



## ADVOCACY GROUP

Regulatory & Housing Policy

August 3, 2007

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**Sent via e-mail**

Dear Mr. Butterfield,

The National Association of Home Builders (NAHB) welcomes this opportunity to provide comments on the draft submitted by the Environmental Protection Agency (EPA) entitled "An Approach for Estimating Changes in Children's IQ from Lead Dust Generated during Renovation, Repair, And Painting in Residences and Child-Occupied Facilities" (the Approach). The Approach deserves very close Scrutiny by the Clean Air Scientific Advisory Committee panel (CASAC), especially if CASAC is to act as the peer reviewers for the Approach. The Approach presents a simple, intuitively appealing model, but a check of the facts shows that it does not describe or correspond to the remodeling process, its statistical procedures are fatally inappropriate, and it is not supported by the empirical record.

NAHB represents more than 235,000 member firms involved in home building, remodeling, multifamily construction, property management, housing finance, building product manufacturing and other aspects of residential and light commercial construction. More than 14,000 firms belong to NAHB Remodelers™. They comprise about one fifth of all firms that specify remodeling as a primary or secondary activity. Also of special concern under this proposal are the effects on rental properties. Because the Approach was written to inform the economic analysis of EPA's proposed "Lead in Renovation, Repair, and Painting" (RRP) rule, it may be used to establish requirements for remodeling and renovation work practices; training, certifying, and accrediting, NAHB Remodelers, renovators and their firms, NAHB's 14,000 remodeling firms, nearly 1000 multifamily construction firms and property management companies are concerned. Under EPA's proposed rule these two important segments of NAHB's membership face a significant regulatory impact. It could affect thousands of remodeling firms, and it may have an adverse affect on hundreds of thousands of people who live with lead-based paint in their homes.

EPA's model in the Approach is a simple one: RRP produces dust, dust contains lead, children ingest the dust, the lead goes into the blood, and the blood distributes the lead to body tissues where it does damage. Each of those statements has some degree of truth, but none of them are deterministic. The outcomes—and frequently the inputs—of each those statements are random variables. Once each of these statements is quantified with data, the result is number that cannot be known in any particular case. Instead, one

gets a distribution of the number, with a central tendency and a measure of dispersion. One might say the results are “wobbly.” What EPA has done is pile six wobbly variables on top of each other to produce a precise result. NAHB avers that EPA has failed to show any kind of result at all.

In terms of probability, for EPA’s model to work, several uncertain things must happen jointly: the RRP activity must leave significant dust AND the dust must contain significant lead AND the children have to ingest the dust AND the lead will have to be absorbed into the blood AND the lead will have to do damage. That is a very strong joint probability to assume. As appealing as the model is, the facts do not support it. Partly this is because the Approach relies on OPPT numbers, which were designed to create high dust levels, not to emulate RRP conditions and practices. Partly of the failure of the Approach is due to an error of statistical procedure. And part of the failure of the Approach is that it is refuted by the facts, to the extent that failure to reject the null hypothesis is a rejection of the alternative and an acceptance of the null. Model or no model, RRP activities do not, on the whole, raise blood lead levels (BLLs). For those publicized events where someone was injured by lead from RRP activities, there are other, unpublicized events where lead injury was prevented by having some RRP done.

### **OPPT data do not characterize RRP.**

#### *OPPT study exaggerates the amount of dust present.*

For all quantitative descriptions of RRP, EPA relies on data from its own research, published in January of 2007 by the Office of Pollution Prevention and Toxics (OPPT).<sup>1</sup> OPPT assumes there is no cleaning during the process of remodeling. All of the dust was retained loose in the work except for that which escaped; no dust was removed intentionally as part of a cleaning process. Therefore, the total amount of dust generated would also be the highest amount of dust present at any time. Remodelers do not let dust and debris accumulate like that. Remodelers clean as they go; they clean dust and debris as an integral part of the work. Continual effort is made to keep dust levels low, because homeowners won’t tolerate extensive fugitive dust. At no time is the amount of dust present equal to the total amount generated; at all times, the amount of dust present is less than the total amount generated, because some dust has already been removed. Therefore, the OPPT study, and *a fortiori*, the Approach overestimates the amount of dust that would be in the work area at the close of “the dust-generating phase.” See Draft for CASAC July 2007, Ex. 4-2 and text section 4.1.1.2, 9. 53.

#### *Pre-cleaning*

Battelle Laboratories (EPA’s contractor) tried to clean *every* floor surface to a level below 10µg/sq.ft. Finding that goal unattainable, they settled for an *average* level below

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<sup>1</sup> *Characterization of Dust Lead Levels after Renovation, Repair and Painting Activities*. EPA, January, 2007.

40µg/sq.ft. At this average, assuming there is any variation in the samples at all, some of the samples would be above 40µg/sq.ft. Sometimes the workers could not even attain the 40µg average.<sup>2</sup> Therefore, Battelle's workers were unable to ensure that every floor surface as free from lead hazard before the work began. Pre-cleaning is a chimera that has no apparent affect on the lead status of the home at the conclusion of RRP, when the premises are returned to the resident.

As noted in NAHB LSWP, the floor lead dust levels ranged from 0.1µg/sq.ft. to 9,407 µg/sq.ft. in a HUD funded study of 424 occupied residential dwellings. The pre-cleaned homes of the OPPT study are obviously not representative of the homes remodelers will work in, and they do not represent the target housing where RRP will take place.<sup>3</sup>

### *Sample Size*

The OPPT study was conducted in 12 buildings. These buildings included an apartment building and a duplex, so there were fifteen units, but the apartment unit characteristics are not likely to be independent of each other. Likewise, the duplex units are not independent because of the common structure and builder. Therefore, OPPT does not have a set of 15 independent randomly chosen units. From its own experience, NAHB understands the difficulty of finding data sources and research sites for this kind of research. However, the difficulty of finding data does not impart any extra validity to sparse results. Instead, it means that if the results must be used at all, they must be used very cautiously, because the estimates are based on very few degrees of freedom, and there can be great variability in outcomes. It is much harder for statistics to make precise, reliable estimates when sample sizes are small like this.

## **Dust sampling and imputation**

### *Background Concentration*

Background air concentrations are assumed to be equal to national ambient concentrations. However, this will not be true if the home has degraded lead paint or other lead dust sources. The age of the home can act as a proxy for the existence and condition of lead paint in the home. Yard dust also is relevant to background (non-activity related) suspended lead dust.

### *Settling of airborne dust*

The imputation of dust amounts on settling of airborne dust over a one-week period, based on air concentrations. However, air concentrations of dust are not a valid predictor of settling patterns in the presence of any air movement, such as HVAC activity, the movement of persons, or clean-up of the site. EPA assumes that the site will be left still, sealed, and unoccupied for a week, but in fact, the remodeler is generally under great pressure to clean the site as soon as possible in order to return use to the

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<sup>2</sup> OPPT page 6-6.

<sup>3</sup> LSWP page 31, citing Wilson, J., et al, *Evaluation of HUD-funded Lead Hazard Control Treatments at 6 Years Post-intervention*, Environmental Research, pp 237-248, Volume 102, Issue 2, October 2006.

occupants. The long settling period described by EPA will never happen on a job site. See Equation 4-4.

### **Modeling of exposures**

#### *The economic benefit would be limited to activities stopped by the rule.*

It is important to remember that the purpose of the Approach is to assist in estimating the economic benefits of regulating RRP to the extent, if any, that the RRP activities create a hazard. It is not supposed to be a model of the extent or consequences of exposure to lead, nor is it supposed to be a study of whether particular RRP activities create lead hazards. The purpose is to assist the estimation of the economic benefits, if any, that would result from the elimination of any hazards shown to be created by RRP, and hazard has not been defined in terms of IQ, floor dust lead concentration, or (for EPA purposes) air dust concentration.<sup>4</sup> If RRP activities do not move the lead loadings above the hazard levels, then the rule will have no economic impact, so the effects of low dust loadings or BLLs (less than 10 µg/dL) are not relevant to the economic impact of the rule. Those low dust loadings are not affected. They have no place in the Approach.

#### *Mathematical error*

The derivation of  $ACONC_{PH=ii,CO}$  is erroneous, for it does not weight the model for the area of house or extent of renovation. Instead, the activity concentrations  $ACONC_{PH=ii,CO,ACT}$  are averaged arithmetically without weights in Equation 4-2. The activity averages themselves are weighted for the workspace, adjacent room, and rest of the building in equation 4-1. However, those weights are internal to each activity and they do not necessarily reflect the extent of the remodeled area. The weights in Equation 4-1 must always sum to unity, by the definition in the penultimate equation on page 54. Incidentally, the OPPT study found there was no contamination of the rest of the house beyond the workroom and the adjacent room, so the dust air concentration where  $LOC = 3$  will always be zero. Hence, the third term of Equation 4-1 is always zero.

#### *Ignored sources of lead*

10. Section 3.3 states a half-truth that reveals the intent of the document. It states, “A child’s exposure to Pb over the first six years of life consists of exposure to both Pb released as a result of RRP activities and background concentrations.”<sup>5</sup> The implication of this statement is that no exposure comes from drinking water, food, food wrappers, candy, toys, jewelry, lead crystal, lead-glazed table-ware, pewter eating or drinking utensils, old painted furniture, hobbies that use lead, or exposures while away from the home. This statement also ignores the exposures that can come from mouthing of intact or deteriorating interior surfaces coated at some depth with lead-based paint, which are not yet releasing dust. These cannot be amalgamated into “background,” because it is clear that background only applies to ambient dust. It is not helpful to children’s health to assume away any risk from the continuing presence of lead based paint; any such risk

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<sup>4</sup> The Occupational Safety and Health Administration has rule regulating lead dust air concentrations, which is currently under review.

<sup>5</sup> Approach, page 33.

must be quantified. An economic analysis would have to consider the risks from leaving the paint alone and compare them to the risks of RRP activities. As the NAHB LSWP study shows quite clearly, RRP always reduces lead dust levels, when done in accordance with EPA's and NAHB's recommended work practices.

### **The empirical record**

#### *Rabinowitz(1)*

The empirical record does not support the theory that remodeling causes higher blood levels. The earliest article known to NAHB is by Rabinowitz, *et. al* from 1984.<sup>6</sup> NAHB has access only to the abstract, where the authors say postnatal BLLs were "highly correlated" lead in dust and soil, reporting the correlation (perhaps Pearson's *r*) and the *p* levels. The abstract goes on to say, "Refinishing activity in the presence of lead paint was associated with elevations of PbB." However, the abstract reports no level of statistical significance, as it does for the previous variables, so the correlation may merely be positive by randomness, and not statistically different from zero. CASAC members may wish to investigate this.

#### *Rabinowitz (2)*

At approximately the same time in mid-1984, Dr. Rabinowitz *et al.* wrote a brief article that focused specifically on paint refinishing or resurfacing (the terms are used interchangeably in the article) and its effect, if any, on children's BLLs.<sup>7</sup> The particular 249 children were chosen according to the level of umbilical cord lead at birth, and they were sorted into low, medium, and high groups, where "high" meant >10 µg/dL. The paint content of their homes walls and sills was also grouped into low, medium, and high levels of lead, where "high" was > 3 percent. Complete lead paint data were available for only 91 of the infants. The only explanatory variables were the lead level of the paint and the dichotomous variable of whether refinishing or resurfacing work had been done in the previous six months. The children's blood was checked every six months; there were 438 six-month intervals, resulting in 438 blood samples.

The authors report that out of all the events where there was "resurfacing," and the lead content of the paint was known, one group had a significant increase in BLLs, which was the group with high lead levels in the paint (>3 percent). These are likely to be older homes, since the lead content of paint was higher in the earlier 20<sup>th</sup> century. The medium and low paint lead levels did not show a significant relationship to resurfacing, even though the middle group spanned the regulatory criterion of 1 percent; the middle group ranged from 0.5 to 3.0 percent lead in the paint. The paint level was unknown in 106 events, which is more like a random sample. Where there was resurfacing within a six-month interval, and the paint content was unknown, the mean change in BLL was 0.9 with a standard error of 0.8; there is no significant difference between the BLLs of

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<sup>6</sup> Rabinowitz, Michael, Alan Leviton, Herbert Needleman, David Bellinger, and Christine Waternaux. "Environmental correlates of infant blood lead levels in Boston." *Environmental Research*, Volume 38, Issue 1, October 1985, Pages 96-107.

<sup>7</sup> Rabinowitz, Michael, Alan Leviton, and David Bellinger. "Home Refinishing, Lead Paint, and Infant Blood Levels, *American Journal of Public Health*, vol. 75, p. 403. 1985.

children where there was resurfacing and where there was not. Any statistical significance comes from only from the high lead homes, which will tend to be older and more likely to have deteriorating surfaces.

### “Phase III”

EPA contracted for its own study of the relationship, if any, between RRP activities and elevated BLLs, which was the “Phase III” or Wisconsin Blood Lead Study.<sup>8</sup> As NAHB has explained elsewhere, the contractor conducted an improper hypothesis test and excluded all of the observations between 7 and 10µg Pb/dL of blood. When all the data are included, the significance of RRP for elevated BLLs disappears. Therefore, the Phase III study is consistent with the idea that RRP is not associated with elevated BLLs in children, and it is not consistent with the idea that RRP is associated with elevated BLLs in children.

### Rochester Lead in Dust

The Rochester Lead-in-Dust study also failed to find a positive association between RRP and children’s BLLs. In fact, the relationship was negative for both interior and exterior renovation. That is, RRP was associated with a decrease in BLLs, as NAHB would expect. However, only the exterior renovation was significantly negative at the 5 percent level in univariate regression, neither variable was significant in multivariate regression.<sup>9</sup>

### Reissman

A 2002 study by Reissman *et al.* again failed to show any statistically significant effect of RRP on elevated BLLs.<sup>10</sup> The authors state, “... renovation work had a weak and nonsignificant association with case status,” and they conclude “...some type of renovation and repair work occurs commonly in homes occupied by young children in the target areas of New York City, although there is little or no overall association between renovation and risk for elevated BLLs”. Like the Rochester Lead-in-Dust study and like the Phase II study, the Reissman study is not consistent with the idea that RRP is associated with elevated BLLs, and is consistent with the opposite, that RRP is not associated with elevated BLLs.

### MMWR

One final article needs discussion, only because it is mentioned frequently, presumably by people who have not read it. This article is a report from the New York State Department of Health (NYSDOH) that appeared in 1997 in the *Mortality and Morbidity Weekly Report* (MMWR) published by the Centers for Disease Control.<sup>11</sup> Though EPA

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<sup>8</sup> Lead Exposure Associated with Renovation and Remodeling Activities: Phase III, Wisconsin Childhood Blood-Lead Study, March 1999 (EPA 747-R-99-002)

<sup>9</sup>Bruce P. Lanphear, Principal Investigator, *et al. The Relation Of Lead-Contaminated House Dust And Blood Lead Levels Among Urban Children, Final Report, Volume II.* Table 19, page 28. 1994.

<sup>10</sup> Reissman, D.B., et al. 2002. *Is Home Renovation or Repair a Risk Factor for Exposure to Lead Among Children Residing in New York City?* *Journal of Urban Health: Bulletin of the New York Academy of Medicine*, 79(4): 502-511.

<sup>11</sup>Center for Disease Control (CDC). 1997. Children with Elevated Blood Lead Levels Attributed to Home Renovation and Remodeling Activities – New York, 1993-1194, *Morbidity and Mortality Weekly Report*, 45(51-52): 1120-3. <http://www.cdc.gov/mmwr/PDF/wk/mm4551.pdf> .

has claimed the NYSDOH study shows that half the children in New York with elevated BLLs came from households with multiple RRP activities RRP, the facts contradict that statement.<sup>12</sup> Of the 4,608 children with elevated BLLs, 320 came from 258 households were attributable to RRP activity, and of those 320 children, 150 came from households reporting multiple RRP activities. That is a maximum possible value of 3.26 percent for this random variable. When published, the MMWR editors spent considerable text explaining why the article itself was not valid scientifically, though they felt it called for more research. The MMWR article is simply not a scientific study.

In sum, one study may show a significant relationship, another finds a significant relationship only for one sub-sample and fails to find a significant relationship in any sets that do not include that small sub-sample, and three studies fail to find any significant relationship at all. The consensus must be that RRP does not cause elevated BLLs in children.

### **Conversion of loadings to concentrations**

#### *Non-representative data*

To determine a relationship between lead loadings and concentration, EPA uses antiquated data from a time when ambient lead dust was quite high, due to sixty years of burning leaded gasoline. Though little leaded gasoline was still being sold (it was not banned until 1996), the residue of that lead was still abundant. Ambient lead levels are now much lower, which calls into question the relevance of any relationship between lead loadings and concentration that may have existed in 1989, almost twenty years ago.

#### *Carpeting and Upholstery*

EPA glosses over the issue of converting loadings from carpet. In fact, the literature is settled that it is very difficult to clean lead dust from carpets and upholstery. There is no reason to believe that equation 4-5 will hold for carpeted or upholstered surfaces, if it holds anywhere.

#### *Omitted Variable Bias*

The proposed transformations of dust loadings into concentrations is fatally defective because of the omission of important explanatory variables. Exhibits C-7 and C-8 list the correlation coefficients of several variables with the dust lead concentration and the log of that concentration. All of the listed variables are significantly correlated with the log. Some of the variables are merely transformations of others, but some have independent meaning, including the interior XRF reading, the yard dust lead concentration, and a dummy variable for the presence of lead-based paint. Yet none of these explanatory variables were used in the regressions. The regressions used only one explanatory variable, the log of the vacuum dust lead loading, even though other explanatory variables were suggested by theory and correlated in fact with the dependent variable. The omission of relevant variables lead to omitted variable bias, and the regression estimates are not valid estimates of the true value of the parameter coefficient.

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<sup>12</sup> EPA Economic Analysis for this Proposed Rule, 2006, Chapter 5, p. 6.

In the presence of omitted variable bias, the relationship between the estimate and the true value is unknown.

Data on the relationship between dust lead loadings and concentrations were collected in 1989-1990. The sample consists of 284 houses from 30 counties (77 built prior to 1940, 87 units – 1940-1959, 120 units – 1960-1979). EPA developed a set of weights to extrapolate the sample results to all US private residencies.

Using this data set EPA constructs a regression model to predict lead concentrations (blue nozzle) from vacuum floor dust lead loadings. Additional explanatory variables considered are:

- building vintage (<1940, 1940-1959, 1960-1979);
- a dummy variable for the observed presence of lead-based paint (LBP);
- vacuum window sill dust lead loading;
- average yard soil dust lead concentration;
- maximum interior and exterior X-ray fluorescence (XRF) lead concentration.

All explanatory variables are found to be highly correlated with dust lead concentrations in a log-log form. In a log-log regression analysis, the inclusion of yard soil lead and interior XRF lead concentration in addition to dust lead loadings, dramatically improves the fit of the model boosting  $R^2$  from 0.46 to 0.55. Similar increases in  $R^2$  are achieved in regressions stratified by building vintage: in buildings built prior 1940, both interior XRF and yard soil lead concentration are significant, in newer buildings only yard soil lead concentrations retain significance.

Even though average yard soil dust lead concentrations and interior XRF lead concentration strongly influence predicted dust concentrations, they are excluded from the final model used in the EPA report, where there is only one explanatory variable – dust lead loadings. This clearly introduces the omitted variable bias into the model, since dust lead loadings pick up effects of the omitted variables. Consequently, the model coefficients on dust loadings are upward biased, that is they attribute unnecessarily high levels of dust lead concentration to dust loadings and not to yard soil dust lead and interior XRF lead concentration. One can see that the coefficients for vacuum loadings are much lower in the multiple regressions in Exhibits C-10 and C-11, on pages C-11 and C-12, compared to univariate regressions for the same housing vintage group, though the explanatory power of the multiple regressions is higher, as measured by the adjusted  $R^2$ . Omitting these known, relevant explanatory variables introduces additional bias and makes model predictions unreliable.

EPA apparently settled on univariate regressions because it did not have the data for multivariate, but lack of data is not a reason to say something that is plainly wrong.

As a result of the omitted variable bias, all of the regressions and all of the estimates derived from them are without basis. Even their proposed margins of error are meaningless. There is no way to calculate, estimate, or model dust lead concentrations

from dust lead loadings using these regression coefficients. As a result, all of the projected BLL changes and IQ changes as a result of RRP are wrong. They do not have a scientific basis, and they cannot inform an economic analysis of the proposed RRP rule.

*Unreliability of BLL and IQ projections*

Chapters 5 and 6 of the Approach become irrelevant once the defects appear in the concentration calculations. It may useful, however, to make the point explicit. The IEUBK and Leggett models both depend on lead concentrations to estimate lead uptake by the body, as stated on pages 93 and 97, for example. With dust lead concentrations, Equation 5-6, and hence 5-2 are not calculatable. Therefore, the Leggett Model cannot be used. On page 98, the first sentence of Section 5.3.1 states that among other inputs, the dust concentrations are used to Implement the IEUBK model. Therefore, it too is missing a necessary input.

**Conclusion**

It is not NAHB's intention to claim that ingesting lead from whatever source is good for anyone's health. However, there can be serious consequences from this rule for the quality and affordability of urban housing and for the health of households who will be given an extra incentive to use unprofessional, untrained remodelers. The Approach unwittingly attempts to impart a spurious precision to the beliefs of well-intentioned people.

It is NAHB's belief that remodeling makes old homes safer, not unsafe, even with respect to lead. When studied scientifically, RRP has not been shown to be related to elevated blood levels. However, even though no scientific evidence has appeared that showed that RRP creates lead-based paint hazards, there is a theory to explain how such a hazard could at least be possible. It is also possible that in some individual cases, careless remodeling actually has created lead safety or exposure problems. For those reasons, just to err on the side of caution, NAHB believes that remodelers should be trained, and certain high-dust practices should be abolished, like mechanized sanding and the use of open flame torches.

Sincerely,



Andrew Jackson Holliday, J.D., Ph.D.  
Regulatory Counsel  
National Association of Home Builders