ile	66 (11) (339)				
Jersey City (NJ) CLEARS	Intervention Group	39	GM	75	12 Months	36	GM	24				

Table H3-2. (cont.)

Name of Study	Group of Housing Units Within the Study	Pre-Intervention Sill Dust-Lead Results			Post-Intervention Sill Dust-Lead Results				Difference from Pre-Intervention			
		N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)	Time Following Intervention	N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)	Time Following Intervention	N	Type of Statistic[1]	Value of Statistic ($\mu g/ft^2$)
Rochester Educational Intervention Study	Intervention Group								7 Months	80	Median Absolute Change (IQ Range)	-58 (-154,-10)

[1] GM = geometric mean. AM = arithmetic mean. CI = Confidence Interval.
[2] Results (for geometric means and medians ONLY) are adjusted to reflect total dust-lead loadings by exponentiating the "bioavailable" dust-lead loadings as reported in the study to the 1.1416 power.
[3] Results for the Baltimore R&M Study are converted from BRM dust-lead loadings to wipe-equivalent loadings.
[4] Results for the CAP study are converted from CAPS cyclone dust-lead loadings to wipe-equivalent loadings.