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Regulatory and Policy Issues for Reuse and Remanufacture of Wood Materials Coated With Lead-Based Paint

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Abstract

At present, there is no regulatory or policy guidance at the Federal level that permits, prohibits, or qualifies practice for salvaging and reusing building materials coated with lead-based paint (LBP). This paper describes the current regulations and standards relative to LBP in buildings (in particular LBP on lumber and timber products), LBP mitigation, and disposal of LBP-containing waste, and the applicability of these regulations and standards to recovering and reusing building materials.

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Problem

At the Federal level, there is at present no regulatory or policy guidance that permits, prohibits, or qualifies practice for salvaging and reusing building materials coated with lead-based paint (LBP), in particular lumber and timber products. Regulations and standards relative to LBP in buildings, LBP mitigation, and disposal of LBP-containing waste have been promulgated by many agencies. These standards define LBP differently and for different purposes: the Occupational Safety and Health Administration (OSHA 1999) regulates lead in regards to worker exposure; the Consumer Products Safety Commission (CPSC 2001), the allowable presence of lead in consumer products; the Department of Housing and Urban Development (HUD 1996), lead in terms of occupant exposure in housing; and the Environmental Protection Agency (EPA 2001), the outdoor release of lead from various sources. Despite regulatory coverage from these various agencies, the applicability of the regulations to recovering and reusing building materials is unclear or nonexistent.

In many cases, this ambiguity creates a disincentive to reusing the high quality materials that are often found under paint. Interpretation and common practice are most frequently driven by risk aversion; thus, the most conservative interpretation drives policy and practice. The paradigm is, if there is no explicit statement that allows a given activity, then the activity is not allowed. Distinctions made under current regulations influence the economics of recovery and potential reuse of painted materials when compared to conventional demolition and landfill disposal of debris.

It is clearly important to mitigate and remove LBP from human exposure, and, at the same time, protect the natural environment, particularly soils and groundwater. However, the current regulations that relate to the building industry (issued by the EPA, OSHA, HUD, and CPSC), while serving environmental and human health concerns, de facto encourage the disposal of not only LBP itself but all underlying materials as well. Much of this material would be valuable were it not for LBP. In addition to wasting potentially valuable resources, this practice increases the landfill burden and the stress on natural systems to produce more virgin materials. Clarification is needed either by modifications to existing regulations or development of new regulations.

The inability to recover and reuse wood building materials coated with LBP is an important problem nationally because of the large volume of these materials that are now and will continue to be generated by demolition activities. For example, this problem affects the ability of Federal agencies to meet solid waste diversion goals. For the Department of Defense, the influx of construction and demolition debris, especially from the thousands of wood structures to be removed in current and anticipated installation, modernization, and consolidation activities, seriously jeopardizes the agency's ability to meet an established measure of merit for 40% solid waste diversion. More ambitious goals, such as those developed by the California Integrated Solid Waste Management Board, target a 50% diversion requirement for construction and demolition debris. These goals would be more readily met if LBP-coated wood could be recovered for reuse.

The objectives of this paper are to describe current regulations for wood materials coated with LBP and to highlight the need for guidance in reusing or remanufacturing these materials so that human and environmental health are protected. It is not the intent of this paper to suggest that existing regulations regarding LBP be disregarded. Rather, the authors hope that specific guidance can be developed that addresses the reuse and remanufacture of LBP-coated wood.

Background

The annual construction and demolition (C&D) debris burden for the United States has been estimated at about 20 million tons from residential demolition, 45 million tons from non-residential demolition, and 60 million tons from both residential and non-residential remodeling and renovation. In total, nearly 125 million tons of building debris is generated each year in the commercial marketplace. About 27 million tons of this debris is recoverable solid wood (Falk and McKeever 2004). An additional 18 million tons of solid wood is available in the municipal solid waste (MSW) stream.

In the case of the U.S. Army, this burden is significant. More than 2.7 million square meters of surplus buildings from the World War II era must be removed, which will generate an estimated 26 million tons of debris (Concurrent Technologies Corp. 2003). An additional 7 million tons of debris will be generated by the replacement of 84,000 family housing units (U.S. Army 2005). Most of these buildings are wood framed. In addition, the construction of new facilities frequently requires the demolition of obsolete buildings, which further adds to the debris burden. For example, hundreds of enlisted men's barracks from the 1950s will be replaced with new barracks. Demolition of each barrack will generate roughly 6,000 tons of debris. These are only a few examples that indicate the magnitude of the disposal problem facing one agency. Other agencies face the same problem.

The C&D debris burden is also felt in the private sector. It is estimated that the equivalent of 250,000 residential buildings are demolished each year in the United States, creating a significant impact on the C&D waste stream (Carliner 1996, EPA 1998).

Over the past several years, there has been a groundswell of interest in the salvage and reuse of wood materials from building removal. Using deconstruction (or dismantlement) rather than demolition, this material can be salvaged in whole form and reused as lumber for the construction of a new building or for remodeling. Alternatively, the lumber can be remanufactured into high value building products (e.g., flooring, molding, trim). It is estimated that more than 1 billion (10^9) board feet of usable lumber is salvageable from only the residential homes demolished each year, representing more than 3% of U.S. annual softwood lumber production (Falk and McKeever 2004).

Most buildings that are candidates for deconstruction were constructed during the decades of old-growth timber harvest and contain wood largely unavailable from any other source. This old-growth lumber is often of higher quality (e.g., higher density, slower grown, fewer defects) than lumber produced today. From a holistic viewpoint, the reuse of these materials helps conserve our natural resources, helps maintain carbon sequestration and ecological balance, such as biodiversity, and can ease harvesting pressure on the existing forest resource.

Approximately 24 million or 25% of housing units in the United States have significant LBP hazards. Although renovation or deconstruction in general potentially increases short-term exposure to LBP, the level of hazard can be mitigated by safe work practices. The President's Task Force on Environmental Health Risks and Safety Risks to Children found that the number of housing units with LBP declined by 10 million from 1989 to 1999 solely as a result of renovation and demolition (Jacobs and others 2002). The removal of older homes allows the creation of new lead-free housing (Farfel and others 2003). Farfel and others (2003) also found that the traditional method of mechanical demolition (a track-mounted excavator), compared with deconstruction, increases lead dust within 10 m of the demolition block site by more than 40 times during the process of demolition and more than 6 times during the removal of debris. Deconstruction, a component removal process, has been found to produce the lowest exposure level of any other form of LBP removal, including scraping, chemical stripping, and demolition (Reames and others 2001).

Case studies representing both private (AFCEE 1999, Triangle J Council of Governments 1995) and military (project documentation,[1] multiple military installations) environments have shown that salvaging or recycling 50% to 90% of a building's content is readily achievable. Keeping tens of millions of tons of building debris out of landfills will be of significant environmental and economic benefit. Unfortunately, the presence of LBP within much of the Nation's building infrastructure creates a considerable obstacle to the salvage and reuse of these materials.

Issues

On one hand, it is desirable to salvage and reuse the high quality LBP-coated wood resource. On the other hand, reuse must not expose workers and the public to the detrimental health effects of LBP. The authors believe that both objectives can be met. However, current regulatory and policy stances have institutionalized a disincentive to reuse or remanufacture LBP-coated wood materials—not explicitly, but through interpretation and common practice.

The requirements for monitoring and protective measures promulgated by the Occupational Safety and Health Administration (OSHA) for all lead-related work may be unnecessarily excessive for deconstruction practices. Initial studies have shown that the component removal process of deconstruction does not create the same level of exposure as do other lead removal activities (Reames 2001).

[1] Project documentation for deconstruction at Fort Carson, Colorado; Fort Gordon, Georgia; Fort Knox and Fort Campbell, Kentucky; Wright Patterson Air Force Base, Ohio; Fort Monroe, Virginia; Fort Hood, Texas; and Fort McCoy, Wisconsin.

The intended destination of the material must be considered. The Resource Conservation and Recovery Act (RCRA) of the Environmental Protection Agency (EPA) defines waste, including what materials qualify as solid waste. However, because reuse (e.g., giving or selling a building material containing LBP to another party) is not focused on waste generation, it is not covered under the RCRA. In 1998, the EPA Office of Toxic Substances proposed a regulation that would prohibit the resale of LBP-containing items or require a warning label upon resale. To date, however, this proposal has not been accepted and therefore has no force of law.

Another consideration is whether a waste is hazardous. Some hazardous wastes are specifically defined in regulations, based on their origin or nature, while others only qualify as hazardous when they meet a particular characteristic, the criteria for which are defined in the rules. In terms of LBP, the most important characteristic is toxicity, as defined by the presence of certain toxic materials at regulated levels. The toxicity characteristic is determined through the use of the Toxicity Characteristic Leaching Procedure (TCLP), a test under which materials are ground up and exposed to an acidic solution to simulate landfill conditions and leaching. If a material leaches out 5 mg/L or more of lead after application of the TCLP, it is considered a hazardous waste.

To properly determine whether a waste is hazardous requires answering some intermediary questions. First, what constitutes a representative sample of the waste? This is a difficult question to answer when considering a building, which is composed of a wide variety of materials. The applicability of the TCLP test and its ability to characterize something as varied and heterogeneous as a building is, in itself, problematic. More fundamentally, if some building materials are not destined for the landfill and are to be reused, is the TCLP test, which is designed to simulate landfill conditions, applicable to qualify these materials? Furthermore, should the definition of hazard be based on materials salvaged from the building, on the materials destined for the landfill after salvaging, or on a broader sample of the building materials? The answers to these questions can determine whether the "building and/or its contents" are classified as hazardous or non-hazardous solid waste, and if deconstruction and salvage of associated material are appropriate.

If a waste is determined to be hazardous, guidance is also needed regarding its "point of origin," or the point at which it was generated. For example, the point of origin could be when painted siding is removed from a building, or when the painted surface of that board is planed off in a remanufacturing process. The operation of removing the siding could be an entirely different procedure from remanufacture, both from a business standpoint and geographically. Who becomes the responsible party and therefore manages the hazardous waste for proper disposal?

It is not always clear how to proceed when trying to salvage LBP-containing materials, especially LBP-coated wood. If lumber removed from a structure has a lead level exceeding the TCLP threshold, the wood could be classified as hazardous waste. The question is, must that lumber be disposed of as hazardous waste or is it hazardous waste only if it is introduced into the waste stream? It is also unclear what, if any, regulatory guidance governs the handling and reuse of LBP-coated lumber. Uncertainties include (1) whether it is permissible to reuse the painted lumber and, if so, what precautions must be taken; (2) whether the paint must be removed prior to reusing the wood and, if so, what lead levels are permissible in the lumber once the coating is removed; (3) how residual wood shavings and paint should be handled and disposed of; (4) whether the lumber (either painted or unpainted) can be transferred from one party to another and, if so, what information or disclosures should accompany transfer; and (5) what, if any, exemptions or restrictions may apply to a salvage and reuse scenario at the individual household level.

There is also the issue of debris. If clean lumber is removed from the debris of a building, the remaining debris may exceed the TCLP threshold because of an increase in the ratio of lead to clean debris, potentially triggering the definition of hazardous waste. Unfortunately, this situation creates a disincentive to resource recovery and conservation. The total amount of lead entering the waste stream will not differ, regardless of whether the clean lumber is removed. However, the reluctance to risk the characterization of the debris as hazardous drives the practice of disposing of the whole building; that is, allowing clean reusable materials to dilute the debris to a non-hazardous level.

The reprocessing and reuse of LBP-containing materials requires clear guidance on how to do so properly, legally, and safely. At present, this guidance is unavailable. What guidance is available is not applicable in the context of recovering and reusing building materials.

Regulations govern LBP in housing where children most vulnerable to the hazards of lead (children under age 6) are present. This is referred to as "target housing" and "residential dwelling or child-occupied facility." These regulations apply to a very narrow definition of the environment. In the context of target housing, LBP hazard is defined as a condition where paint dust is generated by friction or impact (such as at windows and doors) and as deteriorated paint that is detached from the surface and available for ingestion by children (EPA 2001). The paint is defined as not being a hazard if it is in good condition and not subject to friction or impact.

Further, when a residential structure constructed prior to 1978 is sold or leased, the potential for the presence of LBP must be disclosed to the buyer or renter (HUD/EPA 1996). If LBP testing has been conducted, the results must be disclosed. This rule does not require testing or mitigation of LBP—only that the buyer or renter acknowledge the receipt

of the disclosure and is given an opportunity to perform their own inspection before committing to the sale or lease. The required language for this disclosure includes reference to the EPA pamphlet "Protect Your Family from Lead in Your Home" (EPA/CPSC/HUD 2003).

The CPSC has established a limit on the lead content in consumer paints as 0.06% by weight (industrial and other specialty paints are exempt). This limit applies to the lead content of paint on toys, furniture, and other household articles to which children may be exposed (CPSC 2001). This limit was established to correspond to the maximum allowable amount of lead a child might ingest per day without inducing serious health problems (limit = 15 μg). While lead can also be hazardous to adults, it is clear that the intent of the lead content limitation is to protect children from health hazards associated with ingesting lead. These precautions ought to apply to any environment in which children are present, even though this is not explicitly stated in the regulations. What is not clear is how, if at all, these regulations apply to salvaging materials from one structure and reusing them in another structure and in associated processes, such as remanufacturing, transportation, and handling.

Because no clear guidance is available, agencies such as the U.S. Army are reluctant to remove LBP-coated materials from military installations and reuse them in local communities. The preference is to put LBP-coated debris in the landfill debris, in the belief that this is the only safe place for it. The primary motivation is that someone, sometime, will suffer harm, and the Army will be held liable. This conservative and protective posture is not misplaced. However, it is borne out of uncertainty instead of explicit guidance.

Regulations are also in place to protect tradespersons and workers from lead hazards. Of particular interest in the context of construction and materials reuse are the Safety and Health Regulations for Construction, published by OSHA (1999). While not explicitly directed toward lead mitigation activities, these regulations address environments where elevated levels of airborne lead-containing dust are present, which require similar mitigation activities. Worker protection requirements assume the worst exposure. Protective measures may be reduced only when actual exposure levels are below the specified thresholds as verified by monitoring. However, air monitoring conducted during deconstruction projects indicates that actual airborne lead levels have historically been trace amounts, or even non-detectable (Reames 2001; personal correspondence from George H. Thomas III to Thomas R. Napier, April 5, 2002). Yet, OSHA regulations require full personal protective equipment to be used on every project until it is proven such protection is not required. While it is always appropriate to err on the side of safety, such measures might add an expense to deconstruction activities that may not be warranted.

Suggested Actions

Ongoing research is helping to define the real risks in the remanufacture of LBP-coated wood (Falk and others 2005, Janowiak and others 2005). The authors of the work reported here suggest that the EPA, in collaboration with other regulatory agencies, provide clear guidance on appropriate methods and practices for salvaging and reusing LBP-coated building materials, specifically LBP-coated lumber and timber materials. Important issues include (1) removing LBP-coated materials from a structure, (2) handling painted materials, (3) processing painted materials, which may also include removing paint and remanufacturing the material into other products, (4) disposing of waste and residual paint materials, (5) transferring ownership of the materials (with and without LBP), and (6) reusing the materials in another structure or other use.

Such guidance may involve issuing clarifications or qualifications to existing guidance, revising existing guidance, and/or developing new guidance, specifically within the context of the salvage and reuse of building materials. Specific elements of concern include the following:

- Clarify whether materials recovered from building removal through deconstruction and intended for reuse or remanufacture are regulated waste. If so, what agency should be responsible for regulation?
- Clarify and make consistent the methods for analyzing buildings for LBP content. Clarify whether TCLP is the appropriate method to determine whether materials generated in building removal are hazardous, both those materials intended for the landfill and those intended for reuse.
- Clarify whether removing clean building material alters the characterization of the remaining building debris, even though the total amount of lead is not altered.
- Clarify whether the LBP hazard in "target housing" applies to salvaging and reusing LBP-coated building materials. In the context of building material salvage and reuse, clarify what conditions create and do not create a LBP hazard and what conditions allow or prevent the transfer of materials from one party to another. Develop appropriate disclosure language, processes, and precautions that must be taken when removing, transporting, remanufacturing, and reusing LBP-coated building materials.
- Establish reasonable requirements for warning labels or markings that follow a consistent format and are based on realistic scenarios of reuse. For example, does the reuse of a painted wood stud as wall framing (normally enclosed within wall cavity and not accessible to direct contact) require the same level of concern as a salvaged window painted with LBP?

- Consider and address issues of legal responsibility regarding the reuse of underlying wood materials once the LBP coating has been removed through remanufacture. Clarify the chain-of-custody responsibility for future removal, salvage, reuse, or demolition.
- Quantify the acceptable lead content of materials reprocessed from LBP-coated wood materials. Distinguish between the amount of lead allowable on the material's surface (similar to a coating or film) and in the body of the material.
- Examine the actual worker exposure to LBP in the removal of coated wood components in light of the fact that isolated case studies have found no exposure in the absence of grinding, sanding, burning, breaking, etc. Provide better definition within OSHA regulations for destructive mechanical or manual removal processes, manual removal processes for salvage, and protective measures required for each process based on actual on-site conditions.
- Collectively and consistently develop guidance and regulation for lead exposure, thresholds, and content for (1) materials being removed, (2) process of removal, (3) materials intended for remanufacture and reuse, and (4) materials to be considered hazardous waste. Develop guidance and regulation into a single document for ease of implementation.
- Conduct or sponsor further research in developing cost-effective methods and handling of LBP removal from wood and by-product disposal.
- Clarify scenarios where LBP debris from stripping of lead from residential sources can be disposed of in Class I or III C&D landfills as non-hazardous material, when the source of debris (i.e., building materials) is considered household waste before the lead is stripped.
- Establish Best Management Practices for removing LBP-containing materials from a structure, handling materials, removing paint or conducting other reprocessing or remanufacture activities, transferring materials from one party to another, and reusing the materials, either with or without paint coating.

Conclusion

In conclusion, guidance is needed on the appropriate methods and practices for salvaging and reusing building materials coated with lead-based paint. Positive incentives should be integrated into the guidelines that encourage the recovery and reuse of clean materials while safely disposing of only the hazardous portion of the building debris.

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