



National Center for Healthy Housing

March 24, 2006

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Office of Pollution Prevention and Toxics (OPPT)
Environmental Protection Agency, 1200 Pennsylvania Ave., NW.,
Washington, DC 20460-0001
ATTN: Desk Officer for EPA, 17th St., NW Washington, DC 20503

SUBJECT: Comments Regarding Dangerous Work Practices From The National Center for Healthy Housing

Re: Docket ID: EPA-HQ-OPPT-2005-0049

The National Center for Healthy Housing (NCHH) congratulates EPA for proposing a regulation to protect children from lead poisoning caused by housing renovation, repair, and painting that disturbs surfaces coated with lead-based paint.

We offer these comments because we believe the proposed rule will allow dangerous and unnecessary methods of removing or disturbing lead paint that are widely known to do much more harm than good. Indeed, these methods are already prohibited in certain areas and for certain types of housing undergoing renovation, repair, and painting.

EPA requested comment on this issue and others on p. 1612 of the notice in the *Federal Register*. Specifically, EPA said that “[u]nlike with abatement, EPA is proposing to allow the use of these practices during renovation activities. The Agency understands that, because these practices are commonly used during renovation work, prohibiting such practices could make certain jobs, such as preparing a surface for new painting, extremely difficult, if not impossible. For example, contractors indicated there may be no practical way to restore old and historic millwork other than open flame burning, and that prohibiting dry scraping and sanding would cause many problems because wet sanding tends to raise the grain of wood surfaces preventing a smooth finish which consumers demand. The Agency believes that proper training, in combination with appropriate containment and cleanup requirements, is safe, effective, and reliable in preventing the introduction of new lead-based paint hazards. EPA is seeking comment regarding the prohibition of these practices, and specifically whether different prohibitions should apply to interior and exterior renovations.”¹

The current prohibited practices found throughout the vast fabric of state, local and federal regulations regarding lead dust are predicated upon the decades of scientific research and human epidemiological studies that the federal government, including EPA, has funded for the last 30 years. The prohibited practices are based on the wisdom generated by those studies. The prohibitions are important because they are protective of human health in a scientifically demonstrable way.

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The agency does not explain how abatement of lead-based paint is so radically different from renovation, repair and painting that it warrants such a significant rollback of basic prohibitions. When HUD adopted standards for interim controls – controls that are essentially the same as renovation, repair and painting activities – it followed EPA's lead and prohibited dangerous work practices for all paint disturbances that are more than de minimis amounts. At least nine states have adopted similar prohibitions.

EPA apparently based its decision on the recommendations of the Small Business Review Advocacy Panel's Report.² EPA states that it “presented four options to the Panel on this topic. These options included the following: Prohibit these practices during renovations, allow dry scraping and exterior flame-burning or torching, allow dry scraping, and interior and exterior flame-burning or torching, or allow all of these practices. The Panel over-emphasized industry concerns and underestimated the feasibility of prohibiting these practices, especially when cost-effective alternatives exist. The Panel was also concerned about the potential risks associated with these practices, but noted that **reasonable** training, performance, containment, and clean-up requirements **may** adequately address these risks. In Unit IV.D., EPA has followed the Panel's recommendation and requested public comment on the cost, benefit, and feasibility of prohibiting certain work practices, but EPA is not proposing to prohibit any work practices. EPA has determined that the training, containment, and clean-up requirements of this proposal are sufficient to address any risks associated with the work practices prohibited by the abatement regulations.”³

NCHH has the following serious procedural concerns with EPA's statements:

1. EPA did not explain the basis of its determination that training, performance, containment and cleanup would be sufficient. It appears to have based its determination solely on the recommendations of the industry panel.
2. The Panel consisted largely of representatives of small businesses. Without the involvement of other external stakeholders and without external scientific and public health peer review, there was no opportunity to balance perspectives, consensus, and validation. No scientists who conducted the research that is the basis for much of the rule were permitted to comment on the recommendations of the Panel.
3. EPA paraphrased the Panel's recommendations. The Panel's report states that “[t]he Panel notes that proper training, in combination with reasonable performance, containment and cleanup requirements, may adequately address the introduction of new hazards. The Panel recommends that EPA request public comment on the prohibition of work practices and seek comment regarding the cost, benefit and feasibility of such prohibitions.”⁴ The Panel called for proper training and acknowledged that the dangerous work practices represented “new hazards.” This difference is important.
4. NCHH questions whether the Panel considered the possibility that EPA would propose to use a White Glove test as the basis of evaluating the performance of contractors and whether it (the panel) believed that EPA would propose to allow workers who only receive on-the-job training to conduct the work with minimal oversight by a trained supervisor.

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5. EPA fails to mention that six panel members raised serious questions about a rule that would allow the use of dangerous work practices without any additional restrictions. For example:

According to the report, a representative of the National Multi-Housing Council and a multi-family property owner stated that they were “concerned with EPA not prohibiting certain specific work practices.” For example, they state that open flame burning outdoors can release significant levels of lead into the atmosphere and add to the overall environmental lead burden. The representatives were also concerned that EPA's regulation would be different than HUD's prohibitions in federally assisted housing. According to the record, their concerns included the following:

- Multifamily property owners and managers would have an unfair burden to ensure that their contractors follow HUD's more protective standards.
- Different EPA and HUD prohibited practices would be confusing to small businesses.
- The prohibitions should not differ because they should be based on the same sound, scientific data since the health risks are not affected by whether housing is federally assisted.
- Title X requires consistency between EPA and HUD.⁵

One member was identified as a trainer, licensed lead risk assessor, and licensed lead inspector. He stated “that EPA should clearly identify and prohibit some renovation and remodeling (R & R) practices because they may cause lead poisoning.” He went on to state that he “thinks that contractors, if given a choice, would not use appropriate engineering controls, work practices, and cleanup procedures, because of the increased cost and time involved with these efforts.”⁶

A member representing a painting and decorating contractor asserted that “banning work practices would be a less cost-effective way to reduce lead poisoning than instituting performance based work standards. He states that banning work practices to protect the health and safety of low-skilled workers is a worthy goal, but is not cost effective.”⁷ Clearly, this member failed to recognize that the ban on dangerous work practices was designed to protect residents as well as workers.

Another painting and decorating contractor states “that HEPA-attached sanding equipment could become a practical solution to using unshielded equipment, but that the equipment currently has problems.”⁸ In the preamble to the rule and in its economic analysis EPA makes no reference to any problems with HEPA-attached sanding equipment. NCHH's anecdotal discussions with contractors indicate that the equipment works quite well. Furthermore, manufacturers of power tools equipped with HEPA local exhaust ventilation have exhibited their products regularly at the American Industrial Hygiene Conference and Exhibition and other conferences. Apparently, the marketplace responded to the contractor's concerns raised more than six years ago. EPA should not arbitrarily accept a single contractor's assessment without broader analysis of the industry.

Finally, a maintenance and renovation contractor on the Panel also discussed several specific work practices or prohibitions, as follows:

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- Machine grinding and sanding should require HEPA capture and exhaust control.
- Abrasive blasting and sandblasting should require source capture and/or more extensive containment and cleanup measures.
- Dry scraping and heat guns should require more extensive containment and cleanup for both interior and exterior work.
- Machine and hand sanding following chemical stripping also generates high lead dust levels and therefore should not be considered as a low dust generating task.”⁹

This contactor specifically noted that clearance, presumably using dust wipe methods, should be required. In addition, the conditions he suggested for machine grinding and sanding are already part of the prohibitions contained in regulations on EPA abatement and HUD interim controls. In addition, he called for more extensive containment than EPA requires in its proposed rule.

Put simply, EPA cannot properly reach its conclusion to allow dangerous work practices based solely on the Panel's report and without considering the science. EPA provides no other justification for its decision.

NCHH believes that there is little question that removing or disturbing lead paint without proper controls causes substantial contamination, posing serious risks to occupants, workers and others. Eight studies, which EPA may not have fully considered in its development of the proposed rule, support this contention.¹⁰ For example, one recent study found that children with blood lead levels greater than or equal to 10 µg/dL were six times more likely to live in homes that had dust from painted surface preparation.¹¹ Another study showed that the use of power sanding on the exterior of a house undergoing repainting resulted in soil lead levels in the child's play area of over 130,000 ppm and interior floor dust lead levels of 27,600 micrograms per square foot (the respective EPA standards are 400 ppm and 40 micrograms per square foot). In this case study,¹² the cleanup costs were nearly \$200,000 for a single house; these costs could have been entirely avoided if a safer method of paint removal was used instead.

In another case, which was detailed in the peer-reviewed and scientifically based HUD Guidelines,¹³ the following is documented:

“Figure 4.1 A Case Report: Renovation and Lead Poisoning.

“The Marino case report (Marino, 1990) is an example of how uncontrolled renovation work can cause lead poisoning in both adults and children. The dwelling involved was a 2-story, 19th century Victorian farm house with 10 rooms. Most of the wooden floors, moldings, walls, ceilings, and door frames had been painted with lead-based paint. The renovation work included restoration of surfaces by removing the paint down to the bare surface on floors and woodwork and recoating with new varnish. Ceilings were repaired, and wallpaper and paint were removed from a number of walls. Two workers used rotary power sanders, hand sanders, scrapers, torches, heat guns, and chemical paint strippers. The family left the house during most of the renovation work, but returned after it was only partially completed. There was dust throughout the dwelling. After one of the family's

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dogs started to have seizures, a veterinarian determined that the dog was lead poisoned. The mother and two children were subsequently tested. The children had blood lead levels of 104 micrograms per deciliter and 67 micrograms per deciliter, which is 5 to 10 times above the level of concern established by the Centers for Disease Control and Prevention (CDC) (10 micrograms per deciliter). The mother had a blood lead level of 56 micrograms per deciliter. All three were admitted to a local hospital where they were treated for severe lead poisoning. The mother was 8 weeks pregnant and opted for a therapeutic abortion. A babysitter who had two children of her own sometimes cared for all four children in the home. The babysitter's two children were also tested and found to have blood lead levels of 80 micrograms per deciliter and 68 micrograms per deciliter. These two children were also hospitalized and treated for severe lead poisoning.”

To prevent these kinds of cases, HUD and EPA put significant control measures in place.¹⁴ These measures have been studied extensively and are effective.¹⁵ Among other preventive measures, they include work practices that minimize the creation of lead dust, containment, occupant protection, special cleaning methods, quality control in the form of clearance testing and training and certification of workers. But perhaps the most effective control measure has been the outright elimination of unnecessary and dangerous techniques of lead paint removal or disturbance known to release high levels of lead-contaminated dust and fume. That is the topic of this letter.

More than a decade ago, the U.S. Department of Housing and Urban Development, in consultation with EPA, other agencies and the nation's leading experts, released its seminal *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing*.¹⁶ Importantly, EPA and many state and local governments have referenced this document repeatedly in their own regulations and programs. The procedures in the Guidelines have stood the test of time and are both feasible and effective. In these *Guidelines* and in even earlier regulations and guidance for public housing,¹⁷ certain methods of paint removal or disturbance were recognized to be unnecessarily dangerous and were prohibited outright. In the HUD regulation covering federally assisted housing, 24 CFR 35.140 states the following:¹⁸

- “Prohibited methods of paint removal. The following methods shall not be used to remove paint that is, or may be, lead-based paint:
- (a) Open flame burning or torching.
 - (b) Machine sanding or grinding without a high-efficiency particulate air (HEPA) local exhaust control.
 - (c) Abrasive blasting or sandblasting without HEPA local exhaust control.
 - (d) Heat guns operating above 1100 degrees Fahrenheit or charring the paint.
 - (e) Dry sanding or dry scraping, except dry scraping in conjunction with heat guns or within 1.0 ft. (0.30 m.) of electrical outlets, or when treating defective paint spots totaling no more than 2 sq. ft. (0.2 sq. m.) in any one interior room or space, or totaling no more than 20 sq. ft. (2.0 sq. m.) on exterior surfaces.
 - (f) Paint stripping in a poorly ventilated space using a volatile stripper that is a hazardous substance in accordance with regulations of the Consumer Product Safety Commission at 16 CFR 1500.3, and/or a hazardous chemical in accordance with the Occupational Safety and Health Administration regulations at 29 CFR 1910.1200 or 1926.59, as applicable to the work.”

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The prohibition of dangerous methods of paint removal is a type of engineering control. Rather than attempting to control emissions after they have occurred, engineering controls are designed to prevent or minimize emissions from occurring in the first place and are frequently cited in other EPA, HUD and OSHA regulations as being the best method. They have long been shown to be preferable to other forms of exposure control, such as sealing the work place, ventilation and creation of complex negative air pressure zones, personal protective equipment, and administrative controls, all of which have a much higher potential for failure. Furthermore, engineering controls are often less costly, because other control measures such as installation of negative air pressure zones, airlocks and so on can be expensive in their own right.

EPA should apply these principles to those activities covered by the proposed regulation.

NCHH believes that the prohibited work practices outlined above should also be prohibited in the final regulation for the following reasons:

1. **The amount of lead fume and lead dust that can be released from even a small area with a low concentration of lead-based paint undergoing torching, blasting or power sanding is quite large.**

The HUD Guidelines contain the following calculation:¹⁹

“To understand how easily leaded dust hazards can be created from jobs disturbing lead-based paint, consider the following example. Suppose renovation work is done on only 1 square foot of painted surface and all the lead paint inside that square foot is turned into dust [or fume] by sanding or some other work [such as torching]. If the paint has 1 milligram per square centimeter of lead in it (the lowest level covered by HUD) and if the dust is spread out over a 100-square-foot area [a 10 foot by 10 foot room], there will be about 9,300 micrograms per square foot of leaded dust present.” This is much higher than the current EPA dust lead hazard standard for floors, which is 40 micrograms of lead dust per square foot.

While some of this could conceivably be cleaned up, a significant part will also be re-suspended into the air, settling out after cleaning has occurred. While such re-suspension is also possible to a lesser degree for larger particles, it will be increased by a particle size distribution dominated by those with smaller aerodynamic equivalent diameters that are typically produced by fume formation, power sanding and blasting.

EPA has not sponsored the necessary research to show that cleanup is feasible following the large generation of small particles produced by commonly prohibited methods. The weight of existing scientific evidence suggests that cleanup may be difficult and costly, if not impossible. Therefore, such methods should not be permitted in the final regulation.

2. **Prohibited work practices pose substantial risks to current and future occupants, as well as workers and pedestrians and those in nearby properties.**

So-called “traditional” lead-based paint removal methods that were employed between 1970 and about 1990 sometimes resulted in increases, not decreases in the blood lead level of children who lived in those houses, especially if baseline blood lead levels were low.^{10, 20} A common practice in these early efforts involved the use of fuel-powered torches and power sanding to rapidly remove lead paint. In those years, the importance of controlling settled dust from lead paint was not fully understood. It is now clear that lead-contaminated settled dust is the principal exposure pathway for children in the U.S. today.²¹ Lead exposures to workers burning or power-sanding lead paint have been shown to be orders of magnitude larger than OSHA's Permissible Exposure Limit, ranging as high as 11,000 micrograms of lead per cubic meter.²² With airborne levels as high as this, it is likely that nearby properties will also become contaminated, posing risks to other innocent parties. These high exposures to workers, children, pedestrians, and nearby residents can all be avoided if such paint removal practices are prohibited and replaced by safer methods.

3. **EPA's failure to include prohibited work practices in its regulation will create confusion in the housing renovation, painting, and repair industries.**

There is no reason to create two different sets of work practices to govern the same work, one for housing receiving federal assistance (or that complies with state and local requirements) and another for renovation and repair that is not assisted. Contractors often perform the same kind of work both in housing receiving federal and/or local assistance and in housing receiving no such assistance. Because HUD's lead safe housing rule prohibits unsafe work practices in federally owned and assisted housing, and EPA's failure to conform its final rule to HUD's regulation, contractors will need to determine the set of requirements that apply. To create a level playing field, as well as to ensure the public health, EPA should conform its requirements to those in the HUD regulation, which has now been in place for nearly 6 years, and OSHA regulations, which have been in place for decades (see below). It is worth noting that the prohibition of work practices is also included in regulations for housing administered by the Department of Defense, Department of Veterans Affairs, Department of Agriculture and others. At least 9 states²³ and numerous localities have also banned these practices. The practices are also prohibited in EPA's Lead-Based Paint Activities regulation governing abatement projects.

4. **There are safer methods of removing lead-based paint that are known, feasible and effective.**

One of the largest studies of lead paint hazard control in housing, covering nearly 3,000 housing units in 14 jurisdictions across the country, showed that modern methods of removing or disturbing lead paint, which included building component replacement, off-site and on-site paint stripping using chemicals, and wet scraping were effective and could be performed safely.²⁴ The use of these methods did not produce large amounts of lead fume or settled lead dust and the dust that was generated could be cleaned fairly easily. Furthermore,

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mean settled dust lead levels remained below baseline levels for at least 6 years and the blood lead level of children living in the units declined by over 30% over two years.^{25, 26} None of the local jurisdictions involved in this study ever found it necessary to request from HUD (the study's funder) a waiver to permit the use of prohibited practices of removing lead paint. Indeed, neither HUD nor any other federal agency has ever reported receiving a request for a waiver to permit the use of prohibited practices, demonstrating that unsafe practices are not necessary.

5. **There is evidence suggesting that lead dust from previous renovation, repair or lead hazard control work can be a significant source of exposure to children.**

The failure to prohibit dangerous work practices means that many homes will be unnecessarily contaminated, posing risks for future generations who will occupy those homes. A national survey showed that there were 2.7 million housing units in 2000 in which lead paint was no longer present, but in which there were still lead dust hazards.²⁷ While it is difficult to know precisely how many of these older units once had lead paint (as opposed to those that never had lead paint), one of the likely reasons lead dust hazards were found in these units is that previous renovation, repair, and painting work that removed or disturbed lead paint also generated large amounts of lead dust that did not dissipate over time. If such work released lower levels of lead dust at the outset (as would be the case if EPA prohibited the dangerous methods), the contaminated dust is much more likely to be removed by routine cleaning efforts. The fact that lead dust levels did not increase in the evaluation of HUD's lead-based paint grant program shows that modern methods do not leave dust hazards following the work. All the evidence shows that the use of the prohibited work practices generates a high amount of lead dust.

6. **The high temperatures from fuel-powered torches exceed those known to volatilize the lead compounds commonly found in lead-based paints.**

Table 1 shows the melting points of some of the lead compounds typically found in lead-based paint. Propane, butane and acetylene torches produce adiabatic flame temperatures of 1980° C, 1970° C, and 2400° C respectively.²⁸ Clearly, it is likely that the lead in lead paint will be volatilized into fume at such temperatures. Fume is commonly and incorrectly regarded to be a gas. In fact, fume consists of very small particles. Such small particles form because the lead is initially turned into a gas when it comes into contact with the high temperatures produced by flames; the gas then cools and condenses into small particles when it comes into contact with cooler surrounding air. Such particles are more readily absorbed into the human body and tend to have smaller settling velocities than larger ones. These small particles will not settle out of the air very quickly. In addition, fume is far more difficult to clean up, because the particles that do eventually settle are more likely to reside in surface imperfections and soil. The smaller settling velocities of such small particles also means that they will travel further, thereby contaminating nearby properties, soil, and housing units. In the few instances where burning of lead paint was studied, airborne levels of lead were found to be extraordinarily high and it also proved to be difficult to clean up lead dust.²⁹ Although not well characterized, it is also likely that burning of old paint films will release a variety of volatile and semi-volatile organic substances that could pose

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important risks to both workers and occupants. The likelihood that lead fume will be formed from torching lead-based paint, together with the difficulty of controlling and cleaning up small particles, shows that this method of lead paint removal should not be permitted.

Table 1.

Melting and Boiling Points of Lead Compounds Commonly Found in Lead-Based Paint Compared to Temperatures Produced By Torches Fueled By Propane, Butane or Acetylene.

Lead Compound	Melting Point (°C)	Adiabatic Flame Temp Range for Butane, Propane and Acetylene (°C)
Lead Oxide	888	1980-2400
Lead Carbonate	315	1980-2400
Lead Acetate	280	1980-2400
Lead Chromate	844	1980-2400

7. **OSHA currently prohibits the use of torches on painted metal, unless air line respirators are used. EPA's proposed regulation could cause violations of this OSHA standard, creating even more confusion in the industry and serious harm to workers and others.**

EPA's proposed regulation could inadvertently lead to violation of an OSHA construction industry standard on welding, cutting or heating painted metal surfaces. This is likely to create even more confusion in the construction industry. Based on a number of studies, OSHA currently prohibits welding, cutting or heating of steel surfaces coated with paint (even if the paint does not contain lead), because worker exposures are extraordinarily high. Specifically, OSHA Standard 1926.354(c) (1) states "...all surfaces covered with toxic preservatives shall be stripped of all toxic coatings for a distance of at least 4 inches from the area of heat application, or the employees shall be protected by air line respirators."³⁰ The use of airline respirators is impractical in housing and is not typically used by the housing renovation, repair, and painting industry. This OSHA standard is separate from the OSHA Lead Construction Standard (29 CFR 1926.62).

The OSHA construction standard on welding, cutting and heating applies to those who perform such work in housing; it is not limited to structural steel work, such as bridge demolition. The standard, while intended to control exposures primarily to lead and zinc, is also intended to control exposures to other compounds, including organic compounds that are likely to be released when a paint film encounters high heat. This standard has been in place for over 30 years and should not be overturned by an EPA proposed regulation,

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because EPA has not demonstrated that flame treatments of painted metal can be performed safely.

8. **EPA's proposed method of containment will not control the large amounts of dust and fume that will be released if the prohibited practices are permitted.**

EPA has not proposed to include the negative air pressure zone and workplace isolation protocols commonly found in the asbestos abatement industry. Instead, the proposed method is modeled on the containment procedures in the HUD Guidelines, which assume that the dangerous practices are prohibited. One study of lead paint removal using torches was undertaken in public housing using an enclosure/ventilation system typical of asbestos work.³¹ This study found that, despite the use of asbestos-like containment and negative air pressure ventilation procedures, worker exposures and dust deposition levels were still extraordinarily high. Use of such enclosures is likely to be cost-prohibitive in the millions of dwellings undergoing renovation, repair or painting. EPA failed to cite any research demonstrating that such enclosure systems could effectively control lead emissions when prohibited practices are used. The only evidence available shows that such enclosures are insufficient to prevent the dispersal of lead during and after lead paint removal.

9. **Statements that prohibited methods of removing lead paint are sometimes necessary, for example in historic properties, have not been substantiated.**

The evidence shows that removal of lead paint can be accomplished in historic properties without resorting to use of prohibited practices. The HUD Guidelines, which were developed in concert with historic preservation experts and agencies, states:

“If paint is to be removed, the preferred treatments include wet sanding of deteriorated peeling paint; finish sanding with special mechanical sanders with a high-efficiency particulate air (HEPA) vacuum local exhaust ventilation, low-heat paint stripping; chemical strippers (except methylene chloride); and offsite stripping with heat or chemicals. Do not use open flame or high heat removal of lead, or dry sanding or abrasive removal. Comply with worker safety requirements.”³²

In short, HUD, in concert with EPA, has released guidance on how historic preservation requirements and lead paint disturbance or removal can be performed together. The guidance states that prohibited forms of paint removal should not be used, and notes that such methods can pose significant risks to these valued properties from unintended property fires, surface damage caused by abrasion and so on. Although hundreds of thousands of housing rehabilitation, remodeling, repair, painting and renovation projects receiving HUD funds have undergone historic preservation reviews, a review of the agency's public records on waivers shows that HUD has never received a waiver request for the use of prohibited work practices in historic properties. It is clear that it is indeed feasible to treat or disturb painted surfaces in historic properties without resorting to prohibited methods. EPA has failed to cite any body of research demonstrating that prohibited practices are necessary in historic properties.

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Thank you for the opportunity to provide these comments on this important regulation. While prohibition of these dangerous paint removal methods may require changes for some contractors, the evidence clearly shows that such changes are feasible, economical, and most importantly, will protect the health of workers, children, pregnant women, those in nearby properties, and other at-risk populations.

Sincerely,



Rebecca Morley
Executive Director

Endnotes

¹ EPA, Proposed Renovation, Repair, and Paint Rule, January 10, 2006, *Federal Register*, Vol. 71 at page 1592.

² Small Business Review Advocacy Panel, "Final Report of the Small Business Advocacy Review Panel on EPA's Planned Proposed Rule: Lead-Based Paint ; Certification and Training; Renovation and Remodeling Requirements", March 3, 2000, Docket #EPA-HQ-OPPT-2005-0049-0163.

³ Supra note 1 at 1625. Emphasis added.

⁴ Supra note 2 at page 7.

⁵ Id at page 50.

⁶ Id at page 51.

⁷ Id.

⁸ Id.

⁹ Id.

¹⁰ Rabinowitz M, Leviton A, Bellinger D. Home refinishing: Lead paint and infant blood lead levels, *American Journal of Public Health*. 1985; 75:403-404.

Shannon M, Graef J. Lead Intoxication in Infancy. *Pediatrics*. 1992; 89(1):87-90.

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¹¹ Reisman, et al. Is home renovation a risk factor for exposure to lead among children residing in New York City? *Journal of Urban Health*. 2002;79(4):502-11.

¹² Jacobs, D, Mielke H, Pavur N. The high cost of improper removal of lead-based paint from housing: A case report. *Environmental Health Perspectives*. 2003;111:185-186.

¹³ Guidelines For The Evaluation and Control of Lead-Based Paint Hazards in Housing, Chapter 4, U.S. Department of Housing and Urban Development, Washington DC, 1995.

¹⁴ Guidelines For The Evaluation and Control of Lead-Based Paint Hazards in Housing, U.S. Department of Housing and Urban Development, Washington DC, 1995.

¹⁵ Evaluation of the HUD Lead Hazard Control Grant Program, National Center for Healthy Housing and University of Cincinnati, Columbia, MD, May 1, 2004.

¹⁶ Guidelines For The Evaluation and Control of Lead-Based Paint Hazards in Housing, U.S. Department of Housing and Urban Development, Washington DC, 1995.

¹⁷ Lead Based Paint: Interim Guidelines for Hazard Identification and Abatement in Public and Indian Housing, U.S. Department of Housing and Urban Development, Washington DC, 1990.

¹⁸ 24 CFR 35.140.

¹⁹ HUD Guidelines Chapter 4.

²⁰ Aschengrau A, et al. Residential lead-based-paint hazard remediation and soil lead abatement: their impact among children with mildly elevated blood lead levels. *American Journal of Public Health*. 1987; (10):1698-72.

²¹ Lanphear, et al. The Contribution of Lead-Contaminated House Dust and Residential Soil to Children's Blood Lead Levels: A Pooled Analysis of 12 Epidemiological Studies, *Environmental Research*. 1998; 79:51-68.

²² Jacobs, D. Occupational exposures to lead-based paint in structural steel demolition and residential renovation work. *Int J. Environment and Pollution*. 1998; 9(1):1-14. Also see NIOSH, HETA 99-0113-2853, HETA 93-0818-2646, HETA 96-0200-2799, HETA 98-0285-2989 NIOSH, HETA 99-0113-2853, HETA 93-0818-2646, HETA 96-0200-2799, HETA 98-0285-2989), which showed that these methods generate large amounts of lead in settled dust (HETA 98-0285-2989, 99-0113-2853). NIOSH evaluations have found that technically feasible and effective alternatives to hazardous activities exist, including power sanding with HEPA exhaust control (NIOSH, HETA 99-0113-2853, HETA 93-0818-2646, HETA 96-0200-2799, HETA 98-0285-2989, HETA 92-095-2317).

²³ California, Indiana, Maine, Massachusetts, Minnesota, New Jersey, Ohio, Rhode Island, and Vermont

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²⁴ Evaluation of the HUD Lead Hazard Control Grant Program, National Center for Healthy Housing and University of Cincinnati, Columbia, MD, May 1, 2004

²⁵ Wilson, J, et al. Evaluation of HUD funded lead hazard control treatments at six years post intervention. Environmental Research (accepted)

²⁶ Evaluation of the HUD Lead Hazard Control Grant Program, National Center for Healthy Housing and University of Cincinnati, Columbia, MD, May 1, 2004

²⁷ Jacobs, et al. The prevalence of lead-based paint hazards in U.S. housing. Environmental Health Perspectives. 2002; 110:A599-A606.

²⁸ Flame Temperatures of Common Gases, Engineering Toolbox, www.engineeringToolBox.com. March 12, 2006

²⁹ Jacobs, D. Occupational exposures to lead-based paint in structural steel demolition and residential renovation work. International Journal of Environment and Pollution. 1998; 9(1):1-14. Also see NIOSH, HETA 99-0113-2853, HETA 93-0818-2646, HETA 96-0200-2799, HETA 98-0285-2989 NIOSH, HETA 99-0113-2853, HETA 93-0818-2646, HETA 96-0200-2799, HETA 98-0285-2989), which showed that these methods generate large amounts of lead in settled dust (HETA 98-0285-2989, 99-0113-2853). NIOSH evaluations have found that technically feasible and effective alternatives to hazardous activities exist, including power sanding with HEPA exhaust control (NIOSH, HETA 99-0113-2853, HETA 93-0818-2646, HETA 96-0200-2799, HETA 98-0285-2989, HETA 92-095-2317).

³⁰ 29 CFR 1926.354(c) (1)

³¹ Jacobs, D. Occupational exposures to lead-based paint in structural steel demolition and residential renovation work. International Journal of Environment and Pollution. 1998; 9(1);1-14.

³² HUD Guidelines, Chapter 18.