Should the EPA Lead Dust Standards be Lowered?

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Dust Lead Standards

- Are they health-based?
  - Blood Lead Level
  - Probability of Exceedance
- Are they attainable?
- Can typical and high risk dwellings meet them over time?
- Are they measurable?

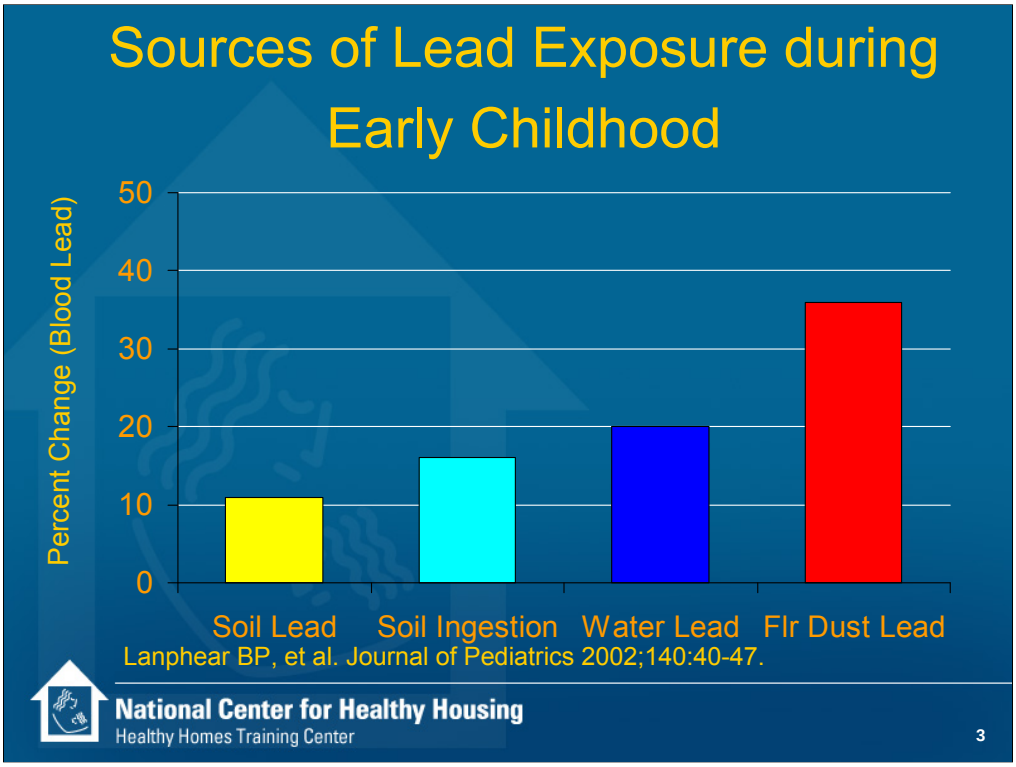

Figure represents percent difference in predicted blood Lead levels between the 5th percentile of the condition and the 95th percentile of the condition from a sample of 249 children in Rochester, NY. The results control for iron intake, paint chip ingestion, trough dust lead, time spent outdoors, property ownership and race. The children were followed from age 6 months to 24 months. For example, a child living in a home with floor dust lead at the 95th percentile (30.7 ug/ft2) is predicted to have a blood lead level 36% higher than a child living in a home with floor dust lead at the 5th percentile (0.8 ug/ft2), after controlling for the other factors.

	5thº%tile	95thº%tile
Soil lead	0.18 ppm	46.6 ppm
Soil Ingestion	Yes	No
Water lead	≤ 5 ppb	> 5 ppb

History of Dust Lead Standards

- Bioavailable Dust lead fraction
  - 200 µg/ft^2 (floor) and 500 µg/ft^2 (sill)
    (Farfel et al. - Baltimore Late 1980s), based on blood lead of 25 µg/dL
- Total lead – Dust lead levels
  - 100 µg/ft^2 (floor) and 500 µg/ft^2 (sill)
    (EPA Guidance, 1995)
  - 40 µg/ft^2 (floor) and 250 µg/ft^2 (sill)
    (HUD Std.1999) (EPA Std. 2001)

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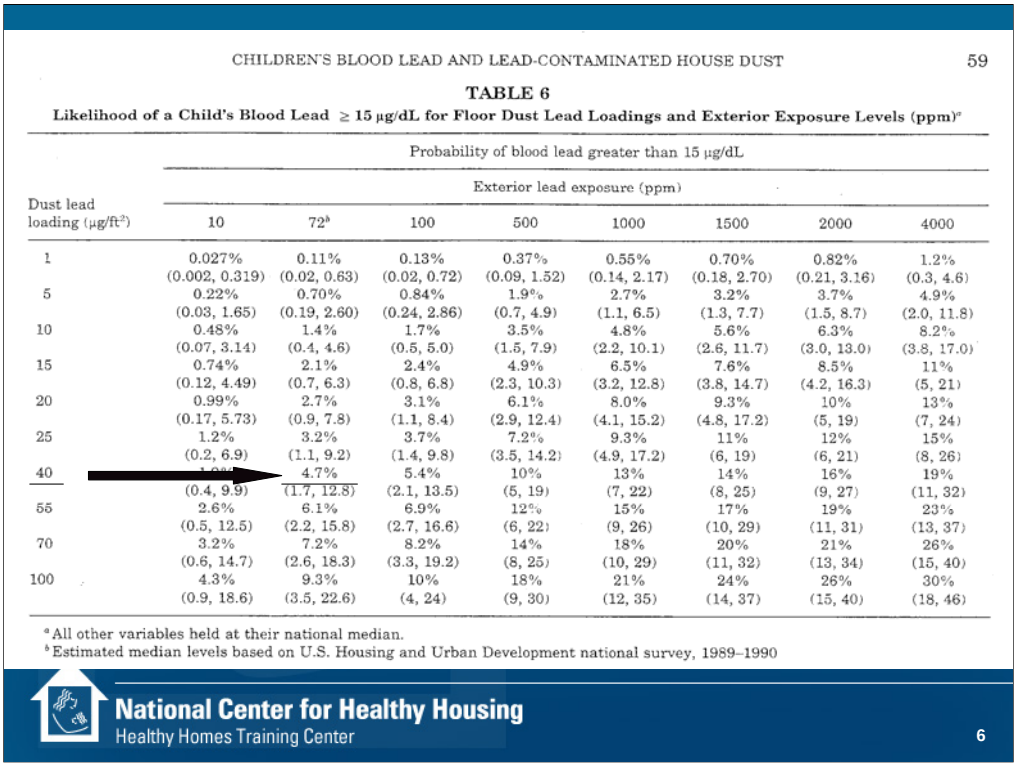
Existing Floor Dust Lead Standard

- Existing floor standard protects 95% of children from developing a Blood Lead > 15 µg/dL (from pooled analysis of high risk houses)
- In 1997, average lab reporting limit was about 25 µg/wipe (using flame AAS)
- Typically regulatory standards are set at least 3 to 10 times above detection limits, to ensure reliability of measurements



CHILDREN'S BLOOD LEAD AND LEAD-CONTAMINATED HOUSE DUST 59

TABLE 6

Likelihood of a Child's Blood Lead ≥ 15 µg/dL for Floor Dust Lead Loadings and Exterior Exposure Levels (ppm)[a]

	Probability of blood lead greater than 15 µg/dL							
	Exterior lead exposure (ppm)							
Dust lead loading (µg/ft²)	10	72[b]	100	500	1000	1500	2000	4000
1	0.027% (0.002, 0.319)	0.11% (0.02, 0.63)	0.13% (0.02, 0.72)	0.37% (0.09, 1.52)	0.55% (0.14, 2.17)	0.70% (0.18, 2.70)	0.82% (0.21, 3.16)	1.2% (0.3, 4.6)
5	0.22% (0.03, 1.65)	0.70% (0.19, 2.60)	0.84% (0.24, 2.86)	1.9% (0.7, 4.9)	2.7% (1.1, 6.5)	3.2% (1.3, 7.7)	3.7% (1.5, 8.7)	4.9% (2.0, 11.8)
10	0.48% (0.07, 3.14)	1.4% (0.4, 4.6)	1.7% (0.5, 5.0)	3.5% (1.5, 7.9)	4.8% (2.2, 10.1)	5.6% (2.6, 11.7)	6.3% (3.0, 13.0)	8.2% (3.8, 17.0)
15	0.74% (0.12, 4.49)	2.1% (0.7, 6.3)	2.4% (0.8, 6.8)	4.9% (2.3, 10.3)	6.5% (3.2, 12.8)	7.6% (3.8, 14.7)	8.5% (4.2, 16.3)	11% (5, 21)
20	0.99% (0.17, 5.73)	2.7% (0.9, 7.8)	3.1% (1.1, 8.4)	6.1% (2.9, 12.4)	8.0% (4.1, 15.2)	9.3% (4.8, 17.2)	10% (5, 19)	13% (7, 24)
25	1.2% (0.2, 6.9)	3.2% (1.1, 9.2)	3.7% (1.4, 9.8)	7.2% (3.5, 14.2)	9.3% (4.9, 17.2)	11% (6, 19)	12% (6, 21)	15% (8, 26)
40	[illegible] (0.4, 9.9)	4.7% (1.7, 12.8)	5.4% (2.1, 13.5)	10% (5, 19)	13% (7, 22)	14% (8, 25)	16% (9, 27)	19% (11, 32)
55	2.6% (0.5, 12.5)	6.1% (2.2, 15.8)	6.9% (2.7, 16.6)	12% (6, 22)	15% (9, 26)	17% (10, 29)	19% (11, 31)	23% (13, 37)
70	3.2% (0.6, 14.7)	7.2% (2.6, 18.3)	8.2% (3.3, 19.2)	14% (8, 25)	18% (10, 29)	20% (11, 32)	21% (13, 34)	26% (15, 40)
100	4.3% (0.9, 18.6)	9.3% (3.5, 22.6)	10% (4, 24)	18% (9, 30)	21% (12, 35)	24% (14, 37)	26% (15, 40)	30% (18, 46)

[a] All other variables held at their national median.
[b] Estimated median levels based on U.S. Housing and Urban Development national survey, 1989–1990

Figure presents the predicted probability of a child having a blood lead level of ≥ 15 µg/dl given a specified floor dust lead loading and soil or exterior dust lead levels, while controlling for other factors (water lead, maximum paint lead, paint condition, mouthing behavior, child age, race, and SES). The results are from a pooled analysis of 12 epidemiologic studies (1,297 children in 5 urban settings and 7 mining communities). Studies were conducted between 1985 and 1996, with a median age of 1993.

(Lanphear BP et al., The contribution of lead-contaminated house dust and residential soil to children's blood lead levels. Env. Res. (1998) 79, 51-68.)

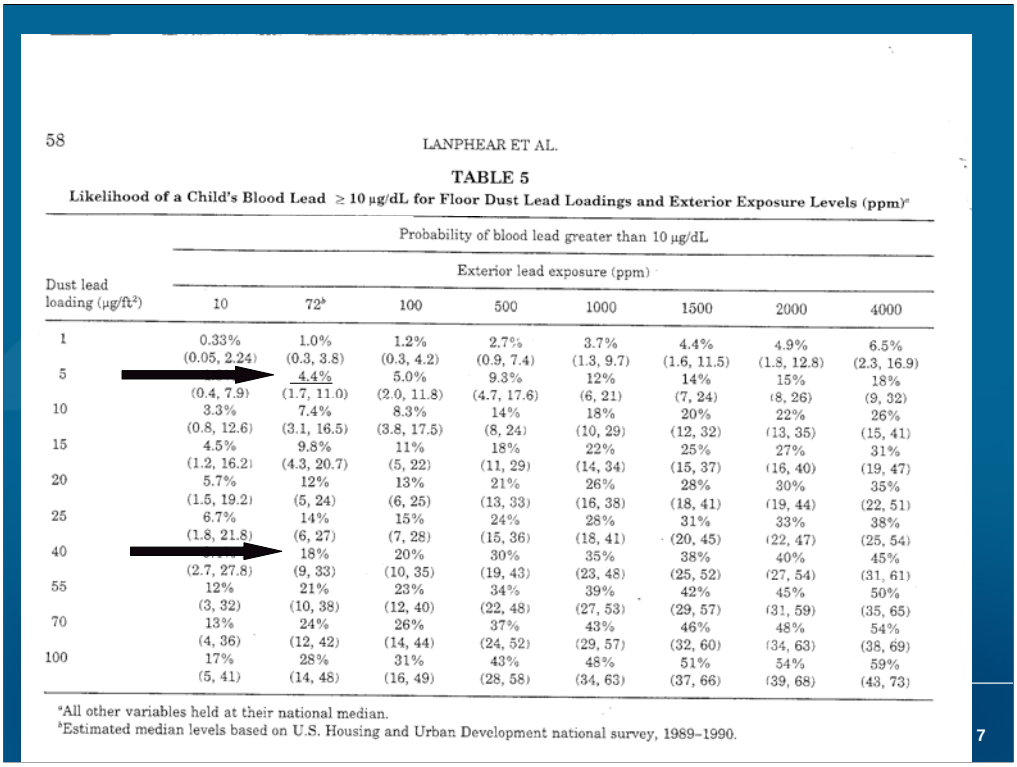


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TABLE 5

Likelihood of a Child's Blood Lead ≥ 10 µg/dL for Floor Dust Lead Loadings and Exterior Exposure Levels (ppm)[a]

Dust lead loading (µg/ft²)	Probability of blood lead greater than 10 µg/dL — Exterior lead exposure (ppm)							
	10	72[b]	100	500	1000	1500	2000	4000
1	0.33% (0.05, 2.24)	1.0% (0.3, 3.8)	1.2% (0.3, 4.2)	2.7% (0.9, 7.4)	3.7% (1.3, 9.7)	4.4% (1.6, 11.5)	4.9% (1.8, 12.8)	6.5% (2.3, 16.9)
5	[illegible] (0.4, 7.9)	4.4% (1.7, 11.0)	5.0% (2.0, 11.8)	9.3% (4.7, 17.6)	12% (6, 21)	14% (7, 24)	15% (8, 26)	18% (9, 32)
10	3.3% (0.8, 12.6)	7.4% (3.1, 16.5)	8.3% (3.8, 17.5)	14% (8, 24)	18% (10, 29)	20% (12, 32)	22% (13, 35)	26% (15, 41)
15	4.5% (1.2, 16.2)	9.8% (4.3, 20.7)	11% (5, 22)	18% (11, 29)	22% (14, 34)	25% (15, 37)	27% (16, 40)	31% (19, 47)
20	5.7% (1.5, 19.2)	12% (5, 24)	13% (6, 25)	21% (13, 33)	26% (16, 38)	28% (18, 41)	30% (19, 44)	35% (22, 51)
25	6.7% (1.8, 21.8)	14% (6, 27)	15% (7, 28)	24% (15, 36)	28% (18, 41)	31% (20, 45)	33% (22, 47)	38% (25, 54)
40	[illegible] (2.7, 27.8)	18% (9, 33)	20% (10, 35)	30% (19, 43)	35% (23, 48)	38% (25, 52)	40% (27, 54)	45% (31, 61)
55	12% (3, 32)	21% (10, 38)	23% (12, 40)	34% (22, 48)	39% (27, 53)	42% (29, 57)	45% (31, 59)	50% (35, 65)
70	13% (4, 36)	24% (12, 42)	26% (14, 44)	37% (24, 52)	43% (29, 57)	46% (32, 60)	48% (34, 63)	54% (38, 69)
100	17% (5, 41)	28% (14, 48)	31% (16, 49)	43% (28, 58)	48% (34, 63)	51% (37, 66)	54% (39, 68)	59% (43, 73)

[a]All other variables held at their national median.
[b]Estimated median levels based on U.S. Housing and Urban Development national survey, 1989–1990.

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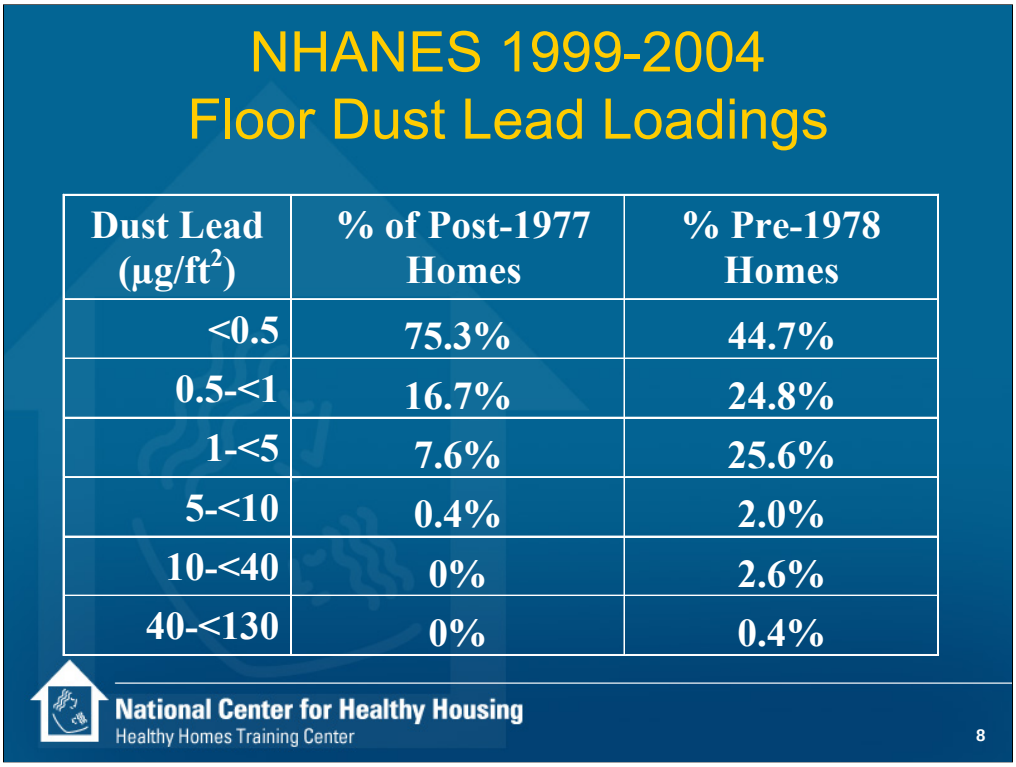
The results are from same study as previous slide.

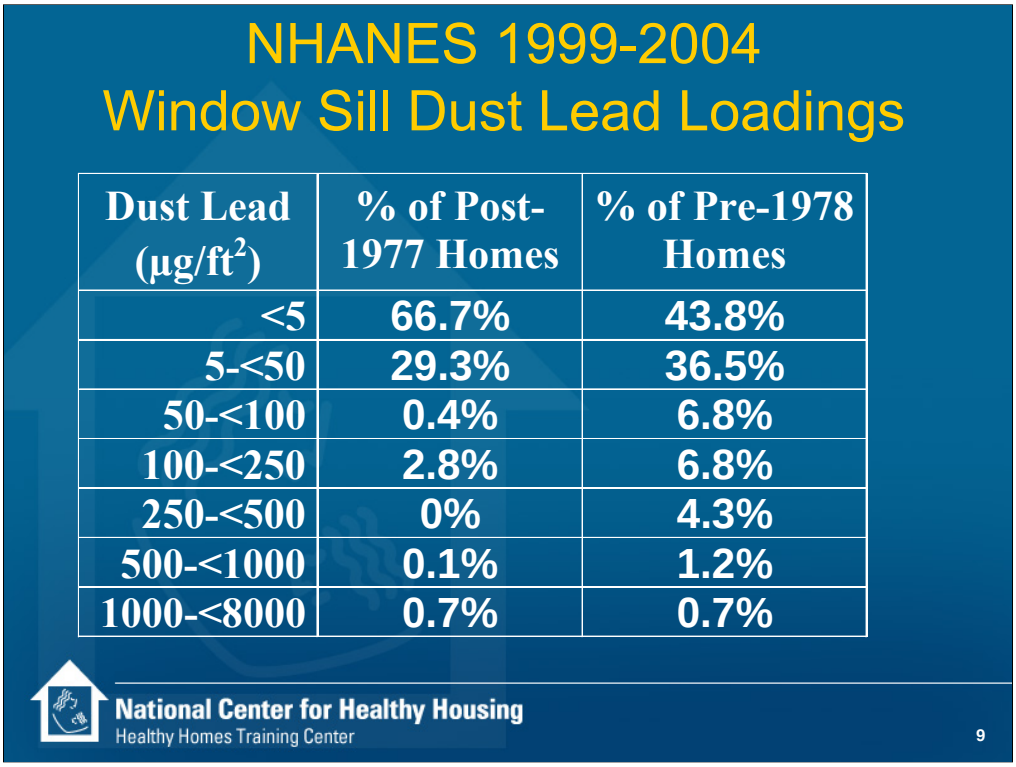
Figure presents the predicted probability of a child having a blood lead level of **≥ 10 µg/dl** given a specified floor dust lead loading and soil or exterior dust lead levels, while controlling for other factors (water lead, maximum paint lead, paint condition, mouthing behavior, child age, race, and SES).

(Lanphear BP et al., The contribution of lead-contaminated house dust and residential soil to children's blood lead levels. Env. Res. (1998) 79, 51-68.)



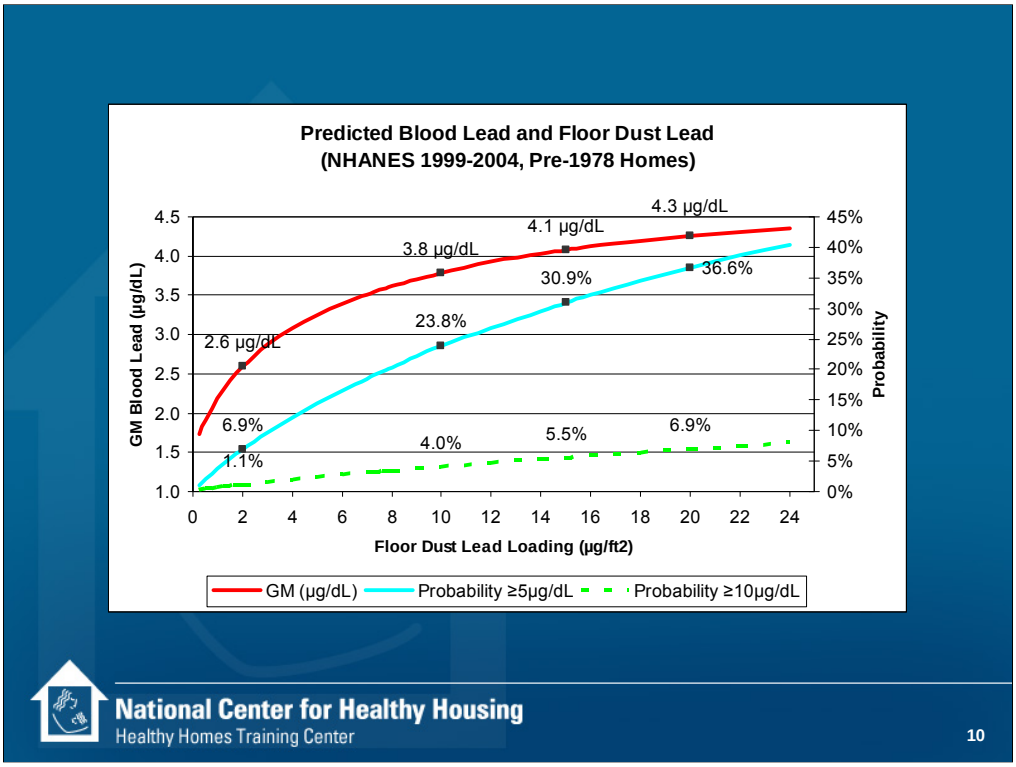
For the first time in 1999, the National Health and Nutrition Examination Survey (NHANES) collected dust lead for homes of participants surveyed. Single dust wipe samples were collected from the living areas of the homes. Under contract from HUD, Healthy Housing Solutions, Inc. analyzed these data and compared them to blood lead levels of children in the survey.

Publication pending: Gaitens JM et al., U.S. children's exposure to residential dust lead, 1999-2004: I. Housing and demographic factors. Env. Health Prospect. (submitted)



Data from same source as previous slide (sill dust lead loadings).

Publication pending: Gaitens JM et al., U.S. children's exposure to residential dust lead, 1999-2004: I. Housing and demographic factors. Env. Health Prospect. (submitted)



Publication pending: Dixon SL et al., U.S. children's exposure to residential dust lead, 1999-2004: II. The contribution of lead-contaminated dust to children's blood lead levels Env. Health Prospect. (submitted)

Predicted probabilities of blood lead levels ≥ 10 µg/dl or ≥ 5 µg/dl, at given floor dust lead loadings when controlling for factors below. Based on NHANES data from 1999-2004 (pre-1978 homes only). Predicted geometric mean (average) blood lead level if all children lived in a home with specified floor dust lead level.

<u>Significant Factors in Model</u>

Age (quartic function)

Race/ethnicity

Country of birth

Poverty income ratio

Anyone smoke inside the home

Serum cotinine concentration

Year of construction

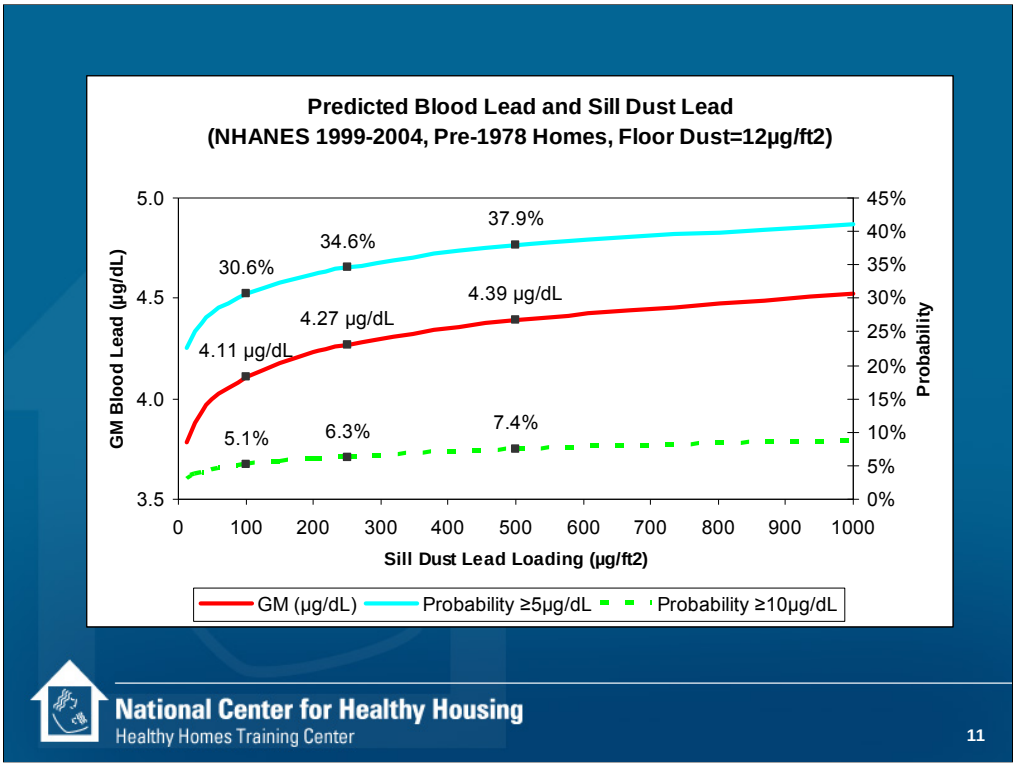
Home-apartment type

Renovation in pre-1978 home

Deteriorated paint inside pre-1950 home

Floor surface/condition and floor dust lead (cubic function)

Sill dust lead

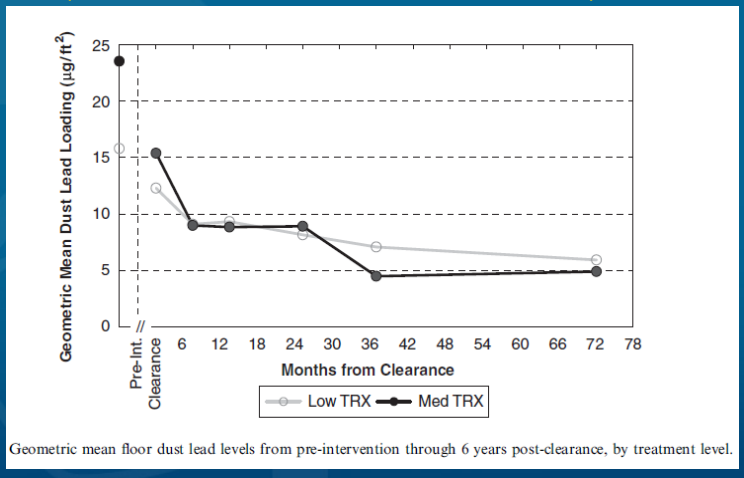


Publication pending: Dixon SL et al., U.S. children's exposure to residential dust lead, 1999-2004: II. The contribution of lead-contaminated dust to children's blood lead levels Env. Health Prospect. (submitted)

Predicted probabilities of blood lead levels ≥ 10 µg/dl or ≥ 5 µg/dl, at given sill dust lead loadings when controlling for factors below and setting floor dust lead to 12 µg/ft^2. Based on NHANES data from 1999-2004 (pre-1978 homes only). Predicted geometric mean (average) blood lead level if all children lived in a home with specified sill dust lead level.

Six-Year Follow-up of Evaluation of HUD LHC Grant Program

(Wilson et al. 2006. Env Res 102: 237-248)



Geometric mean floor dust lead levels from pre-intervention through 6 years post-clearance, by treatment level.

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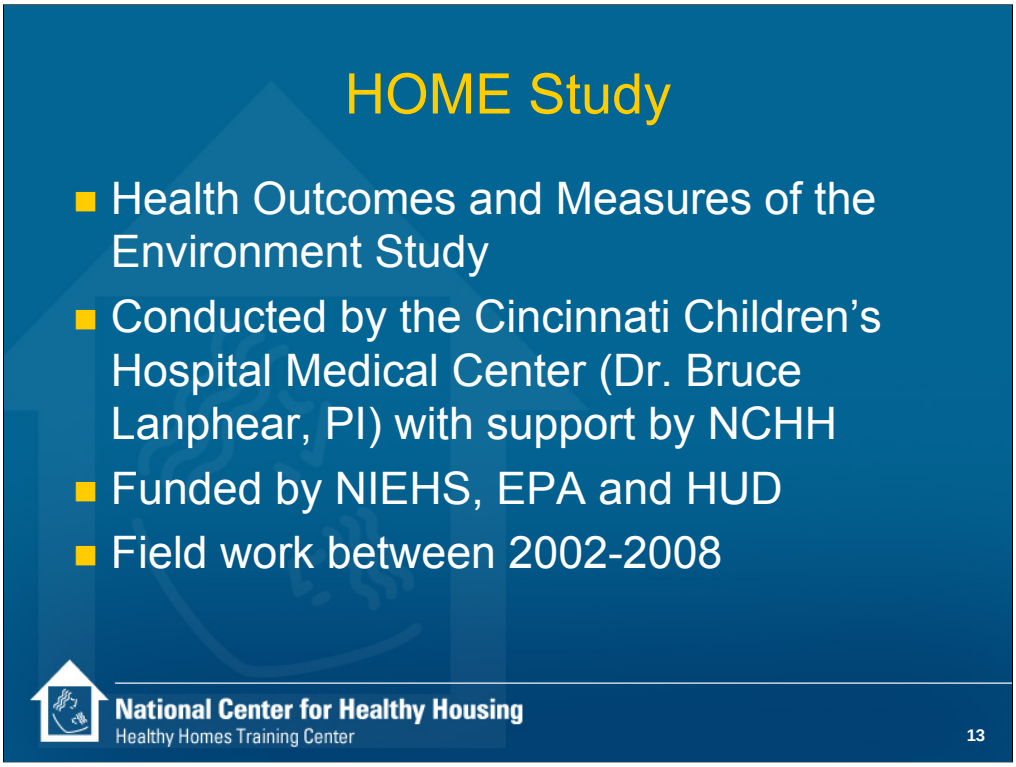
Findings from Six Year Follow-up to Evaluation of HUD Lead Hazard Control Grant Program. This study was completed by NCHH and Battelle in 2001-2002. Results provided early indication that floor dust lead levels could not only clear at levels well below 40 µg/ft^2 (and 100 µg/ft^2), but the dust lead levels would decline and remain below 10 µg/ft^2 for at least six years in homes that had been abated or had interim controls.

Wilson J et al., Evaluation of HUD-funded lead hazard control treatments at 6 years post-intervention. Env Res. (2006) 102: 237-248.



The following slides present early data from an ongoing study in Cincinnati that is examining the efficacy of primary prevention on children's blood lead. These slides focus solely on the dust lead outcomes of the study and whether lower dust lead levels that can be maintained.

Core Elements of HOME Study Lead Hazard Controls

Stabilize flaking, peeling or deteriorating lead-based paint

Create smooth and easily cleaned floors and windows

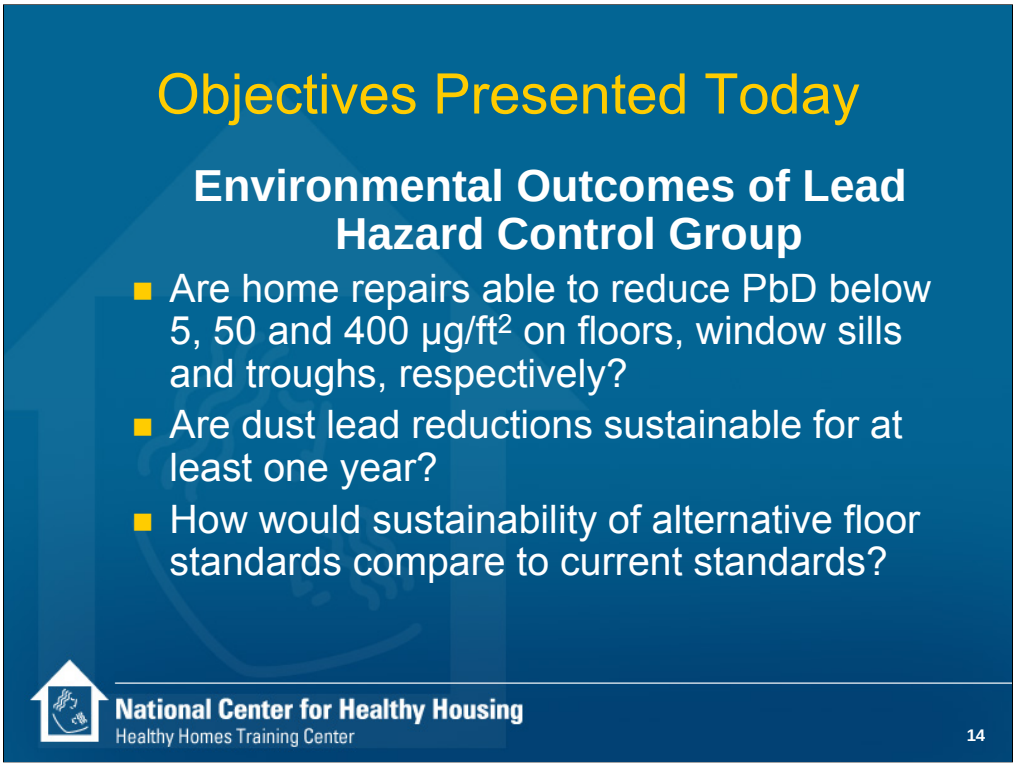
Install trough liners in windows to create a smooth and easily cleaned surface

Replace windows if > 10% deterioration and lead-based paint present

Extensive dust control and clearance testing

Cover bare lead-contaminated soil in play areas with mulch or groundcover

Install water filter if Pb concentration exceeds 2 ppb



Housing:

Age of Housing

59% Pre-1940

22% 1940-1960

19% 1960-1978

Tenure

69% Owner-Occupied

31% Rental

Children/Families:

Income

22% <$30,000

54% $30-80K

24% >$80,000

Race

69% White

24% Black

7% Other

Target "Clearance" Levels Are Achievable

- Floors: 99% of homes (142/143) were below **5 µg/ft²** at "clearance"; one home had a value of 5.4 µg/ft²
- Sills: 100% of homes with sills (132) were below **50 µg/ft²** at "clearance"
- Troughs: 99% of homes with troughs (141/142) were below **400 µg/ft²** at "clearance"; one home had a value of 753 µg/ft²

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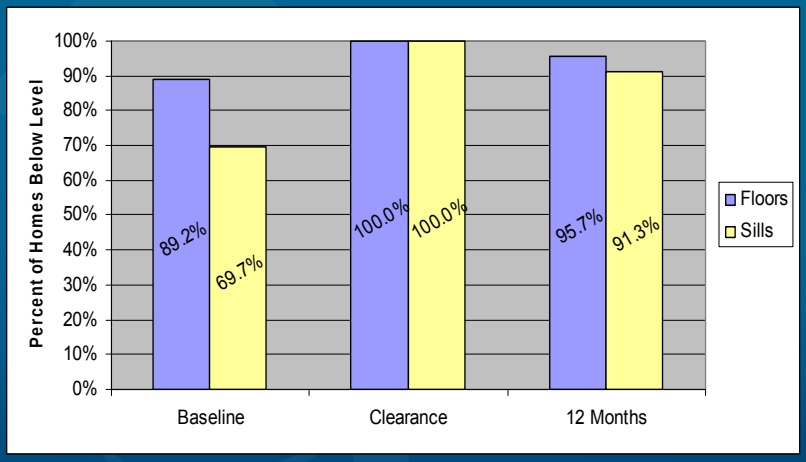
Sustainable Dust Lead Loadings
Floors: 10 µg/ft²; Sills 100 µg/ft²



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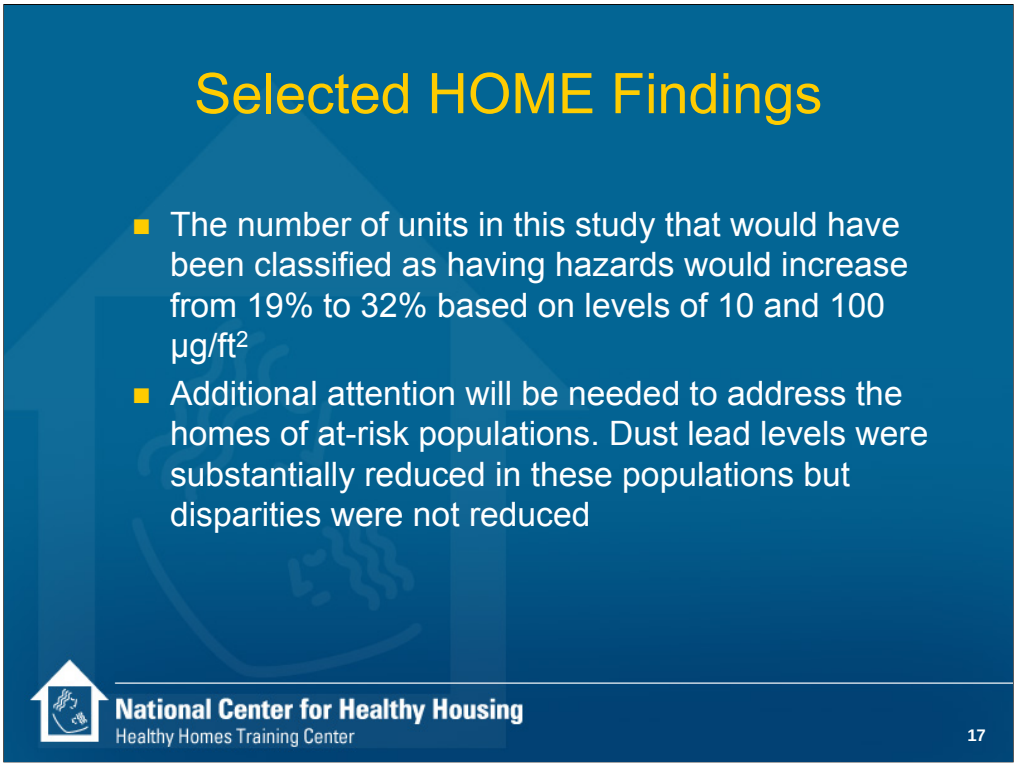

Families earning less than $30,000, Blacks and renters had lower reductions in percentages of homes exceeding the alternate standards (10, 100) than the overall study population

	Floors	Sills
Rental:	-49%	-49%
Black:	-54%	-46%
Lower Income:	-29%	-36%
Overall:	**-60%**	**-71%**

Measurement

- Reporting limit today for FAAS is in the 3-6 µg/wipe range. This translates to a lowest feasible standard per EPA rules of 12-25 µg/ft^2 for floors and 48-100 µg/ft^2 for sills
- Lower reporting limits feasible
  - ICP, Graphite Furnace
- May result in higher lab costs

A Dust Lead Standard of <10 µg/ft² (floors) and <100 µg/ft² (sills)

- **Protective** – Vast majority (>95%) of children will have blood lead < 10 µg/dL
- **Measurable** – 2-3 times greater than lab detection limit (Flame AAS)
- **Feasible** – Long-term studies show most houses can comply using existing lead cleaning methods
- **Not A Burden** – New evidence is that > 90% of pre-1978 homes are:
  - < 10 µg/ft² (floors)
  - < 100 µg/ft² (sills)

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Recommendations

- EPA should revise the standard
- EPA should be required to periodically review the science, as it does for NAAQS and other lead standards; Dust lead should be kept as low as possible
- Parents, contractors, risk assessors and others should immediately keep floor dust lead <10 µg/ft^2 and sill dust lead <100 µg/ft^2
- Local jurisdictions should consider adopting the NCHH recommended standard
- **We should act on what we know!**

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