Economic Policy Institute Briefing Paper

1730 Rhode Island Ave., NW • #200 • Washington, DC 20036 • 202/775-8810

LEAD-BASED PAINT ABATEMENT IN PRIVATE HOMES

A Study of Policies and Costs

by Meg Koppel and Ross Koppel

Introduction and Overview

Approximately one-half of the U.S. housing stock, 57 million homes, contains some lead-based paint (LBP). These homes span all income groups and geographic regions of the country and include most dwellings built prior to 1978, the year lead was banned from residential paint in the United States. Lead-based paint creates a hazard when it deteriorates (chips or flakes), is worn by friction or impact (on windows, doors, and steps), or is disturbed by renovation or by preparation for repainting. Most of these activities create lead-laden dust. Contrary to the popular belief that the major danger to children is eating paint chips, a more pervasive danger of LBP is its potential to generate lead-laden dust, which is easily ingested or inhaled.

Lead is a known poison the use of which was restricted by many developed nations between 1920 and 1940. Lead causes hypertension, irritability, stomach pains, muscle and joint pain, brain and nerve damage, and diminished intelligence. At higher levels lead can cause convulsions, paralysis, and death. The effects of lead arc especially profound on young children because of their ongoing neurologic development and because their hand-to-mouth behaviors cause them to ingest more dust. While the relationship between LBP and elevated blood lead levels is well documented, the degree of risk is unclear.' The best estimate is that small children living in homes with LBP are

15 times more likely to have elevated blood lead levels than small children living in homes without LBP (National Research Council 1993).

Fortunately there are many ways to control or remove LBP dangers in homes. Many of these methods can be taught in a few days-less for workers who are knowledgeable about construction materials and processes. In addition, houses can be tested to ensure complete LBP cleanup work. Unfortunately, while new technologies for paint removal *or* encapsulation facilitate LBP control, these processes produce lead dust that must be removed before the dwelling is habitable. Unless rigorous cleanup methods become standard, renovation and LBP control work will probably increase the risk of lead poisoning. Many homeowners, renovators, remodelers, and painters are not aware of these hazards of LBP.

To address these concerns, federal and state governments have initiated a major campaign to inform the public and to regulate LBP abatement work. Title X of the Housing and Community Development Act of 1992 is the first major federal legislation specifically addressing LBP hazard reduction in both public and private housing since the 1978 ban on lead in residential paint. The act specifies agencies' responsibilities for setting LBP standards and requires states to commit resources to reducing LBP hazards in private housing. It also requires that home buyers and renters be informed of LBP dangers in any pre-1978 house. This last requirement will go into effect in October 1994.

A market for LBP hazard reduction is developing rapidly, but government remains an important player facilitating the expansion of this market. Most LBP abatement contractors, for example, are located in states that mandate hazard reduction and/or certify LBP contractors. Lack of information about LBP hazards limits demand for hazard-reduction services. Poverty, restrictive credit markets, and the high cost of importing experienced LBP abatement contractors to regions not served by local firms also limit demand. The expected costs of litigation may be low compared to the cost of preventive hazard reduction. Contractors and workers must pay the cost of training and, in some states, of certification. In the face of uncertain demand, these entry costs may limit the supply of qualified firms and workers. Health risks to workers may also discourage participation. Likewise, insurance premiums for contractors are often high because of the health and liability risks and because of the inchoate LBP hazard insurance market. Government can, however, encourage the expansion of this market, and thus increase LBP hazard reduction, by providing information on the identification and control of hazards, by regulating hazard reduction standards and contractors, and by subsidizing hazard reduction where necessary.

The costs of LBP control must be contrasted to the medical, social, educational, and economic costs of inaction. These costs include special education for lead-poisoned children and their potential lost earnings as well as lost earnings of workers poisoned on the job. Treating and caring for a lead-poisoned child is time consuming, disrupts the family, and reduces parents' productivity. These costs are currently distributed across a variety of public programs and are thus "hidden." LBP policy is inseparable from access to health care, quality of housing, definitions of acceptable risk, and life chances.

The costs of lead abatement vary depending on the method of hazard control-full abatement, hazard reduction, or interim controls. A full description of the calculation of these costs is given in a later section. Full abatement requires that all LBP be removed and all residual dust be cleaned up. It may involve replacing such components as windows, doors, and trim, and costs between $5,500 and $40,000. Hazard reduction of LBP addresses deteriorated paint, LBP on friction surfaces (windows, doors, stairs) and dust levels. It encompasses a wide range of techniques, but does not require removal of all LBP. Instead of removing paint, encapsulants might be used to make housing safer, but the danger remains of future deterioration of LBP. Hazard reduction costs between $3,000 and $15,000. Interim controls focus on short-run solutions to LBP hazards. Walls with exposed LBP are repainted, windows and floors are scrubbed with a high-phosphate detergent, and dust is thoroughly cleaned with high-efficiency particle vacuum cleaners. Interim controls for a period of seven years cost between $500 and $5,000. Total cost of LBP control or abatement in private housing depends on the number of homes affected. Looking at the 9.6 million homes with LBP that house small children, the cost would be approximately $21.4 billion for interim controls, $45.9 billion for hazard reduction, and $68.8 billion for full abatement.

The cost of addressing LBP hazards in only those homes with small children and with low to moderate incomes would total about $16.6 billion. After taking into account the funds that are provided by existing programs and the work that can be undertaken directly by landlords and homeowners, a gap of between $7.2 billion and $13.3 billion remains. The annual cost over a 10-year period, for example. would be between $720 million and $1.3 billion.

In addition, the Occupational Safety and Health Administration estimates that 226,026 construction workers are exposed to LBP hazards as they renovate, repair, repaint, or abate LBP in buildings over 20 years old. Compliance with new (1993) safety regulations is expected to cost an average of $432.38 per worker per year, for a total cost of $98 million per year. This cost amounts to just under 1% of the $103.7 billion spent yearly on home renovation and rehabilitation.

LBP hazard reduction will stimulate additional employment and income in the home renovation and repair industry. The overall effects on employment depend, of course, on how these activities are paid for. If other public or private spending is reduced, then employment declines elsewhere in the economy will offset these increases. However, the composition of employment may be weighted toward higher-paying jobs. On average, the wages of construction workers are higher than the wages of other similarly educated workers. Estimates of the gross increase in employment from reducing LBP hazards are shown in **Table 1.**

TABLE 1

Additional Gross Work and Taxes from LBP Abatement

Level of LBP Work	Worker-Years	Wages	Federal Income Taxes
Full abatement	7 million	$133.2 billion	$9.8 billion
Hazard reduction	4.7 million	$88.8 billion	$6.6 billion
Interim controls	0.9 million*	$14.9 billion	$1 .1 billion

• Workers devoting some hours to maintenance.

Public Policies for LBP Hazard Reduction

Several federal and state programs currently fund LBP hazard-reduction activities. This funding includes federal grants distributed by the Department of Housing and Urban Development and mandated through Title X, HUD’s HOME grants, and the low-income housing tax credit for property owners with rental units. In addition, HUD insures rehabilitation loans for owner-occupants and for rental properties. New federal mandates require additional reductions in LBP hazards, but existing programs do not provide sufficient assistance to enable states, families, and landlords to comply. Proposed and potential new taxes for this purpose include the following:

- Taxes directly on private property or transfer taxes are economically efficient taxes for LBP hazard reduction, and they link well with the new LBP hazard warning for all purchasers of pre-1978 homes. However, such taxes may reduce sales of real estate by increasing the cost of homeownership.
- American families are highly mobile, and a broad segment of the population is likely to occupy a home containing lead-based paint at some time. There is, therefore, a benefit to the general public from abating LBP hazards and thus a rationale for the use of an income tax credit for home improvements that reduce these hazards. Using Massachusetts as a guide, tax credits of 28.5% at an average cost of $4,779 per unit for hazard reduction would cost the treasury $1,362 per home. About 111,000 homes are likely to be eligible annually, resulting in a loss of revenue of $143 million. However, such a tax credit will not solve the affordability problem for low-income households.
- Excise taxes on lead and paint, based on the “polluter must pay” principle, may be politically popular but fail to tax those company shareholders who gamed in the past. A tax on lead would fall overwhelmingly and without justification on consumers of vehicle batteries. Moreover, to the extent that consumers substitute imported for domestic batteries, successful battery recycling programs in the United States may be disrupted, raising the environmental hazards from lead. In contrast, a tax on paint manufacturers might be justified on the basis of the past actions of the paint industry in continuing to produce, until 1978, a product whose hazards were known and which had been banned in many developed nations by the 1940s. Additionally, paint manufacturers stand to gain from increased paint sales as a result of public spending on lead abatement, most of which involves extensive repainting.
- The past behavior of many industries-paint and lead to be sure, but also oil, gas, many metals, real estate-has contributed to the hazard of lead poisoning. A small, broad-based tax on larger corporations to finance a trust fund for LBP abatement would create fewer market distortions and might be more equitable than narrower taxes on paint and lead.

Lead-Based Paint in Privately Owned Housing

Data on the extent of lead-based paint in privately owned housing come from the Department of Housing and Urban Development. Based on a 1996 national survey, HUD found:

- 57 million homes built before 1980 contain LBP.
- 9.9 million are occupied by children under age 7.
- 3.8 million units occupied by children under age 7 have peeling lead-based paint and/or excessive amounts of lead dust.
- 45% of homes with the most dangerous LBP hazards and with children are rental properties. Of these, 75% house poor tenants. This suggests that a substantial portion of properties occupied by low-income residents may be eligible for tax credits.
- 10.7 million units have interior lead dust that exceeds safety levels on floors and/or on window sills and/or in window wells.[3]
- 80% to 100% of houses built before 1940 have lead in their paint; between 52% and 72% of housing built between 1960 and 1979 (when the paint industry was adjusting to voluntary lead paint standards) contain LBP.

Urban areas have the largest numbers of older homes and thus the largest number of homes with LBP. In addition, minority children are more likely to be housed in pre-1978 units with deteriorated conditions (U.S. Department of Commerce 1987). The relationship between minorities, housing quality, poverty, and exposure to LBP hazards is evident in the data on blood lead levels. The most recent recommended safe ceiling for children's blood lead levels is ten micrograms per deciliter. The Agency for Toxic Substances and Disease Registry (U.S. Department of Health and Human Services, ATSDR 1988) estimated that, in 1984, 68% of African-American children living in center cities of metropolitan areas and in households with incomes less than $6,000 had blood lead levels greater than 15 micrograms per deciliter. This contrasts with the national average of 17% of city children with such blood lead levels.'

The Link Between LBP and Lead Poisoning

Deteriorated LBP accounts for the largest portion of elevated blood lead levels in children, most of it through the lead LBP adds to household dust. A lesser amount comes from eating paint chips or chewing on surfaces containing LBP.[6] The direct link between deteriorated LBP and lead in dust is well established.' Other important sources of lead exposure include soil and drinking water, and smelters, old furniture and toys, pottery, imported cosmetics, and the solder used in food cans. Multiple sources of lead may contribute to poisoning. For example, lead in soils might contribute to lead levels in household dust.[8]

Within homes, LBP hazards are categorized either as priority hazards-where deteriorated or peeling LBP and high levels of lead in household dust are present-or secondary hazards—well-maintained dwellings with LBP intact. The lead dust and deteriorating paint in priority-hazard homes pose immediate dangers to residents. Secondary hazards also pose a risk to families and workers whenever the paint is disturbed in preparation for repainting, renovation, or rehabilitation.

Translating the data on the incidence of LBP on house surfaces into a risk of lead poisoning is difficult. The potential risk to children exists for all houses containing LBP to the extent that the paint is not maintained or is disturbed. The ability of current or future property owners to pay for the upkeep of their housing units is difficult to predict. Ignorance about LBP routinely leads to accidental exposure of families and workers during renovation and repair.'

The Effects of Lead Exposure in Children

Lead toxicity can be asymptomatic in children (U.S. DHHS, Centers for Disease Control 1991a). Symptoms, when they appear, are hard to distinguish from other illnesses. Small children and fetuses are especially at risk because their central nervous systems are still developing. Their hand-to-mouth activity also increases their risk of exposure. Mildly elevated blood lead levels in children have been linked to loss of intelligence and to delayed neurobehavioral development. Other effects linked to elevated blood lead levels in small children and fetuses are decreased growth, kidney and other organ problems, hearing loss, and inability to maintain a steady posture. Higher concentrations of lead in blood can cause convulsions, coma, and death. It is not yet known whether effects of lower lead concentrations in children's blood can be reversed. Damage at higher levels is believed to be permanent. Children undergoing treatment are particularly sensitive to exposure to lead and must be housed in lead-free environments."

The incidence of childhood lead poisoning due exclusively to LBP in housing is difficult to ascertain." ATSDR reported that screening programs vastly underestimate the number of children exposed to LBP hazards.[12] The data also tend to exclude Hispanic, Asian, and other minority populations, as well as those living outside metropolitan areas. Moreover, only a few states have universal reporting from laboratories processing lead tests. ATSDR's best estimates indicate that, in 1984:

- 13.6 million children lived in homes with concentrations of 0.7 mg/cm^2 or higher of lead in paint.
- 1.8-2.0 million of those 13.6 million children lived in deteriorated old housing.
- 17% of all children under age 7 in metropolitan areas had blood levels greater than 15 micrograms per deciliter (µg/dl), 5.2% had blood levels greater than 20 µg/dl, and 1.5% had blood levels greater than 25 µg/dl as a result of LBP exposure.[13]

Estimates of Lead Poisoning Among Workers

Lead exposure for construction workers involved in remodeling, rehabilitating, or maintaining existing homes is poorly documented. Paradoxically, the new requirements for testing workers under the 1993 OSHA guidelines for construction workers should increase reports of elevated blood lead levels in workers while the work practices of some firms are made safer. Smaller firms that work in older housing and firms that employ large numbers of part-time construction workers are less likely to meet new federal lead exposure standards.

The effects of lead on adults vary somewhat from those in children (NRC 1993) and are often misdiagnosed (Gostin 1993). Infertility in men has been noted at levels as low as 40 µg/dl. The risk to fetuses, a concern among working women, starts at levels between 15 and 20 µg/dl (U.S. DHHS, ATSDR 1988).

The Department of Labor estimates that 178,544 workers are potentially exposed to LBP each year at 2,698,000 projects for remodeling residential units.[14] Lead abatement workers and those responsible for in-place management of LBP add an additional 12,238 and 35,244 workers, respectively, who are potentially exposed each year.

Little is known about construction workers' incidence of elevated blood lead level. Few residential construction workers have been screened, since the change in OSHA standards is new and because of the general ignorance of potential exposure to LBP. A few states, such as New Jersey and California, have surveillance or reporting programs (New Jersey Department of Health 1993; Waller et al. 1989). Workers in construction trades ate over-represented among those diagnosed with blood lead concentrations over 25 μg/dl. In the New Jersey sample, 44% of the painters and LBP abatement workers with high blood lead levels had levels greater than or equal to 40 μg/dl.

Risks of Lead Poisoning from LBP

The populations most at risk for lead poisoning from LBP are children under age 7, fetuses, and construction workers involved in renovation, rehabilitation, or repair of surfaces containing LBP. While all the data indicate there is risk, the degree of risk of lead poisoning from exposure to LBP for these populations is still emerging. Schwartz and Levin (cited in NRC 1993) found a relative risk factor of 15 for children during the summer living in homes with LBP compared to those in homes without LBP. That is, children exposed to LBP in their homes were 15 times as likely to have elevated blood lead levels as those in LBP-free homes. The National Research Council (1993) found that blood lead levels were systematically higher among children with high lead-based paint in their homes. Several studies (NRC 1993) have shown a mean increase in blood lead levels in children living in recently refinished (renovated) homes. The Centers for Disease Control (U.S. DHHS, CDC 1991b) cites a mean increase of 2.13 micrograms per deciliter for pregnant women living in pre-1900 housing compared to those living in lead-free housing. While none of these data are as rigorous as one would like, the risks of elevated blood lead levels from exposure to LBP appear significant and compelling.

LBP Hazard-Reduction Markets in Private Housing and the Role of Government

The market for LBP hazard reduction is developing rapidly, but the role of government remains critical. Homeowners, for example, who do not live in states with active LBP control programs find it difficult to hire trained LBP hazard-reduction firms or workers.[15] Most LBP abatement contractors are located in states that mandate hazard reduction and/or that certify LBP contractors. Homeowners outside these states face the costs of either importing LBP abatement contractors certified in other states or taking a chance that untrained local firms will follow HUD and Environmental Protection Agency guidelines. Moreover, states with active programs encourage competition; prices for LBP hazard reduction are inversely related to the number of certified firms within the state or in a neighboring state.[16] Government can also help expand the market for hazard reduction by providing information about LBP poisoning risks and cost-effective and safe techniques for removing LBP. Parents may want to address the hazard but fear that any action may exacerbate the risk to their children. Housing owners may have misinformation about abatement costs. Workers may fear placing themselves and residents at risk. Reliable information can overcome these fears. Demand for abatement may be constrained if renters risk eviction for requesting LBP hazard reduction from landlords or if landlords can refuse to rent to families with small children. Prohibitions on such behavior can increase the extent of the market. Finally, poverty and restrictive credit markets limit the market for LBP hazard reduction. States with active LBP regulation tend to offer greater access to public financing, and have more private suppliers of abatement services.

Thus, government can reduce barriers to LBP hazard reduction through information that encourages owners and tenants to initiate preventive measures in their homes. Government regulation sets safety standards, retains affordable housing by protecting tenants from eviction or from denial of access, controls incompetent firms, and limits lead in paint. However, the effectiveness of regulation in this setting is complicated by the traditional practices of home repair, of small handyman enterprises, and of the ubiquitous but inconspicuous nature of the danger. LBP abatement work is frequently similar to conventional tasks but requires very different forms of protection, attention, and cleanup. Workers and firms must be taught methods of LBP removal and containment that do not endanger themselves or the residents for whom they work.

Benefits of Addressing LBP in Private Housing

The federal role in expanding private demand for, and supply of, LBP hazard reduction can be justified on the basis of the gains that accrue. Currently, the costs of the deleterious effects of lead on children and workers are distributed across a variety of public programs and impose hidden costs on society. For those on Medicaid the costs are distributed across all taxpayers and the medical system. Middle- and upper-income families with lead-poisoned children help pay these medical expenses, but the full costs of lead poisoning exceed the direct medical expenses. Social costs include special education for lead- poisoned children, lost earnings of workers poisoned on the job, potential lost future earnings of affected children, and the disruption to families with LBP and poisoned children. The CDC (1991b) estimated that the average cost of *ignoring* LBP hazards was $4,323 per affected child for health care, special education, and lost earnings. In these estimates, the CDC uses a discounted average medical cost based on the initial medical screening plus the probability that children will need followup medical intervention at blood lead levels greater than or equal to 25 µg/dl, rather than the 1991 CDC guideline of 10 µg/dl and retesting at 15 µg/dl. Using these thresholds would increase the CDC estimates substantially. In addition to the costs of failing to prevent LBP poisoning in children, there are parallel costs associated with worker illness and loss of productivity. Contractors are also obliged to pay for insurance that does not reflect the actuarial costs of hazards in homes and of abatement work. The current boutique market in insurance tends to include high premiums and limited coverage.

The experiences of Massachusetts, perhaps the leading state on protecting tenants, reveal the complexities of laws requiring lead abatement, especially in rental units. Landlords in Massachusetts, who may not refuse to rent to people with children, must abate or control hazards if a small child is in the home. Alternative housing must be provided while the work is conducted, and there are stiff penalties for violations. Massachusetts demonstrates how abatement contractors have improved their craft and offer competent work at predictable costs. In many ways, Massachusetts represents the advantages of combining market forces, regulatory stimulus, and a variety of financing mechanisms. These include low-cost loans to small property owners who meet a needs test, a $1,000 tax credit for residential hazard- reduction using certified and licensed contractors, and a general hazard-reduction fund financed by annual fees from abatement contractors. The stringent eligibility requirements for loans appears to have limited their effect on abatement activity. The tax credit, which does not require a needs test, stimulated a greater-than-predicted level of activity. There have, however, been problems. Massachusetts has been obliged to review its LBP-related laws and tax-credit policies. In addition, there are frequent reports of landlords refusing to rent to families with small children, of LBP hazard-control costs beyond the fiscal resources of the landlords, and of intemperate penalties.

Lead is an old problem, but public awareness, markets, technologies, and governmental responses are still emerging. Regulation in this setting must be especially responsive to the dynamics of markets and advances in technology.

Is Increased Information Enough to Reduce LBP Hazards in Private Housing?

The current &bate over the dangers of LBP is characterized by conflicting information about the dangers of lead poisoning and the role of government in stimulating abatement activity. The lack of consistent information stems in part from differing definitions of the problem. In the 1960s, political forces gathered to improve the housing conditions of poor minority children. Because low-rent or public urban buildings were (and are) more likely than other buildings to have deteriorated paint and to be occupied by poor and minority children, there was a compelling reason for early LBP research to focus on poor minority children living in cities. Lead poisoning from paint came to be perceived as confined to poor urban minority children eating paint chips. The social definition of the problem as one affecting only poor urban children kept the message about LBP hazards from reaching middle- and upper-income families.

As more research has confirmed the effects on children and adults of lead in blood, child advocates, public health workers, and pediatricians have become more vocal about LBP as an environmental hazard. The problem was redefined as an environmental threat to all small children in households containing LBP. The most recent manifestation of this shift is seen in the 1993 statement of the American Academy of Pediatrics calling for universal testing of children. Prior to this, many pediatricians failed to recommend blood lead tests or even to inquire about risk factors for middle-class children in obvious jeopardy of lead poisoning. The dissemination of information on LBP was also slowed by priority conflicts among pediatric health care workers facing more challenges than resources." In addition, LBP hazards require that housing agencies work closely with health agencies--typically groups with different goals.

The federal government has sought to become an information center for LBP hazards and for lead poisoning. Title X mandates distribution of informational material and requires notification of LBP dangers to renters and buyers of pie-1978 houses. Title X also requires states and localities seeking Housing and Community Development funds to develop LBP hazard strategies as part of their Comprehensive Housing Affordability Strategies. Information campaigns are a relatively low-cost initiative for the federal and state governments.

Information is essential for guiding homeowners who may want to hire contractors or abate or control LBP within their properties. Several training programs enroll homeowners, and some states are considering certification for homeowners or landlords of small properties. Because the techniques can be taught in two days, this policy is efficient--enhancing lower-cost **LBP** hazard control and safety for both those doing the work and the residence. Information, however, has not been, and will not be, enough to ensure serious increases in LBP hazard reduction in private housing.

Regulations, Markets, and the Supply of Workers for Lead-Based Paint Abatement in Private Housing

Public information campaigns and federal and state regulations, shaped in part by recent medical data, are expanding the market for LBP hazard control. Requirements for hazard reduction and for certified personnel to assess risks and remove LBP spumed an increase in training facilities and in the number of LBP contractors.

This increase in the supply of LBP inspectors, risk assessors, workers, and contractors influences the cost and accessibility of LBP control in several ways. Beyond the positive relation between the number of LBP personnel and competition, the evidence suggests that areas with experienced LBP workers and contractors see lower costs due to work efficiencies-the workers move down the learning curve (Higgins 1993). Thus, factors affecting the supply of LBP personnel limit or enhance the amount and distribution of LBP hazard reduction. These include worker-certification requirements, availability of training institutions, the pay for LBP-related work, and the number of LBP contractors.

The EPA is releasing training regulations for personnel who assess and remove LBP. Training of LBP workers is a key element in the national policy for LBP abatement. As of this writing, however, training and certification standards for lead testing and abatement are unclear. Our survey of state LBP programs found that 90% of the states did not require certification by LBP contractors, although several states expect to have such requirements in place soon. Almost a fifth of the states' spokespersons were not certain about their own certification requirements. The training curricula and prerequisites proposed by the EPA are designed to provide the needed skills while not creating unnecessary barriers to occupational entry.

The EPA regulations are enforced by state regulators and spurred by insurance companies and state regulators who require that workers and contractors be certified. Landlords and homeowners also seek certified workers to reduce liabilities associated with LBP work performed on their properties. Even some manufacturers of LBP abatement and control supplies (e.g., makers of paint strippers and encapsulants) requite that purchasers of their products be certified.‘*

In light of the efforts to train and certify workers, the most striking finding of a series of interviews with abatement experts is the extreme caution many express about residential safety after LBP abatement. Many experts said they would trust only a small fraction of the firms (with the exception of contractors in Massachusetts)-including even those staffed by people who had completed LBP-related courses (Newman 1993; Zaccarini 1994).[19] Successful firms[20] emphasize that applying the suggested standards of LBP control and abatement generates high levels of decontamination and worker safety. Such practices become routine and efficient (Farfel and Chisolm 1991; Higgins 1994).[21]

New safety standards will also raise costs. In 1978, the construction industry was exempted from the then new safety standards for lead hazards. In 1993, OSHA issued ***Interim Final Rules for Lead Exposure in Construction.*** The new regulations ended the 15- year regulatory differential. The cost of these new safety regulations will be reflected in the price of LBP hazard reductions. Under the previous (less protective) regulations, some of the costs were borne by the industry and some were absorbed by the health system, consumers, and workers. OSHA provides estimates on the new safety compliance costs for 936,670 construction workers exposed to lead hazards. It estimates the total annual reoccurring cost of compliance for the workers exposed to lead risks will be between $365 million and $445 million. (The authors use these OSHA cost estimates for the 226,026 workers who are involved in home renovation and LBP hazard reduction [U.S. Department of Labor, OSHA 1993, Table 8].[22]) Safety costs to do-it-yourselfers, who are a significant element of the LBP risk-reduction picture, are unknown.

Using the midpoint of the OSHA estimate-$405 million for all construction workers--the average safety-related cost per worker per year of these regulations is $432.38. The total annual cost of OSHA safety compliance for the 226,026 workers is $98 million, or less than 1% of the $103.7 billion yearly cost of home renovation and rehabilitation.[23] As a percentage of labor costs for lead abatement, assuming a work crew of one skilled worker and three laborers, the annual safety compliance cost of $432.38 is 1.56% of the yearly labor cost for such a crew.

Finally, new regulations require hazardous waste disposal of construction debris with even moderate levels of LBP. Contractors must also meet state and sometimes municipal requirements regarding transport, testing, disposal, and classification. The management of waste emerges as a significant economic cost-as much as 50 times higher than conventional trash disposal. However, new methods of LBP removal and disposal offer greater safety for workers, homeowners, and the environment.

Thus, forces and countervailing forces are at work to increase the supply of firms and workers in this industry. Regulations can raise the number of qualified abatement contractors and still increase the costs of abatement by restricting entry of individuals and firms to those who have completed the approved training courses, requiring expensive testing of LBP and household dust, requiring methods of LBP removal or encapsulation that are often more expensive (and safer) than other methods, requiring worker-safety equipment and monitoring of work areas, and requiring disposal and transport of construction debris as hazardous waste.

Insurance: A Major LBP Hazard-Enforcement Mechanism

Most insurance companies would rather not participate in any form of lead hazard coverage. Residential insurance underwriters seek to avoid LBP liabilities via exclusions or limitations, and only about 20 companies write LBP removal contractor policies-most of these holdovers from the asbestos removal boom (Anderson 1993). The result is that many small firms are discouraged from offering lead abatement services because LBP-removal contractor insurance can be difficult to obtain, comes with high deductibles, and is too expensive-premiums add as much as 5% to 20% to the cost of the job."

The insurance industry's timid response to LBP hazard reduction, however, is expected to change because of pressures from regulators and lawmakers, growing public awareness of LBP, market opportunities, and improving technologies and methods that reduce uncertainties. This can have the effect of increasing the demand of homeowners and landlords for abatement of LBP hazards while simultaneously reducing the costs for all types of insurance connected to LBP hazards by spreading underwriting risks.

Several factors are driving insurance carriers to become prominent participants in removing or containing old paint. Advocacy groups such as the National Center for Lead-Safe Housing are seeking mandated coverage for LBP hazards. If these advocates are successful, underwriters will write more LBP-related policies and will become actively involved with LBP testing, abatement, containment, or management. Insurance companies will also insist that landlords perform LBP hazard reduction and him only certified LBP hazard-reduction workers or contractors. Thus, insurance may become the mechanism for enforcing hazard reduction and use of certified contractors.

This new role for insurance underwriters as enforcers of LBP reduction may be reinforced by subsequent efforts of homeowners or landlords, who will seek adjustments in policies as they engage in activities to contain LBP hazards. Underwriters will need to evaluate this work before extending premium discounts or coverage changes. Such actions will be reinforced by Title X, which requires that home buyers be warned of LBP hazards.

LBP hazard-reduction contractors will be subject to other forms of regulation, often from states and localities. A survey conducted by the authors of states' LBP efforts indicates that many states will be introducing review boards, certification panels, and inspection and licensing mechanisms. In the tradition of much other state experimentation, the most successful methods are likely to be popularized and adopted by legislatures (Farquhar 1994a, 1994b).

Financing LBP Removal: The Role of Public Policy

Costs of LBP cleanup vary by the size of the house, by the amount of LBP, and by the degree of hazard reduction sought. Based on data from a variety of sources,[25] the total cost for the 54 million private homes with LBP are estimated to be $388.8 billion for full abatement, $259.2 billion for hazard reduction, and $120.9 billion for interim controls. For homes with children, the total costs are, respectively, $68.8 billion, $45.9 billion, and $21.4 billion. The average costs per home are $7,168 for full abatement, $4,779 for hazard reduction, and $2,229 over a seven-year period for interim controls. (Recall that the CDC's estimate of the cost per child of ignoring lead-poisoning hazards was $4,323 in 1991.)

Costs of abatement far exceed annual aggregate expenditures for maintaining and repairing homes, which were $51.3 billion in 1992, or for painting in existing homes, which was $11 billion

(U.S. Department of Commerce 1992). Abatement activities substantially increase renovation and rehabilitation costs. In addition, homeowners bear other direct costs, some of which may be included in prices quoted by contractors. These include risk assessment (or testing), relocation of family during the work, permits (required in some states), maintenance and repair costs, clearance testing, painting, and future controls (if not a full abatement).

Why Publicly Finance LBP Hazard Reduction in Private Housing?

The requirements of emerging regulations and the associated high costs of hazard reduction mean that standards set by the federal government cannot be met without some public funding. The cost of required LBP work as a percentage of the homeowners' incomes or of housing values for low- and middle-income households is often overwhelming.

Currently, Title X requires that all federally funded housing be made lead-safe. As a result, funds in existing public programs (e.g., Title I loans, HOME grants) are being diverted to LBP removal in publicly funded housing, leaving less available to serve private housing units. A reallocation of budget items has therefore already occurred. Many homeowners will not receive help from existing federal and state programs, are unable to obtain loans for this purpose from private lenders, and lack resources to undertake lead abatement. This unavailability of assistance applies to many of the homes most at risk.

While LBP is found in homes throughout the nation, the homes with the greatest dangers and highest risks are disproportionately distributed among those with low- to moderate-incomes. HUD estimated (1990) that 3.8 million households with children under age 7 had priority LBP hazards. Of these homes, almost 2 million had residents with incomes under $30,000. In addition, there are an estimated 6 million additional homes with intact LBP where small children reside (HUD 1990). Over 1.5 million of these homes with intact LBP were occupied by families with lower and moderate incomes in 1990. Thus, there are about 3.5 million homes with children that will require public funding to control or abate LBP hazards and meet the requirements of Title X, which becomes fully effective in October 1994. Contrary to some impressions, a significant percentage-more than a third-f the 2 million homes with limited incomes and deteriorated LBP are owner-occupied.

The financial needs and incentives for landlords are different from those of owner-occupants. Owning rental property is a business, with allowable business deductions from income taxes and, presumably, some asset value to the business. Landlords may deduct LBP hazard-reduction costs. However, for landlords encumbered by high debt and/or those who have suffered market-value declines, the cost of LBP hazard reduction might mean abandoning their properties or increasing rents beyond what their tenants can bear or regulators allow. Public funds applied to rental units, therefore, need to reflect the complex tangle of tenants' needs and governmental goals for maintaining affordable housing while addressing LBP hazards.

Existing Federal and State Budget Items/Programs for LBP Hazard Reduction in Private Housing

Several federal housing programs currently target funds for low- to moderate-income families who do not have access to private funding. Unfortunately, HUD has no estimate of the current percentage of these public funds used for LBP hazard reduction. Because so few people are aware of the LBP hazards, the proportion of existing housing program funds are probably quite small (Goldman 1993). The major programs are:

Federal grants distributed by HUD and mandated via Title X. These grants have been available specifically for LBP hazard reduction in privately owned homes since 1992. The objective of these funds is to provide money to state or local governments to implement LBP hazard-reduction programs for private housing, to assist with startup costs associated with developing LBP hazard-reduction programs, and to motivate states to pass certification and training legislation that matches or exceeds the federal guidelines. State certification laws are required to receive grant funds. Benefits are targeted to low-income families or rental property owners who meet the grantees' (state or local government) requirements, and to contractors seeking state certification. These funds are designated by Title X ($50 million in 1992, $90 million in 1993) and renewed by the federal government.

HUD's HOME grants. These grants, totaling $1 billion in 1993, are made to state and regional housing departments specifically to address private affordable housing. LBP hazard reduction is an eligible activity. Funds for rental units are restricted to those housing occupants having incomes less than or equal to 30% of the regional median income adjusted for family size. Owner-occupants may not have incomes higher than 55% of the median regional income for a four-person household. The emphasis of this program is to maintain or increase the number of affordable housing units by renovating (or rehabilitating) existing structures. About 20,000 units were rehabilitated under the HOME program as of September 1993, 39% of these owner-occupied.

Community Development Block Grants. CDBG funds, totalling $4 billion in 1993, can also be used for LBP abatement along with rehabilitation. About 19% of these funds are used for rehabilitation of low-to-moderate income housing (HUD 1990). Both these and the HUD grants use established state and local agencies to apply the funds. All housing funded through HOME and CDBG must now be lead-safe housing before being reoccupied. LBP hazard reduction can increase costs of rehabilitation from 10% to 40%.[26] A 20% increase in the cost of rehabilitating homes to address LBP hazards would reduce the number of units rehabilitated by about 16%.[27]

The Low-Income Housing Tax Credit. This tax credit can be used to address LBP and is available to property owners with rental units occupied by a specified percentage of low- to moderate-income tenants. Expenses for rehabilitating housing are eligible for a credit of about 70% for units not receiving federal assistance and about 30% for units receiving federal funds. The credit is taken over a lo-year period. The property owner must continue to rent to low- and moderate-income tenants for 15 years after receiving the credit. These monies are focused on maintaining the supply of affordable housing for low-income tenants. Both property owners and low-income tenants benefit.

Credits are administered by designated financial organizations in each state. The Internal Revenue Service reviews and credits the tax return. Estimates suggest that very few of the tax credits are used for LBP hazard reduction, although it is an eligible activity. In 1991, the IRS reports that there were 22,835 tax returns using the credit, for amounts totaling over $53 million. In 1992 there were 33,098 returns totaling over $66 million. These funds are supplied from general revenues.

HUD-Insured Rehabilitation Loans. HUD insures rehabilitation loans for owner-occupants under Title I of the National Housing Act that may be used for alterations, repairs, or improvements to existing structures. These loans could be for as much as $17,500 in 1990, with a 15-year repayment period. HUD also supplies owner-occupants with funds from Section 203(k) of the National Housing Act. These loans may be used for rehabilitating an existing home, financing rehabilitation and refinancing the debt on an existing home, or financing the purchase and rehabilitation of a home. In 1990, the loans were capped at the lower of $124,875 or 95% of the regional median price for a single-family home.

Mortgage Insurance Through HUD. For rental properties, HUD provides mortgage insurance under Section 221(d)(4) of the National Housing Act for development of multi-family dwellings or for rehabilitation of existing rental units. Section 223(f) provides mortgage insurance for existing multiple housing units and can include rehabilitation costs. In 1990 HUD insured mortgages for about 85,000 rental units.

State Financing Initiatives for LBP Hazard Reduction in Private Housing. Several states are developing funding sources to address LBP abatement. For example?

- Maryland collects a $10 per unit tax on all rental units built before 1950 and a $5 per unit tax on those built between 1950 and 1978. This tax is expected to generate $3.3 million in annual revenues and leverage an additional $900,00 in federal funds. All funds will be applied to LBP hazard reduction.
- Maryland collects fees from approved training courses to fund its certification program for abatement contractors, workers, and LBP inspectors.
- Maryland provides deferred payment loans and forgivable loans for hazard reduction in rental units occupied by small children and pregnant women. During the "period of forgiveness," landlords must market to and serve low- and moderate-income families with children and pregnant women.
- For single family homes and rental buildings with one to four units, the housing finance agency of Maryland loans state money at low interest rates and with flexible repayment terms. Sometimes payments can be deferred until resale of the property.
- Massachusetts collects annual fees from abatement contractors, workers, and LBP inspectors. These fees go into a general LBP hazard-reduction fund.
- Massachusetts offers a $1,000 tax credit (a new level of $2,500 has been proposed) to residential hazard reduction in homes using certified and licensed contractors.
- Massachusetts also provides low-cost loans for properties with one to four units through a quasi-public financing company to those who meet the needs tests.

In total, an estimated 1,049,000 homes are renovated or otherwise helped each year with existing federal funds.[29] However, existing programs are limited in scope and funding, and few directly address LBP-related needs. Attempts to divert funds from housing now served by existing programs to address only LBP hazards in homes with small children will adversely affect current attempts to maintain affordable housing units and will neglect housing needs of families with older children, of the elderly, and of the handicapped. Furthermore, many homes with **LBP** hazards and small children need general rehabilitation; funds must be devoted to both rehabilitation and reduction of LBP hazards. The amount of funds needed beyond the current federal spending will depend on the extent to which funds in current programs are redirected to lead abatement.

How Much Additional Funding Is Needed?

The figure of 3.5 million homes in need of assistance to reduce LBP hazards, described above, probably underestimates the magnitude of the problem.[30] Using the costs of hazard reduction, which are intermediate between those of full abatement and interim controls, to estimate the costs of the cleanup work in these homes yields a figure of $9.5 billion, $3.3 billion for owner-occupied housing and $6.2 billion for tenant units. However, existing programs will help with some of the LBP-reduction work, and some landlords and homeowners will be able to address lead abatement in their own properties and homes. A rough idea of the minimum amount of public spending required for LBP hazard reduction can be arrived at by assuming that 20% of homeowners and 60% of landlords undertake LBP reduction on their own and that existing programs can be directed toward addressing LBP in another 20% of these homes. On these admittedly optimistic assumptions, an additional $3.7 billion will be required to assist households with lead-control activities and $3.5 billion to assist landlords. Thus, if LBP hazard reduction were to be accomplished over a lo-year period, it would require at least $720 million of additional spending each year.

These costs do not include funds for additional units that become hazardous or that are newly occupied by families with small children; administrative costs for contracting; evaluations; relocation of families; and state regulation of contractors, workers, testers, and inspectors. This IO-year period also does not sufficiently consider the critical three-year period for small children living with priority hazards today.

Funding LBP Abatement for Households That Need Help

Trust Funds

Trust funds, in which monies are collected through an excise tax or fee on some activity related to the purpose of the fund, are a common way of setting aside tax revenues for specific uses, such as lead abatement. In the United States, there are a number of trust funds directed specifically to environmental hazards and related health issues. These include the Aquatic Resources Trust Fund, the Leaking Underground Storage Tank Trust Fund, and Superfund. Most of the excise taxes for these environmental trust funds cannot be directly targeted on those who profited in the past while creating the environmental hazards. As is the case with chemical waste sites addressed by Superfund, lead-based paint hazards in housing are hazards created, not necessarily illegally, in the past. When initially proposed, Superfund was to collect fines from Probably Responsible Parties (PRPs) for those sites identified as eligible for cleanup under the provisions of the law. General revenue funds were to be appropriated to compensate the fund for those PRPs that either no longer existed or were unable to contribute. PRPs are required to pay fines into the fund whether or not their activities were legal at the time of the disposal of the waste. PRPs include those companies that created the chemical hazardous waste, those that were directly responsible for disposal of the chemical waste, and those that owned and profited from the waste site.

Super-fund collected far too little from the PRPs to support the cleanup. Less than 1% of the projected revenues collected for Superfund over the five-year period (1986-91) were fines from PRPs (Hird 1993). Many larger companies initiated long and inconclusive legal battles. Many PRPs are no longer in existence.

To respond to the need for more funds, Congress decided to distribute the burden more widely. Superfund now taxes imports and production of crude oil or refined products, selected hazardous chemicals, and selected imports that contain specific chemicals. Superfund also imposes an adjusted income tax on corporations with incomes over $2 million. The excise taxes on petroleum products and on chemicals (which raised about $800 million in 1993) were levied on the basis that these products accounted for the largest number of hazardous substances in Super-fund sites. However, the link between past behavior and current production is tenuous. The “polluter must pay” principal is not supported by the impact of these taxes on consumers or on current producers of the taxed products (Hird 1993). There is general agreement that because chemical and petroleum products represent intermediate goods, consumers pay through higher prices for final products across a broad spectrum of goods-often not associated with products that originally created the hazard. Furthermore, the excise taxes that form the backbone of the fund are very regressive in nature (Gaines and Westin 1991).

The corporate income tax portion of Superfund imposes a 0.12% tax on the adjusted income of corporations with income over $2 million. This levy reflects Congress' effort to find additional revenue and to broaden the tax base, and collected about $600 million in 1993. It is based on the belief that a broad spectrum of corporations are, directly or indirectly, polluters who contribute to the level of toxic wastes. This tax is not tied to the ***amount*** of waste generated by a firm, but it assumes a tie between the amount of income and the waste generated. A trust fund for financing LBP abatement in private homes would raise dedicated funds for this purpose and has the same political appeal as other environmental trust funds. House bill H.R. 2479, if enacted, would create a lo-year trust fund dedicated to LBP hazard reduction in private housing. The intent of the bill is to fund additional LBP hazard reduction for housing of low-income families, especially tenants, and to reduce the amount of lead in the environment by discouraging its use in products where alternatives are easily substituted. In addition, states receiving grants must have certification and training regulations, thus protecting households against unsafe practices. The bill strongly favors rental properties with low-income tenants over owner-occupied housing. Owner-occupants receiving assistance would have liens placed against their homes payable to the trust fund.

While a trust fund helps ensure that tax revenues are spent for the intended purpose, the regional nature of LBP hazards in private housing may make a uniform national formula for disbursing funds undesirable. While maintaining affordable housing for low-income tenants is critical, and while rental units make up about two-thirds of the homes most in need of immediate assistance, a national formula may not reflect individual states' particular needs. In states with a large number of owner-occupied homes with priority LBP hazards, grants to low- and moderate-income households may be most effective. In regions with low-income rental housing, loan funds may be more appropriate. Local oversight and flexibility in setting eligibility rules is critical to the effectiveness of abatement efforts.

The revenue source for the trust fund proposed in H.R. 2479 is a $0.45 excise tax per pound on lead production (lead as it is sold from the smelter), lead imports, and imported products containing lead. Exporters of lead would receive rebates for the tax paid. A $0.45 tax per pound on smelted lead is projected to raise about $1 billion a year.[31] However, there are serious drawbacks to such an excise tax. First, the tax is about two times the market price for lead, and would seriously disadvantage U.S. lead producers in world markets. Second, about 80% of lead is used for lead-acid storage batteries in the United States. Currently, there is no replacement for the lead-acid battery in transportation. Demand for vehicle batteries by consumers (by far the largest users of lead) is, therefore, inelastic: consumers will almost certainly pay the tax when buying batteries. While the idea of an excise tax on lead for funding of LBP hazard reduction seems directed at the toxic substance creating the health hazard, the association of today's production with past distribution of LBP in households is weak at best.

Another proposed excise tax—a tax on paint-shares some of the same problems as the excise tax on lead. Paint might be a more reasonable target for an excise tax, since the historic role of paint manufacturers was to resist the elimination of lead in paint. Also, almost all LBP abatement and control work requires repainting and thus increases profits to paint manufacturers above current levels-a "windfall profits" argument. Yet because there are few low-cost substitutes for paint, excise taxes will also increase the costs to consumers and make maintenance of LBP surfaces more expensive. To raise the funds needed to address the 3.5 million target homes with LBP, a tax on paint and coating products of between $.76 and $1.60 per gallon would be required.[32]

Specific excise taxes, like those proposed on lead or paint, are generally not best for households because they tend to fall on the consumer. The experience of Super-fund suggests that broader-based taxes on business income may generate more money and less litigation, even if these taxes have only tangential links to the businesses responsible for creating the environmental hazard. These taxes spread the collection of funds across a broad range of products, effectively reducing the burden on any one set of consumers. In addition, such a tax may be justified by the fact that many parties shared in the creation of the hazard, most unknowingly. The list includes lead-mining companies and importers, other metal mining companies, lead smelters, paint manufacturers, contractors who applied the paint, homeowners and landlords who used the paint and/or did not maintain the LBP in their housing units, contractors and/or homeowners who disturbed the paint during renovations, and realtors who sold homes with LBP hazards.

It would be difficult, however, to raise sufficient funds for lead abatement through an increase in the current environmental corporate tax alone. As noted above, current Superfund corporate income taxes are set at 0.12%. To raise the funds needed to address the 3.5 million target homes would require an increase in the corporate tax of up to twice the current level-to 0.24%—which would bring the tax to slightly over one-third of 1% (0.36%) of corporate income for Superfund and LBP abatement.

Taxes on housing are another source of revenues for a lead-abatement trust fund. Collecting taxes on housing built before 1978 is more closely in line with the concept of taxing those who benefit. One strategy reflecting this perspective is Maryland’s rental unit tax, discussed above. Nationally, there are 26 million rental properties built before 1978. A $10-per-unit annual tax (somewhat similar to that of Maryland) would collect $260 million a year. If many states collected similar taxes to capture increased federal matching funds, the budgets of existing federal housing programs would swell accordingly.

Another housing tax, a property transfer tax, could be used to collect funds for LBP hazard reduction. Transfer taxes based on a progressive formula could be levied on homes at the time of sale and paid in some combination by the buyer and the seller of the property. Insofar as the buyer pays the transfer tax, the amount would be included in the house price and could be financed over the life of the mortgage.

The size of any transfer tax is critical. Several years ago, Philadelphia found that a 5.07% transfer tax (the nation’s highest) reduced sales of homes by about 5%. Of course, in this instance, buyers could look elsewhere, for example, in suburbs or other areas. If a transfer tax is national in scope, however, there are no comparative disadvantages. Far more important, a national transfer tax for lead abatement would be dramatically less than the Philadelphia tax. A 0.20% tax on a median-priced existing home ($106,800 in 1993) would yield $214 per sale. Homes built before 1978 make up about one-half of the 3.8 million existing homes sold annually. Transfer taxes assessed only on these homes would generate $406 million annually. However, while a tax on homes built before 1978 is not regressive, it creates two distortions. First, it creates a bias for buying post-1978 homes over maintaining the other half of the housing stock. This factor both creates windfall profits for owners of newer housing and may encourage deterioration of the existing housing stock. Second, because a transfer tax makes homeownership more expensive, first-time buyers may find the additional cost another barrier to homeownership unless allowed to finance the tax as part of the mortgage. A 0.20% transfer tax on all housing sold (an average of $219 per home) would be more equitable and would yield about $1 billion annually. It is doubtful that a transfer tax of 0.20% will substantially reduce the number of homes sold.[33]

Income Tax Credits

Trust funds are only one method of delivering public funds to LBP hazard reduction in private homes. Another is an income tax credit, which reduces the burden on homeowners who pay for LBP abatement themselves. This method is especially attractive if the taxes that are increased to finance LBP hazard reduction fall on homeowners. An income tax credit could also be structured as a bonus to rental property owners who may already deduct the cost of LBP hazard reduction as a cost of doing business. Thus, it is a further incentive to maintain affordable housing. For all property owners with LBP hazards, an income tax credit provides incentives for abatement and reduces some of the sting of LBP hazard-reduction costs that cannot be recaptured in the value of the property.[34]

Using the Massachusetts LBP tax credit experience as a guide to the number of homes that might take advantage of a tax credit, and extrapolating to the entire country, a 28.5% credit would *cost the* treasury $151 million annually.[35] Funding to pay for this credit could come from general revenues or from one of the taxes discussed above.

Gross Employment Effects of Lead Hazard Reduction Activities

Abating and controlling LBP hazards in homes generates jobs, income, and taxes. Based on current project? full abatement of American homes with LBP is estimated to require 7 million worker-years, hazard reduction 4.7 million worker-years, and interim controls of homes (over the course of seven years) 0.9 million worker-years. Estimated total wages would be, respectively, $133.0 billion, $88.7 billion, and $14.8 billion, and estimated federal income taxes on these wages would be $9.8 billion, $6.5 billion, and $1.0 billion.

Note that these are ***gross employment*** effects. That is, if other services or goods must be cut from the budgets of property owners or the government to finance LBP hazard reduction, these employment gains will be offset by losses elsewhere.

Conclusions and Recommendations

Lead-based paint is a major health, social, and economic problem. Half the homes in America-57 million dwellings-have LBP on their walls, doors, windows, or stairs. When LBP is disturbed or deteriorates it produces lead-laden dust that is easily ingested or inhaled. Young children are particularly vulnerable.

The costs of addressing this hazard are high. Full abatement of an average home costs $7,168, hazard reduction $4,799, and interim controls (over seven years) $2,229. The costs of inaction, however, are also high.

To reduce the hazards of lead-based paint in the 3.5 million homes occupied by low- to moderate-income households with young children most in need of action will require at least $7.2 billion of additional public spending, or $720 million a year in new taxes spread over 10 years.

Income tax credits are a way of providing incentives for LBP hazard reduction by those who must pay for it out of pocket. Such credits will increase LBP abatement by middle- and upper-income homeowners, who are the direct beneficiaries. Benefits to the general public include an increase in safe housing and a decrease in the costs of lead abatement as the market for LBP hazard reduction expands.

A combination of funding sources may be the most effective means of addressing LBP hazards. For example, a very modest transfer tax of 0.1% (an average of $110 per home) on all transfers of homes would yield about $500 million a year. Increasing the corporate income tax to 0.2% from its current 0.12% would yield an additional $500 million. This combination of taxes shares the burden of raising $1 billion between households and business without the regressive effects of an excise tax, and it raises sufficient funds to reduce LBP in the targeted low- and moderate-income households with children over a lo-year period. It would also finance an income tax credit for the middle- and upper-income households likely to take advantage of it each year (based on the Massachusetts experience) over the same period.

Increasing funds for existing federal housing programs that have LBP hazard reduction as an eligible activity is probably the most desirable way to address the needs of low- and moderate-income households because it takes advantage of established channels for rehabilitating existing housing. Local control by regional housing authorities and/or nonprofit agencies allows funds to be spent in the way most appropriate for local conditions. In addition, it allows LBP hazard reduction to be coordinated with complementary government efforts, such as household energy conservation programs.

Creating a trust fund that dedicates funds to the reduction of LBP hazards can also work if properly integrated with regulations, local needs, and existing housing programs.

Whatever funding mechanisms are employed, careful records need to be kept of homes in which LBP work was funded. This information is required for project evaluation and to track the control of LBP in the housing stock.

Public information campaigns are an important means of addressing LBP hazards. Information is needed to prevent childhood lead poisoning from LBP and to guide action. Since local building inspectors and local licensing and inspection departments are often ignorant of LBP hazards, information campaigns should be aimed at local authorities as well as homeowners and landlords.

Local governments should develop methods of regulation and enforcement that ensure the safety of workers and residents. Most rehabilitation, maintenance, and renovation contractors know little about LBP.

Unions have been among the most active participants in LBP worker training, apprenticeship programs, and awareness efforts. Training about LBP, however, should be fully integrated into construction-related vocational education and expanded to include all workers at risk.

August 1994

Endnotes

1. See the literature review in Chapter 3 of ***Measuring Exposure in Infants, Children, and Other Sensitive Populations,*** NRC 1993.

2. Results can be found in ***Comprehensive and Workable Plan for the Abatement of Lead-Based Paint in Privately Owned Housing***, pp. xvii-xix, U.S. Department of Housing and Urban Development 1990. Estimates from other sources often assume all housing older than 1978 or 1980 have LBP. The HUD estimates use the midpoint of their confidence interval and thus appear more conservative.

3. The 10.7 million housing units with high lead dust levels exceed 200 micrograms per square foot (200 $\mu g/ft^2$) on floors, and/or 500 $\mu g/ft^2$ on window sills, and/or 800 $\mu g/ft^2$ in window wells. (Over 90% of these homes have excessive dust only on window sills and window wells.)

3. We have used the 95% confidence interval for HUD's survey; most often one sees the midpoint of these intervals published. See Table 3-2, pp. 3-7, in ***Comprehensive and Workable Plan for the Abatement of Lead-Based Paint in Privately Owned Housing, U.S.*** Department of Housing and Urban Development 1990.

5. The contrast between the proportions of black versus white children with blood lead levels higher than 15 $\mu g/dl$ are equally striking. About one-quarter of the poor urban African-American children were estimated to have elevated blood lead levels greater than 20 $\mu g/dl$; the comparable figure for whites is ***8.4%.***

6. For references on sources determining the relative importance of deteriorated LBP in causing elevated blood lead levels, see ***Preventing Lead Poisoning in Young Children,*** pp. 18-19, U.S. DHHS, Centers for Disease Control 1991a. See also Chapter 3 of ***Measuring Lead Exposure in infants, Children, and Other Sensitive Populations, NRC 1993.***

7. A good literature review on exposure to lead by sources can be found in Chapter 3 of ***Measuring Lead Exposure in Infants, Children, and Other Sensitive Populations,*** NRC 1993.

8. The ATSDR estimates that 5.6 million children living in the 100 largest cities in the United States are potentially exposed to lead in soils from combusted fuels. These children are not exclusive of the 13.6 million children living in homes where they are potentially exposed to LBP (U.S. DHHS, ATSDR 1988). Mielke contends that lead loading in soils from past use of leaded gasoline contributes largely to elevated blood lead levels in children in some major metropolitan centers. He finds addressing lead in soil to be cost effective (Mielke 1992, 1993). However, there are not yet definitive data on the size of the contribution that lead in soils makes to lead in household dust where LBP is also present.

9. There are no data on the degree to which renovation contributes to LBP poisoning among children or workers. HUD experts suggest that up to 80% of all "abatement" is accidental

during renovation. All public health officials that we spoke with were aware of cases of childhood blood poisoning directly as a result of renovation in a privately owned home.

10. The National Research Council recommends more evaluation of techniques for analyzing blood lead levels, both for cost effectiveness and for accuracy over a broad range of lead concentrations (NRC 1993). Glotzer et al. (1994) find that costs are minimized by using venipuncture as the initial screening test. Venipunctum was more cost effective as compared to either (1) using a capillary sample initial screen with venipuncture confirmation of levels over 15 μg/dl, or (2) using capillary tests for low-risk initial screenings and venipuncture for high-risk initial screenings based on responses to a questionnaire (see below) about possible exposure. This result held across a wide range of scenarios. Only when the cost of venipuncture was high and the incidence level low did use of the questionnaire to determine initial screening methods become more cost effective.

Questionnaires used to assess the degree of risk of exposure to lead include questions about the age of the home, the condition of the paint, whether any recent renovations have been undertaken, whether the child visited another house or school with peeling paint, and whether the child has friends or relatives being treated for elevated blood lead levels. See the CDC document ***Preventing Lead Poisoning in Young Children*** (U.S. DHHS, CDC 1991a), Table 6.2, for an example of a questionnaire.

11. The estimated number of children with elevated blood lead levels in the United States comes primarily from a 1988 study by the Agency for Toxic Substances and Disease Registry. Screening in almost all regions of the country is targeted to children who receive services from Medicaid benefits. Children who receive health benefits through their parents' employers are screened on the basis of the personal conviction and knowledge of their pediatricians (except in the few states where universal testing is required). Suburban families report resistance to their requests for blood lead tests. In Connecticut, the health department reported an increase in screening following the release of the American Academy of Pediatrics policy statement ***(Pediatrics,*** July 1993) supporting universal screening.

12. The ATSDR used data from the National Health and Nutrition Examination Survey (NHANES) for the years 1976 to 1980 and the results of screening programs to project children's exposure to LBP hazards.

The national reporting of data from screening programs was interrupted from 1981, when grant programs were shifted to block grants under local health department control, until 1991, when the CDC reestablished a federal program to fund screening and environmental investigation and began collecting reported incidence of lead poisoning. In 1993, there were 37 grantees under this CDC program. The ATSDR collected data from screening programs in 1986 to calculate updated estimates of exposure levels.

13. ATSDR also estimated that 250,000 children under 6 years old had elevated blood lead levels of greater than 25 μg/dl in 1988. The most current federal data (1992-93) reveals that 2.8% of children have significantly elevated blood lead levels. These data are from Dave Fomey, CDC. He cautions that the blood level requiring action differs locally and that CDC data in this period were not collected by specific blood levels. Also, some grantees have

better surveillance programs than others.

14. See the ***Federal Regisrer,*** Vol. 58, No. 84, Tuesday, May 4, 1993, pp. 26611-20.

15. The Los Angeles Times (Sunday, March 27, 1994, p. K1) reported the costs and difficulties of finding a contractor. California did not have regulations regarding certification and training at that time.

16. In Massachusetts, 8,000 private abatements were completed that met conditions for the state tax credit. The average cost was $3,500. Massachusetts has the largest number of certified contractors.

Maryland set a system of three spending limits on three types of hazard reduction in its grant program. These spending limits of $1,650, $3,500, and $6,000 correspond to differing degrees of removal and control. Maryland recently passed certification and training standards.

Philadelphia reports an average cost of about $10,000 for abatement of private housing. Most of these are owner-occupied houses in low-income neighborhoods. Pennsylvania has yet to pass legislation on training and certification.

17. See, for example, the letters to the editor in *Pediatrics*, Vol. 91, No. 6, June 1993.

18. At least one manufacturer of stripping and encapsulating materials will only sell to certified personnel who also complete the manufacturer's training on use of its product.

19. Several experts (Newman 1993; Keck 1993) noted the kind of preparation received in apprenticeship programs. They stressed the importance of workers' understandings of substrate material of construction basics and of carpentry skills.

20. Interviews with Higgins (1994), Newman (1993), Keck (1993a); Keck in ***Deleading*** (1993b).

21. HUD (1991) cautions that "dust generation and deposition was a major problem with earlier efforts to abate lead paint using methods such as open flame burning and dry scraping with no containment or cleanup."

22. The OSHA-derived figure of 226,026 workers exposed to lead hazards who work in LBP abatement/control or renovation is approximately 5% of the total number of workers involved in all forms of construction.

23. The $103.7 billion figure is from the National Association of Home Builders. The exact number for safety costs is $97,729,122.

24. The 20% figure is very high. It may result from small contractors who are obliged to purchase liability insurance in million-dollar increments (but do not do a million dollars worth of work).

25. The National Association of Home Builders computed a distribution of abatement costs (Seiders 1991) using HUD data. Using the midpoint of each range identified by NAHB, full abatement of 54 million housing units would cost about $389 billion. The authors also fix the midpoint of the upper limit at $30,000.

COST OF FULL ABATEMENT

Mid-Point of Cost Range	Number of Units	cost
$1,250	29,5 19,000	$36,898,750,000
$3.750	6,368,000	$23,880,000,000
$7,500	3,022,000	$22,665,000,000
$12,500	4,803,000	$60,037,500,000
$17.500	4,533,000	$79,327,500,000
$22,500	756,000	$17,010,000,000
$30,000	4,965,000	$148,950,000,000
	53,966,000	$388,768,750,000

NET PRESENT VALUE OF INTERIM CONTROLS OVER 7 YEARS

Mid-Point of Cost Range	Number of Units	Cost
$1201	29,519,000	$35.460.860.114
$1,916	6,368,000	$12,198,381,964
$2.630	3,022,000	$7,947,439,252
$3.344	4,803,000	$16,061,935,571
$4,058	4,533,000	$18,396,873,163
$4,773	756,000	$3,608,174,743
$5,487	4,965,000	$27,242,973,016
	53,966,000	$120.916.637.824

To determine costs for the 9.6 million homes with LBP and with children under the age of seven (HUD 1991), we distribute these homes evenly across the cost ranges. This distribution reveals that the cost of full LBP abatement of homes with children would be $68 billion.

Addressing all the target homes with interim controls results in lower total costs than either full abatement or hazard reduction. The National Center for Lead-Safe Housing estimates a range of costs for interim controls at $500 to $5,000. Using the NAHB distribution of homes across seven price ranges, total costs for interim controls in a year would be $86 billion. These costs, however, are not one-time costs because interim controls require regular evaluation for touching up paint, repeated cleaning, and periodic clearance tests. We set a yearly cost of $150 to maintain interim controls over a six-year period following the initial expenditure. The net present cost at a 5% discount rate is $121 billion for 54 million homes.

Total costs for addressing homes with young children, assuming the costs are evenly distributed across the price ranges, would be about $21 billion.

26. The average dollars applied to rehabilitating a housing unit using CDBG monies is just over $9,000 (HUD 1990). An average estimated cost of $4,779 is about half the usual funds spent. However, Maryland has shown there are great efficiencies when combining LBP hazard reduction with rehabilitation. It is probable that there is a wide range of efficiencies depending on the region and the specific housing units.

27. An estimated $9,310 per unit rehabilitation cost from CDBG (calculated from HUD 1990, p. 6-19) increased by 20%, would reduce the total number of units rehabilitated by 16% to 17%.

28. For a more complete discussion see Farquhar 1994a.

29. This a broad estimate based on 20,000 units from the HOME program, 781,000 units from the CDBG program ($4 billion times 55% divided by an average $9,310 cost per unit), 33,000 returns for the Earned Income Tax Credit, 85,000 rental unit loans (HUD 1990), 85,000 Title I loans (HUD 1990), and an estimated 45,000 owner-occupant loans insured under Section 203(k) of the National Housing Act.

30. This neglects, of course, the rapid turnover of lower-rent units. Many more units are potentially hazardous to children as families move.

31. In 1993, the Bureau of Mines estimated production from smelters at 1,170 metric tons, or about 2,574,000 pounds. This includes lead smelted directly from refined ore (primary lead) and lead from scrap (secondary lead), usually from recycled lead-acid batteries. Imports were about 160 metric tons and exports about 130 metric tons. The tax would be figured on production from the smelters minus exports, plus imports.

32. In 1992, 582 million gallons of architectural paints were produced at a value of $5 billion; 1,219 million gallons of all types of paints and coatings were produced in 1992 at a value of $13 billion.

33. There were 3.8 million existing homes sold at a median price of $106,800 in 1993. There were 669,000 new homes sold in 1993 at a median price of $126,000.

34. Income tax credits deliver funds mostly to moderate- and upper-income property owners and have earned a mixed review for their effectiveness. In theory, they should increase activity. The most comparable tax credits were the federal and state energy tax credits.

These required expenditures on home renovation to meet certain standards of energy efficiency or to incorporate specific technologies. The tax credits were substantial, in some cases up to 40% of the expenditures. However, analyses of the 15% federal energy tax credit for energy conservation or for solar technologies were inconclusive in determining if demand for such technologies increased (General Accounting Office 1982, Lazzari 1982, Rossner 1982, Sawyer and Wirtshafter 1984).

The analogy to adoption of energy-conserving technologies is limited, however. The entire population was aware of the need to conserve energy in the 1970s and had experienced the energy crisis directly. Moreover, there is a qualitative difference between saving money on fuel and protecting the health of children.

35. Massachusetts makes up about 2.4% of the U.S. population. Over three years, 8,000 tax credits (2,666.67 a year) were used in the state. A 28.5% credit on the average hazard reduction of $4,779 would be $1,362; 111,111 tax returns times $1,362 would require $15 1 million.

36. To estimate the employment effects of increased abatement activity, the authors interviewed abatement contractors on total costs and on labor costs and benefits, and used the information in conjunction with national data on wages and benefits. The interviews indicated that 50% of the total cost of a typical abatement project is allocated to labor costs. Using the three average cost figures ($7,168 for total abatement, $4,779 for hazard reduction, and $2,229 for interim controls), the labor cost was then allocated among the typical work team of one skilled worker and three helpers. The average wage for the four LBP workers is $9.66 per hour, with average total compensation (benefits plus hourly wage) of $14.10. This is calculated from: (1) the average wage of $14.21/hour for precision workers; (2) the average wage of $8.14 per hour for laborers; and (3) benefits as 33% of the total compensation paid to the skilled worker and 31% of the total compensation for the helpers.

Hours per project were determined by taking half of the three respective lead abatement job costs and dividing by hourly labor costs. Total number of hours for each of the three types of abatement activity were calculated by multiplying the number of average job hours by the number of hours by the number of housing units requiring LBP-related work. Worker-years equal the total number of hours divided by 1,960.

In calculating the cost of interim controls the authors assumed that such actions are largely implemented by homeowners. Eighty percent of all rental units were assumed to employ a maintenance worker at the national average for compensation of laborers (i.e., $8.14 per hour), and maintenance workers completing interim controls were assumed to spend 126 hours over a seven-year period.

Bibliography

Alliance to End Childhood Lead Poisoning and National Center for Lead-Safe Housing. 1993. ***A Framework for Action to Make Private Housing Lead-Safe: A Proposal to Focus National Attention.*** Washington, D.C.: the Alliance and the Center.

Anderson, Jack. 1993. Presentation at a panel, "Risk Assessment and Interim Controls as Tools in LBP Abatement," National Lead Abatement Council Conference, Washington, D.C. (July).

Cushman, John H. Jr. 1994. "Administration Plans Revision to Ease Toxic Cleanup Criteria." New ***York Times,*** January 31, p. Al.

Davis, Richie. 1993. "Legislature to Look at Lead Paint Law: Compromise Sought; Strict Protection of Children at Issue." ***The (Greenjield, Mass.) Recorder,*** June 29, p. 1.

Dryer, M. S., R. A. Levy, and K. B. Nander. 1986. "Improving Medication Compliance Through the Use of Modem Dosage Forms." ***Journal of Pharmacology Technology,*** Vol. 2, No. 4, pp 166-170. (July/August).

Farfel, Mark R., ScD, and J. Julian Chisolm Jr., MD. 1990. "Health and Environmental Outcomes of Traditional and Modified Practices for Abatement of Residential Lead-Based Paint." ***American Journal of Public Health,*** Vol. 80, No. 10, pp. 1240-1245.

Farfel, Mark R., ScD and J. Julian Chisolm, Jr., MD. 1991. "An Evaluation of Experimental Practices for Abatement of Residential Lead-Based Paint: Report on a Pilot Project." ***Environmental Research,*** Vol. 55, No. ***2,*** pp. 199-212.

Farquhar, Doug. 1994a. ***Preventing Lead Poisoning: A Policy Guide for Legislators,*** Denver, Colo.: National Conference of State Legislatures.

Farquhar, Doug. 1994b. ***Lead Poisoning Prevention: A Directory of State Contacts, 2994.*** Denver, Colo.: National Conference of State Legislatures.

Fomey, Dave (Centers for Disease Control). 1993. Interview by Meg Koppel, Atlanta, Ga.

Gaines, Sanford E. and Richard A. Westin, eds. 1991. ***Taxation for Environmental Protection: A Multinational Legal Study.*** Westport, Conn.: Quorum Books.

General Accounting Office. 1982. ***Studies on Effectiveness of Energy Tax Incentives Are Inconclusive.*** Washington, D.C.: U.S. Government Printing Office.

Glotzer, Deborah E., Howard Bauchner, Kenneth A. Feeberg, and Sean Palfrey. 1994. "Screening for Childhood Lead Poisoning: A Cost Minimization Analysis." ***American Journal of Public Health,*** Vol. 84, No. 1, pp. 110-2.

Goldman, Ellis (Office of Policy Development, HUD). 1993. Interview by Meg Koppel, Washington, D.C.

Gostin, Judy (Occupational Health Division, Pennsylvania Dept. of Health). 1993. Interview by Meg Koppel, Harrisburg, Pa.

Higgins, Tom. 1993. "Minimizing and Disposing of Hazardous Waste Generated on a LBP Abatement Project." ***Deleading,*** pp. 8-9 (October).

Higgins, Tom (Aulson Company). 1994. Interview by Meg Koppel, Peabody, Mass.

Hird, John A. 1993. "Environmental Policy and Equity: The Case of Superfund." ***Journal of Policy Analysis and Management,*** Vol.12, No. 2, pp. 323-43.

Hunter, Paul (Childhood Lead Poisoning Presentation, Dept. of Health). 1993, 1994. Interviews by Meg Koppel.

ICF Incorporated. 1993. ***Background Papers for Task Force on LBP Hazard Reduction and Financing.*** Contract Number 68-D2-0064. Washington, D.C.: Environmental Protection Agency.

Keck, James (Maryland Training Center). 1993a. Interview by Ross Koppel, Baltimore, Md.

Keck, James. 1993b. Cited in Kathleen L. Martens, "Lead Based Paint Risk Assessment," ***Deleading,*** pp. 4-5 (June).

Lazzari, S. 1982. ***An Economic Evaluation of Federal Tax Credits for Residential Energy Conservation.*** Washington, D.C.: Congressional Research Service.

Maryland Department of Housing and Community Development. 1992. ***The Community Development Administration Program Guide.*** Crownsville, Md: the Department.

Mielke, Howard W. 1993. "Lead Contaminated U.S.A. Communities: Comparison of Louisiana and Minnesota." ***Applied Geochemistry,*** Suppl. Issue No. 2, pp. 257-61.

Mielke, Howard W., et al. 1992. "Dust Control as a Means of Reducing Inner-City Childhood Pb Exposure." ***Trace Substances in Environmental Health,*** Vol. 25, pp. 121-8.

National Research Council. 1993. ***Measuring Lead Exposure in Infants, Children, and Other Sensitive Populations.*** Washington, D.C.: National Academy Press.

National Center for Lead-Safe Housing. 1993. ***Lead-Based Paint Hazards and the Comprehensive Housing Affordability Strategy, How to Respond to Title X: Recommendations for Addressing Lead-Based Paint Hazards in Housing to Reduce Childhood Lead Poisoning.*** Technical Assistance Bulletin 1. Columbia, Md.: the Center.

National Conference of State Legislatures. 1994. "Survey Data from State Taxing Offices." Washington, D.C.: NCSL.

Newman, Bruce (trainer and equipment supplier). 1993. Interviews by Ross Koppel.

New Jersey Department of Health, Division of Epidemiology, Environmental, and Occupational Health Services. 1993. ***Surveillance of Occupational Lead Exposure in New Jersey 1985-1991.*** Trenton, N.J.: the Department.

Norman, Robert 1994. "Update on Needleman Case." ***Pennsylvania Division Newsletter (American*** Association of University Professors). Vol. 38, No. 2.

Rall, David P. 1994. "Test Kids' Blood for Lead and Let Industry Pay for the Cleanups." New ***York Times,*** January 24, p. 15.

Sawyer, Stephen W. and Robert M. Wirtshafter. 1984. "Market Stimulation by Renewable Energy Tax Incentives." ***Energy,*** Vol. 9, Nos. 11-12, pp. 1017-22.

Seiders, David F. 199 1. "The Outlook." ***Housing Economics*** (National Association of Home Builders). (November).

U.S. Public Law 102-550. 102d Congress, 2d sess. 1992. ***Housing and Community Development Act of 1992.***

U.S. Department of Commerce, Bureau of the Census. 1987. ***American Housing Survey, 1987.*** Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce, Bureau of the Census. 1992. ***American Housing Survey, 1992.*** Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Health and Human Services, Agency for Toxic Substances and Disease Registry. 1988. ***The Nature and Extent of Lead Poisoning in Children in the United States: A Report to Congress.*** Atlanta, Ga.: ATSDR.

U.S. Department of Health and Human Services, Centers for Disease Control. 1993. "Adult Blood Lead Epidemiology and Surveillance-United States, Second Quarter 1993." ***Morbidity and Mortality*** *Weekly Report,* Vol. 42, No. 35, pp. 684-685.

U.S. Department of Health and Human Services, Centers for Disease Control. 199la. ***Preventing Lead Poisoning in Young Children.*** Atlanta, Ga.: CDC.

U.S. Department of Health and Human Services, Centers for Disease Control. 1991b. ***Strategic Plan for the Elimination of Childhood Lead Poisoning.*** Atlanta, Ga.: CDC.

U.S. Department of Housing and Urban Development. 1990. ***Comprehensive and Workable Plan for the Abatement of Lead-Based Paint in Privately Owned Housing: Report to Congress.*** Washington, D.C.: Government Printing Office.

U.S. Department of Housing and Urban Development. Office of Public and Indian Housing. 1991. ***Lead-Based Paint: Interim Guidelines for Hazard Identification and Abatement in Public and Indian Housing.*** Washington, D.C.: HUD.

U.S. Department of the Interior, Bureau of Mines. 1992. ***Impacts of a Flat Tax Levied on Domestic Primary and Secondary Lead Production and Lead Imports.*** Washington, D.C.: the Department.

U.S. Department of Labor, Occupational Safety and Health Administration. 1993. "Lead Exposure in Construction; Interim Final Rule." ***Federal Register,*** Part II, May ***4, 1993.***

Waller, Kirsten, Ana Maria Osorio, Neil Maialish, and Sarah Royce. 1989. "Lead Exposure in the Construction Industry: Results from the California Occupational Lead Registry, 1987 Through 1989." ***American Journal of Public Health,*** Vol. 79, No. 12, pp. 1669-71 (December).

Zaccarini, Richard (Lead Paint Inspection Inc.). 1994. Interview by Meg Koppel, Philadelphia.